

(b) Two handles are furnished on the top of the Controller, viz., the Main Controller Handle and Reverser Handle. On the One-man type cars both handles are removable but on other cars the Reverser Handle only can be removed.

(i) The Main handle, which is the handle of the Controller, is for starting or regulating the speed of the Car by controlling the supply of power from the Circuit Breaker to the motors; eight notches are marked on the top of the apparatus to indicate the various positions to which the Controller Handle may be placed.

(ii) The smaller handle (on the right hand side) is the handle of the Reverser; it is provided for reversing the direction of current through either the "armature" or "fields" of the motors—thus reversing the direction of the motion of the car. The handle of the Reverser has three positions, viz.:—

For Forward Running—The handle turned towards the front of the car.

For Reverse Running—The handle turned towards the interior of the car.

Neutral or "Off" Position—The handle placed midway between the Forward Running position and the Reverse Running position.

When the handle of the Reverser is in the "Off" position the electrical circuit is open, which prevents current passing from the Controller to the motors. This is the only position from which the Reverser handle can be removed.

(c) There are two types of Controllers in use, viz.:—

The B. 18 Controller and the K. 35 Controller, the differences in construction being as shown in sub-clauses (i) and (ii) hereunder:—

(i) "B. 18 Controller"—On this type of Controller there are eight Power notches on the left of the handle of the Controller and six Rheostatic Brake notches on the right-hand side; these Power notches are arranged in two groups, viz., Series and Parallel, each group containing four notches. The first three notches of the First or Series Group and the first three notches of the Second or Parallel Group are Resistance notches; these notches are

only for the purposes of acceleration and must not be used as Running positions on this type of Controller.

The Fourth Series and Fourth Parallel notches are the only Running positions on the "B. 18" type of Controller and with the Controller handle in these notches the steady running speeds that a car with a normal load will attain on a straight level track are approximately thirteen (13) and twenty-two (22) miles per hour respectively.

(ii) "K. 35 Controller"—On this type also there are eight Power notches but no Rheostatic Brake notch is provided. The Power notches are divided into two groups, viz.:—Five Series and three Parallel with a space between each group. The first four notches in the First or Series group and the first two notches in the Second or Parallel Group are Resistance notches; these notches are only for the purpose of acceleration and must not be used as Running Positions on the "K. 35" type of Controller. The Fifth Series and the Third Parallel notches are the only running positions.

On the One-man type cars the "K. 35" Controller is fitted with a "Dead-man's" handle which must be held depressed, when the car is in operation, except when the Air Brake has been applied.

(d) The handle of the Controller is so interlocked with the handle of the Reverser that the former cannot be operated whilst the latter is at the "Neutral" position; and the handle of the Reverser cannot be operated unless the handle of the Controller is at the "Off" position.

(e) When starting the car, and before moving the handle of the Controller from the "Off" position the Motorman must see that the Circuit Breaker is closed and that the handle of the Reverser is set in the required position. The handle of the Controller must then be turned over the Power notches and the finger of the handle must be allowed to rest at each notch until the car has attained the speed that the motors can develop under the conditions of load and grade; if the handle be advanced too rapidly before the car has picked up speed

the acceleration will be jerky and power may be wasted—unskillful manipulation of the Controller may cause the Circuit Breaker to open automatically involving loss of time. The Motorman must, however, move the handle smartly between one notch and the succeeding one; a slow hesitating movement between notches tends to draw an arc between the fingers and segments, and seriously affects the working of the Controller.

(f) The handle of the Controller must not be allowed to remain between the Series and Parallel positions when applying or shutting off power; neither must the handle be kept longer than is necessary at the Resistance or Acceleration notches, otherwise time may be lost, power will be wasted and the equipment may be damaged. If, however, it be necessary to operate a Car with a portion of the motor equipment cut out, the handle of the Controller should be allowed to rest a little longer than is usual at each notch, but in such case, the handle must not be advanced beyond the full Series position.

For general description of the Air Brake and Rheostatic Brake, see Instructions 90 to 98.

(g) The handle of the Controller must not, in any circumstances, be turned backwards by one or more notches in order to reduce the car speed; if the Motorman should require to run on an earlier notch than that on which he is operating, he must place the handle to the "Off" position by a quick movement and then advance it to the required notch as if he were starting.

(h) The handle of the Controller or Air Brake must not be used for any other than its regular and authorised purpose.

(i) The Motorman must, as far as possible, avoid waste of electrical energy, but this economy must always be subordinate in importance to Safety and Dispatch.

(i) Coasting on any falling grade is prohibited, unless power from the Contact Wire is at the same time available.

When coasting, the Trolley must, except as prescribed in Instruction 111, be kept on the Contact Wire with the Main Controller handle held at the "Off" position.

(ii) With a view to economy in the Consumption of current, the Motorman must, subject to sub-clause (i) take

advantage of opportunities for coasting; and to minimise unnecessary wear in the running gear and Brakes, he should, if time permit, when stopping for passengers shut power off as far as possible from, and coast to, the Stopping Place. (See also clause (e), Instruction 86.)

84. Faults Likely to Arise in Electrical Equipment.—

(a) In the event of a car failing to start when the handle of the Controller is operated in a proper manner, the Motorman must follow the procedure set out hereunder:—

(i) See that the Trolley makes contact with the Contact Wire.

(ii) See that the Circuit Breaker is closed. In the case of a One-man type car, the opening of the Circuit Breaker may have been caused by the Emergency Valve operating, resulting in an irregular application of the Air Brakes. The Motorman must close the Circuit Breaker and with the Controller in the "Off" position and the Air Brake handle in the Release position hold the "Dead-man's" handle depressed for about 40 seconds.

(iii) Ascertain whether power is on the overhead conductors by switching on the car lights; if the lights do not appear the Motorman must arrange for a good electrical contact, between the rail and a rear wheel of the car, by means of the Motorman's Insulated Ground Wire being made. (See also clause (d), Instruction 100). If the lights then appear the Motorman must operate the Controller in the ordinary manner, and if the car should still fail to move, it must be regarded as disabled and dealt with accordingly; if, however, the lights do not appear, it may be assumed that power is off the overhead Conductors, and the Motorman must allow the Lighting Switch to remain On and wait until the power is restored.

(b) In the event of the car becoming temporarily charged with electricity, owing to a dirty rail, no passengers must be permitted to alight from or board the car until it has safely passed over such rail, and action must be taken to prevent intending passengers or others from touching any portion of the car, as an Electric Shock may be received.

If the car has become permanently charged, the Trolley-pole must be lowered at once, and secured clear of the overhead equipment; the passengers must then be requested to proceed by another car, and the empty car must be returned to the Car Shed as soon as possible.

(c) A defective motor or Controller may cause the Circuit Breaker to open. A "short circuit" on No. 1 motor of a Single-truck Car, or on No. 1 group of motors on a Bogie Car, will open the Circuit Breaker before the last Series position of the Controller is reached, but a "short circuit," on No. 2 motor on a Single-truck Car or on No. 2 group of motors of a Bogie Car may not open the Circuit Breaker until after the first Parallel notch of the Controller is passed; if, due to this cause, the Motorman cannot move the car, he must proceed to locate and cut out the defective motor, or group of motors, or Controller, as follows:—

- (i) See that the Controller is at the "Off" position.
- (ii) Open the Circuit Breaker.
- (iii) Open the Controller apron and cut out the motor or group of motors that are considered defective.
- (iv) Close the Controller apron and the Circuit Breaker and try to start the car in the usual manner.

(d) If, after the above procedure, the fault should still exist, the Motorman must again connect the motor or group of motors in circuit, and then proceed as before to cut out the other motor, or group of motors, and again try to start the car. If the fault remain, it is probably in the Controller, and the Motorman must endeavour to start the car from the Controller at the rear end of the car. (See clause (g)). If, however, the fault still remain, try each motor or group of motors separately with the rear Controller; if the car will not then start it must be considered as disabled, and dealt with accordingly.

(e) **Power off Overhead.**—In the event of the power failing or its being cut off, THE MOTORMAN MUST PLACE THE CONTROLLER HANDLE TO THE "OFF" POSITION, stop the car, switch on the Lighting Circuit, and watch for the lights to appear.

(f) When power is restored, the Motorman must make every endeavour to avoid throwing too great a load upon the Sub-station, as this may cut the power off again and cause

further delays. With a view to avoiding this liability, Motormen of Up Cars only may take power at once; Motormen of Down Cars must wait thirty (30) seconds before starting.

(g) **Defective Controller.**—If the handle of the Controller should become jammed in any attempt to place it to the "Off" position, the Motorman must at once open the Circuit Breaker and apply the Brake to stop the car; he must then open the apron of the Controller and the Arc Shield, and search for, and remedy any loose finger, loose segment, or loose screw that may be found, and before closing the Circuit Breaker the Motorman must replace the apron of the Controller, and see that the Controller is at the "Off" position. (See Instruction 82.)

(h) In the event of the front Controller becoming defective the Motorman must turn the handles of this Controller to the "Off" positions, open the Circuit Breaker at that end, and, after seeing that the Circuit Breaker at the opposite end of the car is closed, place the Reverser to the Reverse position and proceed to drive from the Controller at that end of the car.

