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सिगनल प्रणाली में सुरक्षा
पर हस्तपुस्तिका
**HAND BOOK ON
SAFETY IN SIGNALLING**

कैमटेक / एस / 2005 / सुरक्षा / 1.0
CAMTECH/S/2005/Safety/1. 0

दिसंबर 2006
DECEMBER 2006

Centre
for
Advanced
Maintenance



TECHnology *Excellence in Maintenance*

Maharajpur, Gwalior - 474020

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SAFETY IN SIGNALLING

Part-A

GENERAL

1. Introduction

To ensure that while working or after working, as a result of the work no unsafe or dangerous situation arises, which may cause harm to personal / equipment is termed as safety.

It is necessary to ensure safety otherwise it may result the loss of human lives, railway properties and also may disrupt smooth operation of the system.

1.1 How to achieve the safety.

- ◆ By obeying the safety rules.
- ◆ By using the safety equipment and precaution.
- ◆ By using the safe methods while working and avoid short cut.
- ◆ By doing proper & time bound inspection / joint inspection & maintenance of the equipment.
- ◆ Ensure availability of the satisfactory of safety equipment in your possession.
- ◆ Ensure availability of fire fighting equipment / First aid box in equipment room.

1.2 Avoid the use of following practice.

- ◆ Short cut operation while working with battery and other equipment.
- ◆ While connecting measuring equipment ensure that the measuring instrument are connected with proper setting as per given.
- ◆ Always use the instrument on higher range of the value if not known.
- ◆ Before Energization, check all the connections are proper as per circuit diagram and fully tightened.
- ◆ Before disconnection of the circuit ensure that information is to be issued to the users / party.
- ◆ Maintain properly and ensure that all the measuring instruments are in working condition.
- ◆ Good & qualitative maintenance is the key of reliability.
- ◆ Your efficiency is judged by your quality of maintenance. Quality of maintenance is worth for department.
- ◆ Never use short cut.

1.3 First Aid in case of electric shock.

- Switch OFF if this is not possible **Protect your-self** with dry insulating material and pull the victim clear of the conductor.
Do not touch the Victim with your bare hands until he is clear of the conductor, but do not waste time.
- Place the victim in the supine position.
- Keep the air passages clear by turning the head to one side, opening the patients mouth and clearing it of water,

saline mucus or blood, a lot of which might have accumulated in the back of the throat.

- If the jaw is rigid try to force the mouth open by pressure on the gum behind the last molar tooth of the lower jaw. When the upper air passages are thus cleared, tilt the head backward and force the jaw forwards from the angles of the jaw in front of the ears. This would prevent mechanical obstructions to the upper air passages.
 - Then hold the chin up and forward with one hand and pinch the nostrils of the victim with the other.
 - Take a very deep breath and apply your mouth to that of the victim and blow into his mouth, until the chest of the victim moves up indicating filling of the lungs (Never allow the chin to sag)
 - When the chest has moved up, withdraw your mouth and allow the chest to sink back. REPEAT this process every three to four seconds until the victim begins to breathe again or until he is taken over by a medical attendant. This method can be continued in an ambulance during transit of the patient from the site of accident to the nearest medical center.
-
- ◆ Have some one else to send for a doctor.
 - ◆ Keep patient warm and loosen his clothing.
 - ◆ Do not give liquids until the patient becomes conscious.

■ Safety precaution

- ◆ The maintenance, operation, and repairing of electrical, and electronic equipment is done by

mechanic / engineer. During the above operation the mechanic/engineer should take the safety precaution. Otherwise the electrical shock may be dangerous to the life of the staff.

- ◆ The following precautions are taken during maintenance, operation, and repairing of electric / electronic equipment.
 - Do not touch the electric / electronic equipment unless sure that there is no leakage current in the body of the equipment.
 - While working on the electrical / electronic equipment always use rubber shoes, mat, globes or dry wooden platform to maintain the separation from the earth.
 - Before switching on the equipment always ensure that the circuit is properly connected and no person is working on the circuit.
 - Before doing any experiment always have full knowledge of experiment and all required tools; equipment and circuits with you.
 - Before starting any maintenance, repair, always disconnect equipment from mains. Never pull the plug from the socket by holding the lead wire of mains.
 - Whenever working on the mains your hands should be dry. Never touch the mains, electrical equipment with wet hands.
 - If there is any high voltage capacitor in the circuit always touch or disconnect the capacitor after discharging it.

■ Fire fighting precautions and its equipment

- ◆ In factory, workshop, offices fire may occur due to either short circuit or any other reason, So to extinguish the fire, fire fighting equipment are used and, its knowledge is necessary.
- ◆ The fire fighting equipment should be placed at such locations from where equipment is clearly visible and easily approachable from working place.

There are following types of extinguisher is used.

1) Carbon dioxide extinguisher (CO₂ type)

- ◆ These extinguishers are Sodium Bicarbonate chemical extinguisher. Those are also known as soda acid extinguisher. It can be applied to fire developed in wood, cotton, and cloths etc.
- ◆ It is made of a cylindrical iron cell filled with sodium Bicarbonate solution and on the neck of the cylinder there is a glass cell filled with sulphuric acid.
- ◆ When ever it is required for use, press the cock of the equipment with a force and keep the cylinder down ward after shacking it, so a chemical reaction take place in the cylinder i.e.



- ◆ Due to this chemical reaction a huge quantity of carbon dioxide gas is produced along with water and through nozzle it comes out with a great force. When it is

applied on fires it cuts off the supply of oxygen of that area and also reduces the temperature causing fire to extinguish.

2) **Foam Type Extinguish**

- ◆ This extinguisher is also same as soda acid but the solution of the sodium Bicarbonate is mixed with Turkey red oil. When it is applied over the fire, Oil is sprayed over the fired material and deposits a layer of foam over it. Which cut off the supply of the oxygen and fire is extinguished.
- ◆ It is suitable for inflammable material like electric equipment, places like petrol pumps, kerosene, aerodrome etc, where highly inflammable material is kept

3) **Water used as fire extinguisher**

- ◆ Water is also used for fire extinguishing. When any fire take place, the fire fighting equipment spray water over it with a great pressure.
- ◆ Due to high pressure of water the temperature goes down, and fire extinguished but it never use over fire developed in oily area because water is heavier than oil and the oil comes over water and fire continued.
- ◆ Water should not be applied over the electrical fire because water is a good conductor and may cause shock to the fighting staff.

4) CTC fire extinguisher

- ◆ In this equipment there is a cylinder filled with carbon tetra chloride gas with a very high pressure.
- ◆ When its cock is pressed. The liquid carbon is spread over the fire and the carbon particle deposit over the surface of fired material and cut off the supply of oxygen. And fire extinguishes.
- ◆ This apparatus is normally used on electrical appliances but never kept inside the room since CTC chemical produce the poisons Phosphine gas.
- ◆ Always used after cover your nose and mouth with wet cloth.

Part-B

Mechanical Gears

1. Lever frame.

◆ Dont's

- Do not open locking box covers except under the personal supervision of Junior Engineer/Section Engineer.
- Do not allow slackness in locking in any case.
- For direct type locking lever frame not more than half inch/12 mm.
- For catch handle type locking lever frame not more than 3/8" /10 mm.

◆ DO'S.

- Do ensure that locking box covers are securely fixed and properly sealed.
- Do ensure that lever collars are used effectively.
- Do ensure that all nuts and bolts are tight and split pins are opened. In no case nails or non-standard pins should be used in place of split pins.
- Do ensure that collar of quadrant are not rounded off.
- Do ensure that lever shoes are not cracked.
- Do ensure that lever shaft (main axle) are at their proper position and alignment particularly at ends.

■ Maintenance

As per SEM part II

- Check bolts and nuts for tightness and opening of split pins including the safety bolts of DW Compensator.
- Lubricate all accessible parts.
- Operate lever and check that full stroke is transmitted.
- Check the painting of levers.
- Check the tripping of D.W Clutch levers.
- All connections including down rods must be examined to detect cracks, slipped threads and spacing.
- Check the pulley block in D.W cabin is in order.
- Check the Double Wire Compensator that when the transmission is at rest, both the grips of Locking Pawl are disengaged with the teeth of Ratchet Rod. The weights must be floating freely and in level with each other. During lever operation, check that they engage with Ratchet Rod teeth.
- Adjust weight levers in such a way that during the hottest period of the day, the lever must not reach the breakage mark on the ratchet rod.
- Check the lubrication of compensator wheel grooves and wire rope with graphite grease Gr. I to IS 508. Check the lubrication of moving parts with axle oil. Check the lubrication where nipples are provided with grease IS-507.
- Check the drum lock fitted on coupled Clutch/Clutch/Direct levers for effectiveness.

2. Points (Rod Operated)

■ Don't's

- Do not work on points without using wooden point block.

■ Do's.

- Facing point locks shall be tested by 'Obstruction test' with a test piece of 5mm thickness placed between the switch and stock rail at 150mm from the toe. With the obstruction in, it shall not then be possible for the lever working the facing point lock to be latched.
- Do ensure that tongue rail is not worn out/damage. If worn-out / damaged, issue memo to P.Way staff for replacing the same.
- Do ensure that all bolts, studs, pins etc. of apparatus used for locking control of out laying siding points are riveted or otherwise secured against interference by un-authorized persons.
- Do ensure that protection cover of points and lock mechanism are in good conditioned and correctly fixed to safe guard against un-authorized interference.
- Do ensure that the end of the facing point lock plunger is square and the edges of notches in stretcher blades are kept square and slump.

- Do ensure that the switches and heel blocks of the points are in square on a straight track.
- Do ensure that the clearance between the bottom flange of stock rail and P-Way leading stretcher is not more than 1/8".

