

CHAPTER XXIV

INSTRUCTIONS FOR PROTECTION TO STAFF

SECTION A - GENERAL

24.1 Scope of instructions-

The instructions in this chapter are not exhaustive. Any carelessness on the part of the staff will not be absolved by the absence of instructions detailed in this chapter.

24.2 Handling by authorised personnel-

All equipments shall be handled only by duly authorised staff particularly in case of wireless transmitters. All connections and alterations, other than the usual manipulations or operation, are to be carried only by staff specially appointed for this work.

SECTION B - PROTECTIVE AND SAFETY DEVICES

24.3 Periodical checking- The condition of the equipment and correct functioning of protective and safety devices shall be checked once in a month by the authorised personnel.

24.4 Checking under fault conditions- When the protective and safety devices have operated under fault conditions, check shall be carried out on the devices for their correct functioning before resetting them for use.

24.5 Altering and disconnecting safety devices-

The safety devices shall not be altered or disconnected, except for replacements without specific approval of the competent authority.

SECTION C- FIRST AID

24.6 First aid-

Since electrical shock may result in the interruption of natural breathing, all staff shall be familiar with the methods of artificial respiration. It is essential that staff are equipped with the knowledge of first aid. Charts explaining such methods should be exhibited in a prominent place where high voltages are incident. Names of staff trained in first aid shall also be displayed.

24.7 First Aid Box-

First aid box shall be kept in wireless stations, first aid rooms in workshops, etc.

SECTION D - ACID

24.8 Battery rooms

- a. Battery rooms shall be provided with good ventilation.
- b. Acid-proof tiles shall be provided on the flooring where acid is handled. It shall be ensured that the floor is kept dry and free from fallen acid.

24.9 Storage of acid-

Acid shall be kept in a cool dry place.

24.10 Diluting the acid

- a. Acid should always be added to water, when dilution is needed.
- b. Where acid is handled, board containing the legend "DO NOT ADD WATER TO ACID" with a pictorial representation shall be hung at a suitable place.
- c. While handling acid containers rubber gloves shall be used.

SECTION E – FIRE

24.11 Ammonia and battery room-

A bottle of strong ammonia should be kept in the battery room at all times.

24.12 Safe working in battery room-

Breaking of the connection in a circuit in which current is being carried or the lighting of naked light in the battery room must be avoided.

24.13 Training in fire fighting-

The personnel should be given training in fire fighting with the basic equipments provided.

24.14 Preventive measures-

- a. Waste material used in cleaning the equipments should not be allowed to accumulate in a corner.
- b. Dangerous growth of vegetation near the equipments or feeder lines or masts must not be allowed.
- c. The roofs of buildings must be kept clear of leaves or combustible materials.

- d. Smoking should be prohibited in petrol storage rooms and battery rooms. 'No Smoking' sign with a Cigarette and red cross shall be displayed.
- e. Oil, paints, etc. should not be stored near the equipments.
- f. Petrol storage rooms should not have sparking equipments emitting sparks like buzzers, relays, fuses, etc.
- g. Handling of petrol such as filling in engine tanks, etc. should not be done while the medium and high power transmitters are radiating in close proximity.
- h. Lighting of fire for cooking etc. within compound walls shall be strictly prohibited.
- i. Buckets filled with sand, water shall be hung at a convenient place.

24.15 Fire Extinguishers

1 TYPES OF FIRE :

- (i) A Class :
Wood, charcoal, jute, cloth, etc. – only water is used to extinguish the fire.
 - (ii) B Class: Oil, petrol, grease, paints etc. –only foam is used to extinguish the fire.
 - (iii) C Class: electrical fire – water is not used only CO2 is used.
- 2 (a) Basic fire fighting equipments should be kept in places with fire risk and it shall be ensured that they are in good condition. Expiry date should be clearly mentioned on them. Notices of instructions for using the fire fighting equipments shall also be provided.
- (b) All electrical installations shall be provided with gas type fire extinguishers. Water should not be used to extinguish electrical fires..
 - (c) In confined places where even the minimum ventilation is not available, vaporising liquid extinguishers should not be used since they may be poisonous and cause harmful physiological effects.

24.16 Precautions during the time of fire.

- (a) Alarm must be given in accordance with local regulations.
- (b) All forced air-cooling devices must be stopped.
- (c) Equipments involved must be disconnected immediately at the supply source.
- (d) Spreading of the fire should be avoided.

SECTION F- ELECTRICITY

24.17 Removal of fuses- Fuses shall be removed or replaced only after the circuit has been completely de-energised. A non-conductive fuse extractor shall be used to remove knife or cartridge type of fuses from their holders.

