

Procedure for Ensuring Safety of Personnel in Railway Environment

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Abstract— This will Ensuring the health and safety of personnel in the railway environment is paramount due to the inherent risks associated with railway operations. This procedural guideline outline comprehensive measures aimed at safeguarding personnel involved in various railway activities, including overhead equipment (OHE), mast erection, boom erection, wiring work by manually or tower wagon, P-way activities and Bracket Adjustment, SED & ATD Checking (Alignment Works), Foundation & Grouting Works (Pre -Wiring Work). Key aspects covered include risk assessment methodologies tailored to railway settings, implementation of safety protocols compliant with international standards, and training programs designed to enhance awareness and competency among personnel. The document emphasizes proactive measures such as regular safety audits, effective communication strategies, and the use of personal protective equipment (PPE) suited for railway-specific hazards. Additionally, emergency preparedness and response procedures are detailed to mitigate potential incidents swiftly and effectively. Statistical analysis underscores the importance of adherence to safety guidelines in reducing accidents and ensuring a secure working environment. By following to these procedures, railway authorities and personnel can collectively contribute to minimizing risks, promoting a culture of safety, and enhancing overall operational efficiency within the railway sector.

Index Terms—Rail Vehicle, Scotch Block, RRV, CMV, PPE, Blowing effect, Railway domain, On the track, Blocked track, Danger zone, Place of Safety, DG, VA, IR, SPS, ATD, SED, PP Rope, OHE, TPI.

1. Introduction

Ensuring the safety of personnel within railway environments is a serious priority for railway operators worldwide. Railway networks are complex ecosystems where personnel engage in various activities ranging from maintenance and operation to passenger service and emergency response.

The inherent risks related with these activities strict safety measures to protect the lives and well-being of railway personnel.

This procedure establishes comprehensive guidelines aimed at addressing and mitigating potential hazards within railway environments. It is research and made align with national and international safety standards, reflecting our commitment to ensuring compliance and enhancing safety protocols across all sides of railway operations.

By outlining clear risk assessment methodologies and implementation strategies, this procedure aims to foster a proactive approach to safety. It emphasizes the importance of continuous training and awareness programs to equip personnel with the knowledge and skills needed to navigate potential hazards effectively. Furthermore, it promotes a collaborative environment and employees work together to uphold safety standards and responsibility.

Systematic monitoring and periodic reviews are important workings of this procedure, ensuring that safety practices remain current and effective in the face of evolving risks and operational progresses in the railway Environment. Through these efforts, we strive to create a health and safety culture where safety is not just a priority but a shared responsibility ingrained in every aspect of railway operations.

Eventually, the goal of this procedure is to provide railway personnel with a structured framework that enhances their health and safety, confidence, and ability to perform their duties in a safe environment. By obeying to these guidelines, we contribute to the overall dependability and sustainability of our railway services and fostering trust among passengers.

A. Purpose:

This document presents the measures to ensure personnel safety when working in a Railway Environment. Requirements formulated with “shall” and “must” are both mandatory.

B. Scope of application

The measures presented here must be strictly applied by all employees under all circumstances, irrespective of their level in

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the hierarchy.

The behavior of each person in a railway environment affects their safety and the safety of others.

In case any part of this procedure conflicts with or is of a lower standard than concerned IR /Metro regulations, the corresponding section(s) of that IR/Metro regulation shall apply.

Where employees apply rules defined by IR/Metro client, the compliance of these rules with the present requirements shall be analyzed and complemented if needed.

2. Literature Review

The safety of personnel in railway environments is a critical concern addressed extensively in the literature, reflecting a comprehensive approach to mitigate risks and ensure the well-being of railway workers across various operational facets.

Identification and Management of Danger Zones: Railway environments present numerous danger zones such as tracks, maintenance areas, and electrified zones. Effective identification and management of these areas are crucial to preventing accidents. This involves implementing robust access control measures, prominent signage, and the mandatory use of personal protective equipment (PPE) to minimize unauthorized access and enhance overall safety protocols (Danger Zone).

Traffic Management Strategies: A significant risk to personnel in railway environments is the potential for collisions with trains or vehicles. Literature emphasizes the importance of clear signaling systems, designated crossing points, and strict adherence to traffic regulations to mitigate these risks. Traffic management not only ensures safe movement within railway premises but also reduces the probability of accidents involving railway personnel (Risk of Being Hit / Risk Related to Traffic).

Electrical Safety: Electrical hazards is a serious threat in railway operations due to the presence of high- voltage systems. Literature underlines the implementation of stringent procedures for insulation, grounding, and regular inspection of electrical equipment to prevent any electrocution and fires in the railway operations. Compliance with all safety standards and continuous monitoring are essential to maintaining a safe working environment in areas with electrical infrastructure (Electrical Hazards).

Measures Related to Rail Vehicles: Safety measures affecting to rail vehicles focus on rigorous maintenance schedules, thorough operational checks, and adherence to speed limits. These practices are critical during manoeuvres, service activities, and general operations involving rail vehicles to minimize accidents and ensure safe operations. Adherence to established procedures and safety guidelines is essential to mitigating risks associated with rail vehicle movements (Measures Related to Rail Vehicles).

Proactive Health and Safety Protocols: Implementing proactive H&S protocols is essential in reducing accidents and incidents in railway environments. This includes the establishment of incident reporting systems, conducting

thorough investigations, and corrective actions to enhance H&S culture and prevent recurrence of incident.

Proactive measures not only improve safety outcomes but also foster a culture where safety is prioritized at all levels of railway operations (Accidents and Incidents).

Training and Guidelines: Comprehensive training plans are crucial for educating railway personnel on specific work activities, emergency response procedures, and regulatory compliance. These initiatives aim to cultivate a culture of safety awareness and responsibility among employees.

By equipping personnel with the necessary knowledge and skills, railway organizations can ensure that safety measures are effectively implemented and adhered to in daily operations (Specific Work Activities Related Do's & Don'ts).

Integrated Approach: Overall, the literature underscores the importance of an integrated approach to railway safety environment, encompassing vigorous risk management strategies, strict adherence to regulatory standards, continuous improvement initiatives, regulatory monitoring and comprehensive training programs. By integrating these elements, railway organizations can effectively mitigate risks and enhance the health and safety standards, and safeguard the well- being of their personnel in diverse railway operational environments.

Ensuring the H&S of personnel in railway environments requires a systematic and proactive approach. By implementing the strategies and recommendations highlighted in the literature, railway organizations can create safer working conditions in the railway environments, reduce the accidents, and ultimately foster a culture where safety is ingrained as a fundamental priority across all aspects of railway operations.

3. Methodology For Ensuring the Safety

The methodology for ensuring railway personnel safety includes stringent control of danger zones like tracks and maintenance areas, ensuring PPE use and adherence to safety protocols. Traffic management strategies ensure safe crossings and visibility, while measures against electrical hazards involve inspections, insulation protocols, and safety standards. Procedures for rail vehicles emphasize maintenance checks, operational guidelines, and speed limits enforcement. A proactive approach to accidents involves reporting, investigation, and corrective actions. Training and briefings reinforce safe practices and emergency procedures, fostering a safety culture and minimizing risks in railway operations.

