

Melbourne and Metropolitan  
Tramways Board



**INSTRUCTIONS  
TO DRIVERS  
IN ELECTRIC TRAM  
OPERATION**



1960

NO 2928

Melbourne and Metropolitan  
Tramways Board

**INSTRUCTIONS  
TO DRIVERS IN  
ELECTRIC TRAM OPERATION**

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The instructions must be read, thoroughly understood and observed by every employee of the Board who is registered as being qualified to drive electric trams. The Board's Rules and Regulations must be known and obeyed. This is the Handbook referred to in Rule No. 158

# SAFETY FIRST

## Melbourne & Metropolitan Tramways Board

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### INSTRUCTIONS TO DRIVERS IN ELECTRIC TRAM OPERATION

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Q. 1.—What are the important items of Electric Tram Equipment?

A.—The important items are:—

1. Trolley bases and trolley poles with wheels or shoes.
2. Lightning arrester and choke coil.
3. Line breaker.
4. Combined line breaker switch and fuse.
5. Controllers.
6. Resistances.
7. Motors.
8. Air compressor.
9. Combined air compressor switch and fuse.
10. Air compressor governor.
11. Air reservoir with safety valves.
12. Air brake relay valve and double check valve.
13. Air brake cylinder.
14. Driver's air brake valves.
15. Air brake pressure gauge (Duplex).
16. Brakes: air or hand applied.
17. Sand gear.
18. Lamps, combined switch and fuse, headlight changeover switch.
19. Foot gongs.
20. Lifeguard equipment.
21. Windshield wipers.
22. Door operating equipment, driver's door valves and air cock (at No. 1 end only).
23. Conductor's bell or buzzer.



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Q. 2.—What is a line breaker?

A.—It is an electrically-operated device fixed under the tram, which closes and completes the main power circuit when the driver moves the controller handle from the "off" position to 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 to some defect of the electrical equipment.

Q. 3.—What is the use of the combined line breaker switch and fuse?

A.—The line breaker switch is used to open and close the line breaker control circuit manually. The fuse automatically opens the control circuit in the event of electrical trouble.

Q. 4.—Name the circuits which are protected by a fuse.

A.—(1) Line breaker control circuit.  
(2) Air compressor circuit.  
(3) Lighting circuit.

Q. 5.—Name the vital points of the line breaker control circuit.

A.—(1) Combined line breaker switch and fuse.  
(2) Ratchet switch segment and spring.  
(3) S.1, S.2 and first earth fingers.  
With the exception of the first item, they are all mounted in the controller.

Q. 6.—What should a driver do first when it is necessary to renew a fuse?

A.—In all cases, put the switch controlling the supply of current for the particular circuit to the "off" position.

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Q. 7.—What is the use of a controller?

A.—The controller is used to control the current to the motors.

Q. 8.—What is the use of the reverse key?

A.—To reverse the direction of travel of the tram, 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. 9.—What are the names of the groups of notches on the controller?

A.—Series and parallel.

Q. 10.—What is the difference between series and parallel?

A.—When the controller is operated on the series notches the motors divide the line pressure (voltage) and the tram attains half speed. When the controller is operated on the parallel notches each motor receives the full line pressure (voltage) and the tram attains full speed.

Q. 11.—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.—(1) In all cases put the line breaker switch to the "off" position.

(2) See that the track ahead is clear for at least one tram length.

(3) Cut all notches to make sure there is no power.

(4) Open the controller case.  
The controller contains special switches for cutting out a defective motor or motors.  
For the position of these switches see the controller pictures on pages 14 to 21 inclusive.

**Note:** On trams 750 and 751 these switches are placed on the end of the contactor box underneath the tram.



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**Caution:** If it is necessary to cut out motors on trams 750 and 751 the trolley pole must first be removed from the overhead wire.

Q. 12.—Describe the use of resistances.

A.—The resistances are placed in circuit with the motors. As the controller notches are cut the resistances regulate the current to the motors.

Q. 13.—When starting or bringing the tram up to speed, how long would you pause on each resistance notch?

A.—Just long enough to maintain smooth acceleration. If a driver dwells too long on a resistance notch, power is wasted, the resistances get overheated and a fire may be caused.

Q. 14.—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 line breaker to blow or the wheels may spin.

Q. 15.—Why is it necessary to pause on the full series running notch before cutting into parallel?

A.—To prevent jolting and to protect the electrical equipment.

Q. 16.—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.

Q. 17.—How long would you operate the tram on the full series running notch?

A.—Only so long as it is necessary to run at reduced speed using power.

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Q. 18.—How can power be saved?

A.—(1) By accelerating as quickly as practicable, consistent with the smooth running of the tram.

(2) By cutting off power as far as possible from a stopping place.

(3) By coasting as far as practicable.

(4) By releasing the brakes immediately power is applied.

(5) By cutting off power before applying the brakes.

Q. 19.—How should a driver report a disabled tram to Radio Centre or Control?

A.—Use P.M.G. telephone if available, otherwise use track phone to nearest depot and ask for Head Office thence Radio Centre or Control. Give your name, tram number, run number, and table number, route, direction of travel, nearest pole number and nature of trouble.

Q. 20.—What must the driver do if the controller becomes locked in the operating position?

A.—(1) Put line breaker switch to the "off" position, apply brakes and stop the tram.

(2) Advise Radio Centre or Control.

(3) Cut out all motors if possible. The tram may then be pushed in either direction.

If it is not possible to cut out the motors the tram may be pushed only in the direction in which it was going, to the terminus or until overtaken by the emergency vehicle.

**Note:** If the controller is locked in the "off" position make sure that the reverse key is in the full forward position. If this is not the cause notify Radio Centre or Control, put the reverse key in the neutral position and the tram may then be pushed in either direction.

Q. 21.—What is the correct procedure to be followed when a tram has to be pushed?



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- A.—(1) All passengers must leave the tram to be pushed.
- (2) Cut all motors out if possible.
  - (3) If the air brake is in working order keep the air compressor switch “on” so that the air brake may be used. If the air brake is out of order put the air compressor switch to the “off” position and use the hand brake.
  - (4) The signal to start (two strokes of the gong) must be given from the rear tram first, and repeated from the front tram, but the driver of the rear tram must not apply power to start until he receives the start signal (two strokes) from the gong of the front tram.
  - (5) Series speed must not be exceeded.
  - (6) The driver of the front tram must keep a sharp lookout and give the signal to stop (three strokes of the gong) in case of emergency, and must also apply his own brake 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 tram, or to prevent it running backwards.
  - (7) The conductor of the front tram must take up a position in the rear saloon at the door to the driver's cabin and keep it open to give a clear view to the driver of the rear tram in case of necessity.
  - (8) At automatic points the front tram must be stopped at the compulsory track stop mark.
    - (a) To proceed on the straight both trams pass under the overhead contactor with power off.
    - (b) To proceed around the curve, the driver of the front tram must indicate the curve to the driver of the second tram and must see that the points are set correctly, using the point bar if necessary. The conductor of the front tram must hook down the trolley pole. On hearing the signal to start the rear tram driver will push the front car until its trolley pole will clear the overhead contactor. The pole will then be put back on the overhead and both trams will proceed around the curve.