■ Maintenance

As per SEM Part II

- Cleaning and lubricating of moving parts. Also check point chairs are cleaned regularly by permanent way staff.
- Check the gauge of the point, opening of the switches and squaring and packing condition of sleepers under gauge tie plate and slide chair fixing bolts .
- Make visuals check regarding the condition of switches sleepers, gauge tie plate.
- Check the switches are housed properly against stock rail and check spring on the switches equally in the normal and reverse positions.
- Check the points for obstruction test.
- Check the ends of plunger of the lock and notches are square.
- Check the lock plunger is 12mm clear from the stretcher blades when unlocked. in case of EFPlocks, check locking Dog protrudes 3mm (at least) after locking both the stretcher.
- Check for tightness of bolts and nuts and arrange for tightening/replacing missing bolts and nuts of flexible stretchers.

- Check lock bars are straight and examine the driving pieces for looseness.
- Check the lock bar clips and stops for tightness and lubricate the bearing of clips.
- Badly worn out clips to be replaced and check if creep is effecting the working of lock bar.
- Check that lock bars lie 38mm below the top of the rail.
- Check the broken wire locks and test for easy movement and also check the point mechanism is butting against its stop in normal and reverse.
- Check that no two similar wards exist for conflicting train movements for hand plunger lock, lever lock.

Lock bar.

■ **Dont's.**

- Do not bend lock bar clips to prevent its leaning away from the rail, lock bar clips stops and guide must be tightly attached to the rail so that lock bar fall close up to the rail.

■ **Do's.**

- Do ensure that with its lever in normal/reverse position, the inside lock bar lies 38 mm below the top of rail and that the bar does not lean away from the rail.
- Do ensure that the end of lock bar is not more than 25 mm clears of the toe of the switch when points are bolted.
- Do ensure that an inside lock bar lies ¼" above the top of rail with its operating lever in the mid position.

- Do ensure that lock bars are kept straight and move both vertically & horizontally.
- Do ensure that at least 9 clips and 3 stops are provided.
- Do ensure that the path rollers are provided in between check rail and stock rail.

4. Point detector (Mechanical)

■ Dont's.

- Do not permit the undue side play; in point/signal slide.

■ Do's.

- Do ensure that the protection covers of detectors are in good condition and securely fixed to safeguard against outside interference.
- Do ensure that detector notches are kept square and not cased off beyond the standard size. Notches in point slides must be properly adjusted.
- Do ensure that an obstruction of 3.25 mm between switch and stock rail at 150 mm from the toe of switch prevents pulling of relevant signal slide.
- Do ensure that notches in signal and point slides are sharp and square.
- Do ensure that all bolts, nuts and check nuts are tight.
- Do ensure that wires are so adjusted that when a signal is returned to the "ON" position, all signal slides of detectors must travel back to their stops with sufficient spring.

■ Maintenance

- Check and tighten the nut and bolts of shoe and unit etc.
- Ensure that signals slides detect the closed switch first before it detects open switch.

As per SEM Part II

- All detectors shall be examined regularly and the slides kept well lubricated.
- **Detector notches:** Detector notches shall be kept square and not eased beyond the standard size. Notches in point slides shall be kept properly adjusted.
- **Cleaning of detector shoes and angle slides:** Detector shoes and their angle slides should be regularly cleaned and graphited to permit movement of the detector shoe.
- **Testing detectors:** Detectors shall be regularly tested by obstruction test.
- **Replacement of cracked or broken parts:** Cracked or broken parts of detectors shall be repaired or renewed.

5. Signals (Semaphore)

■ Dont's.

- Do not take “OFF” any signal by unauthorized means.
- Do not climb on/and work on the signal while the train is passing through.

■ Do's.

- Do ensure that the signal is neither ‘Cocking’ nor ‘Drooping’.
- Do ensure that initial and final idle strokes are available in double wire signal mechanism.
- Do ensure that in case of a slotted signal, it goes back to “ON” when any one of the controls is withdrawn.
- Do ensure that protecting covers of all signal mechanisms are in good condition and securely fixed to safeguards against outside interference.
- Do ensure that guys of signal post are kept tight and in good repair.
- Do replace promptly loose, cracked or broken spectacle roundels or glasses.
- Do ensure that signal lamps are in proper working order and signals are correctly focused.
- Do test on your regular maintenance rounds, (the signals provided with electric reverses) by pulling off signal wires to ensure that electric reverses are not jamming.
- Do ensure that all nuts and bolts of signal fittings are tight.
- Do ensure proper adjustment of back light screen.

- Do ensure that “blanking off” of signal ladders, when required, is provided correctly

■ Maintenance

AS per SEM Part II

- Check the condition of the post, fittings, level of arms and the posts are properly plumbed and lubricate working parts.
- Inspect the platforms where provided for decayed or loose boards.
- Cleaning of the roundels, glasses and lenses.
- Check the founts of signal lamps are in good repair. Check for damaged flame guard, leaky founts and broken burners and non- standard wick.
- Check the focussing of signals.
- Testing of signals.
- Where double wire signal mechanism is used, check lubrication of cam path.
- Check all signal lamps are overhauled.
- Cleaning of signal arms. Painting to be got done if required.
- Check adjustment of back light.

6. Level crossing gate.

■ Dont's.

- Do not under take heavy repair, renewals or alterations to interlocked gates unless arrangement for the protection of the traffic has been made.

■ Do's.

- Do ensure that in open position of the gate, key cannot be extracted from the winch or from the lock fitted on gate leaves.
- Do ensure that gate control lever cannot be operated unless the key from the winch is inserted and turned in the lock provided on the lever.
- Do ensure full opening and closing of lifting barrier booms. Also ascertain that booms are locked in full closed position.
- Do ensure that the bell rings correctly and the red light is exhibited properly.
- Do ensure that positive boom locking is effective.

■ Maintenance

As per SEM Part II

■ Mechanical lifting barriers

- Check that mechanism is kept in good condition free from dust, rust, dirt etc.

- Check that moving parts, gate locks are lubricated properly.
- Proper adjustment of wire sag and tension shall be made.
- Integrity of boom locking and 'E' type lock locking the winch shall be checked.
- Integrity of interlocking shall be checked.
- Cleaning of all pipes and ducts to prevent obstruction by accumulation of dirt.
- Audio Visual warning.
- Approach warning.

Electrical lifting barriers

- Check that machines are kept in good condition free from dust, rust, dirt.
- Check the moving parts are lubricated properly.
- Check the contacts are clean and in proper adjustment.
- Check the commutator is clean and smooth.
- Check the friction clutch, de-clutches when the boom is fully raised or lowered.
- Check the adjustment of the shock absorber.
- Check the time of operation, voltage and operating current.
- Check the gear box is filled with lubricating oil to its level.

Gate locks

- check that gate locks are lubricated regularly.
- Check that 'E' type locks are in good working order.
- Check that gate locks are properly fixed.
- Integrity of interlocking shall be checked.

General

- Check the signal wire transmission is in good working order with special reference to wires crossing gate.
- Audio Visual warning
- Approach warning.

Part-C

Electrical Gears

1. Relays.

■ Dont's.

- Do not energize a relay by giving direct feed.
- Do not over energize relays.
- Do not bridge the relay contacts.
- Do not tilt or over turn a relay to close/ make the contact.
- Do not use a relay, if it is due for overhauling.

■ Do's

- Do ensure that relay seals are intact.
- Do ensure that anti tilting device is provided.
- Do ensure correctness of wiring at relay terminals when a relay replaced.
- Do ensure that the cross protection where provided is effective.
- Do replace relay when its window glass is found broken or any moisture/fungus is inside the relay.
- Do ensure that transportation screw is cut & properly fixed.

- **As per SEM Part-II**
- **Requirements**
 - ◆ Relay of an approved type shall be used.
 - ◆ Line relays of Neutral/Polar Biased/Magnetic latch/Interlocked type rated at 24/60VDC shall normally be used. Normally plug-in type relays shall be used.
 - ◆ Shelf type polar line relays of approved type, shall only be used in line circuit for block working.
 - ◆ Suitable type of Lamp proving relays for ON and OFF proving shall be used for signal lamps operating on DC or AC to meet with parameters to suit various lamps.
 - ◆ Special line relays of reed type shall be of double tuned filter type.
 - ◆ Track relays shall always be of metal to carbon contact type and normally be of plug in type, unless otherwise specially permitted.
 - ◆ In non electrified area, the following relays shall be used:
 - 9 Ohm DC non-AC immunized (Shelf type and plug-in type)
 - 40hm DC non-AC immunized
 - 2.25 Ohm DC non-AC immunized (Shelf type)
 - ◆ In electrified area, the following relays shall be used:
 - 9 Ohm DC neutral, AC immunized.
 - 9Ohm DC biased, AC immunized
 - ◆ Double element motor type relay, operating on 83 & one-third Hz in AC traction area and 50Hz in DC traction area shall be used.
 - ◆ Vane type relays may continue in use till replacement.

- ◆ Relays for track circuit provided with coded, pulsed, electronic (audio frequency or high frequency track circuit), shall be of an approved type of track/line relay or as recommended by manufacturer.
- ◆ Where magnetic latch relays are used, the circuit shall be so designed so as to prevent undue dropping of the relay due to back emf generated by other relays.
- ◆ Wiring of 'Q' type relays shall be done through flexible wire preferably.
- ◆ Mercury wet contact type relay shall be used for flasher circuits, alternatively, a solid state flasher may be used. If solid state flasher is used, flashing indication on operating panel should be provided for indicating healthy condition of flasher.
- **Storage:**
 - ◆ Relays shall be kept in reasonable storage condition. It shall be ensured that such a storage place is not in the vicinity of damp or chemically polluted environment.
 - ◆ Sealing screws of the relays shall be intact.
- **Transportation:**

Care shall be exercised in transporting the relays from the place of storage to the work site so that the relays do not get damaged.
- **Installation:**
- **Location:**
 - ◆ It shall be ensured that as far as practicable, the relay room is not located in the vicinity of chemical factory , loco shed or engine ash pits etc. In case it becomes unavoidable, necessary precautions shall be taken so that relays are least affected by the chemical fumes, dust etc. and are provided with dust free environment. Where

there is concentration of relays, Air-conditioning shall preferably be provided.

