



GOVERNMENT OF INDIA

Ministry of Railways

MAINTENANCE MANUAL
FOR
TRACTION DISTRIBUTION EQUIPMENT
(OHE, PSI & SCADA)
FOR 160 KMPH TRAIN OPERATION

Document No. TI/MI/0060

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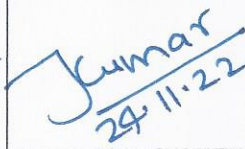
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RESEARCH DESIGNS & STANDARDS ORGANISATION,
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Government of Indian
Ministry of Railways
Research Design & Standards Organisation
Manak Nagar, Lucknow – 226011.
Maintenance Instruction No. TI/MI/0060

1. **TITLE:** OHE, PSI & SCADA Maintenance Instruction for 160 KMPH Train Operation

2. **APPLICATION:** Semi High Speed Routes

3. **OBJECTIVE:**

NDLS-HWH & NDLS-BCT routes are being upgraded for 160 kmph Train operation. The OHE will be subject to more severe dynamic oscillations at 160kmph due to the constant contact and movement of the fast-moving pantograph coupled with wind pressure. Hence, in order to achieve HIGH RELIABILITY and ZERO-DEFECT OHE, and to ensure proper current collection and effective maintenance activities to be carried out as per the maintenance schedule, this maintenance manual is being issued.

4. **OHE MAINTENANCE ACTIVITIES:**

Maintenance is the combination of all technical and administrative action including supervision action, intended to retain an OHE Component in, or restore it to, a state in which it can perform a required function.

Administrative action involves the organization and management of the necessary resources, such as personnel and maintenance vehicles/equipment, and is subject to the influence of policy strategies.

Supervision action is designed to observe the condition of the main OHE components and to improve the diagnosis of how well they are operating over time.

The combination of all technical action intended to put every item in a state in which it can perform a required function, is done through maintenance work which is divided functionally into two different ways of intervening, depending on the acceptable probability of fault occurrence defined (preventive and/or corrective maintenance).

4.1 **Corrective maintenance** is always carried out after a fault has been recognized and is intended to put an item in a state in which it can perform a required function.

4.2 **Preventive maintenance** involves supervision of the condition of the OHE to evaluate the extent of maintenance work required and is carried out at predetermined intervals or according to prescribed criteria with the aim of reducing the probability of failure or deterioration of the functioning of an item. Hence the quantity and the quality of maintenance activities may vary from the minimum for the OHE on technologically poor secondary tracks worked by few trains at very low speed to the maximum for the OHE on technologically advanced mainline tracks worked by a large number of trains at high or very high speed.

Preventive maintenance is based on inspections, observations, checks and measurements, examinations, scheduled maintenance and unscheduled maintenance. Scheduled maintenance is carried out in accordance with an established time schedule (hard time maintenance), while unscheduled maintenance occurs after obtaining an indication regarding the condition of an item (on-condition maintenance).

The frequency and intensity of maintenance work depend on the following main criteria:

- importance of the line,
- maximum line speed,
- number of train (or pantograph) journeys per day,
- type of traffic related to the current intake and to the pantograph strip materials and design,
- type of system and characteristics of the OHE,
- condition and age of the OHE,
- type and extent of air pollution,
- magnitude and duration of short-circuit currents,
- number of operating disturbances.

The OHE is kept in good condition and reliable through a number of elementary operations which may belong to seven different categories of activities:

- inspections, observation, surveillance,
- verifications, checks, measurements,
- scheduled maintenance interventions (hard time),
- on-condition maintenance interventions,
- fault repair interventions,
- extraordinary maintenance interventions,
- renewals.