A. Danger Zone

The danger zone is the area in which a person or tool or equipment which they handle, can be hit due to rail vehicle movement or be placed in danger by the blowing effect caused by the passage of a train. This area can comprise one or several tracks. It extends sideways for a distance of 3.5m from the centre of outermost live tracks.

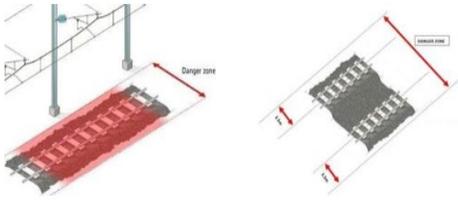


Fig.1. Danger Zone

B. Place of Safety

The place of safety is a place where the workmen can position themselves in safety during the passage of traffic, with a width of at least 70 cm. It could be a verge, a niche (sheltered space), a wide track separation or a blocked track.

Places of safety must never be blocked by the depositing of tools, equipment, or material.

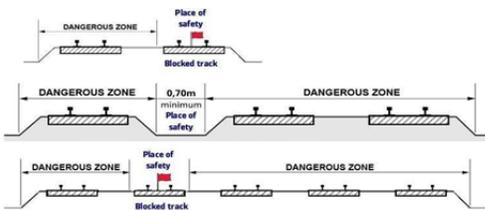


Fig.2. Safety Place

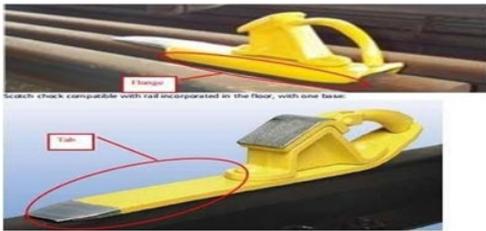


Fig.3. Track Safety

4. Risk Of Being Hit / Risk Related to Traffic

A. Wearing of Personal Protective Equipment



Fig.4. Protective equipment

Workers working in a railway environment must all be equipped with at least:

- High visibility vest or jacket
- Safety shoes
- Safety Helmet

Additional personal protective equipment(s) can be required, depending on the type of activity which the workers are engaged in - gloves, insulating gloves, eye protection, full body harness, nose masks, etc.

At night or during reduced visibility, workers must be equipped with portable tri-colour torch. This torch shall allow the safe progress of the workers and to emit emergency light-signals by hands in case of necessity.

The wearing of any auditory protection equipment is not permitted on tracks.

B. Station And Movement of Workers Within the Railway Domains

1) Common Control Measures:

Workers must follow public paths each time it is possible to do so:

Within the railway environment, they must follow safe paths for accessing the work area during their movements, each time they visit. It is forbidden for any worker to move about in or to stay in the surrounding of the tracks if their work obligations do not call for this. When moving, being stationary or working, workers must enter the danger zone only in case of necessity (impossibility to travel otherwise) with adequate precaution.

Any railway track must be considered as having traffic, in both directions, if not otherwise ensured (dead-end track with absence of train noted, blocked-off track, etc.).

To pass by a stopped railway vehicle, the workers must maintain a minimum distance of 3.5 m from the end of the vehicle. It is recommended to take a safety margin regarding this minimum distance and to raise it at 5 metre or more to take account of the visibility from the driving position of the rolling stock.

Also, it is forbidden to cross a track between two vehicles that are less than 5 meters apart, even if they are parked.

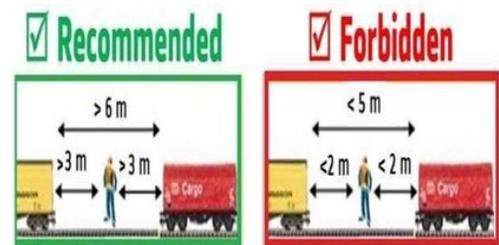


Fig.5. Common control measure

In addition:

- It is forbidden for any worker to take cover under or to lie against a rail vehicle, or to sit on or hold onto the buffers of a vehicle.
- The workers must not stay close to the point machine or rely on them. (Refer figure 7).
- Moving a rail vehicle manually is forbidden, except: Light vehicles designed to be manually moved. On tracks with a descending grade, workers must never be

positioned below the rail vehicle.

- To make workers aware of hazardous situations, a warning signal must be agreed between the driver and the working team.

For example: Driver must honk horn 3 times every time before moving vehicle to warn all persons around.

- Minimum working clearance between live conductor / equipment and such earthed structure / live parts of different elementary sections where men are required to work shall be 4.5m & it must be respected and always maintained by everyone (Refer Figure 6).

For Special cases which are as follows.

For cantilever adjustment it is advised is to keep 4.5 metre clearance while working but in rare case on special derogation it shall be 3 metres (No tools to be extended horizontally / No RT / BT to be changed in clearance of less than 3 metres)



Fig.6. Cantilever adjustment



Fig.7. Cantilever adjustment

2) Pedestrian Movements:

Crossing the Tracks:

When workers are obliged to enter the danger zone, before entering, they must stop and look carefully in both directions, without forgetting that one train can hide another.

When they must cross one track or several tracks, they must:

- Choose a location which offers sufficient visibility to detect the arrival of trains and providing easy exit from the danger zone to a place of safety.
- Preferably use gangways or walkways. In their absence, cross the tracks in a perpendicular fashion.
- Stop before entering the danger zone.
- Carefully look both ways.
- Look for any potential obstacles on the ground.
- Remain vigilant and keep attention to any perceived signs whether visual or auditory.
- Cross the track quickly by the most direct path.

Any person entering or moving in a danger zone must stay aware and care about traffic which can come towards them in every direction.

The use of any equipment, likely to disturb the perception or to distract the attention, is to be avoided: cell- phones, portable radios, blue tooth buds, hoods, earplugs, umbrellas, etc. Telephone, mobile phone, and radio communications must be passed exclusively from a place of safety.

In addition, atmospheric disturbances (snow, wind, storm, rain, dust storm etc.), at the location of work on the tracks or their surroundings, proximity to very busy roads, factories, etc., likely to reduce perception (vision, hearing), must urge the worker on the greatest care.

Workers must not step on the tracks or the sleepers to avoid slipping or falling, especially in damp or cold weather.

Special Case: Crossing the tracks for construction activities for fetching material manually.

1. Track crossing activities are prohibited without Traffic Block and Power Block, but certain activities are allowed by IR personnel with certain safety provisions as stated below.

- It is not recommended to dump the material on opposite side of the tracks where the activities are planned and carried out. However, if required due to geographical constraints Task Manager will take decision on a case-to-case basis.
- Ensure a safe distance of at least 3.5 m between the material storage and centre of running track.