- ◆ Where relays can not be located in the Cabin, they shall be housed in location of approved type which are properly secured.
- ◆ Where relays are likely to be subjected to vibrations, they shall be mounted in such a way that the relays are free from shock and can not be tilted.
- ◆ It is desirable to provide insulating caps on the terminals of shelf type relay to avoid inadvertent short-circuiting during maintenance.
- ◆ When a number of shelf type relays are used, the mounting and arrangement of relay rack shall be such as to facilitate easy maintenance. Suitable anti-tilting arrangement shall be provided wherever shelf type relays are used.
- ◆ Relays shall be housed on level surface.
- ◆ In 'Q' style relay the code pins configurations for plug in relay shall not be changed by drilling additional holes on plug board to avoid fixing of a wrong relay which may lead to unsafe condition. In Siemen's K-50 relays, the Code pins position on base plate should not be changed and to be retained as fixed by the manufacturer.
- ◆ All relay clips shall be checked for proper locking in the base when plugged in. Extreme care, shall be exercised while removing the clips from the jacks of the plug-in type relay.
- ◆ In all installations, a relay index board shall be provided for locating relays easily.
- ◆ Relays involving external circuits shall have cross protection and double cutting. Signal control relays shall preferably be provided with double cutting.

- ◆ A contact chart shall be prepared duly showing the contacts used circuit-wise with reference and spare contacts available, wire count for each contact and relay position in the rack.
- **Sealing of plug-in relays:**
 - ◆ In case of metal to carbon contact type relays, sealing shall be done at Manufacturer's premises before dispatch and if the seals have to be broken due to any defect noticed, resealing must be done at the workshops.
 - ◆ In case of metal to metal contact type relays, sealing of the cover shall be done by the Section Engineer at site. Whenever seals have to be broken at site for maintenance purposes, the same shall be done by an official not below the rank of Section Engineer.
 - ◆ Line relays shall be energized at the rated voltage specified in the specification.
 - ◆ Locking screw shall be removed and the hole sealed in case of Shelf type relays.

■ Maintenance

As per SEM Part-II

- Cleaning shall be done regularly so that dust is not deposited on the relays.
- Anti-tilting arrangement for shelf type relays is available and relays shall not be tilted or turned over to close contacts and relay contacts shall not be bridged.
- During routine inspection and maintenance, if high contact resistance is observed on any contact of metal to metal relays, such contacts can be cleaned. In case of

metal to carbon relays either the spare contact shall be used or the relay shall be replaced.

■ **Periodical inspection**

- All relays used in vital circuits shall be visually inspected each time during inspection.
- Section Engineer shall visually inspect the relays. During visual inspection, relay shall be taken out of service if any of the defects are noticed in respect of:
 - Movement of armature and contact carriage;
 - Wiping of contacts;
 - Arcing of contacts;
 - Pitting or charring of contacts;
 - Dust accumulation on contacts;
 - Electro-plating;
 - Corrosion, rusting of components;
 - Crack or breakage in components;
 - Presence of fungus and ants inside the relay casing;
 - Charring of cover near contacts in the case of plug-in-type relays;
 - Corrosion of Label;
 - Absence or tempering of seal;
 - Any other abnormal condition.

■ **Overhauling**

- a. Track relays of all types and line relays of only shelf type should be overhauled periodically. All other relays may not be overhauled periodically.
- b. All types of track relays should normally be overhauled every 10 years subject to a maximum of 12 years.

- c. Line relays of shelf type should be overhauled every 15 years.
- d. Overhauling period mentioned (b) and (c) above should be counted from the date of manufacture/last overhauling.
- e. The periodicity of overhauling of track relays and shelf type line relays may be reduced by the Railways depending upon intensity of traffic and other local conditions obtaining thereon, such as heavy suburban sections and major route relay interlocking installations.
- f. All metal to carbon contact miniature plug-in type relays other than track relays should be overhauled only when they are removed from service after a failure.

2. Electrical Signal Machine.

■ Dont's.

- Don't leave slackness in circuit controller bands.

■ Do's.

- Do ensure that indication locking where provided is effective.
- Do ensure that signal arm goes black to "ON" when any one the control is withdrawn.
- Do ensure that there is neither 'Cocking' nor 'Drooping' of signal arm.

■ Maintenance

As per SEM Part II

- Check the machine is in good condition, free from dirt, rust and dust, peeling off of electroplating.
- Check lubrication of all the gearing and bearings.
- Check all the contacts for cleanliness, freedom from pitting and proper adjustment.
- Check the cleanliness and smoothness of the Commutators.
- Check and drain out any oil accumulated at the bottom of the case. Oil the machine with good quality high grade lubricating oil to IS. 1628
- Check smooth operation of gear train free of noise.

- Check the wear on the brush. If the wear is such that the tensioning spring touches the brush carrier, replace the brush.
- Conduct positive test-Take off signal, observe latching without clutch slipping; if clutch slips, adjust the clutch.
- Negative test- Near 45° and near 90° before hold off device engages, cut off feed-signal should return to 'ON'.
- Check the gasket on the cover in position.
- Check effectiveness of snubbing.

3. D.C. Track circuit.

■ Dont's

- Do not open block joints in the absence of the Engineering staff.
- Do not over charge track feed battery.
- Do not energise track relay by giving direct feed & do not disconnect battery without disconnecting the charger.
- Do not tilt the shelf type track relay and do not bridge its contacts.
- Track relay terminal voltage should not exceed 250% of its pickup value.
- Do not use 2.25-Ohm relay in track circuits provided with concrete sleepers.
- Do not use the relay, which does not bear test slip indicating date of overhauling or if its window's glass is broken.

■ Do's

- Do ensure that the track circuit can be properly shunted at different points in the track.
- Do ensure that the value of ballast resistance, TSR, rail resistances are in permissible limit.
- Keep constant watch over rod run or any other fitting crossing/passing under the track circuit.
- Do ensure that the track relay is not due for over hauling.
- Do ensure that the voltage across the relay coils is less than 85% of drop away value when the track is shunted with 0.5-Ohm resistance.

■ Maintenance

- Double bond wires in the rails should be provided where the same are not welded.
- Staggering of the polarity between two adjacent track circuits should be maintained. Cross bond should be intact, if any.
- Painting of fish plate insulation joint with non-corrosive paint should be done.
- Adequate packing of insulation joint & only 'J' type clips should be used at glued joint.
- Insulation resistance of Glued joint should not be less than 25 Mega-Ohm in dry condition & 3 K- Ohm in wet condition.
- Track feed batteries should be charged adequately.
- Dead section should not be more than 12 feet in MG & 20 feet in BG.

- Proper drainage and ballast cushion should be maintained with the help of Engineering staff.
- Follow the parameters & record the same in the track circuit history card.
- The value of parameters are quoted below:

■ **Non-RE Area.**

- Maximum value of rail resistance up-to 700 meter track length = 1.5 Ohm per Km.
- Maximum value of rail resistance above 700meter track length = 0.5 Ohm per Km.
- Ballast resistance with wooden sleeper should not be less than 2 Ohm per Km. track length within station section.
- Ballast resistance with wooden sleeper should not be less than 4 Ohm per Km. track length within block section.
- Ballast resistance with PRC sleeper should not be less than 1 Ohm per Km. track length both within & outside station section.
- TSR should not be less than 0.5 Ohm for wooden sleepers and 0.25 Ohm for PRC sleepers.

■ **RE Area.**

- Maximum value of rail resistance up-to 700 meter track length = 1.5 Ohm per Km..
- Maximum value of rail resistance above 700 meter track length = 0.5 Ohm per Km.

- Ballast resistance with wooden sleeper should not be less than 2 Ohm per Km. track length within station section.
 - Ballast resistance with wooden sleeper should not be less than 4 Ohm per km. track length in the block section.
 - For the single rail track circuit with the PRC sleeper, ballast resistance should not be less than 0.6 Ohm per km.
 - For the double rail track circuit with the PRC sleeper the ballast resistance should not be less than 1 Ohm per Km.
 - TSR should not be less than 0.25 Ohm for PRC & 0.5 Ohm for wooden sleepers.
 - The maximum length of track circuit with AC immunized shelf type relay is 750 meter for wooden sleepers well as PRC sleepers.
 - The maximum length of track circuit with AC immunized shelf type relay is 350 meter for PRC sleepers & 450 meters for wooden sleepers.
- **Use Of Track Relay.**
- Up to 100 meter length of track circuit, the relay coils of shelf type track relay should be connected in series to provide for 9-Ohm resistance of track relay in non-RE Area.
 - For more than 100 meter track circuit having wooden sleepers, shelf type track relay coils should be connected in parallel to provide for 2.25-Ohm resistance of track relay in non-RE Area.

- In RE area with PRC sleepers, track relay having resistance 9 Ohm (Irrespective of length of track circuit) should be used.
- In non-RE area with the PRC sleepers relay of 9-Ohm resistance should be used.
- The voltage at track relay terminal should not be more than 85% of its drop away value when track is shunted with TSR.
- Anti tilting device must be provided for shelf type track relays.

4. Axle Counter.

■ Dont's.