In every case in which it becomes necessary to drive a car from the rear Controller the Motorman must first arrange for the Conductor to ride in the front cab, and the Conductor must protect traffic by ringing the Gong as prescribed for the Motorman, and transmit the necessary Bell signals to the Motorman; the speed of the car must not exceed a rate of ten (10) miles per hour. In the case of a One-man type car, arrangements must be made for a competent employe to accompany the car and act as laid down for the Conductor.

(i) **Thunderstorms.**—Where a Thunderstorm is in proximity to the track the Motorman must, if the electric lamps are not alight, close the Lighting Switch in order to minimise risk of damage to the car or equipment.

Except in a case of extreme urgency the Circuit Breaker must not be opened by hand when in the vicinity of a thunderstorm, and in the event of the Circuit Breaker opening automatically, the Motorman must at once close it.

85. Speed of Cars.—(a) The Motorman must regulate the running of the car so as to maintain the Time-table, and as far as practicable he must avoid extremes in speed.

(b) The maximum rate of speed, i.e., the highest rate of speed allowed for any car on the Electric Street Railways or

on any mile or portion of a mile thereof, is 25 miles per hour ; but at the localities mentioned hereunder the speed must not exceed the rate specified for each particular place :—

LOCALITY.	Maximum Rate of Speed
ON ANY LINE—	
When entering or leaving the Car Shed	5
When entering, leaving, or on, any Crossing Loop, Turnout or Cross-over road	
When passing over any Tramway intersection	
When passing over Points in the vicinity of the Car Shed	
When testing the Brakes on taking a Car into Service ; see clause (c), Instruction 76	10
ST. KILDA-BRIGHTON LINE—	
When passing in either direction around the following curves, viz. :—	10
Grey Street and Barkly Street	
Barkly Street and Mitford Street	
Mitford Street and " Broadway "	
" Broadway "—Ormond Road	
Ormond Road—St. Kilda Street	15
Between Young Street and Grosvenor Street on St. Kilda Street, and on Down side of Canterbury Street	
On any curve not specified above	
When descending the grades on—	10
Grey Street, between Fitzroy and Inkerman Streets	
SANDRINGHAM-BLACK ROCK LINE—	
When passing around any curve	10

(c) The Motorman must not take his car within 100 yards of a preceding car, unless the speed of his car be such as to enable him to stop clear of the preceding car by means of the Hand Brake only.

(d) The Motorman must approach every Tramway Intersection or Terminus at such a rate of speed as will enable him, if necessary, to stop at the proper place by means of the Hand Brake only. (See also clause (e), Instruction 86).

(e) During and after heavy wind or rain the Motorman must be on the look out for Stones, Gravel, Sand, etc., which may have drifted on to the track and must reduce speed where necessary to ensure safe and smooth running ; where the car

has to pass over water or slush, the speed must be reduced. If it be practicable to coast at such places the Motorman must cut off power. (See clause (i), Instruction 83).

(f) During foggy weather when the Motorman cannot clearly see a safe distance ahead, the car must be run at such a rate of speed as will enable him to stop clear of any obstruction ; the Head and Tail Lamps must be lighted and kept burning.

86. Compulsory and Conditional Stopping Places.

(a) **COMPULSORY STOPPING PLACE.**—A Compulsory Stopping Place is one at which EVERY car must be brought to a stand, irrespective of whether passengers require to board, or alight from the car.

NOTE.—It must be distinctly understood that all cars must stop at Compulsory Stopping Places.

(b) **CONDITIONAL STOPPING PLACE.**—A Conditional Stopping Place is one at which, provided the Line be clear, the Motorman must not stop except when necessary to pick up or set down passengers.

(c) Compulsory and Conditional Stopping Places are indicated by Printed Signs or by coloured lights ; the respective indications are as follow :—

(i) **Compulsory Stopping Place.**—By a Sign lettered "CARS STOP HERE," or by a Red Light.

(ii) **Conditional Stopping Place.**—By a Sign lettered "HAIL CARS HERE," or by a Green Light.

Unless special instructions are issued to the contrary, where a Stopping Place (Compulsory or Conditional) is located at an intersection of public roadways the Motorman must (except as provided in clauses (b) and (h) hereof) bring the car to a stand in line with the buildings on the approach side of such intersection.

(d) Under ordinary circumstances, a car must be stopped for passengers at an authorised Stopping Place only. It must, however, be stopped at any time or place if necessary to prevent accident. If the car be running on time it may be stopped at any safe place to pick up an aged or infirm person, or (in wet weather) to pick up any lady except on a curve or an ascending grade.

The Motorman must not slow down to allow any passenger to board or alight from the car between Stopping Places.

A car must not be stopped to pick up or set down a passenger at any point at which the track or roadway is broken

or disturbed, or where any obstruction is near the track, or at any other place where the conditions appear to be unsafe to passenger or car. If the obstruction be at a Compulsory Stopping Place, the Motorman must not overrun the Stopping Place but must stop short and there pick up or set down the passengers.

(e) The Motorman must be careful not to overrun, or stop short (unless there is an obstruction as referred to in (d) above), of any Stopping Place; in determining when to shut off power and apply the Brakes, he must take into consideration the grade, the state of the weather, the condition of the rails, and the load. When approaching any Stopping Place occupied by the preceding car the Motorman must regulate the speed of his car so as to enable it to arrive at the vicinity of the Stopping Place as the preceding car moves away, or to be stopped clear of such car as the circumstances may require. (See also clause (i), Instruction 83 and clause (c), Instruction 85).

In foggy weather or when from any cause a good view cannot be obtained the Motorman must always expect the preceding car to be standing at the Stopping Place, and he must have his car under control and be prepared to stop clear of the obstruction. (See also clause (c), Instruction 85).

(f) When approaching any Conditional Stopping Place the Motorman must be on the alert to stop if required and bring the car to a stand-still so that the car entrance will be opposite the point at which passengers are waiting.

(g) Before reaching a Conditional Stopping Place, the Conductor must ascertain whether any passenger wishes to alight; if so, he must give the Motorman the "Stop at next Stopping Place" Signal (1 beat) when not less than two pole-spans from such Stopping Place; the Conductor must announce, distinctly, the name of each Stopping Place, not only when approaching it, but also when the car has stopped. When necessary the destination of the car also must be announced.

Passengers may be allowed to ring one beat on the Bell for the purpose of having the car stopped at any Conditional Stopping Place, or for any reasonable cause. The Conductor must, however, be on the alert to observe any request by a passenger to stop the car, and to cancel any improper Bell Signal given

by a passenger; he must assist any lady with children or carrying luggage, and any old and infirm person or cripple to get on or off the car.

(h) When a car is so fully loaded that it cannot accommodate more passengers, the Conductor in charge may by giving the prescribed Bell Signal (4 beats; given thus—2 pause 2) authorise the Motorman to run past **Conditional Stopping Places**; but the Conductor must exercise care to see that no passenger is over-carried; in any instance in which such course is necessary the Motorman must sound his Gong and the Conductor must call out "Full Car" when passing Conditional Stopping Places. The Motorman must promptly report every case of unusually heavy loading, so that, if necessary, arrangements may be made for dealing with the extra traffic.

(i) Except in the case of a "Through" car the Conductor must announce distinctly the name of each Street and the end of each Fare Section, and immediately after a Street has been passed, he must announce the name of the Street next in advance. In the case of a "Through" car that is scheduled to run through a **Conditional Stopping Place**, the Conductor must, on the occasion of each stoppage, announce where the next ordinary stop will be made.

87. Tramway Intersections.—(a) When approaching any intersection at which the Line crosses a Tramway track the Motorman must exercise due care to avoid over-running the Stopping Place on the approach side of the intersection.

(b) If when approaching an intersection the car should, from any cause, be stopped before reaching the Stopping Place, the Motorman, on receipt of the Conductor's Signal to start, must go slowly forward and bring his car to a Stand at the Stopping Place.

(c) When a Railway Car and a Tramway Car arrive at an intersection at or about the same time, precedence must be given to the car that is first ready to pass over the intersection. The Motorman must not attempt to start from the Stopping Place unless the proper signal is given for his car to proceed.

(d) After starting from the Stopping Place on the approach to any Tramway Intersection, the Motorman must exercise care, operate his Car across the Intersection at reduced speed (not exceeding five (5) miles per hour), and be on the alert to stop immediately in case of emergency.

(e) The Motorman must shut off Power whilst the Trolley is passing under the Overhead Intersection, and likewise when passing under any Section Insulator. (See also Instruction 80).

88. Shunting, etc., at Depots, Car Sheds and Reversing at Termini.—(a) Before any Shunting Operation is commenced, due care must be exercised to see that all Facing Points are properly set. Each vehicle being shunted must be so controlled as to stop it clear of any obstruction and to avoid accident. Care must also be taken to see that the car is not left where it will foul other movements or any Stop-block or other appliance used by the Shed Staff. When placing any car against another the employe in charge must so regulate the movement that the standing car will not be damaged or displaced.

No car must be left unattended unless it is properly secured by Hand Brakes or Chocks. The Air Brake must not be relied upon to secure a car.