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- Q. 22.—If a tram fails to start, how would you test the control circuit?
- A.—(1) See that the trolley pole is on the overhead wire and is not in contact with a section insulator.
- (2) Turn on lights, if they burn this proves that the power is on and the wheels are not insulated from the rails by dirt or other matter.
  - (3) Before making further tests make certain that the track is clear for at least one tram length ahead.
  - (4) See that the line breaker switch is at the “on” position, open door to saloon, cut the first notch on controller and listen for dull thud of line breaker closing underneath the tram.
  - (5) If the line breaker does not close put the line breaker switch to the “off” position, renew the fuse, put the switch “on” and again test for closing.
  - (6) If it still cannot be heard closing or if the tram does not start, put the switch to the “off” position and cut all notches to the full parallel running notch to make certain there is no power at the controller. Open the controller (and the arc shield on K 35 and Dick Kerr controllers) and examine the ratchet spring (see illustrations).

If the spring is unhooked, replace it. If the spring is broken remove it and use the spring from the other controller. Close arc shield (if opened), close controller, put switch to “on” position and test again.
  - (7) If line breaker still fails to operate advise Radio Centre or Control, transfer passengers and arrange for tram to be pushed.
- Q. 23.—If the control circuit is operating and the tram fails to start, how would you test the main circuit?
- A.—(1) Before making any tests, make certain that the track is clear for at least one tram length ahead.
- (2) If the tram will not start on the first notch but will start on a later notch up to full series (this indicates broken resistance) the tram **must not** be operated beyond the full series position.



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- (3) If the tram will not start on any series notch cut the first notch in parallel. If it then starts, the controller handle may be moved to the full parallel position notch by notch.
  - (4) If both these methods fail to start the tram, advise Radio Centre or Control, transfer passengers and arrange for the tram to be pushed.
- Q. 24.—What must be done if the line breaker blows more than once, while the controller is being operated correctly?
- A.—(1) Unless notching too quickly is the reason, this usually indicates a defective motor. If a defective motor is the cause and the line breaker blows in **series**, put the line breaker switch to the “off” position, see that the track is clear for at least one tram length and cut all notches to make sure there is no power at the controller. Then cut out No. 1 and No. 3 motors. Put the line breaker switch “on” and try again. If the tram will not start or if the line breaker still blows, put the line breaker switch “off”, cut all notches to make sure there is no power at the controller, then cut in No. 1 and No. 3 motors and cut out No. 2 and No. 4 motors. Put the line breaker switch “on” and try again. If there is still no success put the line breaker switch to the “off” and advise Radio Centre or Control.
- (2) If the line breaker blows in **parallel**, put the line breaker switch to the “off”, cut all notches to make sure there is no power at the controller and then cut out No. 2 and No. 4 motors. Put line breaker switch “on” and try to start the tram again. If the tram will not start or if the line breaker still blows, put the line breaker switch to the “off”, cut all notches to make sure there is no power at the controller, then cut in No. 2 and No. 4 motors, cut out No. 1 and No. 3 motors, put line breaker switch “on” and try again. If this fails, advise Radio Centre or Control.
  - (3) If the tram starts without blowing when a pair of motors is cut out, notify Radio Centre or Control, ask for a changeover and drive the tram carefully to

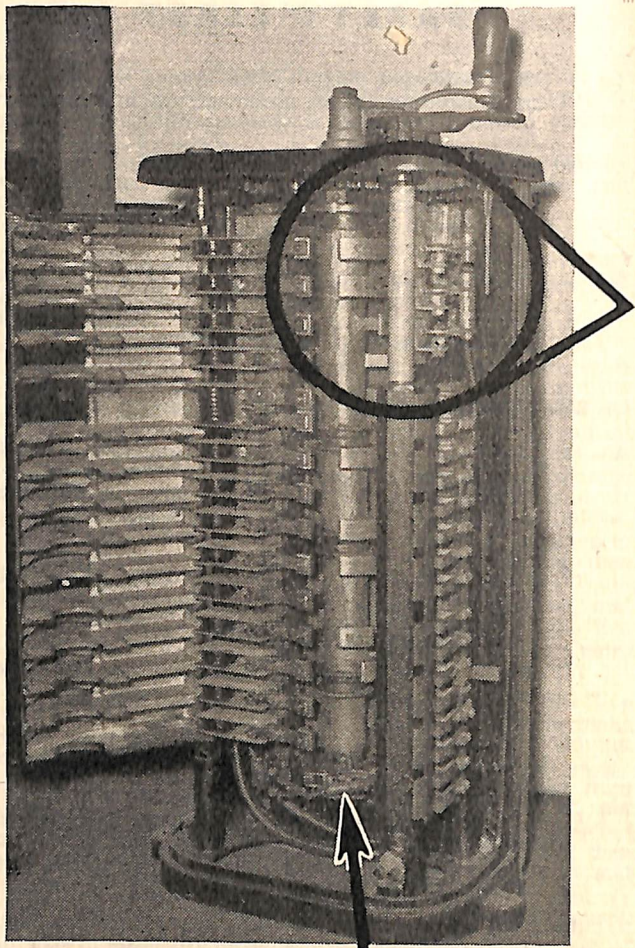
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- the changeover point. When driving with a pair of motors cut out, do not use the electric brake but drive so that the tram can be stopped with the service brake.
- (4) If it is necessary to change ends while driving with a pair of motors cut out, the corresponding motors must be cut out at the other end except on trams with R.C.2 controllers which have the motor cut out switches at No. 1 end only.
- Caution:** It is absolutely essential when the line breaker blows more than once to carry out the foregoing tests otherwise serious damage will be caused to sub-station and tram equipment.