- Don't reset the axle counter if there is no count in axle counter
- Don't by pass TR & don't energize EVR & SUPR by giving direct feed & do not bridge its contacts.

■ Do's.

- Do ensure that counting is possible only when TR is in dropped condition. (where Track circuit exist)

■ Maintenance

- Protectors must be used to protect field/track side Equipment (TX & RX).
- Trolley suppression track circuit must work properly (Track circuit length should not be less than 3 rail length for double line and 5 rail length for single line).

- Wiring to the EVR & SUPR relays shall be done with shielded cables.
- Voltage across EVR & SUPR relays when energised shall be 7 to 9 Volt (CEL Make 12 Volt)and when de-energized shall be less than 0.5 Volt.
- A non-electrolytic capacitor of 4.7 microfarad, 250 Volt shall be connected across the EVR & SUPR relay terminals.
- The percentage release of EVR & SUPR must be more than 65%.
- Periodically tally the counter reading with counter register and see the reason.
- Cable used between EJB and evaluator shall be 4 quad axle counter cable or pet quad of main telecom, cable or jelly filled polythene telephone cable.
- The maximum loss is the axle counter cable should be less than 18 db.
- Adjustment of DIP.
- After fixing the track device and connecting it to EJB, measure RX coil out put it should be greater than 1 Volt in each coil.
- Check the DIP in each coil be placing the dummy wheel and Rx Voltage shall fall below 10% of initial value (1 Volt).
- To get this required value provides nylon pads below Rx coil if necessary or adjusts the TX coil position.
- Ensure that after adjustment of DIP, Rx coil out put is more than 0.7 Volt.

5. Colour light signal.

■ Dont's.

- Do never take "OFF" a signal by giving direct feed.
- Do not open the housing cover in the face of an approaching train.

■ Do's.

- Do replace lamps as per schedule and as per requirement such as in automatic Signalling.
- Do ensure proper focusing of signal in day and night.
- Do ensure that for energisation of UECR at least three lamps are required to light.

■ Maintenance

As per SEM Part II

- Check the cleanliness of Lenses. Housing shall be kept clean.
- Check the lamps are replaced as per the extent instructions.
- Check the lamps are working at 90% of rated voltage.
- Check the lamps used are tested prior to replacement.
- Check the bulbs are seated properly.
- Check the focusing of signals.
- Check all adjusting nuts are properly tightened.

◆ Replacement.

- Defective lenses and glasses must be replaced immediately.
- The frequency of replacement of lamps shall be decided by CSTE of Zonal Railway.
- When double filament lamps are used, they must be replaced when one filament fails. It is preferable to give audio/visual indication at the place of operation.
- New lamp shall be pre-tested as per approved instructions before putting into use.
- **Maintenance checks:** The following checks shall be made periodically:
 - The bulb shall be properly seated and contact springs have adequate tension.
 - The signal focussing shall be checked and adjusted periodically.
 - All adjusting nuts are properly tightened.

6. Electric point detector (IRS type)**■ Dont's.**

- Do not eliminate the shunt contacts.

■ Do's.

- Do ensure proper adjustment of ND,RD,NSH & RSH contacts.
- Do contact obstruction test every time and observe point detection in corresponding position of point.

■ Maintenance

As per SEM Part II

- Check that contacts make or break at same time. Check that the cross protection contact makes only after concerned detection contact open. Normal detection opens then only normal shunt contact to close and vice-versa.
- Check that sleepers are packed well.
- Check tightening of all nuts and screws.
- Check slides and rollers are lubricated with axle oil grade medium to IS:1628.
- Check the wires are neat and tidy.
- Obstructions test.

7. Electric point machine.

■ Don't's.

- Do not operate point manually except through specific crank handle.

■ Do's.

- Do ensure that cross protection is effective.
- Do ensure that track locking, route locking, crank handle release locking are effective.
- Do test the correspondence of the points with indication at panel/cabin.

■ **Maintenance**
As per SEM Part II

- Check the machines are kept free from rust, dirt and fixtures.
- Check for tightness.
- Check lubrication of all gears and bearings.
- Check the cleanliness and smoothness of commutators.
- Check the contacts for freedom from pitting and proper adjustment.
- Check for proper ballasting and packing of sleepers.
- Tighten all nuts, check nuts and bolts. Tighten lock nuts holding the detector slides and lock slides with lugs are kept tight. After tightening, the nut and lock nut should be turned in opposite direction towards each other to lock the nut.
- Check the wires carefully to keep them neatly dressed and clear of all moving parts. Check that wires do not get trapped in the lid when closed.
- Lubricate the slides, rollers and pins with axle oil Medium grade to IS: 1628-Avoid overflow of oil.
- Ensure all the bridge contacts make and break at the same time.
- Check the pins of switch extension piece for any rib formation or excessive wear.
- Conduct obstruction test.
- Check the functioning of overload arrangement and out of correspondence.
- Check the tripping at overload of Friction Clutch.
- Insulation tests on the point machine to be conducted.
- Check all grease nipples provided are in position. Recommended type of grease should be used.

- Check the setting of switches for having required amount of spring action.
 - Measure the voltage and current at Motor terminals for both normal and reverse operations. These should be within the specified limits according to the different types of Point machines.
- **Obstruction Test**

As per SEM Part II

- The point driving rod and the connections of the machine must be so adjusted that with 5mm thick test piece obstruction placed between the switch and the stock rail at 150 mm from the toe of the switch;
 - i) The point cannot be locked;
 - ii) The point detector contacts should not assume the position indicating point closure
 - iii) Friction clutch should slip.

Note: Maintainer should adjust with 3.25 mm obstruction so that it does not fail in 5mm obstruction test.

Part-D

Inter Slotting Equipment

1. Electrical signal reverser (IRS 'B'-Type).

■ Dont's.

- The reverser should not jam.
- Do not leave a reverser in sticking tendency till it is rectified.
- Don't use improper grade oil, grease & dashpot oil for maintenance.

■ Do's.

- Do ensure that the voltage of reverser coil is within prescribed limit (7.5Volt to 12.5 Volt)
- Do reverse the polarity of the terminal of coil periodically.

■ Maintenance

As per SEM Part II

- Check oiling of all moving parts. Ensure oil holes are not clogged by dirt or excessive oil. Lubricate with axle oil Medium to IS: 1628. Ball bearing must be greased with graphited grease (Grease A No. 0to IS: 408).
- Remove the dash pot assembly from reverser and check if the oil level is lower than 35mm above the bottom of the sliding cylinder. Insulation oil for transformer to IS: 335 shall be used for topping up. As the gap between sliding cylinder and plunger is very little, any sludge in the oil will

block the passage and may affect the functioning of dash pot. If the oil is found to be sludgy, it shall be removed. Check the dash pot spring is not broken or cracked.

- Check screws, bolts and nuts-open split pins.
- Check the surfaces of armature and core are clean. Check the lubrication of sliding bar of electromagnet and see it slides freely in the bracket.
- Polarity to the coil of reverser to be changed.
- Check the voltage and current of reverser coil.
- Check the insulation of the coil.
- Check the position of spectacle lever and operating lever to see whether arrow mark on them coincide with the arrow marks on the bridge. If the marks are shifted, check if the dash pot spring has lost tension or the down rod has loosened. Action to be taken as situation warrants.

2. Electrical lever lock.

■ Dont's.

- Do not energise a lever lock coil by giving direct feed
- Do not permit the slackness in circuit controller band

■ Do's.

- Do ensure that locking dog is forced into the notches.
- Do ensure sealing of lever lock.
- Do ensure that the contact pressure between finger contact & segment is sufficient & lock dog shape is not rounded.

■ Maintenance

As per SEM part II

- Check cleanliness and lubrication of all working/moving parts.
- Check the forced drop feature of the lever lock.
- Check the notches are square true.
- Tighten all bolts, nuts, terminals and locking screws.
- Check the cleanliness and proper adjustment of contacts.
- Check contacts are not making other than the required position.
- Check that the lever can not be made free other than in release condition.

3. Circuit controller.**■ Do's.**

- Do ensure proper sealing.
- Do ensure correct adjustment.
- Do ensure that all nuts and bolts are tight and split pins are open.

4. SM'S Slide Control frame.**■ Dont's.**

- Do not maintain or remove locking box if section in charge is not present at the time of locking maintenance / overhauling.

■ Do's.

- Do ensure accuracy of electrical contacts.

■ Maintenance**As per SEM part II**

- Check free working of all slides.
- Check proper making of all contact springs.
- Check the condition of the wiring.
- Test the Mechanical locking.

5. Electric Key Transmitter.**■ Dont's.**

- Do not leave EKT lock in which the key can be extracted without being transmitted from other end till the fault is rectified.

■ Do's.

- Do ensure that the cover is properly closed and nuts are tightened.
- Do ensure proper sealing.

■ Maintenance**As per SEM part II**

- Check lubrication and free working of all moving parts.
- Check cleanliness and good adjustment of all contact springs.

- Check the keys of one transmitter does not fit in any other key transmitter at that station.
- Check, and ensure that key cannot be extracted irregularly.
- Check the seals are intact.

Part-E

Block Instrument, Fuses, Eld & Ld

1. Block instrument.

■ Dont's.

- Do not use common earth for more than one block instrument at the same station.
- Do not use common power supply batteries for more than one instrument at the same station.
- Do not energise TGT / TCF coil by giving direct feed.
- Do not operate commutator shaft manually.
- Do not open block instrument in any position other than '**Line closed**' for repair, testing and token balancing

■ Do's

- Do ensure that it is not possible to operate the block handle from line close to TCF / TGT or vice versa without co-operation of other end block instrument (station master).
- Do ensure that safety catch is not mechanically jammed.
- TGT contact should make only when block handle housed in TGT position.
- Do ensure proper locking and sealing of block instrument.
- Do ensure that forced drop arrangement is effective.