(b) When any car is being taken into Service or when, for any other purpose, a car is to be taken from the Car Shed to a Running Line, care must be taken to guard against any conflicting movement. The Running Line must not be fouled after any car has arrived at the nearest Stopping Place unless the movement is protected by a Red Hand Signal in one or both directions as the circumstances may require. The Motorman must see that all Facing Points are properly set.

(c) When taking a car into the Shed the Motorman must see that all Facing Points are properly set, and as soon as the car is well clear of the Main Running Line he must secure his car and re-set the Points for the Running Line and then work his car slowly and cautiously into the Shed; unless otherwise provided, the Motorman must take the removable handles from the Controller and lay them on the top of the Controller, open the Circuit Breaker, secure the car by means

of the Hand Brake, open the Compressor Cut-out Switch and see that the Trolley is lowered clear of all overhead electrical equipment.

(d) (i) When a car is stabled on a dead-end track in the Car Shed or elsewhere it must, unless instructions are issued to the contrary, be placed as near as possible to the dead-end. The Motorman must, before leaving, test the lights to see that the contact with the rail is good.

(ii) The Officer-in-Charge must issue Special Instructions as to the disposal of the Controller, Air Brake and Door Operating Handles by the Motorman when an "Off" car is allowed to stand unattended at St. Kilda or Sandringham.

(e) Care must be taken not to reverse the position of Facing Points until the car has cleared them.

When shunting from one Line to another, the Motorman must see that the Points are properly set, and that the movement can be carried out with safety. Except in a case of emergency, a car must not be stopped on Points unless they are set for the track on which the car is running. In every instance in which a car is brought to a stand on trailing points not set for the track it is on, the Motorman and the Conductor before setting back, must see that the whole of the car is drawn over the Points or that the Points are reversed.

(f) (i) When nearing a terminus the Motorman should reverse the Destination sign for the return journey. When the car has been stopped at the terminus, the Motorman must obtain the removable handles of the Controller, Air Brake and Door Operating Valve (where provided), and unless otherwise arranged, retain them in his possession. He must then arrange the Tail Light for the return journey. He must then, subject to clause (h), Instruction 79, place the trailing Trolley on the Contact Wire, after which he must proceed to the other end of the car, observe that the leading Trolley-pole has been lowered and secured, place the handles in position, apply the Brake at that end, see that the Head Lights, if required, and Destination sign are correctly shown and, if necessary, signal to the Conductor to release the Hand Brake in the rear.

(ii) In the case of a One-man type car the Motorman must on arrival at Black Rock Terminus open the Centre Doors on the "Up" side, the Centre Doors on the "Down" side being kept closed. On arrival at the Sandringham Station Terminus the Centre Doors on the station side of the car and the end Door on the opposite side must be opened and when all passengers have alighted the end Door must be closed. (See also clause (b), Instruction 28).

(g) Before leaving a terminus the Motorman must carefully feel the axle bearings for any sign of abnormal heating, and, in the event of abnormal heating, must telephone to the Officer-in-Charge for instructions; he must report any instance of hot bearings on the first occasion on which he arrives at the Depot.

(h) The Motorman must see that the Lifeguards are in the correct position before starting from any terminus, and must avoid running over any obstruction which is likely to cause them to fall unnecessarily; the Lifeguards must not be lashed up whilst in service, and any car having a damaged or incomplete Lifeguard must be changed over as soon as possible. (See also Instruction 53). Every instance in which a Lifeguard falls whilst a car is in service must be reported by the Motorman.

(i) On arrival at a terminus, the Conductor must carry out the following duties, and as far as practicable, in the order mentioned:—

- (i) Announce the name of the terminus and next destination.
- (ii) Arrange the front Oil Light and front and side Destination signs for the return journey.
- (iii) Reverse the Trolley-pole of a single truck car or lower the Trolley-pole that will be leading on a Bogie Car. (See clause (h), Instruction 79 and clause (k) hereof).
- (iv) Enter up the Running Journal.
- (v) Release rear Hand Brake (if applied) upon receiving signal from Motorman. (See clause (b), Instruction 106).
- (vi) Signal to Motorman to proceed in sufficient time to enable him to start, if practicable, at the scheduled time. (See clause (g), Instruction 106).

(j) The Conductor must not leave his car at a terminus until every passenger has alighted, and when reversing the side barriers, if provided, he must be careful not to touch, obstruct, or inconvenience any passenger.

(k) To avoid extinguishing the car lights—in the case of a car with two Trolley-poles, the trailing Trolley should be placed on the Contact Wire before the leading Trolley-pole is lowered, if by so doing the Trolleys do not make contact one on each side of a Section Insulator. If a Section Insulator be present one Trolley must be lowered before the other is raised. If during a period of darkness any passenger attempt to board the car whilst the lights are extinguished, the Conductor or Motorman must call out "Wait for the Lights, please." (See clause (k), Instruction 79).

(l) Between sunset and the time of departure of the last Up car, Carmen must see that the lights are displayed at the Compulsory and Conditional Stopping Places. (See clause (c), Instruction 86). Should any light become extinguished when its use is required, the Carman observing it must promptly report the fact to the Officer-in-Charge.

89. Car Stopped by Accident, Failure, etc.—(a) Should an accident cause a car to foul, or to be dangerously close to any adjacent Line, immediate steps must be taken by the Motorman to have such Line protected by sending a competent employe forward at least 150 yards to stop the first car approaching on such Line.

In the case of a One-man type car, when operated under One-man conditions, and no competent employe is available to protect the adjacent Line, the Motorman himself must perform such protection. (See also clause (c), Instruction 47).

(b) When an accident occurs the senior employe present at the scene must send a "Flash" report of the occurrence to the Officer-in-Charge by the most expeditious means available; the Flash message should state concisely the character and locality, and whether any injuries or damage have been caused.

Reports relating to derailments must state the number of the car, the time, place, speed, cause of derailment (if possible), whether No. 1 or No. 2 end of the car was first derailed, whether leading or trailing, whether on a curve or at Points, and the extent of damage, if any, caused to rolling-stock.

The employe receiving a Flash message must at once communicate the particulars to the Officer-in-Charge, and as soon as possible the particulars available must be sent to the Metropolitan Superintendent, District Engineer, Overhead Superintendent, and (as laid down in the General Appendix Instructions for Reporting Accidents) to the Head Office, Spencer Street.

The Officer-in-Charge must proceed to the scene of accident by the most expeditious means and supervise arrangements.

(c) In any instance in which a car is disabled or unsafe to run, the passengers (if any) must be removed and transferred to another car as circumstances permit. Any car which has been derailed must be changed over for examination when it next arrives at the Depot.

(d) Two Lifting Jacks, with the necessary blocks, are provided on each Bogie Car, and one on each Single-truck car, for use as may be required in case of accident or emergency.

The jacks, which are portion of car equipment, are numbered to correspond to the distinguishing number of the car to which they are allotted, and, immediately after use, must be replaced on their proper car. Each Motorman must inspect, daily, the jacks on his car, and report any shortage or defect.

No time must be lost in re-railing a derailed car, but jacks must not be used if the car can be drawn or worked, without damage, on to the track.

(e) Every employe who is available, whether on or off duty, must render prompt assistance in the event of an accident. In any case in which a car is derailed or disabled, the Officer-in-Charge must make the necessary arrangements regarding relief of employes.

(f) In the event of a car becoming disabled on a Double Line and requiring the assistance of another car from the rear, the Motorman must instruct his Conductor to stop such car and verbally instruct the Motorman thereof to proceed to the disabled car and push it to the nearest Depot or other place where it can be shunted out of the way; the speed must not exceed 10 miles per hour while the car is being pushed. The Motorman of the disabled car must ride in front of his car and signal to the Motorman of the assisting car by means of the rear bell.

(g) If Relief can be more readily obtained from the advance, the Motorman of the disabled car must fill in a "Wrong Line Order," Form (as per specimen at end of this instruction),

and hand it to his Conductor, with instructions to proceed to the first cross-over road in advance and hand the "Wrong Line Order" to the Motorman of the car which is to be used for Relief purposes, and to accompany such Motorman to the point at which the disabled car is standing. The Relief Car must be operated at reduced speed and must carry a Red Head Light at night. The Motorman of the Relief Car must keep a sharp look-out for the disabled car.

The "Wrong Line Order," when properly filled in, is sufficient authority for a Motorman to run his car in the Wrong direction from the nearest cross-over ahead of the disabled car for Relief purposes.

The Motorman of the disabled car must see that, at night, a Red light is exhibited on the front and rear of his car.

(h) In the case of a One-man type car, when operated under One-man conditions, the Motorman, after securing his car (see clause (c), Instruction 47) must act as laid down for the Conductor in this instruction.

(i) The Motorman of the disabled car must not allow his car to be moved until the Relief car arrives, unless satisfactory arrangements have been made to prevent the Relief Car from coming to his assistance, and when a written order has been issued, until the man to whom the order was given has returned and handed the order back to the Motorman.

Specimen Wrong Line Order Form referred to in clause (g) of Instruction 89.

ELECTRIC STREET RAILWAYS.

MOTORMAN'S WRONG LINE ORDER.

To the Motorman of car at.....
My car is disabled at.....and
I require your car to come to my assistance on the Wrong
Line. I will not allow my car to be moved until the
arrival of your Relief Car.