Q. 25.—What should be done if a fire occurs on a tram?

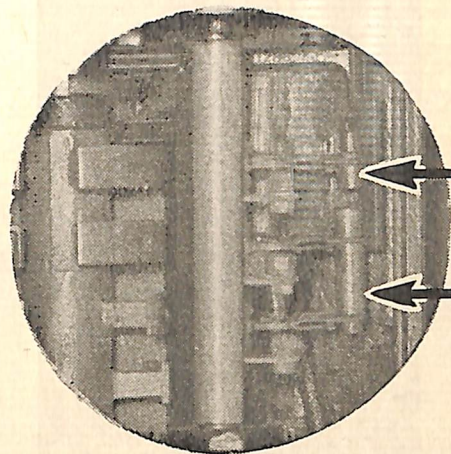
- A.—(1) If the tram is in motion the driver must stop the tram as soon as the fire is discovered and immediately endeavour to extinguish the fire with sand from the sand boxes or with water. A tram must not be driven while it is on fire.
- (2) The conductor must see that all passengers leave the tram promptly, pull down the trolley pole and then immediately call the Fire Brigade by breaking a nearby alarm or by telephone.
  - (3) The Conductor must then notify Radio Centre or Control.
  - (4) Unless absolutely necessary trap doors must not be pulled up until a fire is out. If a motor is on fire, the motor case must **not** be opened.
  - (5) After a fire in a motor or in the motor leads has been extinguished, the driver must cut out the motor affected, ask for a changeover and drive the tram carefully to the changeover point.
  - (6) If a fire in a controller has been extinguished but breaks out again when an attempt is made to start the tram, the driver must extinguish the fire again and arrange for the tram to be pushed.





Ratchet Switch Spring

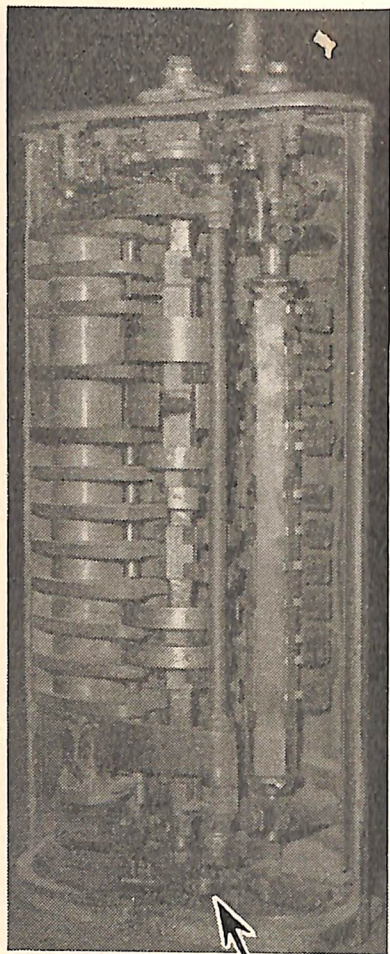
Cut out Motors 2 & 4 Throw  
Switch fully to other side.



Cut out Motors 1 & 3 Throw  
Switch fully to other side.

LOCATION - MOTOR CUTOUT  
SWITCH. G.E. K35JJ. CONTROLLER.





Ratchet Switch Spring.

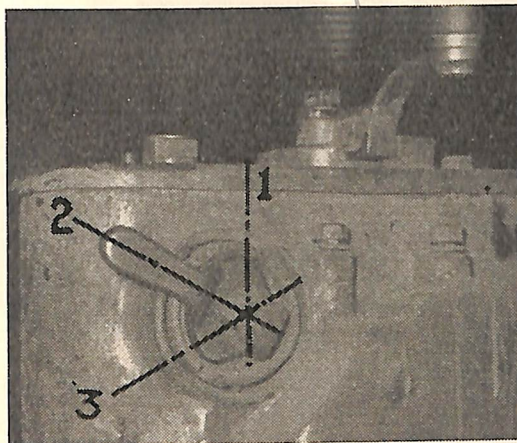
Motor Cutout Switch on outside  
of Controller.

Position N°1. Cuts out Motors 2 & 4.

” ” 2 Neutral.

” ” 3 Cuts out Motors 1 & 3.

Note:- Use "Reverse Key" to operate  
Motor Cutout Switch.



LOCATION-MOTOR CUTOUT SWITCH  
Q2.G1.(DICK-KERR) CONTROLLER.



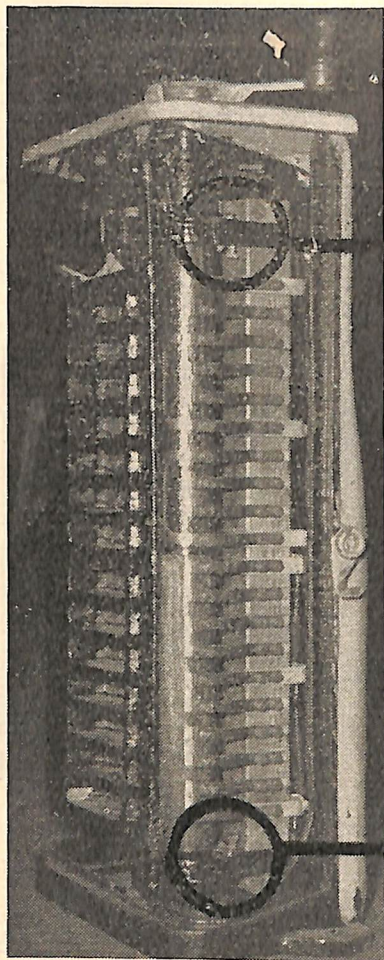
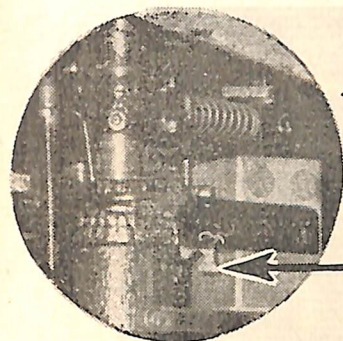
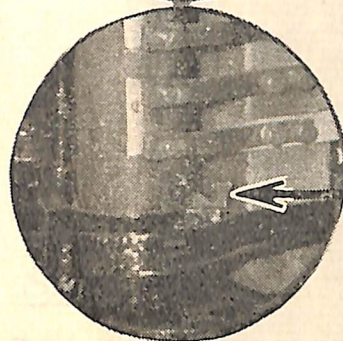


Illustration is Q2CK1. Controller.



Cut out Motors  
1&3. Push Pawl

UP



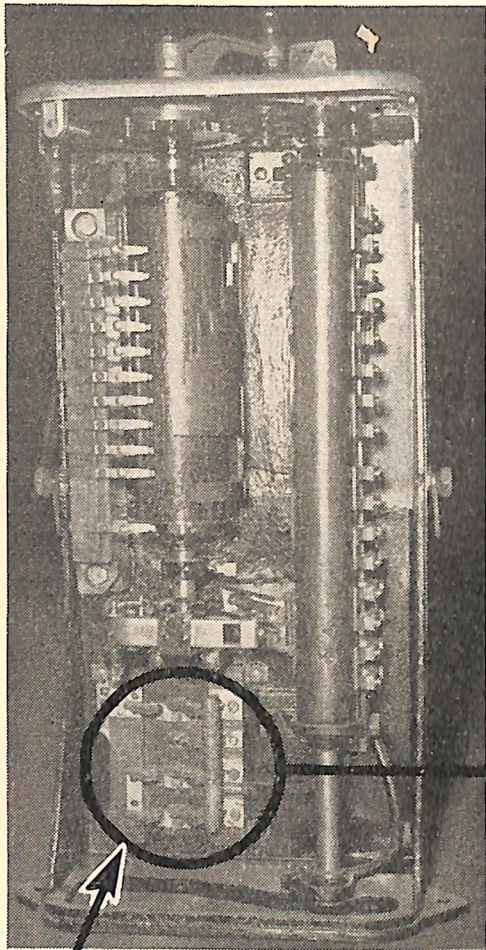
Cut out Motors  
2&4 Push Pawl  
DOWN.