■ Maintenance

As per SEM Part II

- **General**
Maintainer shall ensure by a fortnightly check that:
- **Locks**
Electrical or Mechanical locks are in a condition that they are not liable to be forced.
- **Indicators**
Indicators operated fully and return to the normal position correctly when released.
- **Contacts**
All contacts are clean and free from pitting. If surfaces are pitted, they shall be cleaned with chamois leather and refurbished.
- **Springs**
All springs are in good condition and kept properly adjusted.
- **Relay armatures**
Relay armatures are free and return to their normal position when no current is flowing.
- **Track circuits**
Maintenance Hand Book No. ST 47 on 'DC Track Circuit' Published by IRCAMTECH, Gwalior may be referred to for detailed instructions regarding maintenance.
- **External wiring**
All wiring is in good condition and free from joints. Joints, wherever necessary, are properly soldered and insulated.
- **Terminal screws**
All terminal screws, lock nuts and locking screws are kept tight and split pins opened.

- **Batteries**
Maintenance Hand Book No. ST 50 on 'Lead Acid Battery' Published by IRCAMTECH, Gwalior may be referred to for detailed instructions regarding maintenance.
- **Lightning protector**
Lightning and power protective devices and earth connections are effective and in good condition.
- **Block instrument telephone**
Block instrument telephone, its flexible card and the condenser or other means provided for isolating the telephone from the bloc instrument circuit are in good condition. Their isolation is such that there is no direct path for the current to flow from one circuit to the other.
 - Receiver diaphragms are not buckled and are at the correct distance from the pole pieces.
 - Receiver ear piece fits correctly and is screwed tight.

Note: All the above paras shall be checked once in a month by the Section Engineer/Signal and once in three months by the Senior Section Engineer/Signal.

- When a pair of block instruments of a block section falls in different contiguous Railway/Division, both instruments and their associated equipment shall be maintained by one agency.

- **Overhauling of block instruments**

Periodical overhauling interval shall not exceed ten years for Single Line Token Block instruments and seven years for Double Line Block instruments and Handle type Single Line Tokenless Block instruments. Push Button Tokenless Block

instruments do not require overhauling. The associated Polarised relay shall also be overhauled along with the Block instrument.

▪ **Block earth**

- Block earths and their connections shall be examined at intervals of not more than one month by the Section Engineer/Signal and at intervals of three months by the Senior Section Engineer/Signal.
- Block earths shall be tested for resistance at intervals of not more than 12 months by the Section Engineer/Signal or Senior Section Engineer/Signal in accordance. Where the resistance exceeds 10 Ohm action shall be taken to reduce the resistance by providing additional earths in parallel.
- In AC electrified areas, two different Earth shall be provided for discharger and block earth.
- The four terminal condenser used in filter shall be connected in such a way that the DC circuit is completed through the plate or foil of the condensers. It shall be ensured that any break in the foil or Earth connection, which might affect the efficiency of the filter, puts the circuit itself out of use.

■ **Token Instrument.**

- Care shall be taken to see that the safety catch provided near the spring clutch shaft is in position and functioning properly and free to move about the fulcrum without any friction.
- Token indicator shall be checked to see if it is free to move. The pin shall be oiled once a fortnight with

axle oil medium grade to IS:1628. Effectiveness of 'No token' lock shall be checked. It shall not be possible to take handle to 'Train Going To' position when token indicator shows Red.

- Care shall be taken to see that 'Train Going To' and 'Train Coming From' locks rocker arm is free to move about its fulcrum pin. The locks shall be about 1mm above the rack; if not, the locks shall be changed. The edge of the lock shall be square.
- It shall be ensured that all parts of the instrument, which undergo wear and tear are replaced at the time of overhauling.
- The locking Pawl shall be checked to ensure that it is correctly shaped, square ended and the idth is 9.5mm.
- Care shall be taken to see that in the case of Tablet instrument, the tablet holding arm release lever is working satisfactorily and the tablet can be released only after full rotation and release of the instrument handle in the 'Train Going To' position.
- It shall be checked that the notches in the rack are correctly shaped and square.

Note: RDSO Booklet No. STS/E/BTI/IMI may be referred to for detailed instructions regarding maintenance of token Instruments.

■ **Token block instruments (Single line Neal's instrument)**

- Check locking and sealing.
- Check the SM's lock up key working.
- Check whether instrument is due for overhaul.

- Check the distinctiveness of the tone of the bell when two or more instruments are provided.
- Check the instrument is level.
- Check the polarity of instruments.
- Check and ensure the full deflection of Needle indicator.
- Check the tokens for Burr, etc.
- Check the token indicator is free.
- Check the forced drop arrangement of TCF and TGT locks. Also check the edge of the locks for square.
- Check the polarised relay returns to its normal position.
- Check the Safety Catch is in position and free to move about its fulcrum pin.
- Check the spigot for its tightness.
- Check that token receiver can receive only the token of the correct configuration.
- Check that the tablet releaser actuating link screws are in tact.
- Token census.
- Clean Rack and Pinion teeth and lubricate with axle oil medium grade to IS:1628.
- Inspect contact surfaces and spring tensions. If pitted, clean them with chamois leather.
- Check Earth connections.
- Measurement of earth.
- Check the telephone and telephone core.
- Check the Block and telephone batteries for cleanliness and voltages recorded in the card.
- All wiring of the instruments must be checked.
- Measure the line current.

■ Single Line Tokenless Instruments.

- Check that the Last Stop Signal at the sending station cannot be taken 'OFF' until the receiving station instrument is set to 'Train Coming From' condition and the sending station instrument is set to 'Train Going To' condition.
- Check that the Line Clear can be granted only when reception signals and the Last Stop Signal are proved at 'ON'.
- Check that the last stop signal is replaced to ON by the entry of train in to the block section and the same is maintained in "ON" position until the train has cleared the block section and the instruments are brought back to the line closed condition and fresh "line clear" is obtained.
- Check that opposing last stop signals of the block section cant not be taken OFF at one end the same time,.
- Check that the circuit for proving the arrival of a train is directional.
- Check that the shunting key can be taken out only when the instruments are in line closed condition or train going to condition.

■ Tokenless block instruments (Single line handle type)

- Check the locking and sealing.
- Check whether the instrument is due for overhauling.
- Check and ensure full deflection of indicators.
- Check all contacts are clean and free from pitting.

- Check that all mechanical parts such as springs, screws and nuts etc. are in good conditions and kept tight.
- Check Block and telephone batteries are kept clean, terminals tight and free from dirt or corrosion. Record the values of the batteries.
- Check whether LSS can be taken off without Line Clear.
- Measure line current.
- Check working of all counters.
- Check that shunting key is released in Line Closed or TGT position.

■ **Tokenless block instruments (Push button type)**

- Check that block instruments are free from mechanical damage, corrosion etc. All nuts/bolts are secure and complete.
- Check the locking and sealing of all relays and counters.
- Check that Push Buttons and indicators are free from damage and are in working condition.
- Check that shunting key is released in the line closed or TGT position.
- Measure line current.
- Check the telephone and its chord.
- Check that relays, bell and buzzer are free from mechanical damage.
- Measurement of insulation.

■ **Double Line Block Instrument.**

- Locking assembly shall be replaced during each overhauling irrespective of its condition. It shall also be ensured that all parts of the instrument which undergo wear and tear are replaced at the time of overhauling as per approved instructions.
- Quick acting relays shall not be used for stick circuits of the block instrument. Shelf type relays or alternatively two immunized plug-in type 'Q' series relays connected in tandem or one 'Q' series slow to pick up AC immunized relay shall only be used. The total pick up time of relays used shall not be less than 300ms.
- DC 3-position polarized line relay of approved type shall only be used in the line circuit for block working.
- Block release shall be by the operation of two track circuits sequentially.
- Check that the commutator handle is locked first before the 'Train On Line' indication appears on the indicator when the handle is turned from 'Line Clear' to 'Train On Line' position.
- Check that the Block Clearance Relay picks up only after the commutator is turned to 'Train On Line' position.
- Check that the Last Stop Signal cannot be taken 'OFF' when the commutator is in other than 'Line Clear' position.
- Check that the Last Stop Signal is automatically replaced to 'ON' when the train enters the block section and continues to remain in the 'ON' position until the train has arrived at the receiving station and fresh 'Line Clear' is obtained.

- Check that when the commutator is turned from 'Line Close' position to 'Train On Line' position, the commutator is free for return to 'Line Closed' position.
- Check the locking and sealing.
- Check whether the instrument is due for overhaul.
- Check and ensure full deflection of indicators.
- Check the polarised relay returning to its normal position when no current is flowing.
- Check that electrical and mechanical locks are in proper condition.
- Check all contacts are clean and free from pitting.
- Check all springs are in good condition and kept properly adjusted.
- Check that all terminal screws, lock nuts and locking screws are kept tight and split pins opened.
- Check Block and telephone batteries are kept clean, terminals tight and free from dirt or corrosion. Record the values of the batteries.
- Check whether LSS can be taken 'OFF' without Line clear.
- Check the release circuits for proper making and effective proving of all controls.
- Check the telephone and its cord.
- Measure Line Current.
- **Block working in 25KV electrified area.**
As per SEM part II
 - In 25KV electrified line only following type block instrument shall be used:
Single Line
 - Neal's token instrument
 - Daido's Tokenless block instrument.