(Signed).....Motorman of Disabled Car.

Car Number.....

(Date).....19..... (Time issued).....

Countersigned.....Motorman of Relief Car.

Date..... Time Order Received.....

AIR AND BRAKE APPARATUS.

90. The Air and Brake Apparatus covers the Hand Brake, Air Brake, Sander, Windscreen Wiper, and in certain cars, the Door and Circuit Breaker Operating Mechanisms.

91 (a) The arrangement of the Air and Brake equipment for Cars other than the One-man type is shown on diagram No. 2, and the chief appliances are as specified hereunder:—

Compressor Cut-out Switch and Fuse.

Compressor Governor.

Air Compressor and Motor.

Main Reservoir and Safety Valve.

Pressure Gauge.

Motorman's Brake Valve.

Conductor's Brake Valve.

Brake Cylinder.

Sanders.

Windscreen Wipers.

(b) **Compressor Cut-out Switch and Fuse.**—This is a single-pole switch connected in the power circuit on the Trolley side of the Circuit Breaker, and when closed, it supplies power to the Compressor Motor, provided the contacts of the Compressor Governor are closed.

The Fuse is provided for the protection of the electrical equipment of the Compressor Circuit in the event of a short circuit or an excessive load. Under normal Conditions the Compressor Cut-out Switch must be kept closed. (See Diagram No. 1).

(c) **Compressor Governor, Air Compressor, Motor and Main Reservoir.**—The Compressor Governor is an air-operated electrical switch connected between the Compressor Cut-out Switch and the Compressor Motor. It automatically controls the operation of the Compressor Motor, and thus governs the working of the Air Compressor. When owing to an application of the Air Brake or due to leakage, the Air-pressure in the Main Reservoir falls below a predetermined limit (60 lb. per square inch) the contacts of the Compressor Governor close automatically and thus complete the electric circuit through the Compressor Motor and start the Air Compressor. When by the operations of the Air Compressor the pressure in the Main Reservoir is increased to 70 lb. per square inch, the

contacts of the Compressor Governor open automatically, de-energise the Compressor Motor and stop the Air Compressor.

(d) **Main Reservoir and Safety Valve.**—The **Main Reservoir** is for the storage of air compressed by the Air Compressor. Connected to the Main Reservoir is the **Safety Valve**—The function of the Safety Valve is to prevent the pressure in the Main Reservoir from exceeding a predetermined maximum in the event of the Compressor Governor

Page 58, Instruction 91. First paragraph, clause (a) to read:—

“The arrangements of the Air and Brake equipment for cars other than the One-man type are shown on Diagrams Nos. 2 and 2A, and the chief appliances are as specified hereunder:—”

Page 59, Instruction 91. Add the following to clause (e):—

“Cars 52, 53 and 54 (see Diagram No. 2A) are fitted with a Duplex Air Pressure Gauge in each Driving Compartment. The Red Pointer of the Gauge indicates Main Reservoir Pressure and the Black Pointer Straight Air Brake Pressure. Other Bogie Cars will be similarly equipped.”

position, a small Air port admits air from the Main Reservoir to the Brake Cylinder, producing a gradual application of the Brake for an ordinary stop. (See Instruction 96).

(ii) **Emergency Position.**—When the handle is placed to the Emergency Application Position, a large port is opened, and the air passing from the Main Reservoir to the Cylinder, applies the Brake almost immediately. For other forms of Emergency Braking, see Instruction 97.

(iii) **Neutral or Lap Position.**—When the handle is at the Neutral Position all air ports are closed, and there is no communication between the Main Reservoir, the Brake Cylinder and the atmosphere. If compressed air is admitted to the Brake Cylinder and the Motorman's Brake Valve is then moved to the Neutral Position, the Brake will be held on until such time as the compressed air escapes by leakage.

(iv) **Release or Running Position.**—When the handle is placed to this position a port is opened through which the compressed air exhausts from the Brake Cylinder to atmosphere, and the Brake is thus released. This is the normal position whilst running.

(g) **Conductor's Brake Valve.**—The Conductor's Brake Valve is provided on Bogie Cars only, except the One-man type. By opening this Valve an Emergency Air application is produced. It must not be opened whilst the car is in motion, except the Conductor become aware that the Motorman is from any cause incapacitated, or any similar case of emergency. (See also clause (b), Instruction 97).

(h) **Sanders.**—To operate the Sanders, air is taken from the Main Reservoir through an isolating valve and a reducing valve to the Sanding Air Pipe Reservoir. The Air is then taken to each end of the Car and thence through operating valves to the Sanders.

(i) **Windscreen Wipers.**—The air supply to the Windscreen Wipers is taken from the Main Reservoir Pipe and the action of each Wiper is controlled by an operating valve.

(j) **Pneumatic Doors.**—In addition to the above equipment some bogie cars are provided with pneumatically operated doors under the control of the Motorman. (See Diagram No. 4).

By means of a four position Rotary Valve with removable handle the Motorman is able to open the two "On" side doors, the two "Off" side doors, or all doors as required. To prevent the escape of air at the non-driving end when air is admitted to the Door Engines, a double Check Valve is installed in the piping to each pair of doors. Each Valve consists of a Piston in a Cylinder which is forced over when air is admitted to one end of the Cylinder, thus allowing air to pass to the Door Engines by way of a central port but preventing air passing through the Cylinder to the other end.

A Door Engine is mounted over each of the four doors and consists of a Piston in a long Cylinder. To one end of the Cylinder, through which the Piston rod extends, air at Main Reservoir pressure is always applied. The Piston rod is attached to the top of the door so that the movement of the Piston in the Cylinder operates the door.

In order to obtain the most efficient braking performance

Page 60, Instruction 91. Add the following as an additional Instruction to clause (f) and insert on page 60 following section (iv):—

"The Motorman's Brake Valve on Cars 52, 53 and 54 is of the Self-lapping Type and other Bogie Cars will be similarly equipped.

The Self-lapping Brake Valve has 3 operating positions, viz:—

Release Position

Service Position

Emergency Position (Handle off).

It is operated in conjunction with a **Relay Valve** which provides very rapid rates of application and release and also automatically maintains Brake Cylinder pressure against leakage, provided normal pressure exists in the Main Reservoir.

Brake Cylinder during a brake application and from the Brake Cylinder direct to the Exhaust Silencer during the Release, thereby providing very rapid operations of the Brake".

Page 60, Instruction 91. Add the following as a second paragraph to clause (g):—

"There is no Conductor's Brake Valve on Cars 52, 53 and 54."

Page 60, Instruction 91, clause (h):—

Delete the words "reducing valve" in the second line and in lieu thereof insert the words "Duplex Check Valve."

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By means of a four position Rotary Valve with removable handle the Motorman is able to open the two "On" side doors, the two "Off" side doors, or all doors as required. To prevent the escape of air at the non-driving end when air is admitted to the Door Engines, a double Check Valve is installed in the piping to each pair of doors. Each Valve consists of a Piston in a Cylinder which is forced over when air is admitted to one end of the Cylinder, thus allowing air to pass to the Door Engines by way of a central port but preventing air passing through the Cylinder to the other end.

A Door Engine is mounted over each of the four doors and consists of a Piston in a long Cylinder. To one end of the Cylinder, through which the Piston rod extends, air at Main Reservoir pressure is always applied. The Piston rod is attached to the top of the door so that the movement of the Piston in the Cylinder operates the door.

In order to obtain the most efficient braking performance it is necessary that the brake should be applied at the commencement of the stop with the maximum force required by circumstances and to then graduate the cylinder pressure off as the stop progresses so that a uniformly high rate of braking is maintained during the stop without the liability of wheel skidding or discomfort to passengers. With the Self-lapping Brake Valve this operation can be readily accomplished as the pressure developed and maintained in the Brake Cylinder depends only upon the position of the Brake Valve Handle. In making a brake application, therefore, it is only necessary to move the handle towards Service Position as required to retard the speed of the car and then move it back gradually towards Release Position as the stop progresses with the object of completing the stop with the minimum Brake Cylinder pressure necessary. "Fanning" of this type of Brake Valve is detrimental to a good stop, and is a waste of compressed air.

A **Relay Valve** is fitted in the pipe line between the Main Reservoir and the Brake Cylinder, and is connected by a pipe to the Motorman's Self-lapping Brake Valve. Under the control of the Brake Valve, the Relay Valve permits Main Reservoir pressure to pass direct to the Brake Cylinder during a brake application and from the Brake Cylinder direct to the Exhaust Silencer during the Release, thereby providing very rapid operations of the Brake".

Page 60, Instruction 91. Add the following as a second paragraph to clause (g) :—

"There is no Conductor's Brake Valve on Cars 52, 53 and 54."

Page 60, Instruction 91, clause (h) :—

Delete the words "reducing valve" in the second line and in lieu thereof insert the words "Duplex Check Valve."

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Page 61, Instruction 91. Add the following as new clauses (k) and (l) :—

“(k) **Double Check Valve.**—A Double Check Valve is fitted in the Straight Air Brake Pipe Line on Cars equipped with the Self-lapping Brake Valve in order to confine Brake Valve control to the driving compartment”.