Note: Pawls can only be operated  
when the Reverse Barrel is in the  
Neutral Position.

Ratchet Switch "Not" accessible.

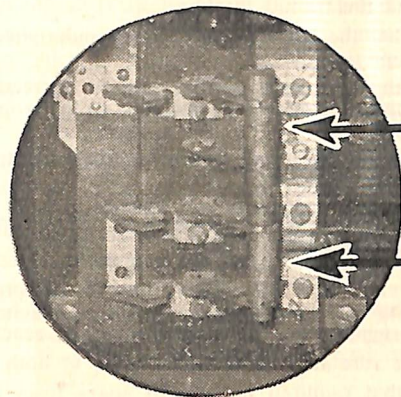
LOCATION MOTOR CUTOUT SWITCH  
Q2CK1 & R.C.I. CONTROLLERS.





Switch on N<sup>o</sup>1 End Only.

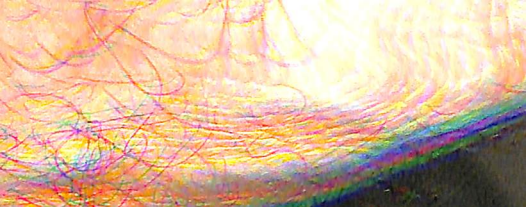
Cut out Motors 2&4 Throw  
Switch fully to other side.



Cut out Motors 1&3 Throw  
Switch fully to other side.

Note: Ratchet Switch "Not" accessible.

LOCATION MOTOR CUTOUT  
SWITCH R.C.2. CONTROLLER.





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- Q. 26.—How would you get a tram ready for the road?
- A.—(1) See that no employee is working in, underneath or around the tram.
- (2) See that the front trolley pole is under the hook and the rope tied down.
- (3) See that the rear trolley pole is correctly on the appropriate trolley wire and the trolley rope securely fastened.
- (4) Put line-breaker and compressor switches to the “on” position.
- (5) Test lights, lifeguards and sanding gear at both ends of the tram. See that sand hoppers are full of sand.
- (6) Adjust destination and route number signs.
- (7) Test air brakes making sure that air compressor stops working when red needle on gauge reaches 70, and starts again when red needle on gauge reaches 60.
- (8) Make sure that hand brake is off at both ends.
- (9) See that required number of spare fuses and lamps are in the proper racks and that the tram is equipped with point bar, run number discs and auxiliary notice boards. Incomplete equipment must be reported immediately.
- (10) Examine the tram for signs of recent damage. Any defect in equipment or damage to the tram, broken windows, dents, scratches and the like must be reported at once. In the absence of any such report the driver will be held to have received the tram in good order and will be held responsible for any damage or loss which he fails to report.
- (11) Sound the gong to warn men working in the pits, drive a short distance and again test the brakes.
- Caution:** If it is necessary for a driver to change poles in a depot, the pole on the overhead wire must be pulled down and secured under the hook before the other pole is released from the hook.

Q. 27.—What are the driver's duties when berthing a tram in a depot?

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A.—Drivers when running trams into Depot must berth them in accordance with the road number shown on their berthing discs or on the car berthing board, whichever procedure is applicable at the Depot concerned.

When berthing a tram, the driver must—

- (1) (a) Operate tram from leading end only.
- (b) Drive at a speed not exceeding 4 miles per hour, with front pole securely under hook and rear pole in trailing position.

Before leaving tram—

- (2) (a) Put all switches to “off” position.
- (b) 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.
- (c) Transfer operating handles to outward end of tram. Place reverse handle on top of controller. Place air brake handle in position and release brakes.
- (3) Untie rope of leading pole.
- (4) Place auxiliary destination signs and run number plates and car berthing discs in the racks provided for the purpose.
- (5) Hand in any defective fuses and lamps to the Depot Starter. Do not leave them in the racks.
- (6) Report all tram defects and irregularities, including lamps or fuses changed, on the tram report form. If there are no defects the tram is to be booked off “O.K.”

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

Q. 28.—What are the main parts of the air system?

A.—(1) The combined air compressor switch and fuse. The switch controls the air compressor circuit and the fuse protects it.



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- (2) The air compressor, driven by an electric motor compresses the air which is used to operate the brakes, the sand valves, the windshield wipers and the sliding or folding doors.
  - (3) The air reservoir which holds the compressed air. A safety valve is fitted and there is a drain cock for removing water from the reservoir.
  - (4) A governor which automatically switches on the compressor motor when the air pressure in the reservoir falls below 60 pounds to the square inch and switches the motor off when the air pressure reaches 70 pounds to the square inch.
  - (5) The motorman's valve for operating the air brakes. As the valve handle is moved to the right, air under pressure is applied through the double check valve and the relay valve to the brake cylinder. The movement of the valve handle regulates the pressure of the air in the brake cylinder which operates the brake levers connected to the brake shoes.
  - (6) The greater the brake cylinder pressure, the greater the force of the brake shoes against the wheels.
  - (7) The door operating valves by which the driver (or, on some trams, the conductor) opens and closes the doors. On sliding door trams there is an isolating cock at No. 1 end only, by means of which the compressed air is disconnected from the door engines.
  - (8) The sand valves. When the driver presses the sand punch with his foot, compressed air is applied to the valves at the bottom of the sand hoppers and sand is blown through the hoses on to the rails.
  - (9) The windshield wiper mounted on the windshield pillar. It is controlled by turning a small knurled knob.
- Q. 29.—What should be done if the compressor motor does not start when the air pressure drops below 60 pounds per square inch?