- Block working with Axle Counter

Double Line

- SGE Block instrument
- Block working with Axle Counter

▪ Single Line token instruments

- Where earth return is used. the rest contact of the instrument shall be substituted by the contacts of a slow release relay. The arrangement shall be such that the relay is energised during the operation of plunger but is dropped only after the condenser has discharged to a safe limit.
- Whenever stray DC is present in the earth, metallic return is provided for block circuit. Metallic return should be used with a modified filter circuit eliminating the condenser. The chokes and surge arrestors shall be retained and shunt resistors shall be provided across the Galvo (150 Ohms) and polarised relay(77Ohms). The resistors shall be of substantial rating so that they do not get open circuited.
- Only frequency modulated single line Daido Tokenless block instrument is approved for installation in electrified sections.

▪ Double Line Block instruments

- IRS type block instrument with block filter shall be used for double line section electrified with 25 KV AC.
- The voltage of the battery shall be sufficient to ensure not less than 18-mA and not more than 25-mA current through the polarized relay.

Needle coil resistance shall be modified to obtain this level of current.

2. Fuse And Lightning Discharger.

■ Dont's.

- Do not use wire in place of fuse.
- Do not replace HRC fuse by a wire fuse.

■ Do's.

- Do ensure that a fuse of correct rating is always used.
- Do ensure that the earth provided for the lightning discharger is effective & has less than 10-Ohm resistance.
- Do ensure that the gases filled lightning discharger are checked for their effectiveness, specially after lightning take place.
- Do ensure that fuse is not due for replacement.

3. Earth Leakage Detectors.

■ Do's.

- Do test earth leak detector for its effective functioning at the time of starting your duty.
- Do ensure immediate attendance and prompt rectification of detected earth fault.

■ Maintenance

As per SEM Part II

- The use of this device is desirable in all electrical signalling installations, such as Route relay interlocking, Panel interlocking, Centralized traffic control and SSI.
- All cables termination devices, pillar boxes, cable heads and glands shall be kept clean and dry. These parts shall be frequently inspected and any tendency for moisture or water leak shall be immediately attended to.

Part-F

Additional Precautions for Signalling in RE area

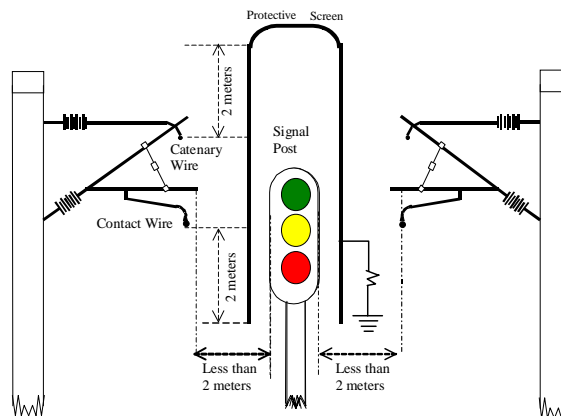
1. Signal (RE Area)

■ Dont's.

- Do not disconnect the protected screen provided at the signal post.
- Do not climb on signal post while maintaining signalling gears with metallic items, which may come in shaded zone.
- Do not disconnect the earthing of any signal.
- Do not energise any circuit on overhead line.

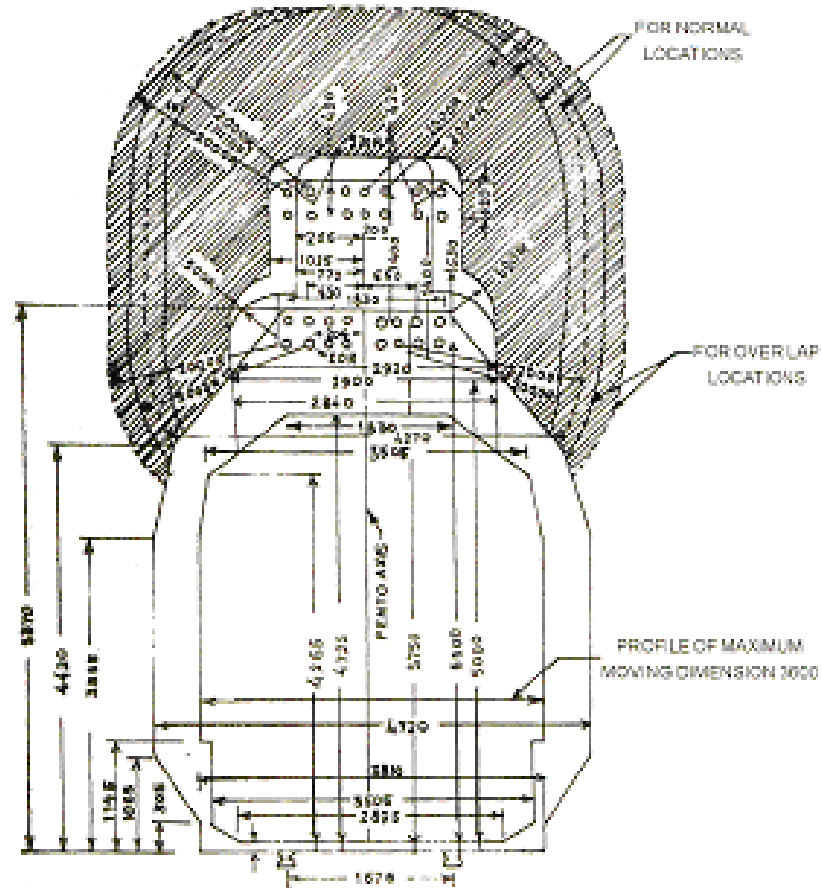
■ Do's.

- Ensure that the protected screen of signal post is properly earthed.



Earthing of Signal Protection Screen

- Ensure that individual earth is in good condition for each signal/location box.
- Ensure that no portion of signal fittings lies in shaded region as shown in figure below.



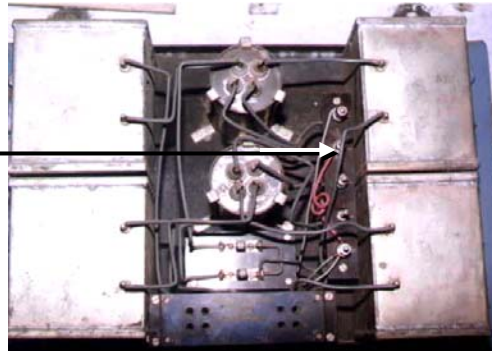
Shaded Region

2. Block Instrument (RE Area)

■ Dont's.

- Do not connect the earthing of any block instrument with any earth provided for other gears.
- Do not join the signaling earth with the system earth at the station.
- Do not use common battery set for two or more block instruments.
- Do not open / disturb the earthing and connections of any parts of block filter unit.

Earth
Terminal



Filter-Unit

■ Do's.

- Ensure proper earthing arrangement of block instrument, block filter unit on each station.

- Ensure that separate earth is provided for each block instrument.
- Ensure that minimum distance between two working earth must be 3 meter from each other.
- Ensure that each block instrument has separate battery set for its working.

3. Track Circuit (RE Area)

■ Dont's.

- Do not disconnect any OHE bond such as longitudinal bond, transverse bond, structural bond and cross bond provided on signal Rail track circuit.



Single Rail Track Circuit

- Do not make through the terminals of 'B' type choke provided on single Rail track circuit.

- Do not install non-AC immunized track relay in track circuit.
- Do not keep the track circuit in working condition only on battery charger.
- Do not disturb longitudinal and transverse bond while replacing bond wires and insulation joints.
- Don't forget to check the presence of stray current, if any while introducing new track circuit
- Do not try to replace block joints with out proper precautions and tools.

■ **Do's.**

- Do inform to the OHE staff immediately if any OHE bonds like longitudinal bond, transverse bond, structural bond and cross bond found open or loose.
- Do check the immunisation of relay while changing the track relay.
- Ensure that the maximum length of track circuit is within limits.
- Do insist P -Way staff to inform S&T and OHE staff before replacing the crossing & rail to ensure continuity of RE bonds.
- Do ensure continuity of earth bonds before opening any insulation joints.

4. Cables.

■ Dont's.

- Do not disconnect the earthing of the cable.
- Do not keep the cable in open space.
- Don't keep cable ends without sealing so as to prevent moisture entering into it.

■ Do's.

- Earth both the ends of cable armour.
- Megger the tail cable once in six months & main cable once a year.
- Disconnect the defective cores from the circuit immediately after localising the fault.
- Do ensure continuity of armour while joints provided in the cable.
- Take precautions as laid down in RE Area while laying cable.

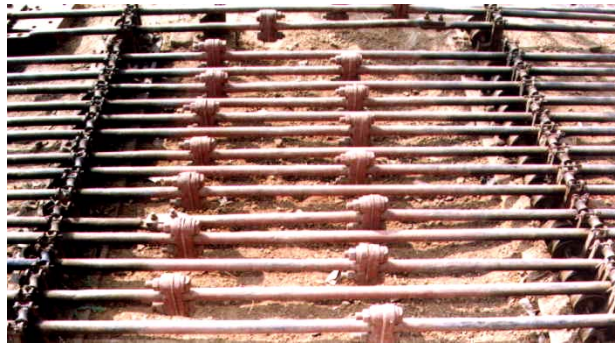
5. Rod Run / Wire Run (RE Area)

■ Dont's.

- Do not disconnect the cabin earth meant for signalling gears provided in cabin.

■ Do's

- Check the value of the every earth provided for signalling gears in the cabin.
- All the rod insulators should be in the same span while changing the broken rod/wire as shown in figure below.

**Rod Insulation****Wire Insulation**

- Check the rod and wire run passing under the track to ensure that these are not touching the rail flange.

6. Earthing (RE Area)

- Check and ensure the following items are earthed separately.
 - Signal post.
 - Lever frame and other metallic parts connected with it.
 - Metallic sheathing or armoring of under ground cable.
 - Resistance of block filter must be earthed where the block instrument works on earth return.

