

## CHAPTER XV

### ELECTRIC INSTALLATIONS IN PASSENGER TRAINS

**15001. System of train lighting on Indian Govt. Railways.-** Following systems of train lighting are working on Indian Govt. Railways :-

- (i) 2 wire 24 Volt D.C., single battery system.
- (ii) 2 wire 110 Volt D.C., single battery system.
- (iii) 24 Volt D.C. Mid-on-generation system.
- (iv) 110 Volt A.C., Mid-on-generation system.
- (v) 400 Volt A.C. 'End-on-generation' system.

These systems are described below :-

- (a) **2 wire 24 Volt D.C. single battery system.-** Most of the coaches on Indian Railways are on this system of train lighting. In this system there are 2 type of vehicles on a train, fully equipped and fitted with dynamo and batteries. Trailers have no dynamo or batteries but are fitted with through wiring only. The trailers have to depend for electric supply on the fully equipped coaches through interconnections called emergency couplers. Only a very few coaches are trailers.

In this system the batteries supply current when the train is stationary or running upto a speed of approximately 20 km. per hour beyond which the dynamos supply current to the lights and fans and also keep the batteries charged. The battery consists of 24 Volt sets working in parallel on these coaches. The batteries and dynamos are suspended from the under frame. The dynamo is driven by a pulley fixed on the carriage axle with the help of a belt.

- (b) **2 wire 110 Volt D.C. single battery system.--** Only a few rakes are equipped on this system. This system is similar to 24 Volt D.C. system except for the voltage.
- (c) **24 Volt D.C. 'Mid-on-generation' system.-** In this system no dynamos or batteries are provided on coaches. Power is generated through diesel generating sets installed in a Power Car provided in the middle of the rakes. Generation is at 440 Volt A.C. which is converted to 24 Volt, D.C. with the help of transformers and rectifiers in the power car. Transmission of power supply for the rake is with the help of 2 main feeders on either side of the power car. Alternate coaches are fed from one main feeder, remaining being fed from the other main feeder. The train lighting equipment in the coaches, namely fans, lights etc. are exactly similar to those on 24 Volt D.C. systems.
- (d) **110 Volt D.C. 'Mid-on-generation' system.-** This system is similar to 24 Volt D.C. 'Mid-on-generation'. The power supply is fed at 110 Volt A.C. and there are no rectified systems on

the power car. The lamps and fans in the system are not inter-changeable with those provided in 24 Volt D.C. or 110 Volt D.C. system of train lighting.

**CAUTION :-** The rake should have all the coaches of the same system of train lighting. Any coach which is not on that system cannot be provided with lights and fans and if electrically connected with other coaches, may cause damage to equipment.

**15002. Essential components of fully-equipped coach:-** Following table shows the essential components of a fully equipped coach, their functions and locations :-

| Item No. | Description                                     | Function                                                                                                                                                            | Location                            |
|----------|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| 1.       | Dynamo.                                         | To supply current to lights and fans and also to charge the battery while the train is running.                                                                     | Under frame                         |
| 2.       | Batteries in boxes                              | To supply current to lights and fans while the train is stationary                                                                                                  | Under frame                         |
| 3.       | Blocking rectifier                              | To prevent battery supplying the dynamo                                                                                                                             | -do-                                |
| 4.       | Lamp resistance.                                | A linear resistance assembly for dropping the voltage so that lamps do not get fused due to high voltage.                                                           | -do-                                |
| 5.       | Junction Box                                    | A box having junction of cables running from U/F to the super structure, fuses for protection of main and auxiliary circuits and main switches for lights and fans. | Inside the coach.                   |
| 6.       | Distribution fuses Boards                       | To provide fuses for protection to individual circuits.                                                                                                             | -do-                                |
| 7.       | Ceiling light fitting and switches.             | To provide light.                                                                                                                                                   | -do-                                |
| 8.       | Fans and fan regulators.                        | To provide fannage.                                                                                                                                                 | -do-                                |
| 9.       | Emergency and battery charging terminal boards. | To provide inter-connection from one coach to another and for charging the batteries.                                                                               | Outside on either end of the coach. |

**15003. Control of electric lights and fans in coaches :-** (a) Switching 'On' and 'OFF' of lights and fans circuits in a rake is effected by operating rotary switches or MCBs in the Junction box provided inside individual coaches. Operation of these circuits is the duty of train-lighting staff

deputed at important stations. Individual switches /regulators of lights and fans are to be operated by passengers themselves.