24.18 Handing circuit breakers

- (a) In the case of manually operated circuit breakers, the face shall be kept turned away from the circuit breaker, while closing.

- (b) While working on non-closed type of circuit breakers, the use of safety goggles is recommended.

24.19 Provision of labels

- (a) All switches and cut-outs from which power may possibly feed shall be secured in open position and suitable label shall be provided. After completion of the work, the label shall be removed only by the person who originally put on the label..
- (b) Sign boards warning danger with legends in appropriate languages may be hung at suitable places where radio frequency voltage or high dc or ac voltages are encountered.
- (c) When more than one repair party is engaged, each party shall provide the label which will be removed after completion of the work by the respective party. If switch locking facilities are available; it shall be locked in the open position and the key retained by the person incharge of the work.

24.20 Working on live circuit:

- (a) Wherever possible work on live circuits with voltages over 350V peak may be avoided.
- (b) The following protective measures shall be taken while working on live parts:
 - (i) Provision of ample light for illumination.
 - (ii) Removal of loose clothes and metallic personal accessories.
 - (iii) Provision of insulation from earth such as provision of rubber floor mats near electrical distribution boards used in battery rooms.
 - (iv) Use of only one hand where practicable, keeping the other hand free.

24.21 Safety guards and covers.

- (a) Suitable protective guards and wire nets shall be provided to prevent staff from making accidental contact at the dangerous voltage and radio frequency high power radiation.
- (b) All covers used for protection against accidental contact with high voltages shall normally be kept closed and opened for maintenance or repair only by authorised staff.

24.22 Safety design and installation practices

- (a) Insulated current carrying parts in the equipment shall be located in such a manner that they are not subjected to abrasion or mechanical damage.
- (b) Where cables pass through metallic parts, insulating bushings shall be provided.

- (c) External conductors connected to the equipment at points within the case shall be so arranged that their terminals are not subject to strain when any outer covering is protected from abrasion and that they are prevented from getting twisted.
- (d) Guard interlocking switches shall be so arranged mechanically, that inadvertent operation is impossible.
- (e) The accessibility in equipments and guards shall be so designed that the operator shall not have access to live parts other than those at extra low voltages.
- (f) If the operator is required to have access to parts of equipment which are dangerous while the equipment is in operation, the covers provided to guard such parts shall not be removable with the equipment switched on or shall themselves switch the current “off” when the covers are removed.

24.23 Earthing

- (a) Accessible metallic parts including hinged components which might become live in the event of a fault, shall be earthed on all equipments and shall be so constructed that these parts are permanently and reliably connected to an earth terminal or contact.
- (b) If the body of the earthing terminal is part of the metal frame or enclosure, a screw or nut of brass or other metal less resistant to corrosion should be provided.
- (c) It should not be possible to loosen the earth terminal screw without the aid of a tool.
- (d) If the equipment or any components are connected by a plug and a socket device; while inserting the plug in the socket, the earth contact shall make its circuit before the current carrying contacts engage and when the plug is withdrawn from socket, it shall break its circuit after the live contacts break their contacts.
- (e) All tall metallic structures shall be suitably earthed strictly.

24.24 Handling electrical equipment:

- (a) While isolating the equipment from the mains supply the disconnection shall be done with the operation of the switches as well as by removal of the fuses.
- (b) The disconnection shall be checked once again before commencing the work on the equipment.
- (c) Since the electrical charge retained by the electrical machinery, when switched off, may cause a severe shock in some cases, the out put terminals shall be earthed, before the mains are handled.
- (d) To ensure that the capacitors are discharged rapidly, after their source of potential has been switched off, or disconnected, their live terminations, shall, wherever practicable, have a discharge path which is either permanent or is applied so that the capacitors are discharged to a safe potential. Capacitors wired permanently across the mains supply shall be

shunted by a resistance so that the discharge time of the capacitor shall not be greater than 100 mili second.

24.25 Handling radio equipment:

(a) Breaking of energised radio frequency output circuits shall be avoided as far as possible.

(b) While energising a radio transmitter, it shall be ensured that no one is at work on the equipment or aerial system, no tools or testing equipment are left in or on the equipment, and all testing apparatuses are removed.

(c) Where other equipment is used close by, measures shall be taken to prevent shock or injury to staff due to radio frequency energy picked up from an adjacent aerial or equipment.

(d) The aerial should be disconnected from the transmission line to prevent introduction of any dangerous voltages due to aerial pick up. If this is not possible, other precautions such as earth at several places may be resorted to. These earth connections shall be very short when compared with the wave lengths.