5. Following are the OHE critical component and their failure modes:

- i) Contact wire parting due to excessive wear caused by overheating, exceeding contact force, excessive tensile stress, hard spots, OHE and pantograph interaction
- ii) Insulator breakage due to fatigue or insulation failure
- iii) Steady arm failure due to uplift
- iv) Cantilever condition due to corrosion
- v) Dropper failure due to fatigue
- vi) Mast bending, corrosion, missing counterweights
- vii) OHE parameters deviation- contact wire height, stagger, uplift, contact force, arcing rate, contact wire wear, ATD tension, x-y parameters
- viii) Defects in Pantograph

The adjustment work is particularly important at crossovers, turnouts and at overlaps spans since any departures from the standards laid down could cause entanglement of the pantograph with the OHE, with serious repercussions.

ix) For efficient condition-based and predictive maintenance following measures may be taken in future:

- a. **Environmental Data** like wind speed should be measured through **anemometers**, temperature rise of OHE components through **thermo vision camera**.
- b. **Physical Data** like Mast bending, corrosion of overhead equipment, missing counterweights etc., broken dropper & jumpers, x-y distance, bird nesting, mast number, bridges and tunnel location etc. can be detected through image processing techniques like **high speed cameras**.
- c. **Geometrical data** like contact wire height, stagger, contact wire wear, contact wire gradient, uplift of contact wire etc. may be collected through contact less measurement system-**Laser based mounted on OHE Recording Car at speed upto 160kmph**.
- d. **Mechanical data - Mechanical sensors like strain gauges** may be mounted on high-speed pantograph for measurement of contact force, contact less measurement system may be mounted on vehicle roof for measurement of ATD

tension (measurement of tension in contact & catenary wire), contact force measurement or image processing to detect location of hard spot, uplift of contact wire, OHE elasticity variation, contact wire wear etc. NETRA CAR [Specification No. TI/SPC/OHE/NETRA/0143 (03/2022)] can be used for measurement of Mechanical Data.

- e. **Electrical data** – arcing rate (contact loss measurement or current measurement), OHE, Rail & feeder wire current through current sensors, measurement of touch potential, soundness of earth connection etc. Instrumentation as per EN 50317 can be used for measurement of Electrical Data.

6.0 INSPECTION SCHEDULE OF OHE:

The following inspection schedules for maintenance of OHE should be followed to ensure good current collection at 160kmph as well as safety of installations and personnel:

6.1 FOOT PATROLLING OF OHE (Para No. 20322 of ACTM Volume II, Part-I):

- 1) The object of foot-patrolling is to have visual inspection of every part of OHE (including feeder line) so that any defect and abnormalities noticed are recorded and reported to the maintenance gangs for attention.
- 2) An experienced OHE Technician (accompanied by a Assistant if deemed necessary by local conditions) should be deputed to patrol the section on foot by day, so as to cover every part of the section including yards once in **10 days and suburban sections once a week**. If this patrolling is done thoroughly, many of the defects will be noticed at the incipient stage, before they develop into major defects. JE, SSE should foot patrol the entire section once in 2 & 4 months respectively.
- 3) The Technician on foot patrol should be equipped with signal flags, an emergency telephone instrument, **mobile phones** and essential tools required for attending to defects on the spot e.g., spanners for tightening bond connections, Bolts and nuts for bonding, small chopper for clearing small bushes and creepers over the OHE mast, spring balance for pulling the Regulating Equipment for checking free movements etc.
- 4) The Technician on patrol duty should particularly look for the following –
 - a. Chipped or damaged insulators.
 - b. Displaced fittings and droppers/**current carrying droppers**
 - c. Excessive sagging or hogging of contact wire
 - d. Whether compensating plate is tilted

- e. Free movement of auto tensioning device and position of counterweight with reference to upper and lower limits of movement marked on the mast.
- f. Presence of protective screens, caution and warning boards and Anti-climbing devices.
- g. Structural soundness of height gauges at level crossings.
- h. Bird nests and pieces of stray wire likely to cause short circuits and branches of trees likely to infringe the OHE.
- i. Defective bonds and earth connections.
- j. Oil leakage if any from AT and drop out fuse position.
- k. Any obstructions including tree branches in the way of free movement of pantograph and trains.
- l. Signs of heavy sparking when trains pass.
- m. Isolators blades being fully in and for signs of sparking or overheating of Isolators as also condition of locks
- n. General condition of switching stations en-route.
- o. Tilting of masts especially on high banks and masts with sand core foundations.
- p. Number plates
- q. Any other abnormal/unusual situation
- r. Visual Checking of AEC & BEC connection with each mast and portal
- s. Checking of 25kV negative Feeder

5) Major defects noticed by the Technician which endanger safety shall be reported forthwith to TPC through the nearest emergency telephone/mobile/telephone. Full details should be given to enable the TPC to decide on the course of action to be taken and if required to regulate train movements in the affected section.