- (b) Guards and conductor of reserved coaches are responsible for ensuring that the electrical equipments and fittings of all coaches are functioning satisfactorily. Where any defect or deficiency is noticed, they should inform the electric staff on duty or advise through control to the next station where electrical staff is provided. Conductors of reserved coaches will also inform the Guard for similar action at his end.
- (i) They should mention in their JTR or special report the station at which the defect was noticed.
- (ii) Whether this was brought to the notice of the Train Lighting Staff and, if so, whether by Control message or through any other means. They should also indicate the station name, the train lighting staff of which were advised.
- (iii) They should indicate what action, if any, was taken by the train lighting staff and where at all the defects were rectified.
- (iv) They should always mention the defects in Guard's Signature Book presented to them by the Train Lighting staff.

**15004. Economy in current.-** Train staff must see that lights and fans of all unoccupied compartments are switched 'Off' by operating the individual switches.

**15005. Timings for switching lights and fans in carriages.-** (a) Lights in trains shall be switched 'On' half-an-hour before sunset and switched 'off' half-an-hour after sunrise. During dull and foggy weather the period of lighting may be extended within reasonable limit at the discretion of the Guard in charge of the train. Lights must be switched 'on' during day at previous train lighting station when train has to pass through a long tunnel.

- (b) Fan circuits shall be energized normally from 1st March to 30th November except at places with a short winter, in which case the District or Divisional Authorities concerned may order to extend this period.
- (c) At starting stations, electric lights and fans circuits will be put 'ON' 30 minutes before the departure and at terminating station, they will be switched off 30 minutes after the arrival of the train. In the case of more important trains, this period may be extended upto one hour with the permission of the Divisional Railway Manager.

**15006. Train Lighting defects requiring immediate attention of Guards.-** Due to very low voltage of Train Lighting system, the currents in the conductors are heavy and any defects in wiring, if neglected, can result in overheating and even fire, leading to considerable loss to the railway and even to fatal burns. Secondly the equipment associated in the under frame, if it works loose and falls on the track, may cause derailment. Since in most cases no train lighting staff is available on the train, proper immediate measures have to be taken by the Guard and conductors of reserved coaches at the spot to avoid accidents. However, in case of 'End-on-Generation' or 'Mid-on-Generation' system of train lighting, electrical staff is always available on the power cars and electrical staff are also available on Air Conditioned coaches and they should be contacted immediately in case of any suspicion of wiring defects, which may lead to short circuit. In non-MOG or EOG Train Lighting systems, some of the usual precautions required to be taken by Guard are indicated below :-