- **Maintenance staff must take the following precautions while working on signalling gears.**
 - The maintenance staff must wear rubber gloves.
 - The maintenance staff must have insulated tools for use.
 - Whenever the maintenance staff works in shaded zone, it is required to ensure proper and perfect earthing of gear.
 - Maintenance staff must be trained to handle the situation arising out of electric shock.

Part-G

Testing of Interlocking (Mechanical, Electromechanical and Relay Interlocking)

■ Essential requirements of Locking to be tested

As per SEM

- It shall not be possible to take 'OFF' a running signal until all points on the running line are correctly set and the facing points locked, all points giving access to the running lines from interlocked siding and goods lines are set against the running lines and interlocked level crossing gates on the routes including overlap are closed and locked across the road way. A signal lever when pulled shall lock or back lock as necessary the levers operating the points and gate locks referred to above.
- It shall not be possible to take 'OFF' conflicting signals at the same time.
- When signals are at 'ON', all points, which would be locked by the taking 'OFF' of such signals, shall be free.
- It shall not be possible to take 'OFF' a Warner Signal until all the relative Stop Signals in advance have first been taken 'OFF' and when 'OFF' it must back lock such signals.
- It shall not be possible to take 'OFF' main home signal to proceed aspect unless all advance signals like advanced starter, intermediate starter and mainline starter are taken 'OFF' to proceed aspect.

- The locking in the frame shall correspond with that shown in the approved interlocking table.
- The locking shall be strong, durable and accurate and it should not be possible-
 - For mechanical lock to enter a notch other than that for which it is intended;
 - To force the locking.
- The locking in the lever frame shall act on the commencement of the movement of the movement of the lever in the case of a direct type lever frame. In the case of a catch handle type of lever frame, the locking shall act on the commencement of the movement of the catch handle.
- The release locking shall not be effected before the completion of the movement of lever and releasing the catch handle in the case of catch handle type lever frame.
- Lever collars and slide collars shall be tested so that it is not possible to operate a lever or slide with a collar placed on it.

■ **Instructions for Testing**

- All levers shall be placed in their normal position before testing is started. When testing against the interlocking table, levers shall ordinarily be tested consecutively beginning from lever number-1.
- In each case where a lever is released by a combination of other levers, it is necessary to have all the levers of the group pulled over to test the back locks, then to put back each lever separately,

leaving the other levers pulled over, to test each individual lock.

■ **Testing of Electromechanical Installation.**

- In electromechanical installations electric lever locks, key transmitters, circuit controllers etc shall be provided as per approved plan.
- Diagram of electrical circuits for each such gears shall be prepared and shall show all the necessary controls which shall be required to release a particular lever.
- Where lever locks have been provided in the mechanical lever frames for controlling operation of Electric Point Machine, Electric Signal Machine or for route holding etc the functioning of the same shall be tested.

i) **Points Lever**

- In points lever ABDE locks are provided for Track and Indication locking. Lever shall be tested to ensure that the lever lock is energised and the lever is free to be operated in A/E position only when the controlling tracks are clear. The lever shall again be locked in D position when the point is being operated from normal to reverse and lever shall be free only when the points has operated fully and locked and detected in reverse position. Similarly, while operating the from reverse to normal the lever shall be first locked in E position to ensure track locking and subsequently will be held at B position

for point operation. The lever lock shall not energise at B position unless the points have operated, set, locked and detected in normal position.

ii) **Signal Lever**

- While pulling the signal lever from normal to reverse the lever shall be locked in A position and will be free only when route for the reception of the train has been correctly set, all facing points locked and all the controlling tracks are clear i.e. all conditions are fulfilled for taking 'OFF' the signal. While putting back the lever from reverse to normal position the lever shall be locked at B position and will be free only when the intended movement is completed and it is free from back locking as well as approach locking where provided. Normal indication locking must also be effective in B position in case of semaphore signal.
- **Testing of electrical locking**
 - The testing of electrical locking shall be carried out in accordance with the approved release circuit of each lever.
 - For testing the electrical locking provided on a lever, the other levers required to release that lever shall be pulled and it must be ensured that the lever is free to be pulled mechanically.
 - All the conditions for the release of the electrical lock of the lever under test shall be set up. The lever shall now be pulled from normal to reverse for

testing of A & D locks and reverse to normal for E & B locks and proper functioning of the lever locks checked.

- A test lamp/ Voltmeter shall now be connected on the electrical lock of the lever under test. The lever shall now be pulled from normal to reverse and vice versa. The test lamp should lit up at lock positions. The lever shall be held at these positions one after the other and all the lock release conditions shall be broken one by one. It shall be ensured that feed to the lever lock is disconnected each time. While doing this test, care shall be taken to test each circuit individually one after the other duly isolating other parallel circuits.

■ **Testing of other electrical equipments**

- Instructions contained in section “E” of testing of electrical signalling installations shall also apply to electromechanical installations wherever relevant.
- All electrical equipments such as electric lever locks, circuit controllers etc. as well as wiring shall be examined and tested for insulation. The insulation must not be less than ten mega ohm. Defective equipments shall be replaced.
- Moving parts of circuit controllers. Their mechanical connections and contract makers shall be checked. Repairs and replacement should be carried out wherever necessary.

■ Testing of PI/RRI

As per SEM Part II the following guide lines are laid down for carrying out system tests.

a. Signal control circuits

- Each route shall be set individually by operating control lever or switch (es) and/or button(s) as the case may be. After checking that the signal for this particular route has been cleared, each track circuit controlling the signal shall be shunted individually to check that the signal goes back to danger. Similar tests shall again be made by de-energizing point detection relays and other relays controlling this route. Each such relay will be de-energised individually and it shall be checked that the signal goes back to danger.

b. Approach locking

- Each route shall be set up individually. After ensuring that the signal for this particular route has been cleared, each track circuit controlling the approach locking shall be de-energised in turn. The signal shall be put back to 'ON'. Efforts shall be made to alter the route under test and to set up conflicting route. It shall be checked that it is not possible to cancel the route set up and/or to set up a conflicting route and/or to individually operate any point in the route under test. This locking shall be effective till the set route is cancelled and the time release circuit has operated provided the track beyond the signal is not occupied.

c. Route release

- Tests shall be carried out to ensure that once a signal is cleared for a particular route, position of none of the points in the route can be changed when track circuit immediately in advance of the signal is de-energised.
- Where sectional route release is provided, it shall be ensured that a sub route does not release only by picking up of the concerned track relay(s) but the same should be released only after the next track circuit has also dropped and picked up.
- Where sectional route release is not provided tests shall be made to ensure that the entire route remains locked when any of the track circuits beyond the signal up to the track circuit controlling the last point is de-energised.
- In cases where the route is controlled by single track circuit the route shall be released after prescribed time delay to be effective after the concerned track circuit has been occupied and cleared by the train.

d. Time release

- Time release, where provided, shall be tested to ensure that it will be possible to alter the route or set up a conflicting route or change the position of the points in the route only after the signal is put back to 'ON' and the prescribed time interval has lapsed. similar tests shall be carried out for overlap release, where time release is provided for releasing the overlap after the occupation of the berthing track.

e. Dead approach locking

- Where dead approach locking is provided, the same test procedure as in (b) will be adopted except that there is no controlling track circuit to be de-energised. After the signal has been taken 'OFF', the approach locking shall be effective till the signal is put back to 'ON' and time release circuit has operated.

f. Signal indication circuits

- Indication of 'ON' aspect of all signals shall be checked for its correspondence with aspect displayed at site. Each signal shall then be cleared after setting its route and the indication of each aspect shall be checked for its correspondence with the aspect displayed at the site. This test shall be carried out for each signal as well as for direction type route indicator where provided. In the case of later, it shall also be ensured that the indication relay is not energised and the indication does not appear until the minimum number of lamps as required are actually lit.

g. Point controlling circuits

- Each point shall be set to reverse position by operating the controlling lever/switch/button. After the point has been fully reversed, each track circuit controlling the point shall be individually shunted in turn and operation of points to normal position shall be attempted. It shall not be possible to operate the point under these conditions. These tests shall

be repeated with the point set in normal position, attempt being made to operate it to the reverse position.

- With the obstruction in the points, the point shall be operated from normal to reverse and reverse to normal and it shall be checked that the over-load relay where provided gets energised and feed to the motor is cut off immediately. Where overload relay is not provided the feed to the motor shall be cut off after the lapse of a prescribed time.
- The out of correspondence test shall be carried out by opening cut out contact of one end of point machine and the point lever/knob/button operated. The other end of the point may operate but the point indication relay shall not energise.

(h) Point indication circuit

- The point shall be operated from normal to reverse and reverse to normal and the position of point detection relay as well as the indication of the point in the cabin/panel shall be checked for correspondence with the position of the points at site. It shall also be checked that with the obstruction in the point, the detection relay is de-energised and both normal and reverse point indication in the cabin / panel are extinguished in case of electromechanical signal and flash in case of PI/RRI installations.
- The operation of the detection relay to the correct position as well as its de-energisation should be checked by making and breaking the relevant point detector contacts at site.

(i) Crank handle inter locking

- It shall be checked that when the crank handle is removed from its normal position in Electric Key Transmitter / other approved relay interlocking arrangement, the signals reading over the concerned route/zone can not be taking 'OFF' nor the points could be operated from the cabin / panel. It shall also be checked that when the signal; reading over the concerned route/zone is taking 'OFF', the crank handle can not be released from its normal position in Electric Key Transmitter/other approved relay interlocking arrangement.