6) The Technician should himself attend to and rectify such of the minor defects (e.g. loose structure, longitudinal, cross bond and BEC connection) which can be rectified by him on the spot without special assistance. To facilitate this, he shall carry with him a few essential tools. Other minor defects should be noted by him in his diary and entered by him in a Register (**see para 20349**) maintained for the purpose in the depot/sub depot. The roster of patrolling Technicians should be so arranged that they will be able to return to the depot sub-depot for submission of report as above before going off duty for the day. Where this is not convenient, the Technician must report the defects on telephone/mobile to the depot/sub-depot followed by a written report in the register on the next day. The supervisor in

charge of the depot/sub-depot will carefully scrutinize the Register and take prompt action to rectify defects reported, making suitable entries in the Register.

- 7) Testing of Emergency Telephone Sockets: During patrol duty, the Technician will speak to TPC from every emergency telephone socket in route. Such calls from patrolling Technicians should be recorded in a Register by the TPC indicating the date, time and serial number/location of the socket tested. Defective sockets should be reported promptly to the S&T Department for rectification.
- 8) Technician shall also check that safety guards provided under the feeders are properly earthed, the clearances are adequate and caution notice boards are in position.
- 9) Following maintenance schedule should be followed by SSE-Incharge, SSE (Sectional) & JE:

SSE-In charge	SSE(Sectional)	JE
Entire section in one year	Entire section in 4 months	Entire section in 2 months

- 10) A proforma for Linemen's Foot Patrol Report is given at **Annexure 3.03 (Para 20349 of ACTM Vol. II, Part-I)**

At 160 kmph OHE will be subjected to more vibrations, which are likely to cause premature failure of OHE Components and hence frequency of foot patrolling has been increased. After a year based on feedback from Zonal Railways frequency of foot patrolling may be reviewed.

6.2 Inspection of OHE by footplate (As per Annexure 3.01 of ACTM Para 20320 of ACTM Volume-II, Part-I)

The object of such inspection is to enable supervisors and officers in charge of OHE maintenance to observe closely the OHE under their charge and should be carried out during day time. Officers and senior subordinates shall travel by the cabs of locomotives and EMU trains as often as possible to observe the general condition of OHE and to get first-hand knowledge of operating conditions. PCEE of Zonal Railway may decide periodicity of footplate inspection by Supervisors & Officers (ADEE, DEE, Sr. DEE) as per local condition.

6.3 IOH (Intermediate overhauling): IOH is the maintenance of OHE with only single cantilever assembly locations and does not include locations holding 2 or more cantilevers e.g. it does not include UIOL, IOL, T/O, G-Jumpers, feeder jumpers, isolators, RRA etc.

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Periodicity: As per Railway Board letter No. 2013/Elect(G)/148/1 dated 10.05.2019 existing periodicity of IOH of single cantilever is after **every two years**. For 160 kmph it should be **Annual** as cantilever will be subjected to more vibration and wear & tear at higher speed.

Para 20961 of ACTM Volume-II, Part-I : Every cantilever assembly shall be adjusted strictly in accordance with the approved structure erection drawing, especially in regard to the positioning of stay arm, bracket tube and register arm. The projection of bracket tube and register arm and the allowance in the stay arm shall be sufficient for slewing of tracks. Normally this allowance is **15 cm to 20 cm** from the centre line of catenary suspension bracket to end of bracket tube and **20 cm** (min.) for register arms. All nuts should be tightened and locking plates provided with split pins or check nuts. Make sure that all temporary earths provided by Contractor's men during construction work have been removed.

In case of Conventional Cantilever assembly, Drop Bracket Assembly should be as per Drawing No. ETI/OHE/P/2360 and steady arm should be as per drawing no. ETI/OHE/P/2390.

6.4 AOH of OHE – ACTM Para 20326: AOH is the maintenance of OHE with locations **holding 2 or more cantilevers**. AOH is important as it have overlaps, turnouts, G-Jumpers, feeder jumpers, isolators, RRA etc.