“(l) **Duplex Check Valve.**—The Duplex Check Valve is fitted in the pipe line between the Main Reservoir and the Sanding Air Reservoir. Its purpose is to prevent the Main Reservoir pressure being reduced to a low value by the excessive use of the Air Sanders, or by air leakage from the Sanding Air Reservoir or its pipe connections. The Duplex Check Valve has two air valves, the lower or feeding valve is adjustable and is so arranged that air pressure in the Main Reservoir must be at least 40 lbs. per square inch before the valve functions to supply air to the Sanding Air Reservoir. The Upper Valve permits the compressed air to return from the Sanding Air Reservoir to the Main Reservoir when the pressure in the latter is for any reason less than that in the former and in this way permits of the Sanding Air Reservoir being utilized as a supplementary Reservoir for the Air Brake and other air-operated equipment.”

Diagrams. Insert new Diagram No. 4 in back of book in lieu of existing Diagram No. 4.

Insert new Diagram No. 2A in back of book.

Amend the words “Reducing Valve” shown on Diagrams Nos. 2 and 3 to read “Duplex Check Valve.”

When the Motorman desires to close the doors he admits air to the other end of the Cylinder by an operation of the Rotary Valve. As the area of the Piston in contact with the air is greater on this side than on the side which has air pressure constantly applied, the Piston is forced over to the "door closed" position. To open the doors the Motorman must return the Rotary Valve to the "door open" position, thus opening a port which exhausts the air from one end of the Door Engine Cylinder to atmosphere. The air pressure on the other end of the Cylinder then forces back the Piston to the "door open" position.

92. Air and Brake Equipment of One-man Type Cars.—

See Diagram No. 3.—(a) In addition to the Air and Brake equipment, as described in Instruction 91 (a) to (i), One-man type cars have the following equipment:—

- Dead-man's Device on Controller.
- Double Check Valve.
- Pilot Cut Off Valve.
- Emergency Valve.
- Circuit Breaker Cylinders.
- Door Operating Valves.
- Door Selection Cocks.
- Valve Pullers.
- Door Engines.
- Doors and Steps.

(b) **Dead-man's Device.**—This is incorporated in a special cover substituted for the cover employed on the K. 35 type Master Controller. It embodies an Air Valve operated by depressing the Controller handle against the action of a return spring. Air from the Main Reservoir Pipe passes through the Valve to the Safety Control Pipe when the handle is depressed and air from the Safety Control Pipe is exhausted to atmosphere when the handle is released.

It is necessary for the Motorman to hold the Controller handle depressed except when the Air Brake has been applied.

(c) **Double Check Valve.**—The function of this Valve is to isolate the Safety Control Pipe at the end from which the car is not being operated and so prevent it being exhausted to atmosphere at the Controller at that end. It consists of a

Piston in a Cylinder to which the Safety Control Pipe is connected at both ends—one pipe going to No. 1 end of the car and the pipe at the other end of the Cylinder going to No. 2 end. A pipe at the top of the Cylinder is taken to the Pilot Cut Off Valve.

When the Controller handle is depressed after the Motorman changes ends, air at Main Reservoir pressure is admitted to one side of the Piston of the Double Check Valve, forcing it over and permitting the air to pass through the top port to the Pilot Cut Off Valve. At the same time the Safety Control Pipe leading to the other end of the car is isolated from the top port.

(d) **Pilot Cut Off Valve.**—The function of this Valve is to allow the Motorman to remove his hand from the Controller handle if the Air Brake has been applied. It consists of a spring loaded Valve which is operated when air pressure is admitted to the Straight Air Pipe by the operation of the Motorman's Brake Valve. The operation of the Pilot Cut Off Valve prevents the passage of air between the Emergency Valve and the Double Check Valve, thus permitting the Safety Control Pipe to be exhausted, when the Air Brake has been applied, without exhausting air from the Emergency Valve and causing the latter to operate.

(e) **Emergency Valve.**—The Emergency Valve consists of a Piston, a Slide Valve operated by the Piston, and also a Relay Valve. Air from the Main Reservoir is admitted to the back of the Piston and also to the top of the Slide Valve. From the front side of the Piston the Emergency Pipe is taken for the operation of the Pneumatic Doors.

Within the Emergency Valve a port leads from the Emergency Pipe Port to both ends of the chamber in which the Relay Valve is situated. A port also connects the pipe from the Pilot Cut Off Valve to this chamber. From below the seat of the Relay Valve a pipe is taken to the Circuit Breaker Cylinders.

The Slide Valve connects ports from the Straight Air Pipe and Brake Cylinder Pipe when the Piston is in the normal position and when it is in the Emergency position air from the back of the Piston is connected to the port leading to the Brake Cylinder Pipe. The operation of this Valve is as follows:—

When the Controller handle is depressed by the Motorman

and the Motorman's Brake Valve placed in the Release position, the Safety Control Pipe is charged with air at Main Reservoir Pressure which enters the Emergency Valve and passes to the top of the Relay Valve Piston which is forced on to its seat against a spring and closes the port which connects the Emergency Pipe to the Circuit Breaker Cylinders. Air then flows through a groove alongside the Relay Valve into a port leading to the Emergency Pipe which is gradually charged with air. This air pressure is also applied to the front of the Emergency Valve Piston which has air direct from the Main Reservoir always at the back of it in the chamber in which the Slide Valve is situated.

When sufficient pressure has built up in the front of the Piston, it throws and uncovers a port which connects the Main Reservoir to the front of the Piston and thence to the Emergency Pipe. At the same time the Slide Valve is operated and connects the Straight Air Pipe to the Brake Cylinder so that normal operations of the Brake can be performed by the manipulation of the Motorman's Brake Valve. When, however, air pressure is reduced in the Safety Control Pipe the Relay Valve operates and uncovers the port which exhausts the Emergency Pipe to atmosphere via the Circuit Breaker Cylinders. Pressure is thus reduced on the front of the Emergency Valve Piston which throws and carries with it the Slide Valve thus connecting the air at Main Reservoir Pressure in the Slide Valve chamber to the port leading to the Brake Cylinder Pipe.

In order to prevent a drop in pressure in the Emergency Pipe, and consequent operation of the Emergency Valve, when two or three door engines are operated at the same time a small Air Reservoir is placed in the Emergency Pipe Line.

(f) **Circuit Breaker Cylinders.**—One cylinder is located adjacent to each Circuit Breaker handle. When the Emergency Valve operates, the air from the Emergency Pipe is admitted to each Circuit Breaker Cylinder, thus forcing forward a Plunger which hits against the Circuit Breaker handle causing power to be cut off from the Controller. When the Plunger is extended the air is exhausted to atmosphere.

(g) **Door Operating Valves.**—Foot operated Valves are installed at each end of the car. They consist of two Plungers (one of which is removable) placed side by side. Pressing down

one Plunger permits air from the Emergency Pipe to pass to the pipe leading to the door engine Valve Pullers. Pressing down the other plunger exhausts the pipe from the Valve Pullers to atmosphere.

(h) **Door Selection Cocks.**—The valve puller for the door to the left of the Motorman is permanently connected to the door operating valve at that end of the car. The two centre doors can be isolated or selected by cocks placed in the pipe lines leading to these doors.

(i) **Valve Pullers.**—Each Door Engine is equipped with a Valve Puller which determines to which side of the Door Engine Piston, air is admitted.

The Valve puller consists of a Spring loaded Piston in a Cylinder to which air is admitted by means of the Door Operating Valve. The air pressure forces over the Piston against the compression of the spring. The resultant movement of the Piston Rod is transmitted by a connector link to the arm of the Door Engine Rotary Valve. When air is exhausted by further operation of the Door Operating Valve the spring returns the Piston carrying with it the connector link and the operating arm of the Door Engine Rotary Valve.

(j) **Door Engines.**—The Door Engine consists of two Pistons rigidly connected by a shaft in which teeth are cut to form a rack which engages a quadrant attached to the lever operating the doors. The Pistons are situated in opposing Cylinders to which air is admitted as determined by the position of a Rotary Valve.

When air is admitted to the Valve Puller the resultant movement of the Rotary Valve arm causes air from the Emergency Pipe to pass through the Rotary Valve to one Cylinder, forcing over that Piston and the racked shaft. The quadrant is thus rotated and the doors open.

When air is released from the Valve Puller the Door Engine Rotary Valve is operated causing air to be exhausted from the Cylinder previously charged and air admitted to the other Cylinder causing that Piston to be forced over reversing the movement of the quadrant, and the doors close.

If air be exhausted from the Emergency Pipe by an operation of the Emergency Valve no air is available for the Door Engine which is then in a state of balance and the doors can be operated by hand.

Isolating Cocks are provided on each Door Engine to cut off the supply of air from the Emergency Pipe when the Door Engine is defective. The defective door can then be operated by hand.

(k) **Doors and Steps.**—The operation of the Door Engine causes a shaft to revolve to which the folding doors are secured thus causing the doors to operate. The shaft is extended below the doors so that its movement will operate a folding step.

93. (a) There are several forms of braking available for controlling a car, viz. :—

- (i) The Hand Brake.
- (ii) The Air Brake.
- (iii) The Rheostatic Brake.
- (iv) The Reserve Power Brake.