(e) Staff shall not be permitted to go near the aerial installations, unless it is definite that no danger exists.

(f) Transmitting equipment with frequency range of 30 MHz and below, and aerial output power of 500 W and above may cause dangerous voltages to be induced in other structures specially those structures protruding in the same plane as the radiating source.

(g) All areas in which radio frequency power density in excess of 0.01 watt per sq cm is known, or suspected to exist must be considered as hazardous areas, and personnel shall be prohibited from doing any work, while the set is energised.

(h) Direct visual examination from the radiation path of any microwave radiator reflector, wave guide, horn or any highly concentrated beam or radiating system during the period of transmission must be avoided.

(i) Staff who must remain in the microwave beam for any length of time shall be provided with and required to wear devices for eye protection with a wire mesh spring.

(j) If more than one transmitter is working on a site, care should be taken to avoid burns from radio frequency pickup from the working transmitters.

(k) All external conductors or metal parts carrying current where radio frequency power may exceed 5 W peak envelope shall be deemed to be live, and shall be protected accordingly. All external circuits and accessories fed with radio frequency where the power may exceed 5W shall be made inaccessible as far as practicable. Where such circuits can not be made inaccessible, warning devices shall be displayed.

24.26 Protective measures for Telecommunication lines entering 25KV substation/switching posts.

When telecommunication lines enter 25KV sub-stations and switching posts (Feeding posts, section and sub-sectioning posts), the following protection measure shall be taken to protect the staff and the Telephone equipment against any fault occurring on the Traction side.

a) Each Telecommunication line before its connection to Telephone equipment shall be provided with heavy duty lightning arrestors and fuses. The heavy duty lightning arrestors shall be of rare gas type with normal flashing voltage of 300 volts. The fuses shall be of 250 volts, 3 amps type.

(b) A common earthing shall be used for earthing of the heavy lightning arrestors and all metallic bodies of sub-stations/switching posts so that no potential difference may arise between these bodies in case of a fault occurring on the Traction Side.

24.27 Precautions in ac electrified area

(a) Instructions issued from time to time by administrations dealing with electrifications must be strictly followed.

(b) Precautions are required to be taken on account of the following:

(i) Proximity of a live conductor

(ii) Pressure of return current in rails.

(iii) Induction in all metallic bodies situated close to overhead equipments.

(c) Any contact, direct or indirect, with the 25KV line is dangerous and shall be strictly avoided.

(d) Whenever staff has to work on installations which are in direct or indirect contact with the rails, they shall:

(i) Use tools (insulated and non-insulated) in the manner approved by the CSTE of the Railway.

(ii) Observe the provisions of Chapter XX of the Way and Works Manual, supplemented by 'Instructions for Railway Staff Working on Tracks Equipped with 25KV, 50 Hz ac traction (see Annexure A).

(iii) The metallic body and supporting frame of the equipment shall be earthed and the resistance of this earthing shall not exceed 10 ohms. There should not be any possibility of simultaneous human contact with metallic bodies connected to different earth.

(iv) Any equipment and portion thereof including the supporting structure falling within 2 meters of the 25KV live contact wire or any metal part electrically connected to this conductor shall be protected by an iron screening, of approved design, solidly connected to

the structural work. The iron screen shall be connected to an earth not exceeding 10 ohms in resistance.

(e) Each time staff has to work on telecommunication circuits along the 25 KV ac line. the following 'protective measures must be observed:

(i) They should be as a general rule use rubber gloves and use tools with insulated handles.

(ii) When the work to be done is meticulous and rubber gloves cannot be used, special precautions should be taken by splitting the circuit into sections by earthing them.

(iii) Before cutting the armour or the lead or the aluminium sheath of the cable or the wires in the cable, establish as a general rule, an electrical connection of low ohmic resistance between two parts of the armour and the sheathing and the wires that are to be separated by cutting.

(iv) Whenever the main telecommunication cable is tapped by derivation cables, the tapping shall be through protective transformers to maintain physical separation between the main and derivation cable conductors.

(v) When more than one repair party is engaged, each party shall provide the label which will be removed after completion of the work by the respective party. If switch locking facilities are available, it shall be locked in the open position and the key retained by the person incharge of the work.

(v) While opening an underground telecommunication cable joint, the cable sheath and armouring which may be at a higher potential than the earth should not be touched without first connecting to a local earth installed temporarily for the purpose.

(vi) As the phantom circuit for block working is derived directly from the main cable, through the plastic insulated conductors, the terminals in the derivation cable termination box on which these plastic insulated conductors for block working are terminated, shall be painted red. The maintenance staff should take necessary precautions while working on cable termination boxes.