Checks to be performed:

- 1) This schedule must be carried out by Inspection Car. **During the schedule, fittings should be dismantled**, all fittings which are found defective must be replaced. In addition, clearances, heights, staggers etc. should be checked and corrected.
- 2) The details of work to be carried out during this schedule are as under-

(a) Masts, portals and cantilever supports:

Check rail level and setting distance against markings on the masts and entries in the Register. **Variation above 30mm in setting distance and 20mm** in rail level should be notified to the PWI for correction. Variations, even within the above limits, should not be permitted if the Schedule of Dimensions are infringed.

- (i) Check all steel parts and remove rust, if any, from painted steel work. Rusted portions, after cleaning, must be given **two coats of zinc chromate primer followed by aluminum paint.**
 - (ii) Check all anchors for tightness of bolts, nuts and check nuts and pins, Lubricate all turn buckles/adjusters and pulleys.
 - (iii) Examine the base of each structure to ensure that muffs permit drainage of water. Clean the muffs removing any muck or dirt. Cracked or damaged muffs must be recast.
 - (iv) Check all bonds thoroughly. Defective bonds must be rectified and missing bonds provided,
 - (v) Check and tighten all G.I. bolts and nuts.
 - (vi) Check all galvanized pipes and fittings. Where galvanization is found to be chipped off, the fitting of pipe should be replaced. **Minor chippings may be repaired using 'cold galvanizing paint'.**
 - (vii) Examine register arm and all hooks and fittings for cracks. Check for cracks on steady arm tube also.
 - (viii) Clean all insulators and carefully check for cracks and broken sheds. If any shed is broken or there is any crack on the core the insulator should be replaced.
 - (ix) Check and adjust heights and staggers on the basis of setting distance and rail level marked. Close co- ordination with Permanent Way Inspectors is required for keeping the permanent way at the correct location.
 - (x) Check presence and condition of caution notice boards, number plates, coasting boards, etc. Paint the boards as required. Ensure that they are all well secured.
 - (xi) Ensure that the drain holes in the tubes are free and not clogged.
- (b) Contact and Catenary Wires:** 107 sq. mm HDGC/**Silver bearing grooved copper contact wire** as per specification no. TI/SPC/OHE/CW (Cu-Ag)/0130(01/2017) is provided with 65 sq. mm Cu-Cd/**Magnesium Copper Catenary wire** as per Specification No. TI/SPC/OHE/CAT(Cu-Mg)/0150.
- (i) Check carefully condition of contact and catenary wires, particularly for kinks and twists in contact wire and broken strands of catenary wire. Any stranded conductor (catenary wire etc.) should be spliced if any strand is broken.
 - (ii) Check condition of PG clamps and jumpers after opening the clamps and tighten properly.

(iii) **Contact wire Hard Spots and wear:** Hard spots are points on the OHE where contact wire wear is likely to be higher than at normal locations, due to less flexibility in the OHE. Smoke pollution aggravates wear at hard spot. The usual spots where the contact wire is likely to show more wear are :

- Support point at curves
- Section insulators
- Splices
- Turn Outs
- Central mast of 2-span un-insulated overlaps of unregulated OHE
- At approaches to tunnels and over-line structures
- Locations where smoke pollution is pronounced
- Pull-offs

At such hard spots, it is important to keep a watch on wear of contact wire by measuring and keeping a record of contact wire thickness periodically. It is essential to concentrate on these spots during annual measurement of contact wire wear.

(c) Droppers:

- (i) Check droppers/current carrying droppers
- (ii) Check current carrying droppers for any damage like strand cutting, wear of fittings, loose fitting and tighten of bolts with required torque wherever required.**
- (iii) Availability of U pin in contact clip.
- (iii) Make droppers vertical.
- (iv) Worn out dropper should be changed.

Current Carrying Droppers

Check Current carrying 'A' dropper as per Specification No. TI/SPC/OHE/CCFD/0160(02/2020)/Drawing Nos. TI/DRG/ OHE/ CCD/RDSO/00001 to 4/20/0 Rev. A for current carrying dropper assembly or one C jumper (in span jumper) in every span is provided.