■ Maintenance

- Buzzers i.e. button pressed, signal failure, point failure, power failure & train acknowledgement are in working order.
- Maintain and compare the emergency counters and the readings.
- Maintain proper locking & sealing of panel cover with emergency operation buttons & counters.
- Track, approach, route & dead approach locking are effective.
- Sectional route release / route strengthening is effective.

■ Do's and Don'ts for Signal Maintainer

■ Do's

- Ensure good visibility of signals by proper cleaning & focusing.
- Be prompt in attending failures.
- Ensure that proper remarks are given against each failure in signal failure register.
- Ensure double locking of relay room & cabin basement.
- Prepare a joint reading record of lever position / indications / panel position immediately after any accident.
- Inform immediately to ASM / P-Way staff when you come across any broken rail / broken switch rail.
- Check and ensure that no infringement to standard dimension.
- Be present physically while disconnection of any gear is going on at site or also while class IV th / Blacksmith is working on any gear.
- Ensure fire-fighting equipment are not over due for recharging. Get aquatinted how to use it.
- Ensure that no window pan is broken of any relay hut or relay room.
- Ensure that relay room / relay hut / battery rooms are properly lit.
- Ensure that exhaust fan is in working condition in battery room.
- Arrange to get rail flanges clear of ballast by 25 mm to avoid track circuit failure.
- Arrange to replace timely 'likely to fail nylon / glued joints' through P -Way staff.
- Ensure proper packing of points insulation joints through P -Way staff.

- Ensure that ‘under moving wheel flashing point ‘ immediately attended by P- Way & S&T staff.
 - Ensure that brake dust / iron chips are cleaned at insulation joints at regular intervals.
 - Ensure that all jumpers & bond wires are intact.
 - Ensure that no any glass / outer casing of any relay is not broken
 - Ensure that all CB’s, Emergency Keys, Block Inst, Resetting Keys, Counters etc. are properly scaled.
 - Maintenance is done as per schedule & updates all records.
 - Earth connections are proper.
 - Earth is watered regularly.
 - In RE area lever frame generator etc are properly earthed.
 - In RE area wire insulators / rod insulation are provided & intact.
 - Bell warning at L-xing gate, where provided is proper.
 - Indications on panel are proper & correspond with gears at site.
 - Replace fused bulbs immediately.
 - Telephones at L-xing gate are in good working condition.
 - Check all ON / OFF change over switches for any overheating.
- **Dont’s.**
- Never take any intoxicant while on duty.
 - Don’t open relay room, cabin basement without proper entry.

- Never adopt friendly way of working on trust by violating rules.
- Never tamper with any scale.
- Never adopt short cut method.
- Never release any route unless proper memo is received.
- Never disconnect a signal gear unless disconnection is granted.
- Don't give indication of disconnected gear to allow signaled move.
- Don't provide bond wire over broken rail unless P-Way staff has made fit the track.
- Don't allow a unskilled staff to repair any gear independently.
- Don't start repairing a damaged point until permitted by authorized officers.

Part-H

Disconnection of apparatus

■ **GR.3.51(3) states**

“ No Railway servant shall interfere with any points, signals or their fitting, Signal wires or any interlocking or block gear for the purpose of effecting repairs or for any other purpose except with the previous permission of the Station Master”.

■ **As per Signal Engineering Manual Part II Para 11.4**

Each Maintainer shall have in his possession a book of Disconnection Notices-Form S7T/DN (Annexure 2). A Maintainer who is in possession of a Competency Certificate cum training History book (Annexure 4) only shall independently undertake works necessitating issues of Disconnection Notices.

Disconnection Notices need not be issued in situations as listed in Annexure-3 provided suitable precautions are taken. In other situations, when it is necessary to disconnect any equipment in his charge for repairs, replacement or adjustment, the Maintainer shall advise the Station Master on duty in writing on Form S&T/DN and obtain the latter's signature before work is started and after it has been completed.

When it is necessary to disconnect point equipment switches or signals for repairs, replacement or alteration, Warner/Distant and Stop Signals governing the lines in question shall be kept in the 'ON' position and made inoperative until the work is completed.

The Maintainer must seal the equipment opened by him under his competence.

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- It is clear from the above that a disconnection notice must be issued by the Signalling staff and acknowledged by the SM before undertaking any work that interferes with the normal working of the signalling gears as also after completion of the works.
 - However, there are some items of normal day-to-day maintenance, inspection of signalling work which do not involve any disconnection/Interference/repair of signalling gear and hence issue of disconnection notice is not required.
 - The situations where issue of disconnection notice is essential is being/can be judged by the maintainers/JE(signal)/SE or SSE(Signal) keeping in view the nature of work involved.
 - A few illustrative examples of items of work which can be carried out by the signalling staff without issuing a disconnection for not disturbing the proper functioning of the gear, are indicated in the annexure for guidance.
 - This circular does not supersede or alter any of the existing rules and/or circulars on the subject but is only being issued to reiterate the extant practice.
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■ **Annexure to Joint Safety and Signalling Circular No. SG.215/14 DATED 12.10.1988.**

List of some of the items where it is essential to issue a disconnection notice

- Disconnection of rod from the corresponding lever of the lever frame for any purpose from the unit worked by rodding, viz., the points, lock bar, etc., to which the rodding is connected.
- Removal of either the points slides or the signal slides of a mechanical point detectors.
- Disconnection of a lock bar of a facing point lock plunger.
- Carrying out changes in the internal wiring (interfering with the working circuit of a relay rooms).
- Removal of a key lock from the lever to which it is fixed.
- Opening of a key transmitter for local releases of its key.
- Disconnection of an arm circuit controller from the semaphore arm.
- Opening up of the back cover or the front cover of a Block/Token/Tablet/Token less instruments for making any adjustments or change of wiring or disconnection of the instrument.
- Disconnection of a circuit controller or a lever lock-cum-circuit controller from the lever to which it is connected.
- Testing of Cables.
- Conducting broken wire test.
- Conducting safety checks by simulating conditions in route relay/panel interlocked installations.
- Changing of signal arms in semaphore signalling territories.
- Alterations to axle counters.

- Removal/Replacement of any relay of a working signalling circuit.
 - Changing signalling cables, wiring etc. of a working circuit.
 - Carrying out alterations in locking.
 - Replacement of signal/point motors and reversers.
 - Any soldering work of a plug in relay.
 - Changing of booms and wire ropes of a lifting barrier (except where alternative means of interlocking the gate by swing gates or interlocked chain working are available as a standby).
- While carrying out some of the work, it is reiterated that the normal precautions for not disturbing the proper functioning of the signalling equipment must be taken.
- Removal of weeds in between rodding.
 - Putting earth for strengthening trestles.
 - Tightening screws, bolts and nuts.
 - Graphiting.
 - Oiling the pins.
 - Replacing split pins.
 - Scraping the paint and repainting of rod runs.
 - Oiling and cleaning of signal spindle.
 - Checking and adjustment of dash spring and its housing.
 - Removal/refitting of glasses, roundels, lamps and lamp brackets during day light hours.
 - Focussing of signals.
 - Painting of signal posts, lever frames and accessories.
 - Lubrication of pulleys.
 - Removal and re fixing of pulleys.

- Replacing number plates.
- Testing locking of lever frame or S.M.'s slide instruments.
- Cleaning of dust and mud affecting the functioning of signalling gears.
- Cleaning of colour light signals without removing lenses.
- Testing of signals.
- Replacement of fused bulbs (ensuring that no phantom indication is caused).
- Replacement of other types of bulbs when fused.
- Replacement of fuses the at a time.
- Inspection of inside equipments by opening the covers of point machines, signal motors and apparatus cases.
- Cleaning of power supply equipment.
- Voltage measurements of track circuits.
- Carrying out functional test of signals/points by pulling relevant levers/operating push buttons/switches.
- Restoration of signal failure that has occurred due to minor defects.
- External/Internal cleaning of block instruments (When no train is in block section or line clear not granted).
- Cleaning of equipment in the relay room without causing any physical or electrical disconnection.

**As per SEM Part II Annexure 3
Situations in which disconnection notice need not be issued
provided suitable precautions are taken :**

**Cleaning and/or lubricating/graphiting without affecting any
physical/electrical disconnection**

Lever frame basement.

Relay Room and Battery Room.

Apparatus case/Battery boxes/Goomty.

Lifting barrier mechanism including winch.

Lever lock and Circuit controller without opening cover.

Inspection and cleaning of inside equipment by opening the covers of point machines, signal motors, reversers, apparatus cases and detectors.

Point, facing point lock and lock bar.

Cranks, compensators, pullies, wheels, roller stands, counter weights and levers.

Power supply equipment.

Insulation joints.

Lens/roundels of signal, point indicator, trap indicator and shunt permitting indicator provided phantom indication to driver of an incoming train is prevented by covering lenses.

Testing of

Track locking, approach locking, back locking, indication locking, route release.

Checking various parameters of axle counter without disconnecting the equipment.

Power supply equipment.

Lever frame, SM's control frame, signal operation, point operation, level crossing gate and slot circuits.

Point by obstruction test for lock only.

Checking and testing of track circuit parameters when the track is unoccupied.

Focusing of colour light signal provided phantom indication to driver of an incoming train is prevented by covering lenses.

Adjustment of

Wire transmission except double wire operated point transmission.

Tightening of terminals using insulated tools without causing any shorts on adjacent terminals.

Replacement of

Electric signal lamp provided phantom indication to driver of an incoming train is prevented by covering lenses.

Bond wire, one at a time.

Plug-in-relay in case traffic condition permits.

Indicator lamps.

Push button/switch/key of panel.

Lock bar clips/bar stop, one at a time.

G.D. tubes.

Fuse, one at a time.

Pulley, bottom roller/top roller in wire and rod transmission one at a time and split pins.

Batteries/cells without affecting disconnection of supply to main equipment.