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- A.—(1) Stop the tram. If the air brake is not effective use the hand brake. If the air brake has been used to stop the tram, apply the hand brake and then release the air brake.
- (2) See that the trolley pole is on the overhead wire and turn on the lights. If they burn, put the compressor switch "off" and then "on" again to be sure it is making good contact.
  - (3) If the compressor still does not start, put the compressor switch "off", renew the compressor fuse and put the compressor switch "on" again.
  - (4) Notify Radio Centre or Control, ask for a changeover and proceed cautiously using the handbrake if necessary. The tram must be changed over whether the fault is corrected or not.
- Q. 30.—What should a driver do if the air compressor governor fails to cut out?
- A.—(1) If the air pressure as shown by the red needle in the gauge does not go over 90 pounds per square inch, notify Radio Centre or Control and drive as carefully as possible using **service** braking only.
- (2) If the red needle rises above 90 pounds per square inch, put the compressor switch to the "off" position and reduce the pressure by making several **service** applications until the red needle falls below 90 pounds per square inch. Notify Radio Centre or Control and drive carefully using **service** braking only. When the red needle falls below 60 pounds per square inch, use the hand brake. Do not switch on compressor again.
- Caution:** If it is necessary to change ends the pressure **must** be reduced to below 90 lbs. per square inch, as described above, before putting the air brake handle to the emergency braking position. When the pressure is over 90 pounds per square inch application of the air emergency brake is liable to lock the wheels and also seriously damage the brake rigging.



Q. 31.—If the air pressure suddenly drops below 60 pounds per square inch and air can be heard escaping beneath the tram, what is the probable cause and what should the driver do?

A.—(1) Probably the drain cock on the air reservoir has been struck and opened or broken by some obstruction on the roadway.

(2) Stop the tram using the hand brake if necessary. Examine the drain cock. If the tap has been opened turn it off. If the cock or a pipe has been damaged causing a leakage of air, switch off the compressor, notify Radio Centre or Control and proceed carefully using the hand brake.

Q. 32.—What must be done if the wheels of the tram become locked?

A.—(1) See that the hand brake is released at both ends of the tram.

(2) Try to unlock the wheels. To do this, first change the poles then go to the rear cabin and, having made sure that the track is clear, smartly cut several notches, tram a short distance back along the track.

(3) Whether the wheels become unlocked or not, notify Radio Centre or Control.

Q. 33.—What should be done if air-controlled sliding doors fail to operate?

A.—(1) If all doors fail to operate, examine the isolating cock at No. 1 end. See that the cock is turned "on", that is, the handle is in the upright position.

(2) If the near side doors only fail to operate see that the conductor's valve lever is in the correct position, that is, pointing in the direction the tram is going.

(3) If one door only fails to operate the cause is probably some obstruction in the floor track. See that the floor track is clear.

Q. 34.—What should be done if air escapes excessively from the door piping?

A.—(1) Turn the isolating cock at No. 1 end to the "off" (horizontal) position.

(2) Notify Radio Centre or Control.

(3) Remove the leading trolley rope and tie it across the outside door openings.

(4) The conductor must then operate the doors by hand.

Q. 35.—What three types of braking are used on a tramcar?

A.—(1) The **air brake**, which is applied by operating the Westinghouse self-lapping valve.

(2) The **electric brake**, which is applied by operating the reverse key on the controller with the controller handle in the "off" position.

(3) The **hand brake**, which is applied by turning the hand brake wheel with the right hand while the right foot holds the pawl into the ratchet.

Q. 36.—What two distinct forms of air brake application are available?

A.—(1) Service braking used for all normal stops.

(2) Emergency braking, known as the "First Emergency".

Q. 37.—What is the correct way to apply the service braking?

A.—(1) Move the brake handle smoothly, quickly and firmly, without hesitation, from the release position towards, but not beyond, the full service position. The extent of the movement varies with the load carried, the downhill or uphill slope and the characteristics of the particular brake handle and valve. (The maximum service position is about two-thirds of the way from release to the "handle off" position and can be found by feeling the service notch with the handle).



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**Note:** The handle must be moved until sufficient air pressure has been applied to the brake cylinder to bring the tram under control. To get the most efficient braking the greatest air pressure necessary should be obtained as soon as possible. Reduction of the speed of a tram is most effectively obtained by slowing down the wheels without skidding them. The wheels are less likely to skid when the speed is high so the greatest pressure should be applied at highest speed.

- (2) As the speed of the tram is reduced, gradually move the handle back towards release position, reducing air pressure and risk of skidding until the car comes to an easy stop without any jolt.
- (3) When the tram has stopped, increase the air pressure till it is ample to hold the car on the particular slope under it.

**Caution:** The **wrong** way to apply service braking is to move the valve handle too slowly, or little by little, and as a result the tram approaches too close to the stop mark before sufficient air pressure has been applied to check its speed. It is then necessary for the driver to increase the air pressure to avoid over-running the stop mark. This causes the brake shoes to grip, skids the wheel and stops the tram with a jolt to the passengers' discomfort. When the brakes lock the wheels they skid and this produces "flats". "Fanning" the brake valve handle, alternately applying and releasing the air, is a bad practice. The braking is much less effective than by the correct method and it only increases wear and tear on the brake valve.

Q. 38.—When should sand be used?

A.—Sand should be used with service braking when rails are greasy: it should be used sparingly. Sand must be

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- (2) Sand must always be used first when applying emergency braking and kept on until the tram stops.
- (3) Sand must be used if the wheels spin on a wet or greasy track when starting. If necessary, sand must be taken by hand from the sand boxes and spread on the rails in front of wheels.
- (4) If the wheels spin when starting on an upward slope the driver should change ends and having made sure that the track is clear, release the brakes and apply sand as the tram coasts for one tram length. Re-apply brakes, change ends again and start again, using sand until the greasy section has been passed.

Q. 39.—What is the First Emergency brake, when is it used and how is it applied?

A.—(1) The First Emergency brake is obtained by applying the full air pressure as quickly as possible.

(2) The First Emergency brake should be used when it is necessary to make a sudden stop to avoid an accident.

(3) The correct way to apply First Emergency brake is:—Apply sand with the **right** foot on the sand punch, put the controller handle to the full "off" position with the **left** hand.

Move the brake valve handle quickly to the extreme right (full on) with the **right** hand.

The three actions should be performed automatically and without delay.

**Note:** A good driver avoids accidents by careful driving and by keeping alert at all times.

Q. 40.—What is the Fourth Emergency brake, when is it used



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- (2) The Fourth Emergency brake is used when the First Emergency brake fails or is ineffective. As soon as this is apparent the Fourth Emergency brake is applied while the First Emergency brake is left on. The hand brake must then be applied.
- (3) To apply the Fourth Emergency brake, pull the reverse key back to the reverse position with the right hand. The right foot is kept on the sand punch and the air is left full on. After the Fourth Emergency brake has been applied the reverse key must not be moved again until the tram has stopped.

When the reverse key is pulled back the motors become generators and produce electric current. Because they are not "balanced" one of the motors is a weaker generator than the others and the current from the strong motor tries to drive this motor in the opposite direction.

Q. 41.—How does the hand brake work, when should it be used and how should it be applied?

A.—(1) The hand brake applies the brake shoes to the wheels using the same levers and rigging that are operated by the air brake.

- (2) The hand brake must be used if the air brake is out of action. The hand brake must also be used when electric brakes are used. In an emergency, should all brakes fail at the driver's end, the conductor must be directed to apply the hand brake at the rear end of the tram.