2. Following guidelines to be strictly implemented by Task Manager:

- Ensure competent supervisor is present at site.
- Ensure IR/PMC supervision is available.
- Ensure that the gang deployed for manual handling are trained in communication of Look Out Person and other safety measures including place of safety.
- If track is straight, look out persons shall be available at Upline & Downline signals / LC Gates /stations with walkie Talkie radio and other Look out person with working gang crossing the track.
- Look out persons that are available on both upline and down line shall communicate to Look out persons available with working gang and this look out person (available with working gang crossing the track) shall communicate by megaphone to the working gang regarding rail vehicle movement and for moving to place of safety.
- In case of curved tracks, multiple Look out persons shall be deployed based on the LMRA and track configuration.
- A minimum distance of 2 m shall be maintained between live OHE wire and body part of worker or tools or metallic supports etc. and follow IE rules.

Rebars, long pipes, metallic survey staff, metallic cap umbrella, long conductor, metallic measuring tapes, metal ladders etc shall not be brought within 2 metres clearance from charged OHE.

- Manual handling of mast, rails, catenary wire drums, cable drums etc where more manual efforts are required to carry load while crossing the track is prohibited.
- Emergency equipment like red hand flags, red banners, whistle, tricolour torch, megaphone, walkie talkie shall be available at track crossing location with Task Performer and Look out persons.

Note: The aforesaid instruction is applicable only for head loading of light weight material like concrete, sand, cement, aggregate etc during track crossing.

3) Moving on the tracks.

As before any crossing of the track, when a worker has to enter the danger zone, before entering, he/she must stop and look carefully in both directions, without forgetting that one train can hide another.

When a worker must move on the track, he/she must move on the track in the opposite direction to the normal traffic direction where possible, without forgetting at any time that traffic can come in the opposite direction.

The worker must permanently pay attention to all visual and audible signals that he notices. He/she must always pay attention to traffic which can come towards them from any direction and take precautions to turn his head immediately each time that he hears a train whistle, traffic noise, etc. behind him/her.

Group movements are particularly at risk and must be managed by a leader. Ideally, such a movement must be protected by the suspending the traffic.

Otherwise, If the number of persons composing the group is greater than the receiving capacity of the smallest place of safety present on the route.

- The group must be organized into sub-groups whose numbers must not exceed the receiving capacity offered by the smallest Place of Safety present on the route.
- The movement must be coordinated to ensure that no overtaking occurs between the sub- groups: it means that the first subgroup starts the move. It must have overpassed the first place of safety and be half the way to the second place of safety before the second sub-group starts to move. The same principle shall be applied between all sub-groups to ensure availability of places of safety all along the route.
- A Gang Leader placed at the head of each sub-group must guide the group.

- The guiding Gang Leader at the head of the first sub-group must be equipped with a horn/Megaphone/whistle to announce the arrival of a traffic. When these sound, all subgroups must return to the safe area.

A designated worker at the end of the last sub-group must frequently look back and pay particular attention not to be surprised by the arrival of traffic. He /she must be equipped with a horn/Megaphone/whistle to announce the arrival of a traffic. When these sound, all subgroups must return to the safe area.

4) Upon the arrival of a train

Upon arrival of rail vehicle, any worker must instantly leave the danger zone to go to the Place of Safety and must remain there until the complete passing of the rail vehicle and potential other simultaneous traffic.

In addition, the worker must observe the passage of the convoy to ensure that there is no anomaly likely to strike him when passing.



Figure 8

Fig.8. Arrival of a train

If a worker is surprised by the arrival of unanticipated rail vehicle, he must not hesitate to throw themselves down flat along the verge, preferably with his head in the direction of arrival of the convoy making sure to bring his/her clothing close to the body (Refer Figure 8)'

5) Use of Road Vehicles:

Road vehicles (site vehicle, automobile...) beside railway tracks must be use in compliance with the rules and instructions as established in Safely Procedure for Working on OR Close Proximity to Existing Indian Railway Track.

The drivers must:

- Permanently maintain a distance of at least 6 m from the closest rail during movement, manoeuvre and parking and 3.5 metre from the centre of live track if fencing is installed.
- "Life is more precious than your time. Do not risk your life while crossing the Level Crossings.
- Trains move faster than they appear to be and can reach the Level Crossings sooner than we can think. Be careful while passing through Level crossings and follow the safety rules and stop before crossing the Railway track, look at both sides of the railway track,

listen for any sound of approaching train and cross only when no train is coming”.

- In proximity to a catenary, while working on the rail vehicle (e.g. tower wagon etc) or material loading/unloading must be undertaken under preventive measures against electrical hazards.

C. General rules for work on the track

1) Authorization for work

Independently of the number of workers, any work in the vicinity of tracks must have a single and designated team leader. He is in charge of defining and verifying the application of safety arrangements provided for in the present owner's requirements (owner might be IR, Metro Client, NCRTC etc ...) like barriers, marking off danger zone, behaviour, etc.

No work on tracks can be undertaken without prior authorization from the railway representative, even for urgent work.

For work on networks not operated commercially, but on which railway machinery circulates from time to time (works train, rail-road vehicles, test vehicles, etc.), the authorization is delivered by a single manager who coordinates all activities on the site, through a permit to work. These situations must be treated with particular attention.

2) Protection of work

Hierarchy for risk control: 3 systems exist to control risks related to traffic of a work on track:

- Work on track on which traffic is temporarily suspended, with implementation of physical protections to prevent trains to enter the work site.
- Work on track on which traffic is suspended.
- Work on an active track.

Priority must be given in this order to select the most adapted system for each work situation.

Work on track on which traffic is temporarily suspended, with implementation of physical protections to prevent trains entering the work site:

To protect worksites on track, interrupting the train traffic on the concerned track(s) or physical separation between the workspace and the adjacent tracks must be given priority over measures based on the reaction of workers to an announcement signal.

This shall be achieved by scheduling (on track operations outside the IR / Metro operating hours).

Locking the movement of point machine using padlocks to prevent train from entering the work zone. (This activity shall be done by competent IR /Metro Representative, or any other person designated on their behalf).

Work on track on which traffic is temporarily suspended:

The line blockage of a track consists of interrupting all railway traffic over a pre-determined portion of track for a defined period.

Note: The electrical locking out (Power Block) of a line is under no circumstances to be considered as the blockage of a track because it does not prevent circulation of non-electric vehicles (diesel engines, Tower wagon etc).

This blockage of a track is done upon request from the team leader to the designated Representative of the IR/Metro, according to a procedure established by the network operator) (IR /Metro)

In case of agreement, the designated representative from IR /Metro must deliver a certificate/Permit indicating at a minimum:

- The track or the section of track made dead and safe for construction activities
- The date and time of the start of the block.
- The provisional duration of the operation.

It is essential to clear the work zone before the established time for the end of the work, under conditions defined by the network operator. In case of necessity, an amendment to or a renewal of the block certificate/Permit must be obtained to continue the work.

One must be particularly vigilant in environments where new railway staff or provisional staff or in case of personnel speaking different languages not understood by each other (Linguistic complexities).