(d) Turn outs

- (i) With OHE Inspection Car running on main line checkup if pantograph glides smoothly under the loop line OHE.
- (ii) With OHE Inspection Car running on loop line checkup if pantograph glides smoothly under the main line OHE.

(iii) Check stagger of both the OHEs at turn outs. (It shall not normally exceed 300 mm).

(iv) Check up for hit marks, if any.

(v) As per CEDE/NCR letter no. EL/TRD/NCR/Gatimaan dated 19.11.2018 following checks to be carried out:

1. At obligatory mast vertical gap between main line and turn out contact wire is to be maintained between 50 to 60mm.
2. At 5m distance from obligatory mast, gap is to be maintained at 50 mm.
3. At 10m distance from obligatory mast, gap is to be maintained between 40mm to 50mm.
4. Track separation is to be kept between 290mm to 550mm. Mast should be changed if track separation is less than 290mm.
5. Span length of turnout location reduced during increasing track separation.
6. From main line to loop line "take off" may be maintained in between 720 to 750mm.

(vi) Checkup rail level and setting distance and track separation of the obligatory mast.

(e) Section Insulators Assemblies:

- (i) Clean insulators and replace chipped or cracked insulators.
- (ii) Check runners for flash-marks, hit marks and proper adjustment.
- (iii) Check for excessive contact wire wear near anchor clamps.
- (iv) Check the level of the assembly and adjust if necessary.
- (v) Tighten PG clamps of droppers and stiffeners.

(f) Isolators: Double pole Isolator type II should be provided at Insulated Overlap of 1250 Amp rating as per Specification No. TI/SPC/PSI/ISOLATOR/0210. Mounting Arrangement should be as per Drawing No. ETI/OHE/G/06005 Sh-2 & ETI/OHE/G/06008 for mast and portals respectively.

- (i) Check number plates for cleanliness and security.

- (ii) Check correctness of operation, alignment of contacts and arcing horns.
- (iii) Check earth continuity where applicable.
- (iv) Lubricate moving parts and locks.
- (v) Check interlocks where provided.
- (vi) Check that the distance between male and female contacts in open position is 380mm to 500 mm depending upon the type of Isolator.
- (vii) Wherever Earthing Heels are available with Isolator, ensure the smooth operation of its blade and clearance (minimum 320 mm) in Isolator closed condition.

(g) Short Neutral Section Assemblies (Para 20312 of ACTM Vol. II, Part-I)

SNS maintenance schedule is followed based on the OEM recommendations mainly to maintain profile of runners, insulating rod and to rotate or replace insulating rod when permissible wear is reached.

Short neutral sections assembly incorporating light weight contact wire insulator of composite type (resin bonded glass fibers core protected with PTFE) has now been adopted as standard. Ease of installation even on flat curves and difficult locations, substantially reduced maintenance and other advantages are gained by introducing short neutral section. Conversion of existing overlap type neutral sections to short neutral sections may be done where it is not yet done. Short neutral sections should also be introduced in lieu of insulated overlaps opposite to the feeding posts at sub-stations. (Board's Ref. 86/RE/501/1N/S) dt. 16/22.7.1987.)