If a driver temporarily leaves the driving cabin of his tram, he must first apply hand brake, release air brake and make sure that the hand brake is holding the tram and then re-apply the air brake.

- (3) To operate the hand brake, the pawl must be forced into the ratchet with the side of the right foot. The hand wheel is turned until the slack is taken up and the handle is brought to a position on the right of the wheel from where it can be pushed down with repeated powerful strokes until the tram has stopped. When releasing the hand brake, the wheel should never be

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allowed to spin freely as the handle may strike the driver and injure him.

**Important:** The hand brake must be used if the air brake is out of action and therefore drivers must be efficient in its use.

Q. 42.—What should be done if the air brake fails when the tram is on an uphill slope and the tram rolls backwards?

A.—(1) Leave the controller key in the forward position and smartly cut one notch of power.

(2) Quickly apply hand brake.

(3) As soon as hand brake is on, cut off controller.

Q. 43.—What should a driver do if all the lights fail, assuming that the otherwise normal operation of the tram shows that power is on.

A.—Remove the pole from the overhead and renew the fuse. Replace the pole on the overhead and see that the lighting switch is "on". If the trouble still exists notify Radio Centre or Control. Do not move the tram. The conductor must warn following traffic and control its movement past the stationary tram until the Emergency Vehicle arrives.

Q. 44.—What precautions are necessary when there is water on the track?

A.—Drivers must strictly observe the following:—

(1) In water up to 2 inches deep do not operate beyond series speed.

(2) In water between 2 inches and 9 inches (i.e. bottom of axle box) in depth, proceed at walking pace, if possible without power and keeping the foot on the life-guard pedal to prevent its being tripped by the water.

(3) Trams must not be driven through water exceeding a depth of 9 inches.



Q. 47.—When passing under overhead crossings, section insulators or frogs, what is the correct position of the controller handle?

A.—The controller handle must be in the "off" position.

**Note:** (1) Several notches may be cut on smartly

after passing according to the speed at which the car is travelling.

(2) When travelling under line contactors

of automatic point controllers and traffic signals, the speed of the tram should not exceed **three miles per hour**.

Q. 48.—What should be done when the trolley wire breaks and falls on the roadway?

A.—(1) The conductor must immediately notify Radio Centre

or Control giving the location of the breakage.

(2) If the broken wire is hanging so as to endanger trams, other vehicles or pedestrians, both driver and conductor must take up positions, one on each side of the "Break" and warn people of the danger until the arrival of the Tower Wagon or some authorised person from the Chief Engineer's Department. If a

person is in contact with a live trolley wire or span wire immediately request Control to cut the power off until the person is released.

Q. 49.—How would you free a person who has come in contact with a live wire from the overhead?

A.—(1) Obtain a dry board such as a motor hatchway cover

and, being careful to avoid contact with the wire, stand on the board as close as possible to the victim.

(2) Using any dry non-conductor such as a hat, a coat, rope or boards, free the victim from the wire with a

single quick motion either by pulling him away by his clothing or by pushing the wire away from him.

(3) In all cases treat the wire as being alive.

**Caution:** The wire must not, on any account, be allowed to make contact with persons, animals, the tram or any metal.

(4) If a tram becomes stranded in water, remove the trolley pole from the overhead wire. Notify Radio Centre or Control. Operating hours for Radio Centre and Control are:—

**Radio Centre Head Office**—7.0 a.m. to 11.0 p.m. Monday to Saturday inclusive.

**Carlton Electrical Control**—At all other times including all day Sunday.

At night the conductor must warn and control following traffic until the Emergency Vehicle arrives.

Q. 45.—What should be done if a trolley pole becomes badly damaged and unusable?

A.—(1) Tie down the damaged pole securely.

(2) Use the leading pole in the trailing position with the

**offside**. Proceed carefully, particularly at overhead rope tied to a saloon entrance stanchion on the

**Note:** Keep pole clear of route number box and metal frame of tram.

Q. 46.—If the trolley pole leaves the overhead wire when the tram is running, what should be done?

A.—It is essential that the driver stop the tram as soon as possible after a pole becomes dented, to reduce the possibility of a swinging pole breaking a span wire or damaging overhead fittings or the pole itself.

**Note:** (1) Under no circumstances must a section insulator be bridged by both poles or

both poles allowed to touch the wire at railway crossings.

(2) If the tram stops with the trolley pole on a section insulator or any other special

overhead fitting, remove the pole from the fitting before letting the other pole touch the wire.



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Q. 50.—What precautions should a driver take to prevent damage being done to trolley pole guides?

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

**Note:** Care must be taken when leaving a terminus or shunting point to make sure that the front trolley pole is under the hook and securely tied down. Failure to do this can cause serious damage to the tram and overhead equipment.

Q. 51.—What should a driver do when a tower wagon or any emergency vehicle is on the track?

A.—Bring the tram to a stop not less than two tram lengths (100 feet) from the vehicle and wait until he has received the "all clear" signal from the linesman or a member of the emergency crew before proceeding.

Q. 52.—What special care and procedure are necessary when repairs to overhead wire or fittings are in progress?

A.—(1) When a tower wagon "crew" is working proceed as instructed by a linesman. If there is an obstruction or a break the driver will proceed at sufficient speed to clear the fault and put the controller to the "off" position. The conductor will pull the trolley pole well down until the fault is passed. The driver will then stop the tram and the conductor will replace the trolley on the overhead.

(2) If a red flag by day or a red lamp by night is fixed to a span wire near the overhead wire, drivers must coast past the spot with the trolley pole pulled down.

(3) If a green flag by day or a green lamp by night is fixed to the span wire, drivers must proceed with caution past the spot.

Q. 53.—What precautions must be taken when a tram is parked at a siding or if the tram has to be left standing on the track?

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A.—(1) The line breaker control switch must be put to the "off" position.

(2) Apply hand brake, release air brake and make sure hand brake is holding the tram.

(3) Leave hand brake on and re-apply air brake. The air compressor switch must be left in the "on" position.

(4) Remove reverse key and air brake handle and place them on canopy beside the destination box.

(5) With the exception of trams parked at a siding, the conductor should be instructed to remain on the tram. This is necessary to comply with the rule which provides that the tram must not be left unattended.

Q. 54.—What are the likely effects when the wheels of a tram are insulated from the rails by dirt, sand or other material?

A.—(1) The tram will not start when the brakes are released and notches are cut on the controller.

(2) The lights may not burn.

**Note:** There may be sufficient contact for the lighting current to flow but too great a resistance for a starting current for the motors.

(3) The compressor motor will not start.