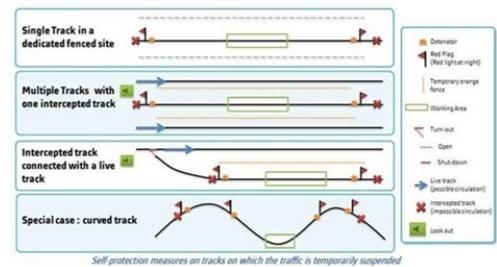


Fig.9. Vigilant in environments

Work on an active track (without line blockage) Working on an active track is forbidden unless there are no alternative control measures. If this cannot be avoided, any work on the active track must be:

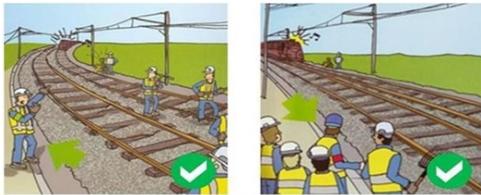
- Declared and signaled in compliance with the prescriptions of the network operator.
- Surrounded by watch out persons/ Look Out Persons to alert the crew of the arrival of a train.
- Performed by a crew in which all the members are trained in the railway's guidelines issued by RDSO / IR /Metro Operator.

Watch out person /Look Out Person must be positioned by the team leader to allow a sufficient early warning with regard to arrival of train on the live track. The recommended distances for positioning these watchers is 240 meters (1st banner flag with look out) and at 600 meters (2nd banner with look out) from location of work. While working on curved track the

provision of flag man to be increased based on specific risk assessment.

The Watch out /look out person should have green flag also with him and after removal of red banner flag he should show green flag to driver for clearance for train movement. The watch out person /Look Out person are equipped with whistle /megaphone with warningsiren and red and green hand flags and red banner flags. The emission of the signal must be sufficiently loud and early to allow the crew to clear the work zone safely several seconds before the effective arrival of the train into the zone concerned or adjacent track.

At the signal from watch out /look out person, all personnel must immediately stop their activity, clear the danger zone and go to the pre- identified Place of Safety.



Self protection measures when the track is open to traffic - The role of the look-out is to watch for approaching trains and warn workers on the track

Fig.10. Pre- identified Place of Safety

Job For any work close to an active track, the danger zone of this track must be physically protected (by providing fencing) If not possible, the danger zone must be indicated by signage (marking a line with lime powder at a distance of 6 meters from center of track) and for any team of more than 3 persons, a safety marshal / look out person/watch out person dedicated exclusively to safety must be designated. This person shall permanently keep a watch over the workers while they remain in the work zone. The team leader can assume this function for work involving 3 persons or less.

These alerting systems are to be implemented at every access to the work zone from which a train could physically approach the worksite, to alert both the driver of the concerned train and the workers, sufficiently early so that they can exit the danger zone before the arrival of the train.

In all the cases, the team leader is responsible for controlling or having the site safety controlled, including relevant checks of the implementation of those systems.

5. Electrical Hazards

A. Nature of the Electrical hazard

Electricity is one of the main causes of accident, with potential severe consequences. Indeed, it is not visible and in certain circumstances, it can propagate from its environment without a physical contact.

Other than direct and indirect contacts (i.e., via non-insulating object), different phenomena can in fact provide an electrical flux to pass from one support to another: arc ignition, induction, and electrostatic phenomena.

Ignition occurs in the form of an electrical arc when two elements approach each other without contacting. A minimum distance of approach is to be respected to avoid these phenomena, depending on the electrical voltage. Induction is created by electromagnetic fields. It electrically charges linear conducting infrastructures (barriers, adjacent catenaries...) without contact from a powered infrastructure in the neighboring. It is not rare, on parallel tracks of which a single one is powered, to measure a voltage of several thousands of volts on the catenary of a non-powered track.

In addition, the rail is used to ensure the return of traction currents. In a normal operating state, a rail does not carry a dangerous voltage. Only the difference in potential between two sections of rail is to be considered (between two distinct rails, from one part to another of an insulating joint or a broken rail...).

B. Behaviors in an electrified railway environment

As a precaution, any conductor and electrical installation must be considered as live, if not otherwise ensured.

In addition, in an electrified railway environment, it is forbidden:

- To approach equipment on which abnormal phenomena occur: sizzling, sparks, etc.
- To work on an electrical installation without being qualified and authorized to do so.
- To block the access and hinder the maneuver of electrical energy control elements.
- To climb onto posts supporting conductors without being authorized to do so.
- To engage in or to pursue work on outside installations during a storm (unless it is to secure the installation).
- To light a fire (barbecue, etc.) in the immediate neighborhood of electrical lines or close to duct and utility vaults.
- To approach a fire in the immediate neighborhood of electrical lines before they are powered down.
- To throw water, direct a water jet or to urinate on installations or electrical apparatus and their supports.
- To use metallic objects in the vicinity of installations comprising bare powered conductors (meters, measurement rulers, metallic measuring tapes, ladders, umbrellas, etc.)

In addition, one must:

- Not touch, unless by necessity, catenary supports
- Avoid leaning (tools, materials, etc.) on catenary supports.
- Not simultaneously touch two parts of a rail, not connected to each other or separated by an insulating joint.
- Never rely on a lighting indicator of presence of voltage to verify the absence of voltage in an equipment (the information delivered could be false in

case of failure of the lamp).

C. Work in an Electrical Environment

1) In the vicinity of electrical installation

Any work whose nature or for which the tools employed involve risk of entering, even accidentally, into a zone at 5 m from un-insulated equipment for which the voltage is above 50,000 V (sub-stations) or at 3 m from equipment for which the voltage is 50,000 V or less, must be performed under electrical locking out conditions and/or by personnel specially trained and authorized.

Reference: Para 11 of Railway Board Letter No. No. 2021/CEDO/SD/RSOD2021 dtd. 27.07.2022

REQUIRED CLEARANCE BETWEEN THE OVERHEAD LINE & RAILWAY TRACK:

SN	Overhead crossing voltage	Min. clearance from rail level		Min. clearance to be maintained between highest traction conductor & lowest transmission line crossing conductor At Mid Span
		Existing power line crossing for Non-Electrified Territory	New Power line crossing or Crossing planned for alteration	
1	Upto & including 11 kV	Normally by Underground Cable		
2	Above 11 kV & upto 33 kV	10860	14860	2440
3	Above 33 kV & upto 66 kV	11160	14960	2440
4	Above 66 kV & upto 132 kV	11760	15560	3050
5	Above 132 kV & upto 220 kV	12660	16460	4580
6	Above 220 kV & upto 400 kV	14460	18260	5490
7	Above 400 kV & upto 500 kV	15360	19160	7940
8	Above 500 kV & upto 800 kV	18060	21860	7940

Note:

- All height/clearances are in mm and under maximum sag conditions.
- If the crossing is provided with a guarding, a minimum clearance of 2000mm shall be maintained between bottom of guard wire and highest traction conductor.
- Power line crossing in yards and stations area shall be avoided.
- For electrification works of existing track or construction of new track/gauge conversion with electrification, existing power line crossings can continue. If dimensions are as per column (5) above, even if dimensions of column (3) are not satisfied i.e., for electrification works column (3) is not applicable.

Minimum clearance between any conductor not adequately insulated and any railway structure under most adverse conditions.