(b) **The Hand Brake** operates on the car wheels through the brake shoes and is applied by turning the hand wheel at either end of the car. It is held in position by a foot operated locking device.

The Motorman must Signal the Conductor to apply the Hand Brake where necessary when the car is in motion. Except when necessary to prevent accident, the Conductor must not apply the Hand Brake unless he receive the signal from the Motorman to do so. (See clause (b), Instruction 106).

The Motorman must, by means of the Hand Brake, counteract unsteadiness due to defective Rheostats, but must not, otherwise, start the car whilst the Brake is on.

(c) **The Air Brake** operates by air pressure upon the car wheels and through the same brake shoes as the Hand brake. Details of the Air Brake mechanism are given in Instructions 91 and 92.

When from any cause the Air Brake is inoperative, the speed of the car must be limited to a rate at which the car may be controlled, or, where necessary, stopped by means of the Hand Brake alone; in such circumstances the Hand Brake will form the Service Brake, but in cases of emergency the Motorman must make use of the Emergency Brake. (See Instruction 97).

The handle of the Controller must always be at the "Off" position when a Service Brake is applied.

The Air Brake must not be relied on to secure a car on any gradient.

(d) **The Rheostatic Brake** is operated by converting motors into generators and dissipating the energy by heating the Rheostats in the electrical circuits.

(e) **The Reverse Power Brake** can only be employed on the single truck—two motor—equipment and is operated as detailed in clause (e), of Instruction 95.

94. Bogie Cars.—(a) In the Bogie and One-man type car equipments the separate forms of Braking are as shown hereunder :—

(i) **Service Brake.**—By an ordinary application of the Air Brake or (if the Air Brake be inoperative) Hand Brake. (See clause (b)).

(ii) **First Emergency Brake.**—By Air Emergency Application. (See clause (c)).

(iii) **Second Emergency Brake.**—(One-man type cars only). By Dead Man's Device. (See clause (d)).

(iv) **Third Emergency Brake.**—By using the Motors as Generators. (See clause (e)).

(b) **Service Brake.**—This application, which is used for general purposes, consists of an ordinary application of the Air Brake Apparatus. To apply the Brake the Motorman, after placing the Controller to the Off position, must turn the handle of the Brake Valve to the Service Application position, and when the desired effect has been produced, he must turn the handle to the Neutral position; if the Motorman find that his application is insufficient he must make another, but lighter, application, and again turn the handle to the Neutral position. These operations must be repeated until sufficient pressure has been applied to gradually bring the car to a stand; the Air Brake must be released before the car is actually stopped. (See also Instruction 96).

(c) **First Emergency Brake.**—The First Emergency Air Brake is applied by placing the handle of the Brake Valve to the Emergency Application position, and applying sand to the rail. (See Instruction 99).

(d) **Second Emergency Brake.**—The Second Emergency Brake on One-man type cars is applied by removing the hand

from the Main Controller Handle. This applies the Main Reservoir air pressure directly to the Brake Cylinder.

(e) **Third Emergency Brake.**—The Third Emergency Brake can only be applied by means of the "K35" type of Controller. The Motorman must place the handle of the Controller to the Off position and then place the handle of the Reverser to the position in which an application of power will oppose the motion of the car; the handles must be left in above-mentioned reversed positions until the car has been stopped.

This application is not dependent on the supply of power from the Trolley, and, as it is likely to damage the electrical equipment, must not be used except in cases of extreme urgency.

95. Single-truck Cars.—(a) In the Single-truck car equipment the separate methods of braking are as shown hereunder :—

(i) **Service Brake.**—By an ordinary application of the Air Brake or (if the Air Brake be inoperative) Hand Brake.

(ii) **First Emergency Brake.**—By Air Emergency Application.

(iii) **Second Emergency Brake.**—By Rheostatic.

(iv) **Third Emergency Brake.**—By Reversing.

(v) **Fourth Emergency Brake.**—By using the Motors as generators.

(b) **Service Brake.**—This application, which is used for general purposes, consists of an ordinary application of the Air Brake Apparatus. The Motorman, after placing the Controller to the "Off" position, must turn the handle of the Air Brake Valve to the Service Application position, and, when the desired effect has been produced, he must turn it to the Neutral position; if the Motorman find that his application is insufficient, he must make another, but lighter, application and again turn the handle to the Neutral position. These operations must be repeated until sufficient pressure has been applied to gradually bring the car to a stand; the Air Brake must be released before the car is actually stopped. (See also Instruction 96).

(c) **First Emergency Brake.**—The First Emergency Air Brake is applied by placing the handle of the Brake Valve to

the Emergency application position, and applying sand to the rail. (See Instruction 99).

(d) **Second Emergency.**—To use the Second Emergency (the Rheostatic Brake) the handle of the Controller must be turned backwards from the "Off" position to bring the braking notches into action; the movement of the handle of the Controller to the first braking notch couples the motors so as to act as generators and short circuits them through the Rheostats which are gradually cut out by the handle being moved to the full braking notch. This produces a considerable braking effect whilst the car is moving rapidly. This application is not dependent on power from the Trolley, and may, therefore, be used even if the Trolley-pole be lowered, and it will operate (though less effectively) when one motor is cut out. When applying this Brake, the same care must be exercised when passing over Brake Notches as when passing over the Power Notches, and the handle of the Reverser must be set for the direction in which the car is running; the handle of the Controller must not, however, be moved too rapidly, as such a course may cause damage to the equipment, or skid the wheels.

(e) **Third Emergency.**—To apply the Third Emergency Brake, the Motorman must perform, in the order named, the following operations:—

- (i) Place the handle of the Controller to the "Off" position.
- (ii) Place the handle of the Reverser to the position at which an application of power will oppose the motion of the car; and
- (iii) Turn the handle of the Controller to First Series, and, if necessary, to (but not beyond) the Second Series notch.

If the Controller be turned beyond Second Series notch the Motors may lose their braking power, and the equipment may be damaged.

This application, whilst dependent for its action on power from the Trolley, will operate (though less effectively) when one Motor is cut out.

(f) **Fourth Emergency.**—To apply the Fourth Emergency Brake the Motorman must perform, in the order named, the operations specified hereunder:—

- (i) Place the handle of the Controller to the Off position.

- (ii) Place the handle of the Reverser to the position at which an application of power will oppose the motion of the car; open the Circuit Breaker; and
- (iii) Turn the handle of the Controller to the Full Parallel position, and hold it at such position until the car has been stopped.

This Application is not dependent on the supply of power from the Trolley; nevertheless its action is likely to cause serious damage to the electrical equipment, and it must not be used except in a case of extreme emergency.

96. Service Braking.—Due care must be exercised in operating the Service Brake, which, for an ordinary stop, must be applied gradually and released. To avoid causing discomfort to passengers, and unnecessary strain on the equipment or needless loss of compressed air, a light application should be made at a sufficient distance before reaching the stopping place; when the car has been brought nearly to a stand the Air Brake should be released, and, where necessary, the Hand Brake must then be applied. (See also clause (e), Instruction 86).

97. (a) Emergency Braking.—There are various forms of Emergency Braking, which, when used, must be applied in the order set out in Instruction 94 or 95.

- (i) On Bogie Cars, there are two and on One-man type cars three separate forms of Emergency Braking.
- (ii) On Single-truck Cars, there are four distinct forms of Emergency Braking.

(b) If all the methods of Emergency Braking fail the Motorman must, except on the One-man type of car, signal to the Conductor to open the Conductor's Brake Valve. (See clause (b), Instruction 106, and clause (g), Instruction 91).

(c) When an Emergency Brake is used, the hand Brake must not be applied until the car has almost stopped; excessive braking causes the wheels to skid, which defeats the object in braking.

- (i) An Emergency Brake may not stop a car on a gradient, but it will reduce the speed of the car to a low rate. If the Hand Brake be defective, the Motorman must take the necessary steps to scotch the wheels, or arrange for his Conductor to do so, where it is desired to bring the car to a stand.

- (ii) The Motorman must furnish a report to the Officer-in-Charge, as soon as possible in every instance in which he uses an Emergency Brake. This clause will not, however, apply to the testing operations prescribed in clause (c), Instruction 76.

98 (a) Falling Gradients.—When descending any gradient the speed of the car should be controlled by applying and retaining sufficient air in the Brake Cylinder to prevent the car from accelerating beyond the prescribed rates of speed. (See Instruction 85).

(b) Skidding or Slipping.—The Motorman must endeavour to avoid skidding the wheels of the car. If the wheels slip whilst power from the overhead is applied, the Motorman must place the Controller to the "Off" position and apply power again in the regular way.

The best effect in checking the speed is produced by retarding the rotation of the wheels without skidding.

If the wheels skid whilst the Brake is applied, he must apply sand to the rail, release the Brake sufficiently to allow the wheels to revolve, and again apply the Brake in such a way as to avoid skidding. (See also Instruction 99).

If, when the Conductor applies the Hand Brake, the wheels skid, he must release the Brake and, if necessary, apply it again.