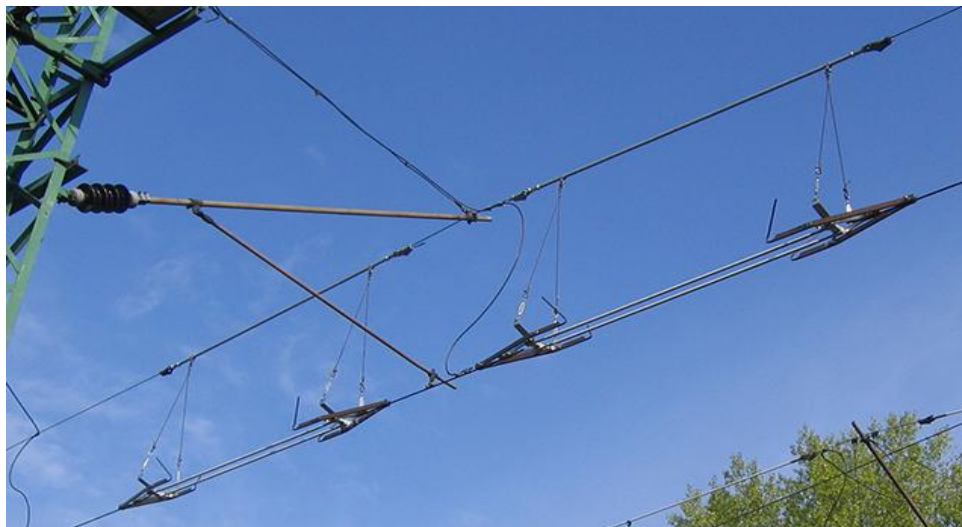
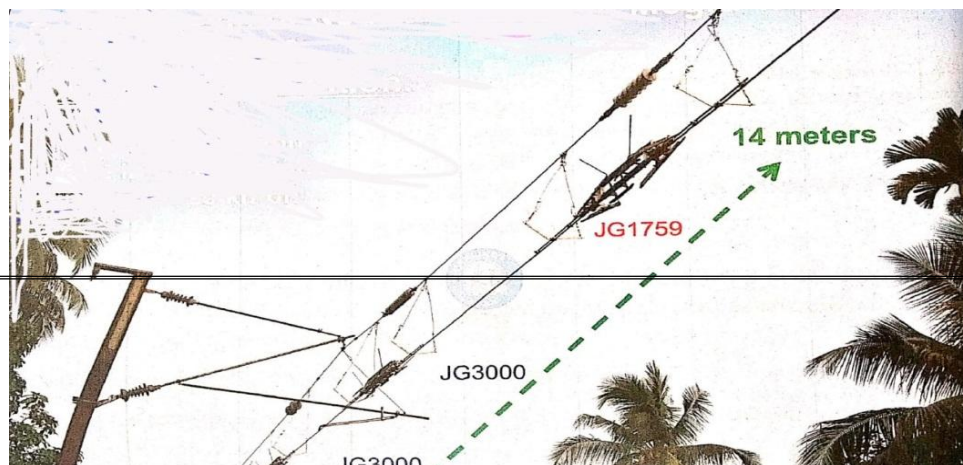
- 1) The essential points to be checked during periodical maintenance are as under:
 - a) PTFE in Arthur Flury make SNS /Rain shed in Galland make SNS.
 - b) Electrical erosion of PTFE coating
 - c) State of cleanliness of insulators.
 - d) Burning of arcing horns
 - e) Pantograph hit marks on the underside of Runners, PTFE insulator and end fittings of the contact wire insulators to ascertain need for adjustment of SNS.

- f) Wear of Runner and PTFE Insulator rod (in AF make SNS)/Shoe (in Galland make SNS) , if wear is 2 mm or more than 2 mm then the Runner/Insulator Rod should be replaced.
- g) Insulation resistance.
- 2) As per Railway Board's Letter no. 2013/Eect(G)/148/1 dated 10.05.2019, SNS maintenance schedule is **annual**. For 160 kmph this periodicity may be reduced to **quarterly as OHE will be subjected to more vibration & wear in contact wire side insulating rod**.

Short
Neutral
Section
(SNS)

Maintenance should be carried out **quarterly** along with following:

- Cleaning of SNS insulator: Preferably cleaning of SNS insulator shall be done quarterly for normal/non- polluting section. For polluted section cleaning shall be done monthly. In addition, visual check or under power block, cleaning of insulator should be done if locomotive is passing with VCB ON condition.
- Adjustment of SNS during change of track layout (gradient, curve, implantation, height etc.) should be ensured.



(h) Overlaps:

- (i) Check height and stagger of OHE in the overlap section.
- (ii) Check whether the normal minimum clearance of 500mm is available between the two OHEs in an insulated overlap and 200mm in an uninsulated overlap.
- (iii) Check whether the lifting of out-of run OHE is correct.
- (iv) Check that parallel running of contact wires in the overlap for a minimum 2m in the panto sweep region

(i) Contact Wire thickness (Para 20309 of ACTM Vol. II-Part-I):

The thickness of new contact wire is 12.24 mm. It will be necessary to replace the contact wire when it has worn to a thickness of **8.42 mm**. Measure and record thickness of contact wire as detailed in **Para 20309 of ACTM Vol. II-Part-I**.