Sl	Voltage	Minimum Clearance
(a)	Upto and including 650 volts	2500mm
(b)	Above 650 volts and upto & including 33kV	3700mm
(c)	Above 33kV and upto & including 66kV	4000mm
(d)	Above 66kV and upto & including 132kV	4600mm
(e)	Above 132kV and upto & including 165kV	4900mm
(f)	Above 165kV and upto & including 220kV	5500mm
(g)	Above 220kV and upto & including 400kV	7300mm
(h)	Above 400kV and upto & including 500kV	8200mm
(i)	Above 500kV and upto & including 800kV	10900mm

Minimum height above rail level for telegraph, telephone and other such low tension wires crossing a railway is: 6100mm

Minimum Horizontal Distance of Structures:
The minimum horizontal distance measured at right-angle to, and from the centre of nearest track to any part of the structure above ground level, carrying electrical conductor crossing a railway line shall be:

(i) For new structure :	(H+6) M
(ii) For existing rigid well founded post/ structures	: 3m, or 1.5m away from the toe of embankment/ top of cutting, whichever is more

Where, 'H' is the height of post/ structure from nearest ground level

Note :

- Rigid well founded post/structure: Any post/structure which is so constructed or guyed as to remain in a vertical position, or falling this to continue to provide the minimum horizontal clearances of 2.135m from the centre of nearest track, with one or all of the conductors broken or with its conductors attached, when subjected to maximum wind pressure, shall be considered to be a "rigid well founded post/structure".
The existing rigid well founded post/structures, presently at a distance equal to or more than (ii) as given above, but less than (H+2.135)m, shall be inspected by railway's nominated electrical official once in a year jointly with the owner of the post/structure and certify the safety of the structure, keeping appropriate records of inspections.
- If the existing post/structure carrying electrical conductors crossing a railway line, is not rigid and well founded then the minimum horizontal distance, measured at right angles from the centre of nearest track, shall be equal to height of post/structure above ground level plus 2.135m.

Note: Whenever work is being carried out below transmission line deployment of discharge rod is mandatory at both end of the working location.

2) Locking out – tag out of electrical installations (LOTO)

Electrical LOTO ensures the absence of power, in all or part of an installation, for the defined duration. The 5 essential steps for performing a LOTO are:

- Separation: cut off the power sources of the considered section.
- All possible sources of power for the considered section must be identified, even those usually inactive.
- Locking out: lock-out all power systems to prevent any risk of re-powering.
- Identification: tag out the locked-out zone.
- Verification: Check the absence of voltage before any work is performed.

The LOTO operations must be performed by a specifically trained and authorized person.

When LOTO is performed by a third party, the LOTO Authorized person must deliver a LOTO certificate /Permit detailing the considered zone and period. This certificate /Permit must be held by the team leader for the whole work period.

It is essential to clear the concerned zone before the scheduled ending time, even if the return of the certificate /Permit by the worker is a condition for unlocking the installation. In case of necessity, a formal extension or renewal of the LOTO certificate /Permit must be obtained.

The implementation of padlocks by to lock physically the power sources must be requested to the LOTO operator/ IR/Metro.

If there is no possibility to lock physically by each potential source of energy or if there is a risk of electrical induction, the work zone must be protected by earthing and/or short-circuiting devices on each side of the worksite (between the work zone and any possible source of powering).

Note: For operation of isolators at sub stations, electrically tested gloves with working potential of more than 42 kV shall be used.

3) Measurement and Electrical Tests

Certain measurements and tests require the presence of personnel close to energized equipment. Only workers specially trained and authorized can perform such operations. In case of necessity for keeping a worker in this neighbouring zone, measures of protection must be established based on a specific risk assessment considering involuntary direct or indirect contact and arcing.

The measures implemented could be:

- Implementing insulating covers.
- Wearing insulated gloves, shoes, and helmet.
- Positioning the worker on an insulating mat, etc.

In addition, such operations must be performed under the surveillance of another worker who could cut off the power and rescue the exposed worker if necessary.

6. Measures Related to Rail Vehicles

A. Wearing of Personal Protective Equipment

The following personal protective equipment are required for working on Rail vehicles (tower wagon, CMV, RRV etc..)

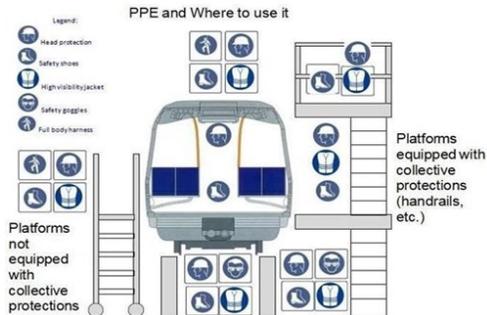


Fig.11. Personal Protective Equipment

B. Boarding and descending from Rail Vehicles Boarding / descending from rail vehicles is a source of risk of falling and/or being struck by a train.

Boarding and descending from any vehicle, including rail vehicles used for working at railway sites, must only be undertaken when the vehicle is at a standstill toward a place of safety, when it exists.

The workers must use the available equipment to access the vehicles, in order of priority:

- Platforms providing level access,
- Steps and stepladders facilitating access,
- Doors equipped for driver access (equipped with steps or ladders and handrails).

Any worker descending from a rail vehicle must check beforehand that no train traffic likely to place him in danger arrives.

For boarding or descending from a rail vehicle, when the steps for accessing a vehicle exceed 50 cm the worker:

- Must face the vehicle.
- Must look at the state of the ground before stepping onto it.
- Must proceed, keeping permanently 3 points of contact.
- Must put anything he/she is carrying down on the floor of the train (or pick it up from the floor of the train), even backpacks.

In case of impossibility to proceed keeping 3 points of contact when descending from a vehicle, the worker must first sit on the floor of the train, then descend from the vehicle without jumping from the sitting position.

C. Presence of worker(s) in the driving cab of Rail Vehicle Unless specifically authorized, the presence of workers in the driving cabin during movements is forbidden.

Workers potentially present in the driving cabin must under no circumstances perturb the action or the concentration of the driver:

- They must only speak to the driver in case of necessity.
- They must not lean neither position any equipment around the driving levers. In all cases, emergency stop devices must always remain easily accessible.
- Workers must leave the driving cabin if the driver asks them to.
- In addition, in order to avoid any accidental starting of moving when the rail vehicle is in service, the driver must engage the emergency stop push button prior to any exit from the driving cabin.

D. Posture of workers in a moving vehicle

Rail Vehicle's movements can be dangerous for people on board the vehicle: untimely or intense braking, high speeds, potential infrastructure faults etc.

The workers on-board the rail vehicle must remain seated or permanently use the grasping means (handrails, handholds etc).

They must move when the rail vehicle is stopped and be careful to hold on at each instant when they must move around when the rail vehicle is moving.

To make workers aware of hazardous situations, a warning signal must be agreed between the driver and the working team.

For example: Driver has to honk horn 3 times every time before moving vehicle to warn all persons around.

On track, electrified by catenary, any work on the upper section of the Rail vehicle (elevated working platform of Tower wagon / CMV/RRV etc.) it is forbidden in the absence of the implementation of Power & Traffic Block including grounding (deployment of discharge rods) on both sides of the work zone, after verification of the absence of voltage.