Q. 55.—What should be done if a tram becomes insulated from the rails by sand, dirt or other material?

A.—(1) Driver is to apply air brake and hand brake. It must be remembered that in such circumstances all metal parts of the tram are alive and therefore it is imperative that no contact be made between the tram and the roadway (or between the tram and another tram) by passengers or crew until the pole has been removed from the overhead

(2) Conductor is to warn all passengers to remain where they are on the tram.



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- (4) Conductor will then jump to the roadway from the smoker entrance and pull the pole from the overhead and place it under the hook, taking care not to touch the tram.
- (5) Conductor is to then request the passengers to leave the tram and wait on the footpath.
- (6) Conductor is to notify Radio Centre or Control and wait for the Emergency Vehicle.

Q. 57.—What should be done if the tram becomes "alive" or if passengers complain of receiving shocks from any metal part of the tram?

- A.—(1) Conductor is to request all passengers to remain where they are on the tram, driver is to apply air brake and hand brake.
- (2) Conductor will then jump to the roadway from the smoker entrance and pull the pole from the overhead and place it under the hook, taking care not to touch the tram.
  - (3) Conductor is to request the passengers to leave the tram and arrange for them to be picked up by the following tram.

- (4) Conductor is to notify Radio Centre or Control.
- (5) Conductor is to then close doors or lower barrier rails and pull down blinds and alter destination signs.
- (6) Conductor is to put pole back on overhead while standing on rear bumper.
- (7) Proceed to nearest Depot unless instructed otherwise.

Q. 58.—What should be done in the event of power failing in the overhead wire?

- A.—(1) Place controller handle in "Off" position, stop tram and turn light switch "on".
- (2) Apply handbrake and release air brake in order to maintain air pressure in the reservoir.

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- (3) Conductor must then jump to the roadway from the smoker entrance and pull the pole from the overhead and place it under the hook taking care not to touch the tram.

- (4) Conductor is to request the passengers to leave the tram and wait on the footpath.
- (5) Driver is to put the light switch to the "on" position.
- (6) Driver is to jam the point bar between the back of a rear wheel and the rail.
- (7) Conductor is to replace trolley pole on overhead.

(8) If lights come on, driver is to enter the tram and drive on to clean rail. Conductor is to then request passengers to re-enter tram. (Do not leave point bar on track).

- (9) If lights do not come on when pole is replaced on overhead, wait for following tram and get pushed on to clean part of rail. The driver must remain on the tram while it is being pushed in order to operate the brakes if necessary. Passengers should not be permitted to board until the wheels are making good contact and there is no risk of any kind to the passengers.
- (10) The dirty track must be reported to Radio Centre or Control.

Q. 56.—What should be done when a tram is badly derailed and the electric contact between the wheels and the rails is broken?

- A.—(1) It must be remembered that in such circumstances all metal parts of the tramcar are alive therefore it is imperative that no contact be made between the tram and the roadway (or between the pole and another tram) by passengers or crew until the pole has been removed from the overhead.

- (2) Conductor is to warn all passengers to remain where they are on the tram.
- (3) Driver is to apply hand brake.



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### A. B. C. FOR TRAM DRIVERS.

AIR PRESSURE is of vital importance. Glance occasionally at the pressure gauge.

BRAKES are most effective while the wheels are still turning NOT when the wheels are locked. Avoid skids.

COMFORT of passengers must be considered at all times.

DISTANCE behind the tram in front must not be less than three full pole lengths (120 yards) when travelling at more than series speed.

ELECTRIC SHOCKS can be serious. See that the switch controlling the circuit you are about to examine is in the OFF position. When on the roof of a tram be careful not to make contact with any metal work, particularly the route number box, while handling the trolley pole. Before opening the controller case, see that the track ahead is clear, put the line breaker switch to the OFF position and test the controller by cutting all notches.

FIRE may occur on a tram. Be prepared by knowing what you must do.

GONG signals are important, be sure you know them. Always sound the gong when passing a stationary tram, sound it repeatedly when approaching workmen on track or road; and be prepared to stop in an emergency.

HEADLIGHT on at the driving end, destination box open in the rear cabin. Make sure your lights are burning.

INSPECT your tram at terminus for hot bearings, loose axle box covers or any damage to Ifleguards. Make sure the front pole is under the hook and securely tied.

JUNCTIONS and compulsory stops must be approached with care. Be always on the alert so that the tram can be stopped quickly in an emergency, particularly when descending grades.

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(3) If the power failure exceeds three minutes the conductor must notify Radio Centre or Control, stating route and position.

(4) The driver must remove the pole from the overhead and replace the pole after one minute. (This allows sub-station equipment to operate).

(5) When the overhead power is off at night, the driver must protect the tram by standing on the track at the front end, the conductor protecting on the rear end in like manner.

(6) When the power is restored, make sure that air brake pressure is available before starting the tram.

Q. 59.—How should trams be started after delay caused by a traffic block?

A.—After a traffic block, trams must be started one at a time, each driver must wait until the tram ahead has moved at least a distance of one pole span.

Q. 60.—What should a driver do at each terminus?

A.—(1) Make a brief inspection for hot bearings, loose axle box covers and for any damage, especially to Ifleguards.

(2) Make sure that the trolley poles are in the correct position for the return journey, with the rear pole on the overhead wire and the front pole under the hook, and securely tied down.

Q. 61.—What persons, apart from the tram crew, are permitted to ride in the rear cabin of a tram?

A.—Traffic Inspectors, Civil Branch Staff inspecting tracks and Track Cleaners on duty.

All such persons must produce a Tramways Board's pass or other authority at the request of the conductor.



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**KNOWLEDGE** of the route is necessary. Keep in mind, especially at night, the exact position of all loops, cross-overs, curves, junctions, cut-off and slow-down discs.

**LIFE-GUARDS** save lives. Inspect the gear at every terminus. Do not place any object near the life-guard pedal. If the movement of the pedal is obstructed the life-guard gear will not operate.

**MOTORS** may become defective. Every driver must know the correct, safe way to cut out a pair of motors.

**NOTICE BOARDS** must be inspected every day for new notices and instructions.

**OVERHEAD LINES** particularly span wires are broken, only too often, when drivers run through special work at excessive speed. A sparring trolley pole can cause a great deal of damage.

**POWER** should be saved as often as possible. Cut off power as far as possible from stopping places and stop the tram by a steady application of the air brake. Cut off power when your tram is running down grades or when the necessary speed can be maintained while coasting. Cut off power when passing under insulators and frogs.

**QUICK ACTION** may be necessary to avoid an accident so always be alert and ready for any emergency.

**RULES and REGULATIONS** and all notices must be strictly observed. Read them and make sure you understand them.

**SAFETY** of your passengers is in your hands. Safety when boarding, safety when riding and safety when alighting.

**TRAFFIC REGULATIONS** must be observed. Keep yourself conversant with current Regulations. These may be perused on application to the Depot Master or officer in charge. Always obey traffic signals.