(j) Neutral Sections:

Carry out all checks as for an insulated overlap in case of overlap type neutral sections and as for section insulators in the case of section insulator type neutral section.

(k) Overline, Structures/Tunnels

- (i) Check and record horizontal and vertical clearances and adjust OHE as required.
- (ii) Check for any flash-marks on the underside of the bridge structures.
- (iii) Check that the prescribed height of contact wire is available,
- (iv) Check that the gradient of contact wire on either side as per SED.
- (v) Check that smoke screens are properly secured and have adequate clearance from OHE. If not, get these attended to by Engineering Department.
- (vi) In tunnels get necessary repairs done by Engineering Department.
- (vii) Check rail level mark on sides of tunnels.

(I) Level Crossings

- (i) Check height and gradient of contact wire.
- (ii) Check condition of road surface and clearance of height gauge (a red band may be marked on the uprights at a distance of 4m from bottom face of the boom to facilitate measurement of clearance.)
- (iii) Check the availability of danger board & public caution boards at height gauges, Staff caution boards and shock treatment board/Chart at gate lodge.

(m) Regulating Equipment: Regulating equipment (Three Pulley Type higher tension) should be provided as per RDSO specification no. TI/SPC/OHE/3PHTATD/0150 with ACS 1 with counter weight eye rod as per drawing no. ETI/OHE/SK/588 Rev. B. Counter weight assembly should be provided as per RDSO Drawing No. ETI/OHE/SK/587 Rev. B & X-Y value adjustment chart as per Drg. No. TI/DRG/OHE/ATD/RDSO/0003/99/1. **Checks to be performed as per SMI NO. TI/MI/00029 Rev. 3.**

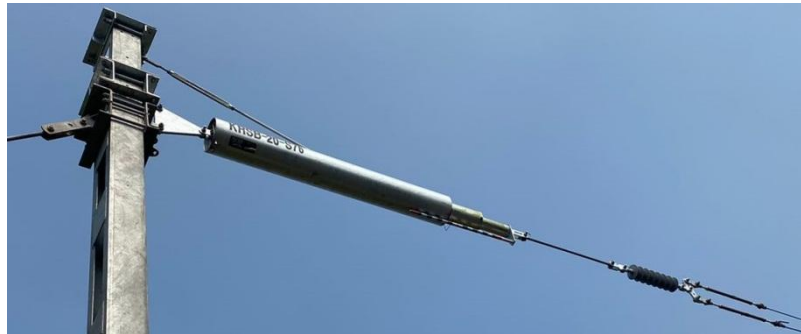
**Three Pulley Higher Tension ATD:**

- (i) Check 'X' and 'Y' dimensions three pulley type equipment against prescribed values for the temperature at the time of checking. Make use of turn-buckles to adjust as required.
- (ii) Check that the compensating plate is vertical. If not, adjust as required.
- (iii) Lubricate rope and other moving parts.
- (iv) Check if 20mm wide bands in black colour are painted on the mast to indicate upper and lower limits of movement of counter weight.

- (v) Check condition of stainless steel wire rope for any signs of corrosion and breakage of strands.

Spring Type ATD:

Spring type Auto Tensioning Device, which can be used at locations having space constraint for providing Counter Weights.



Spring ATD is Maintenance-free system with the anticipated service life more than 30 years. It's installation and operation are easier than pulley type regulating equipment. It also minimises human/material resources for maintenance due to Lower weight & Small size. It is safeguard against accidents due to no hanging counter weight as pulley type regulating equipment. Spring ATD can be used for higher tension and high speed.

Checks to be performed

Spring ATD maintenance schedule shall be based on the OEM recommendations. However, mainly function of each part, activation/movement of Spring ATD, corrosion, crack, and damage, galvanization and attachment of body should be checked.

(n) Bonds & Earthing Connection.