E. Working on or around the vehicle.

This paragraph concerns any work which requires the presence of personnel on or around a rail vehicle, i.e. inside, above, below or beside the vehicle.

1) Protection of the train

Protection of the train regarding railway traffic: In the case of scheduled work on a vehicle stopped on a track, the vehicle and the work zone must be protected from traffic on the concerned track or section of track, in compliance with the control measures defined. The blocking arrangement (Power & Traffic Block) must be extended to adjacent tracks if the workers operate in their respective danger zones.

Prevention of autonomous (self) movements of the vehicle: The vehicles must be immobilized by putting in place, at least, one scotch block in each direction.

In the case of a descending track, additional scotch block(s) must be positioned to prevent a runaway of the vehicle.

If the IR /Metro forbids the use of scotch blocks, the effective application of permanent brakes must be checked visually when ready to start any work, or when boarding the vehicle.

The workers must pay particular attention to the risk of slight movements related to potential loosening of brakes, the play between chocks and wheels during change of equipment, etc.

They must:

- Permanently avoid positioning their hands, arms, and legs between two elements that risk approaching each other or in proximity to the wheel tread.
- Inform the other workers and ensure the absence of danger for them.

7. Accidents & Incidents

A. Rescue Planning

Emergency Instructions to follow in the case of incident or accident must be prepared (or existing instructions must be taken into acknowledgement) by the Team Leader. The Team Leader must inform the workers of these.

These instructions must provide:

- The contact details of the emergency services.
- The means of communications necessary for alerting the emergency services and the conditions for verifying their availability.
- Identification and communication of the location.
- First aid while awaiting the emergency services (presence of employees / workers who had received training to provide first-aid, of first-aid kit, fire extinguishers, etc.).
- The persons to inform and their contact details (Team Leader, Immediate supervisor, EHS, concerned Railway authorities etc.)

During work, the crew must be able to alert the emergency services without delay by cell phone, radio or telephone communication on the worksite.

B. Behaviors in case of an incident or accident

The promptness and good quality of the rescue are such as to limit the consequences of injuries. Any injured worker has the obligation to report the injury to get treated.

Any person noticing an accident, must take all measures to immediately alert the rescue by providing as much information as possible on the nature of accident, its location, the number of victims, the nature, and the seriousness of the injuries.

Depending upon their skills and without putting themselves at risk, they must provide the injured with first aid and make themselves at the disposal of the emergency services when they arrive.

C. Rescue of an electrified person

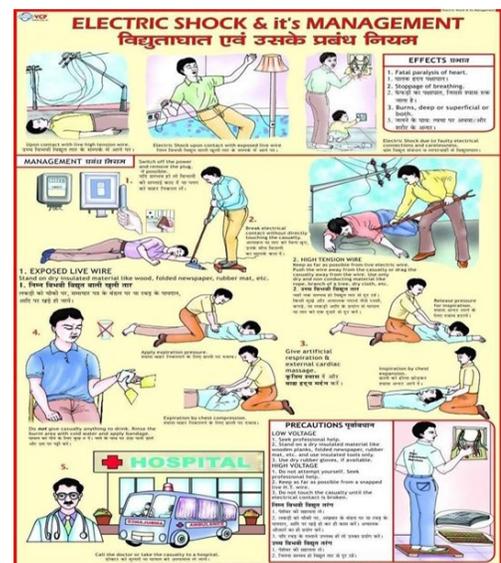
In case of accident caused by electricity, rescuing a victim can be a source of accident for the worker performing the rescue.

The worker detecting such an accident must first cut off power of the concerned equipment or have it cut-off. If the worker has the assurance that the power has been cut-off, he/she must

- clear the victim.
- call the emergency services or have them called.
- help the victim or have him/her helped, by providing first- aid assistance depending upon his skills or by placing him in a recovery position.

If the worker does not have the assurance that the power has been cut-off, he/she must:

- Wait for the confirmation of cut off the voltage before any contact with the victim, unless using a specific insulated rescue rod
- clear the victim from electrical contact.
- call the emergency services or have them called.
- help the victim or have him helped, by providing first aid assistance depending upon his skills or by placing him in a recovery position.



D. Personal injury accident on-board a Rail Vehicle

In case of accident inside a rail vehicle requiring the intervention of emergency services, it is important to stop the rail vehicle in an appropriate place for their arrival and for supporting the victim.

Thus, the Team Leader must:

- Each time it is possible, have the rail vehicle driven to an accessible place (station, level crossing, etc.)
- Contact the Task Manager /Task Performer so that he/she calls the emergency services, providing them with as much information as possible: sex, age of the victim, nature of the injuries, state of consciousness, etc.
- Help the victim or have him/her helped, by providing first aid assistance depending upon his/her skills or by placing him/her in a recovery position.

8. Specific Work Activities Related Do's & Don't's

A. Foundation & Grouting Works (Pre-Wiring Work) Do's

- Before start of the activity LMRA & TBT to be conducted by supervisor and work shall start only after ensuring control measures as identified during LMRA at site location.
- Stack materials like metal, sand, water, cement, etc. at least 6 m. away from the Centre line of the track.
- Tools & tackles are also to be kept sufficiently away from the track, like rule no.1
- If the implantation is less than 2.8 m or the soil condition is of easily collapsible nature, request for CAUTION ORDER to work on the foundation side of the track.
- Use Aluminium ladder for men & material getting into the pits for more than 1.2 m depth.
- Use pathway available along the track for handling the materials but do not cross the track.
- If walking on track is required, walk on the track by facing the direction of train traffic.

Don'ts

- Stacking of materials, tools & tackles, etc. to be avoided opposite to foundation side of the track which will force working / crossing the track.
- Do not walk on the track, unless it is required for the type of jobs being carried out.
- Don't execute blasting without the railway representative, authorized by railways for such operations.
- No member of the working crew shall stand near the track when a train passes.
- Do not take rest (sit) over the rails.
- Do not lean against the OHE mast.
- Do not take rest under counterweights.



Fig.12. Do's and Don'ts

B. Mast Erection Works (Pre-Wiring Work)

Do's

- Before start of the activity LMRA & TBT to be conducted by supervisor and work shall start only after ensuring control measures as identified during LMRA at site location.

- Use full body harness with double lanyard while working at height.
- Use safety helmet with chin strap, safety shoes, reflective jacket.
- Ensure PTW for Working at height & PTW for Lifting operations.
- Use hand gloves while handling steel structures.
- Poly Polypropylene ropes of adequate diameter shall be used as guide ropes to avoid oscillation of hanging loads and they shall be in good condition.
- Ensure safe-working loads of the crane deployed.
- Use web slings of required length and having valid TPI.
- Fitters / Asst Fitters shall use tool carrying bags while working at height.
- Lift/lower tools etc. from height through ropes only (No throwing from height is permitted)
- While rigging / moving the steel structures from the stack for lifting operations using the slings or during sorting out operations, ensure that the feet of the workmen are kept away by a sufficient distance from the structures. This will avoid structures falling over or hitting on leg / feet causing injury / permanent disability.