(c) Brake Defects.—The Motorman must devote attention to the condition of the Air Brake, and at once investigate any indication of defect in any portion of the Apparatus. In the event of any defect in the Air Brake, Rheostatic, or Hand Brake equipment, the particulars must be communicated to the Officer-in-Charge as soon as possible. If the Brakes on any car in traffic are unserviceable, the Carmen must arrange for all passengers to alight and to proceed to their destination by the next following car; the defective car must be run empty to the Car Shed.

The Motorman must, on each trip, frequently observe the indication on the Pressure Gauge.

- (i) If at any time the pressure has fallen below 55 lb., the Motorman must bring the car to a stand clear of Crossings and carefully note whether the Compressor is operating, and if the Compressor be working and the Pressure Gauge is not affected thereby, the Air

Brake Apparatus must be regarded as unserviceable; if, however, the Compressor be not operating the Motorman must see whether the Compressor Cut-out Switch is open and, if so, close it and note whether the Compressor is then actuated. If although the Compressor Switch is closed the Compressor is not working the Motorman after opening the Compressor Cut-out Switch, must renew the Fuse in the Switch, and, if the second and a third Fuse blow, the Air Brake Apparatus must be deemed to be unserviceable.

Note.—The Compressor Cut-out Switch (see Diagram No. 1) must always be opened—i.e., placed to the "Off" position—before attempting to examine or change the Fuse.

- (ii) If at any time the pressure rise above 75 lb. the Motorman must Stop the car, and by applying and releasing the Brake endeavour to reduce the pressure in the Reservoir, and, if by these operations, the pressure be sufficiently reduced, he must before starting, note whether the Compressor operates; if when the Air Pressure is reduced, the Compressor starts, but the Compressor is not automatically cut out when a pressure of 70 lb. is restored, the Motorman must open the Compressor Cut-out Switch and regard the Air Brake Apparatus as unserviceable.

99. Use of Sand.—The Motorman must frequently stir up the sand in the boxes, see that the sand gear works properly, and keep a sufficient supply of sand in the boxes whilst the car is in traffic. Any defect of the sand gear must be noted in the Trouble Card Book; baskets, cans, etc., must not be carried in the sandboxes. In any instance in which it is necessary to use sand for Emergency Braking purposes, the Motorman must start the sand before applying the Brakes.

The Motorman should not use sand on or near any points unless such a course be necessary.

PREVENTION OF ACCIDENTS.

100. (a) Employees must exercise care in the performance of their duties to prevent accidents or injury to themselves or others, and must spare no opportunity of warning those who neglect to take proper care.

Reckless exposure of himself or others to danger on the part of any employee will be treated as an offence against these Instructions.

Before using tools or appliances of any kind, employees should make sure that they are in a safe position to perform the service required.

Foremen and Gangers must satisfy themselves that the men concerned understand what is required to prevent accident to themselves or others.

(b) The Conductor, when alighting from the car, must always face the direction in which the car is travelling; he must not unnecessarily lean out of, or alight from, the car on the side for which the barrier is in use.

When cars are passing through the gate-ways of the Car Sheds, the Conductors must remain inside the cars. If it be necessary to adjust destination signs or other outside equipment before a car goes into service, this duty must be performed whilst the car is stationary.

(c) Every employee must exercise proper care in getting between vehicles for the purpose of coupling or uncoupling them, and in the performance of any other duty that necessarily exposes him to danger or risk of personal injury.

Except where instructions are issued to the contrary, any employee who may have occasion to go under a car on a Running Line must previously obtain one handle of the Controller from the Motorman and see that both Hand Brakes are fully applied so as to be quite sure that the car will not be moved until all is clear. Immediately after the work has been completed, the handle must be returned to the Motorman.

(d) When it is necessary to use the Motorman's Insulated Ground Wire the employee concerned must be particularly careful to first make good contact with the rail with one end of the wire before placing the other end of the wire on the rear wheel of the car. The wire must be held by the insulated portion and when the contact has been made the employee concerned must turn his head so that if arcing occur his eyes will not be affected.

(e) Employees are warned of the risk of electric shock or burning which might be incurred by tampering with any electrical apparatus, overhead connections, or dangling wires. They must always bear in mind the danger of touching, or allowing any conducting substance with which they are in contact to touch any Transmission or Contact Wire, or other "Live" material. It must, however, be borne in mind that under certain conditions the same danger exists, in the handling of ladders, etc. Each employee must, therefore, be on his guard to avoid exposing himself or others to this risk, particularly those engaged on the roofs of vehicles, buildings, or verandahs, or on or under overhead structures or over-line bridges. (See also clauses (l) and (m), Instruction 79.),

Any employee who is required to handle a Live Wire must avoid risk by using some dry non-conducting material. Employees must make proper use of articles or appliances provided for their safety and convenience.

Employees must make themselves familiar with the instructions under the heading of Directions to be observed in cases of Electric Shock. (See end of this book).

(f) Any employee who observes any damage or irregularity connected with the overhead equipment must do all in his power to prevent injury to any person or damage to property, and must warn pedestrians and drivers of vehicles to keep clear of the equipment. He must take immediate steps to stop any cars that may foul the damaged equipment, and as quickly as possible report the derangement, or ensure its being reported, to the Officer-in-Charge, stating the extent, locality, and whether the Up or Down Line is, or both Lines are, affected. The time the trouble was observed, and its nature and consequences so far as can be ascertained must be also given. (See also Instruction 124).

If the employee observing the irregularity consider the conditions dangerous, he must remain at the site and perform such services as the occasion may require until the danger is removed, or he has been released by the Officer-in-Charge.

The Officer-in-Charge or other official receiving the report of any fault or irregularity in the overhead construction must immediately report the particulars to the Overhead Depot, Batman Avenue. The Officer-in-Charge must proceed to the scene by the most expeditious means available.

(g) An unauthorised person must not open, close or otherwise interfere with any overhead switch or feeder.

(h) No employe shall, under any circumstances, operate appliances or machinery except in the authorised manner, and all are cautioned against interfering with any apparatus in such a way as to prevent its legitimate action.

Carmen must not needlessly remove the apron of any Controller or the door of any Motor Case, and must not interfere or permit any unauthorised person to interfere with the adjustment of any Circuit Breaker or other electrical equipment.

101. (a) Most accidents are due to some form of inadvertence. Sometimes the Carmen are at fault, but most accidents are due to a lack of care on the part of others. Wherever the fault lies, it is the most earnest wish of the Commissioners to minimise, and if possible eliminate the risk of accident.

(b) Each Instruction contained in this book is based on an established principle for avoiding some particular form of accident or irregularity, and if any employe wilfully ignore an Instruction or permit it to be ignored, he courts a recurrence of the unsafe conditions that the Instruction is designed to prevent. Remember always the cardinal principle "SAFETY FIRST."

(c) Every employe is enjoined to study and strictly observe all Instructions, including special or local Instructions and Notices that have any bearing on his duties. He should possess a thorough knowledge of what each particular Instruction prescribes or implies, and thus be prepared to act accordingly when the occasion and the requirements of safety demand it.

(d) When the car is in motion, responsibility for safe running rests mainly on the Motorman. Appliances are provided for quickly and effectively controlling the car, and by a strict observance of Instructions and orders, the exercise of vigilance, good judgment, and proper care, the risk of accident will be reduced and the interests of the Carmen and the department will be conserved.

(e) **Motormen :** Note.—A likely irregularity calling for prompt action is a vehicle suddenly emerging at an excessive rate of speed from a side or cross street and attempting to cross the track whilst your car is approaching. Although the Driver of the vehicle is required to look for your car, you must regard him

as unaware of its approach ; therefore sound the Gong when approaching any side or cross street and continue to sound it ; if necessary, slacken speed and be ready to stop and do not attempt to pass any vehicle unless certain that there is ample room.

Be especially cautious when approaching any wagon laden with long timber or other projecting material ; always remember that a wagon or other vehicle conveying such loading, forms a large arc when turning—when the front of the wagon is being turned away from the track the rear portion of the load turns towards, and may foul, the track. If in doubt, stop ; do not accept any risk or leave anything to chance.

Always slow down and proceed cautiously when approaching or passing a restive horse ; horses when frightened may back towards your car instead of moving away from the track.

(f) **Conductors :** Note.—Some persons who are injured when attempting to board or alight from a moving car may claim that the car was started whilst they were in the act of boarding or alighting, and that you are responsible for the occurrence.

When you see any person about to board or alight from the moving car ; shout to them ; warn them of the danger—hold them if practicable, but Call out—"Wait till the car stops." By thus shouting a warning you will also attract the attention of other passengers to the danger, and, if an accident occur, witnesses will be available to prove you are not to blame.

In the event of any passenger falling from a car whilst it is in motion, the car must be stopped at once and all necessary assistance must be rendered.

NOTE.—Attention is also directed to Instructions Nos. 2, 3, 13, 16, 19, 20, 27, 28, 33, 40, 41, 42, 45, 46, 47, 48, 49, 50, 51, 52, 53, 55, 62, 75, 76, 77, 79, 82, 83, 84, 85, 86, 87, 88, 89, 96, 97, 98, 99, 102, 106, 107, 108, 111, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125.

SIGNALS.

102. Carmen must obey all Signals relating to the movements of a car.

103. (a) Hand Signals will be made with Flags by day, and with Lamps by night or in foggy weather. A Red Light or a Red Flag is a signal of "Danger," i.e., "Stop"; in the absence of a Red Light, any light waved violently denotes Danger.