- (a) **Shunting.-** Special care should be taken when shunting the coaches, to avoid rough shunting lest it may result in damage to suspension of dynamo, battery box or other train lighting equipment on the underframe.
- (b) **Insecure underframe equipment.-** If any under frame equipment is observed to be unsafely hanging, efforts to secure this equipment by tying it with strong rope or wire should be made after which train should be allowed to proceed on restricted speed to the next station where it can be attended either by electrical or mechanical staff. Alternately such equipment may be removed. In both cases the incident should be reported to the train-lighting staff at the next train lighting station.
- (c) **Obstructions on permanent way.-** Damages to dynamos and other under frame equipment or their suspension can also be caused by obstruction on the track or by flying ballast. In such cases, under frame should be examined, If it is found that any equipment is hanging unsafely same action as in para 'b' above should be taken.
- (d) **Electric fire.-** As already stated overheating and fire can be caused due to short-circuit in train lighting wiring. In such cases, Guard should remove battery fuses, emergency couplers of the coach, a dynamo belt and put out the fire and advise Train Lighting staff through memo to SM and also at the next Train lighting station.
- (e) **Total failure of lights on a train.-** This may be due to dynamo failure, battery fuse blown or junction box fuse blown or due to short circuit. In such cases, Train lighting staff should be called at the next Train Lighting station to attend.
- (f) **Dim lights on a train.-** The usual defects which cause dim lights are :-
  - (i) **Missing/loose dynamo belts:** If the belt of a dynamo drops en route/ or is loose, it stops generation so that the load has to be supplied from the batteries throughout the run. This results in the batteries getting run down and consequent dim lights. The coach should be got attended at the next Train Lighting station. Advice should be sent through message so that missing belt can be replaced or loose belt can be tightened.
  - (ii) **Run down batteries:** Run down batteries are due to batteries getting run down before starting. This happens either on account of the switch having been left 'ON' by mistake or lighting and fannage is switched 'ON' for several hours before the departure of the train. In these cases, Train Lighting staff should be contacted who will provide external charging, if time permits. In most of such cases, the lighting becomes normal during the run of the train as batteries get charged.
  - (iii) **Short Circuit on the coach :-** This may happen en route and occasionally it may also lead to smoke and fire. Action to be taken has already been indicated.
- (g) **Fans stoppage :-** If all the fans on a coach stop working, this may be due to fan fuse blowing or fan main switch not having been operated. Train Lighting staff should be contacted at the next Train Lighting station. If individual fan is not working, it may be due to carbon brush not bedding or some defect in the circuit. Train lighting staff should be contacted.

(h) **Lights not burning in a coach :-** Either main lighting switch not operated from the junction box or lights fuse in the Junction Box is blown or bulb has fused. Train lighting staff should be contacted at the next Train Lighting station.

(i) **Cooperation with Electrical Staff :-** Electrical staff are responsible for ensuring that electrical equipment and fittings are in proper working order before handing over a rake for service. The Electrical and Operating staff throughout the line must cooperate with each other to ensure observance of safe practices.

**15007. D.R.S. Cards :-** In order to localise losses due to thefts, the starting station enters train lighting deficiencies on the rake in the D.R.S. card (Deficiencies in Rolling Stock Card). This card is handed over at the starting station by the Electrical Supervisor to the Guard and is examined en route at important junction stations by the Electrical staff after checking the deficiencies. If any additional deficiencies are found en route due to theft, these are entered on the card. This card is finally handed over by the Guard to the Train Lighting supervisor at the destination station.

**15008. Air-conditioned coaches :-** The following types of air-conditioned coaches are working on Indian Railway :-

- (i) II class 2-Tier air-conditioned sleeper coaches. They are fitted with 110 V. D.C. 2X5/7.5 ton plant and have 46 berths.
- (ii) I Class air-conditioned coaches with 110 V. D.C. 5-Ton or 7.5 ton plants; having 14 or 18 1<sup>st</sup> class AC berths.
- (iii) II class- 3 Tier Air Conditioned sleeper coaches. They are fitted with 110 VDC 2 x 5 / 7.5 ton plant and have 64 berths.
- (iv) Partial A.C. coaches. These have 110 V. or 24 V. D.C. 2 x ½ ton A.C. plants. These have 2 or 3 air-conditioned compartments with 6 or 8 1st class A.C. berths. Rest of the coaches are ordinary first class.
- (v) Composite AC coaches. These are fitted with 110 V. D.C., 2 X 7.5 ton plant having 10 1st class AC berths and 36 chair car seats. The Guards are not required to do anything on the electrical or air conditioning equipment. The AC coach incharge (ACCI) is trained to take necessary measures in this regard. The Guards should, help the AC Coach staff in having the water storage tanks properly filled at junction stations.

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