**UNIFORMS** must be used with care and kept clean and free from grease and dirty marks. Take pride in your appearance.

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**VEHICLES** on the track must be approached with care. Stop a safe distance away and sound your gong. Should it be impossible for the track to be cleared immediately do not sound the gong unnecessarily. When an **emergency vehicle** is on the track, wait until you receive an "all clear" signal before proceeding.

**WHEELS** make an intolerable noise when they have bad flats. Correct use of the brakes to avoid skidding and safe driving without the need to use emergency braking will prevent the formation of flats.

"X" is the road sign of a Railway Crossing. Always look at the position of the catch points before proceeding across.

**YARD SHEETS** must be inspected every day, both before signing on and after completion of duty.

"ZEBRA" **CROSSINGS** for pedestrians must be observed. Be sure you know where they are and be prepared to stop if necessary.

### POINTS TO REMEMBER.

1. **ALWAYS** remember a driver's first consideration and duty is the safety of the public at all times.
2. **ALWAYS** make certain that all passengers are safely on or off the tram before starting.
3. **ALWAYS** remember when passing a stationary tram to reduce speed, sound gong loudly and be prepared to stop quickly in case of emergency.
4. **ALWAYS** when approaching stopping places, where safety zones are not provided, keep a sharp look out for intending passengers waiting on footpath.
5. **ALWAYS** obey promptly the signals of traffic constables, or traffic lights at intersections, junctions, pedestrian crossings and the like.



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6. **ALWAYS** extend courtesy to other road users.
7. **ALWAYS** stop at all compulsory stops (other road users expect you to stop).
8. **ALWAYS** stop at full (compulsory) track marks.
9. **ALWAYS** observe half (provisional) track marks as required.
10. **ALWAYS** 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 (5) five miles per hour at all points, crossings, curves and slow-down discs and to (4) four miles per hour when passing workmen on the track or roadway. Also reduce speed when passing stationary trams or when passing schools during the hours children are entering or leaving.
11. **ALWAYS** apply sand for all emergency stops and when starting and stopping on greasy rails. Oil, bitumen, mud or dead leaves, even overnight dew, will make the rails greasy.
12. **ALWAYS** apply the hand brake before leaving a tram standing on a grade.
13. **ALWAYS** put the reverse key in neutral position before placing the trolley pole on the overhead wire or putting the line breaker control switch to the "on" position.
14. **ALWAYS** put to the "off" position the switch controlling any circuit you are going to examine.
15. **ALWAYS** when shunting at a turnout or crossover stop the tram well clear of the points, so that you can see that they are correctly set before starting on the return journey. (Failure to do this may derail the tram).
16. **ALWAYS** notify the emergency mechanic or inspector if you suspect something is wrong with your tram.

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17. **ALWAYS** remember when driving on badly lighted roads, or in foggy weather, to reduce speed so that a stop may easily be made in case of emergency.
18. **ALWAYS** endeavour to arrive at Bundy clocks and connecting points with other routes on proper table time.
19. **ALWAYS** remember after passengers have safely boarded and alighted and your tram is stationary for any length of time at Bundy clocks, intersections, crossovers and termini, to wave the following traffic to proceed.
20. **ALWAYS** when crossing line of traffic while running out of or in to a depot, give clear and distinct warning to other road users, and operate the tram at a slow speed so that it can be stopped immediately in case of emergency.
21. **ALWAYS** allow tramway breakdown vehicles, ambulances, fire brigade, police cars and the like to pass. Slow down if necessary.
22. **ALWAYS** remember if you discover anything abnormal in connection with overhead equipment, track conditions, or roadway to advise Radio Centre or Control immediately by 'phone stating name of street and nearest pole number.
23. **ALWAYS** remember to slow down at curves, through junctions, crossovers, intersections, bridges, railway crossings, track repair work and overhead repair work. This will help to prevent the trolley wheel leaving the overhead wire, prolong the life of track work and reduce the possibility of accidents.
24. **ALWAYS** remember if you are in doubt about the running of your tram to notify the first inspector you meet or the City mechanic; if no one is available, notify Radio Centre or Control by 'phone.
25. **ALWAYS** remember when passing a slow-down disc (yellow with black cross) to reduce speed to five miles per hour.

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**26. ALWAYS** remember that if urgent assistance is required ring Radio Centre by P.M.G. phone 62 1094 or 62 1095 7 a.m. - 11 p.m. Monday to Saturday or Control at all other times, including all day Sunday, Phone 34 3279 or 34 2488 or by track phone if P.M.G. phone is not available.

**27. ALWAYS** remember that a sudden stop by the tram ahead of you is a common occurrence, and be prepared for it.

**28. ALWAYS** make allowances for the reckless, careless actions of others. Adjust your driving to meet all hazards of weather, road and traffic conditions. The expert driver is always on the alert and avoids getting into situations that demand emergency action on his part.

## REFERENCE INDEX FOR THE QUICK SOLUTION OF EQUIPMENT DEFECTS

Defect In	Relevant Matter
Air System	Pressure too low—Page 24, Q. 29. Pressure too high—Page 25, Q. 30.
Brakes	Wheels locked—Page 26, Q. 32.
Controller	Locked "on" or "off" position—Page 9, Q. 20. Inspection of, for failure of car to start—Pages 11 and 12, Qs. 22 and 23. 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 35, Q. 55. Procedure to adopt if alive due to derailment—Page 36, Q. 56. Procedure to adopt if alive due to defect in wiring, etc.—Page 37, Q. 57.
Circuit Breaker	Continually blowing—Pages 12 and 13, Q. 24.
Doors (Pneumatic)	Reference—Page 26, Q. 33.
Fire on Tram	Procedure to Adopt—Page 13, Q. 25.
Line Breaker	Testing of line breaker control circuit—Page 11, Q. 23.
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**REFERENCE INDEX FOR THE QUICK SOLUTION OF  
EQUIPMENT DEFECTS—(Continued)**

Defect In	Relevant Matter
Motors .....	Procedure to adopt when cutting out defective motors—Pages 12 and 13, Q. 24. Leads on Fire—Page 13, Q. 25.
Main Power Circuit	Symptom of, and testing procedure Pages 11 and 12, Qs. 23. and 24.
Overhead .....	Procedure to adopt when noted—Pages 33 and 34, Qs. 48 and 52.
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Wheels .....	Locked—Page 26, Q. 32.

PROCEDURE TO ADOPT IF CAR IS DERAILED—Page 36, Q. 56.

PROCEDURE TO ADOPT IN CASES OF EMERGENCY—

**Ring—Radio Centre** 7.00 a.m. to 11.00 p.m. Monday to Saturday inclusive, 'phone 62 1094 or 62 1095

**Carlton Electrical Control** at all other times including all day Sunday, 'phone 34 3279 or 34 2488 or, if P.M.G. 'phone is not readily available, use track 'phone.

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