(b) Except where they are employed for the purpose of marking the actual point of obstruction, Hand Lamps and Flags, when used as signals, must always be held in the hand, and not placed upon, or stuck into, the ground, or fixed elsewhere.

(c) Hand Signal Lamps and Flags must be kept clean and ready for immediate use. Flags which have become so worn or soiled as not to be readily distinguished at a proper distance, must be replaced.

104. In the absence of Hand Signal Lamps or Flags, Hand Signals, as described below, may be used by employes when engaged in the working of cars.

(i) Both arms raised above the head denotes "Danger—Stop."

(ii) One arm held in a horizontal position denotes "All Right."

105. A Green Hand Signal waved slowly from side to side by trackmen indicates that cars must reduce speed to five (5) miles an hour, or such other speed as may be prescribed, over the portion of the Line protected by such Green Signal. (See Instruction 115).

106. (a) Gong and Bell Signals.—All Signals given by the Motorman or Conductor must be correctly and clearly sounded.

(b) The Signal Code for the Motorman and the Conductor is as specified hereunder:—

See Instruction	SIGNAL	Beats on Gong	How to be given
76 (a)	<i>By Motorman—</i> Before moving the Car under any circumstances	2	This Signal must be given by two consecutive beats, and must be continued or repeated as circumstances may require; but the Motorman must be prepared to stop the Car if his Warning Signals are not obeyed, or if he should have reason to apprehend danger
107	When meeting another Car and when passing a standing Car		
107	When passing around a street Corner		
107	When approaching any Street where the view is obstructed		
49	To warn employes or other persons, or drivers of vehicles on or close to the Line; or to drive animals clear of the Line		
111 (c)	Lower the Trolley	1 Beats on Bell	
—	For Conductor to come through	1*	
97 (b)	For Conductor to open Emergency Brake Valve	3*	Consecutively
93 (b)	Apply Hand Brake	6*	3, pause 3
88 (i)	Release Hand Brake	3*	Consecutively
86 (g)	<i>By Conductor to Motorman—</i> Stop at next Stopping-place	1	
106 (e)	Proceed	2	Consecutively
86	Stop for over-carried Passenger	2	1, pause 1
106 (d)	Danger Stop (Emergency Stop signal)	3	Consecutively
86 (h)	Car full. Do not stop to pick up Passengers, applicable to Conditional Stopping-places only	4	2, pause 2

* These signals by the Motorman, must be given by means of the rear Bell.

(c) The signals by the Conductor to the Motorman must be given on the front Bell. The use of any unauthorised communication by the Bells or Gong is strictly forbidden.

(d) Except in the case of the Emergency Stop Signal, the Motorman must acknowledge each Bell Signal by repeating it on the Gong—on receipt of the Emergency Stop Signal, the Motorman must, as quickly as possible, stop the car.

(e) When for any purpose the car has been brought to a stand on a Running Line, whether at an authorised Stopping Place or elsewhere, the Motorman, except in the case of a One-man type car when operated under One-man conditions, must not move the car until he receives the Proceed Signal from the Conductor or other authorised person; if such signal be not given distinctly, the Motorman must not start until the signal is repeated clearly. In every case before starting, he must see that all is clear by looking in each direction. (See also Instruction 87). In every case the Motorman must, before starting, give two sharp and distinct strokes on the Gong. Before acting on a Proceed Signal the Motorman must make sure that the signal refers to his car.

(f) In any instance in which on receipt of the Bell Signal the Motorman does not promptly proceed, he must, before starting, look back and await a repetition of the Proceed Signal.

(g) When giving the Proceed Signal, the Conductor must be in a position from where he can see the Exits and Entrances of the Car. He must allow each passenger sufficient time to join, or alight from, the car; he must not accept a signal from the Motorman, but must himself see that each passenger enters or leaves safely. He must not ring the Bell for the purpose of hurrying up any intending passenger, but must respectfully call out, "Hurry on, please!" He must not touch the bell-strap until he is satisfied that each intending passenger has entered, or each alighting passenger has alighted from the car.

107. The Motorman must sound the Gong when approaching any street corner, or before crossing any side or cross street at which the view is obstructed, or when approaching any stopping place, or when approaching any other car, or when passing a standing car, he must, however, avoid unnecessary sounding of the Gong, particularly when passing any place where Divine Service is being held.

108. Carmen must keep themselves conversant with, and strictly observe, all signals displayed by members of the Police

Force or other authorised officials regulating traffic at intersections or elsewhere. Authorised illustrations of the signals and the instructions applicable must be always exhibited in the Rooms and Order Books provided for Motormen and Conductors.

USE OF SIGNALS DURING OBSTRUCTION OR DEFECT ON, AND REPAIRS OR ALTERATIONS TO PERMANENT WAY OR OVERHEAD EQUIPMENT.

109. A Red Flag or Light exhibited on or near the track, or on the overhead equipment, indicates that the Motormen must stop clear of the spot at which the signal is exhibited. (See also Instruction 111).

110. Unless otherwise arranged, Permanent Way Signals must be displayed by hand.

111. (a) In the event of the track or overhead equipment being obstructed by repair work or when it is necessary to carry out work involving an obstruction to traffic, the employee in charge of such work must, before permitting any such obstruction, see that a Red Danger Signal is plainly exhibited at a sufficient distance from the obstruction until the track and overhead are again safe for traffic. On a Single Line, or where both tracks of a Double Line are affected, the Danger Signal must be exhibited, as prescribed above, in both directions.

(b) If, owing to defect or obstruction in the overhead equipment, it should become necessary for a car to coast with the Trolley pole lowered when passing over a portion of the track, the Danger Signal must be exhibited as prescribed in clause (a) hereof, and the Motorman must be informed of the circumstances.

(c) Where, as prescribed in clause (b) hereof, it is necessary for a car to coast with the Trolley pole lowered, the Motorman must, before starting, have a clear understanding with his Conductor in regard to the portion of track over which the car is to run with the Trolley pole lowered.

The Motorman must, before starting, see that no passenger is about to alight from or board the car, and the Conductor must request passengers to keep their seats. After having attained the rate of speed required for coasting, the Motorman

must cut off Power and, by one beat on the Gong, give the "Lower the Trolley" signal. On receipt of such signal, the Conductor must lower the Trolley and hold it clear of the overhead equipment according to the requirements. When the car has reached the point of clearance the Motorman must stop the car and the Conductor must then replace the Trolley on the Contact Wire.

In the case of a One-man type car, when operated under One-man conditions, arrangements must be made for a competent employe to accompany the car, over the area affected, for the purpose of lowering the Trolley and otherwise to act as laid down for the Conductor.

112. When owing to a defect or to urgent repair work, the track or overhead equipment is likely to become obstructed, the provisions of Instruction 111 must be promptly carried out; but where such repair work is not of an immediately urgent character, or in the case of alterations to tracks, Points, or overhead equipment, and the performance of such work or alterations may incur serious interruption to the Car Service, the Ganger or Foreman must, unless the work has been previously arranged for between the Branches concerned, and the necessary notice issued by the General Superintendent of Transportation, communicate with the Officer-in-Charge, who will make any special arrangements that may be necessary in connection with the working of the traffic during the time such repairs or alterations are being effected.

Except in cases of urgency, the ordinary working of the Points must not be altered, unless by previous arrangement with the General Superintendent of Transportation.

PERMANENT WAY AND WORKS AND OVERHEAD EQUIPMENT.

113. The Ganger must keep a register of the names and places of residence of all the men employed under him, so that in case of accident he may be enabled to summon them immediately to assist in any way that may be required. Should any obstruction take place, or other sudden emergency arise, he must immediately collect the number of men required.

114. Each gang of Trackmen or Labourers working on or adjacent to the Running Line must be supplied by the Road Foreman with a Permanent-way Gauge, two Red Flags, two Green Flags and two Hand Signal Lamps. The Ganger will be held responsible for having the Hand Signals constantly in proper order and ready for use. The Flags must be used where necessary during daylight, and the Lamps after sunset and in foggy weather.

115. The Red Signal indicates Danger, and must be used when it is necessary to stop Traffic. The Green Signal waved slowly from side to side by Trackmen indicates that cars must reduce speed to five (5) miles an hour, or such other speed as may be prescribed, over the portion of the Line protected by such Green Signal.

116. (a) In any instance in which the track or overhead equipment is obstructed or unsafe, or in which it is necessary to carry out track or overhead repair work that will involve an obstruction to traffic (in which latter instance, due notice must be given to the Officer-in-Charge) the Ganger must arrange for the Danger Signal being plainly exhibited at a sufficient distance from the obstruction in one or both directions, as the case may require, until the obstruction is removed or the defect remedied.

(b) Any repairs which involve the stopping of cars must, as far as is practicable, be carried out at such time or times as will cause the minimum interference to traffic.

(c) In the event of a Hand-signalman being stationed near the obstruction, he must be informed of its nature, and must protect the traffic until the obstruction has been removed.

For precautions to be adopted, and use of Permanent-Way Signals during alterations or repairs, see Instructions 109, 110 and 111.