Don'ts

- Do not stand below the suspended loads.
- Do not walk over the booms/portals.



Fig.13. Erection Work

C. SPS / Bracket / Guy Rod Erection (Pre-Wiring Work)

Do's

- Before start of the activity LMRA & TBT to be conducted by supervisor and work shall start only after ensuring control measures as identified during LMRA at site location.
- Use full body harness with double lanyard while working at height.
- Use safety helmet with chin strap, safety shoes, reflective jacket, and any other required PPEs as per risk assessment.
- Check the working conditions and fitness and TPI of pulleys prior to using them.
- Have a Safety Marshal /Look out person /watch out person with a whistle/hand flags/tricolour torch/red

banner/megaphone to give prior information about the arrival of rail vehicle.

- Ensure deployment of banner flag (red) with sufficient and visible distance in the block section.
- Get down from mast and remove materials including tools and tackles on getting information about arrival movement of rail vehicle.
- Ensure non usage of metallic hammer while fixing bracket with RI No 3021.
- Phone usage shall be restricted as per Mobile Usage Policy of the Organization.

Don'ts

- Don't allow more than one worker to climb on mast at any time.
- Don't work by sitting on the cantilever insulator.
- Don't walk on other track on which work is not planned and Block not issued.

D. Wiring Work

Do's

- Before start of the activity LMRA & TBT to be conducted by supervisor and work shall start only after ensuring control measures as identified during LMRA at site location.
- Traffic Block to be taken for wiring work. & periodically check the wooden rollers of wiring deck and clamps of the reel wagon (drum trolley) which hold the spindle of the wiring drum.
- Lift and position the collapsible guardrail, as an indication as boundary line of wiring deck
- Periodically check the movement of wiring deck roller and perform greasing once a week to ensure safe transmission of wires.
- Periodically check the conditions of pull lifts, Tirfors, Dynamo meter, etc.
- Check in advance regarding anti-slipping arrangements on B series structures and portal uprights.
- Periodically check the drum supports and braking system and ensure smooth operation.
- Use hand gloves while handling conductor wire.
- Use full body harness with double lanyard while working at height.
- Use safety helmet with chin strap, safety shoes, reflective jacket, and any other required PPEs as per risk assessment.
- Keep sufficient numbers of DG sets and suitable provision of illumination while working during night times.

Don'ts

- Do not use faulty tools which can lead to accidents.
- Do not leave any materials on the working platform /deck after completion of works.

- Do not climb up (ascend) or climb down(descend) from the deck during movements of wiring train.
- Do not use faulty / broken conductor drums.
- Avoid loose wire, joint wires with the lamps and DG sets, as they may entangle the working crew.
- Do not place fittings, small tools etc. spreading over the platform.
- Discard immediately any broken rollers / Pulleys.
- During movement of Tower wagon, persons above the working platform /deck shall be in sitting position to avoid hitting with cantilever brackets.
- Don't start wiring without checking tightness of clamp with shaft of mounted drum.

E. Bracket Adjustment, SED & ATD Checking (Alignment Works)

Do's

- Before start of the activity LMRA & TBT to be conducted by supervisor and work shall start only after ensuring control measures as identified during LMRA at site location.
- Use full body harness with double lanyard while working at height.
- Use safety helmet with chin strap, safety shoes, reflective jacket, and any other required PPEs as per risk assessment.
- Regularly check the Ladder trolley, ladder; pull lift, tirfor, & pulleys for their working condition.
- The Safe Working Load (SWL) shall be prominently marked on the surface of ladder and Ladder trolley.
- Always ensure to Tie 10 meters PP rope at the bottom of OHE Ladder
- For cantilever adjustment requiring load shifting of Contact/catenary wires to be taken using pull lift: -

- *There had been several instances wherein the working crew members were unable to free the load from ladder due to pull lift failure and in the meantime while rail vehicle arrived thus hitting the ladder.*

- *To avoid such an unfortunate situation where the pull lift fails and ladder becomes difficult to remove from the track being in loaded condition, it is recommended that one person should immediately pull the rope downwards (Refer Figure No 19). This action will make the ladder horizontal to ground & provides clearance for safe passage of rail vehicle movement, thus avoiding hitting with the ladder. This is applicable for change of ST and BT.*

- *In case of heavy traffic, it is recommended to change to the stay tube with the help of supporting the weight of OHE on super mast by using pull lift. In case of accidental arrival of any rail vehicle, the ladder shall*

be immediately removed from the track area to avoid being hit by rail vehicle (Fig.20).

(Note: In this situation the ladder is not in loaded condition).

- Always use of 1 ton Pull Lift (Ratchet Hoist) in curve area instead of 0.75 Ton while using for cantilever adjustment.
- Ensure to maintain 3-point contacts while ascending / descending from ladder.
- Have a Safety Marshal /Look Out person /Watch out person with a whistle/red and green hand flags/tricolour torch/red banner /megaphone to give prior information about the arrival of rail vehicle.
- Ensure banner flag (red) with sufficient and visible distance in the block section.
- Work should be started only after providing Safety Marshal /Look Out person /Watch out person on both sides well away from the place of work.
- On getting information regarding the approaching train the ladder shall be immediately removed from the track and kept well away.
- However, to avoid all above points it is advised to fabricate cantilever after getting implantation of grouted mast so that there should not be any requirement of changing RT/BT.

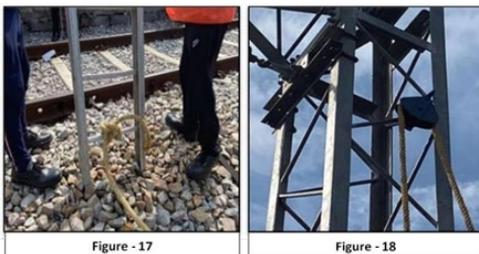
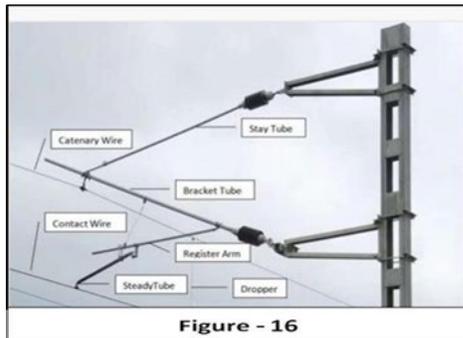


Fig.14. Erection Work

Don'ts

- More than one worker shall not be allowed to climb on bracket at any time.
- Don't work by sitting on the cantilever insulator.
- Don't walk on conductor wires.
- Don't walk on other track on which work is not planned and block not issued.