(vii) In VF repeater stations and cable huts, a caution board shall be displayed to indicate that the maintenance staff must use rubber gloves and stand on rubber mats while working on the cable termination and equipment. The issue of special instructions to the personnel likely to have access to the cable conductors, sheath and terminations, of the cable sections between sectionalising points, must be done. The marking of any accessible part of the installations or apparatus connected to the line that may be raised to a dangerous potential must be done.

(viii) While working on the telecommunication equipment installed on the overhead equipment switching posts, maintenance staff should ensure that the lightning arresters and the fuses connected in the line are in proper working condition before commencing the work.

24.28 Tools to be provided with insulating sleeves in 25 KV AC area.

(a) Tools which are used in signal and telecommunication circuits and on any current carrying parts of signal and telecommunication equipment are required to be insulated to protect the staff from ac induced voltages.

(b) The handles of these tools shall be provided with insulating sheath of rubber or plastic materials of approved type sufficient to withstand 3000 V.

(c) The following tools shall invariably be insulated:

- (i) Screw driver.
- (ii) Pliers
- (iii) Any other tools, whose handles are metallic and which are required for the above purposes.

SECTION G - WORKSHOPS

24.29 Regulation of factories Act - All the safety regulations enjoined in 'Factories Act' shall be complied with.

SECTION H - HANDLING OF MATERIALS, TOOLS AND METERS

24.30 Crane or hoist, handling materials - While materials are being handled by crane or hoist or a winch, care shall be taken that the personnel are away from the danger zone.

24.31 Correct handling of tools - Wherever it is noticed that the tools are not properly handled by the staff, the correct method should be taught so that the workmen do not injure themselves by using wrong methods.

24.32 Voltage handling of tools - While making voltage tests on transmitters, the meter must be insulated from the ground and the test leads shall be able to withstand the high voltages.

SECTION I - TOOLS, GLOVES, BELTS AND HELMETS

24.33 Tools in wireless stations - The tools employed in a wireless station shall be as per Para 24.28

24.34 Gloves

(a) Where high voltages are employed, suitable rubber gloves shall be provided, **but while working on radio frequency circuits, use of rubber gloves is prohibited.**

(b) The gloves shall be designed such that they will not slip off during use, but shall be easy to take off.

24.35 Belts - Safety belts of approved design may be provided for staff working on poles or masts. The belts shall not be less than 7.5 cm wide and shall be made 5 mm thick, good quality, non-fibrous leather.

24.36 Helmets - Helmets of approved design may be provided for staff liable to work in fire fighting and in places of workshop where overhead cranes or hoists are working or where small objects such as nuts, bolts, tools, stones, etc., are likely to fall from above.

ANNEXURE A

Para 24.27(d) (ii)

SUPPLEMENT TO CHAPTER XX OF THE WAY AND WORKS MANUAL

(Relevant Paras)

Instructions for Railway staff working on tracks equipped with 25KV single phase, 50 Hz ac traction overhead equipment and on or adjacent to such requirement.

1. The instructions lay down precautionary measures to be observed by railway personnel working on the tracks equipped with 25 KV ac overhead equipment.
2. Precautions are required to be taken on account of the following:
 - 2.1 Proximity of a live conductor - The risk of direct contact would occur while working very close to a live conductor.
 - 2.2 Pressure of return current in rails- The return current in the rails may cause a potential difference :
 - between rail and the surrounding mass of earth.
 - between the two ends of a fractured rail.
 - between the two rails at an insulated joint.
 - between earth and any other metallic mass.
 - 2.3 Induction in all metallic bodies situated close to overhead equipment- It is important to note that induced voltage may appear at any instant in metallic masses in the vicinity of traction conductors .
3. The precautions laid down must be followed under all circumstances in sections equipped for 25KV single phase, 50Hz ac traction in addition to those in para 2003
 3. (a) No work shall be done within a distance of 2 meters from the live parts of the overhead equipment without a on 'permit to work' (see para 2003)
 - 3.3 No fallen wire or wires shall be touched unless power is switched off and the wire or wires suitably earthed. In case the wires drop at a level crossing, the gatekeeper shall immediately make arrangements to stop all road traffic, power is switched off and the wires duly earthed.
4. During maintenance or renewal of track, continuity of the rails serving electrified tracks shall be maintained by provision of temporary metallic jumpers of approved design for bridging the gap which would be caused during removal of fishplates or rails.
- 7 Use of rails as foot path, a seat or for such other purposes is strictly prohibited.
- 8 In electrified tracks the use of steel measuring tape or long metallic wires shall be avoided.

N.B. Para references given here refer to paras of the Way and Works Manual