BRACKET ADJUSTMENT, SED & ATD CHECKING WORKS (Alignment)



Fig.15. Erection Work

F. Safety Measures for Trolley Movement

Do's

- Before start of the activity LMRA & TBT to be conducted by supervisor and work shall start only after ensuring control measures as identified during LMRA at site location.
- Use full body harness with double lanyard while working at height.
- Use safety helmet with chin strap, safety shoes, reflective jacket, and any other PPEs as per risk assessment.
- The Safe Working Load (SWL) shall be prominently marked on the surface of ladder trolley.
- Fitter working on top of Ladder Trolley must anchor his Full Body Harness hook on Catenary wire only.
- Ladder Trolley shall be accompanied by not less than Six manpower & should be supervised by supervisor.
- While climbing the ladder trolley, minimum four person out of six, must hold the ladder trolley firmly from bottom at opposite side of climbing.
- In case of curve line, 4 persons out of 6 will hold trolley from outer rail (upward rail side) & 2 person will hold from Inner rail side (i.e., two workmen on inner curve and 4. workmen on outer curve along with the PP rope deployed. (Refer fig No 23 given below)
- A toolkit bag must be available for carrying all necessary items required while working on Ladder trolley.
- Ladder trolley when used on track during daytime shall be fixed with red banner and for night and foggy conditions, red colour tri-colour torch shall be used facing the direction from which a train may come. (Refer Figure 22)
- Efficiency of brakes should be checked before putting a trolley onto tracks for work.
- While working on crossover section, care must be taken from movement of trains for both tracks.
- While approaching level crossing the task performers should look out for road traffic and ensure safe passage of the trolley.
- When a trolley is removed from track, it should be ensured that it is placed in laid position along the track, and it does not infringe any running line and the red

banner flag shall be removed.

- Work shall be started only after providing Safety Marshal/Look Out Person /Watch out person with a whistle/red and green colour hand flags/tricolour torch/red banner /megaphone to give prior information about the arrival of rail vehicle.
- No material shall be thrown to catch at top from bottom or from top to bottom, and it shall be always transported through Poly Propylene rope tied with toolkit bag.

Don'ts

- More than two workers shall not work on top platform of Ladder Trolley at any time.
- Trolley should not be pushed but should be held by workmen and moved firmly on curved lines.
- Don't use a ladder trolley without any guardrail at top.
- Don't walk on other track on which work is not planned or block not issued.

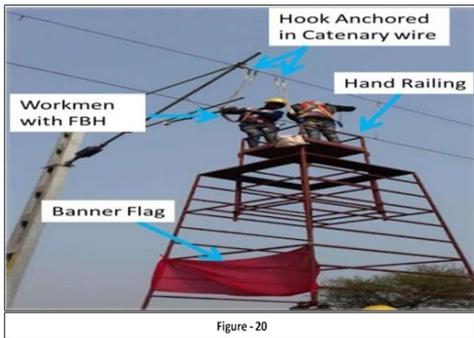


Figure -20

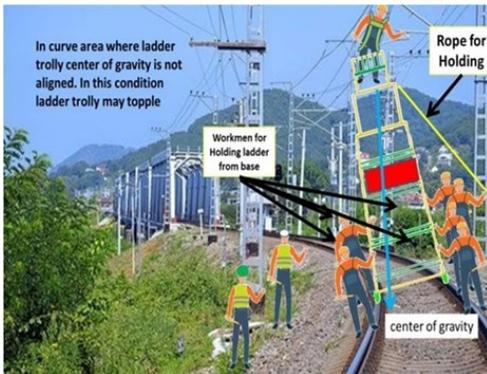


Fig.16. Erection Work

G. Safety Measures for Erection of Section Insulator /Cut in Insulator

DON'TS

- Not more than two workers shall be allowed to work on bracket at any time.
- Don't work by sitting on the cantilever insulator.
- Don't walk on conductor wires.
- Don't walk on other track on which work is not planned and block not issued.

Erection of Section Insulator/ Cut Insulator



Fig.17. Erection of Section Insulator/ Cut Insulator

H. Tower Wagon Checking

- Before start of the activity LMRA & TBT to be conducted by supervisor and work shall start only after ensuring control measures as identified during LMRA at site location.
- Properly secures yourself on the top of the tower wagon while tower wagon is moving.
- While the tower wagon is in motion the workers on top of deck/work platform shall mandatory be in sitting position.
- Keep sufficient distance from the pantograph. Since minute particles are likely to fall in your eyes.
- The floor of the tower wagon deck /platform shall be made non slippery prior to starting work activities.
- Climb on the tower wagon very cautiously as the floor may be slippery.
- Ensure that OHE is dead (by performing VAV testing) if checking is done under power block and get the pantograph released to touch the OHE so that any static/residual charge is wiped out. Panto shall be made ON after power block only and never when OHE is LIVE. Williams, Mickey (2002), 'Microsoft Visual C# .NET', Redmond, Wash.: Microsoft Corporation.

Don'ts

- Don't climb down from the moving tower wagon.
- Don't over crowd the platform of the tower wagon with the persons not required.
- Don't try to hold OHE when tower wagon is moving/in motion.

TOWER WAGON CHECKING

TYPES OF TOWER WAGONS

4 WHEELER

8 WHEELER



I. Safety measures to prevent electrical accident while working in power block

- When power block is granted then information should be communicated to all concerned person in written format.
- OHE line should be treated as live Electric line unless it is tested with VAV during power block activity.
- VAV Test shall be carried out before clamping discharge rods on OHE to ensure that there is no residual current left in the OHE line.
- Before clamping the discharge rod/ earthing to mast ensure the continuity of Structure bond at the location where clamping has to be done.
- Discharge rod shall be applied at both ends from working location. In case of connecting shot with energised wire in OHE, discharge rod should be available with working gang. Fitter shall climb the mast only after ensuring absence of voltage using VAV Detector and deployment of discharge rod.
- Fix the earthing clamp securely to a mast at least one span away from the work site after ensuring that the mast to earth rail bond is intact.
- Clamping of discharge rod should not be loose or in hanging position.
- Always keep an eye on discharge rod while working.
- After completion of the activity don't remove discharge rod unless all workmen and employees are at 4 m distance away from the OHE line.
- When work is completed, and everyone is at safe distance, remove discharge rod from the OHE line and then loosen the clamp from the Mast.
- Please ensure permanent earthing on connecting shot for safety of workmen which will be removed at the time of energisation only with due care

9. Conclusion

In conclusion, the procedure for safety of personnel in railway environments outlines a comprehensive framework aimed at safeguarding the lives and well-being of railway personnel. By addressing critical aspects such as risk assessment, training, monitoring compliance, and continuous enhancement, this procedure ensures robust safety protocols across all facets of railway operations. Active management of danger zones, implementation of traffic safety measures, difficult adherence to electrical safety standards, and maintenance of rail vehicle safety protocols are crucial in minimizing risks and preventing accidents.

Moreover, the proactive approach to incident management, including prompt reporting, thorough investigation, and implementation of corrective actions, fosters a culture of safety and continuous learning. Specific guidelines for work activities, supported by comprehensive training and safety protocols, equip personnel with the necessary skills and knowledge to

navigate hazards confidently.

By integrating these measures into daily processes, railway workers not only comply with safety regulations but also promote a workplace environment where safety is prioritized and everyone plays a role in mitigating risks. This procedure is active in enhancing safety outcomes, fostering trust among workers, and ensuring the sustainable process of railway services. Eventually, it is through the diligent implementation and continuous improvement of these safety measures that the well-being of personnel in railway environments is safeguarded, contributing to the overall reliability and flexibility of railway operations.

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