AEC of 12.24 mm dia. ACSR Raccoon conductor erected on the back side of the OHE masts/Portals. BEC of 20 mm dia. (cross section 238.64 mm^2), galvanized steel conductor laid underground along the UP and DN track separately, 300mm below ground surface and approximately one meter away (or as per site conditions) from the OHE foundation towards opposite direction of track. The BEC is connected to each OHE mast/Portal and Feeder mast by same conductor having Tee connector & Lug Connector as per Drawing No. TI/DRG/OHE/TC/RDSO/00001/20/0 & TI/DRG/OHE/SC/RDSO/00001/20/0. The AEC/BEC and cross bonding scheme is as per drawing no TI/DRG/OHE/ERBOND/RDSO/00001/20/0.

- (i) Check tightness of connection of BEC & AEC with mast/structure.
- (ii) Inspect earths and record earth resistance. Earths having resistance of over 10 ohms should be attended to.
- (iii) The cross bonding of the UP BEC –UP Mast/Portal-UP Traction Rail-DN Traction Rail-DN mast/Portal –DN BEC should be done by 50X6 mm MS/GS flat at every 450 mtr.

(o) Masts:

Check verticality of all masts with plumb-bob and take remedial action as required (Para 20305 **ACTM Vol. II-Part-I**).

(p) Sites affected by accidents:

Such sites should be specially checked and attended to. Porcelain insulators of the affected section should be thoroughly checked for any cracks/damage and to be replaced.

(q) Feeder Lines:

- (i) Check guard wires at road crossings, if any.
- (ii) Check earthing of Tower/Mast.
- (iii) Measure and record earthing resistance of towers.
- (iv) Clean insulators and replace those which are cracked or chipped.
- (v) Check the jumper connections, strain clamps, PG clamps and bi-metallic strip.

(r) PG clamps:

- (i) Check and clean oxide from surface.
- (ii) Apply corrosion inhibiting compound.
- (iii) Tighten to the prescribed torque as mentioned in Para 6.6.

(s) Cleaning of Insulator

Cleaning of Porcelain Insulator (Para No. 20229 & 20314 of ACTM Vol. II, Part I)

Cleaning of porcelain insulator is to be done by wiping the surface with a piece of dry cloth. A wet cloth may be necessary if the coating is hard. If the deposits are oily, petrol may be used for cleaning. If this too is ineffective where encrustation has become hard due to continued neglect, the coating may have to be removed by rubbing with a wet coir rope using a suitable detergent. After removing the deposits,

the surface of the insulator should be washed well with water, wiped with dry cloth and polished with dry cloth until the normal glaze is restored.

All insulators should be looked for any flashover marks, cracks, chippings. Insulators which are chipped should be replaced. Minor chippings can be rendered impervious to moisture by a light coating of Araldite or similar epoxy resin.

The periodicity of cleaning of insulators in polluted locations should be laid down by local instructions. The affected section should be divided into various zones based on the degree and nature of pollution and periodicity of insulator cleaning to be fixed suitably. The cleaning will be required more frequently in foggy weather compared to dry or rainy season. The periodicity may be reviewed based on effect of special measure.

Other steps for reducing flashovers due to pollution:

i) Measurement of severity level of pollution:

The severity level of pollution to be measured as per RDSO maintenance Instruction No.TI/MI/040 or latest so that adequate creepage distance insulators may be used.

ii) Use of 1600 mm creepage distance Composite insulators as per directives issued by Railway Board vide letter No. 2002/EEM/161/21 Vol. II dt 30.09.2020.

Cleaning of Composite Insulators

Clean all Insulators as per RDSO Instruction No. TI/IN/0040, Rev-0 or latest. Check carefully for any damage on sheath and sheds of composite insulators. If any damage found, Insulator may be replaced. As per this instruction following is to be done:

(A) General Instruction: For cleaning of 25 kV Composite Insulators fitted in polluted/heavily polluted area, following schedule shall be followed:

SN	Type of Insulator	Pollution level	Periodicity
1.	Stay Arm Insulator	Polluted Area/ Heavily Polluted Area	Once in a year
2.	Bracket Tube		

3.	9-Tonne		
4.	Sectioning		

(B) Method:

(i) Composite Insulator shall be cleaned with DRY SOFT COTTON CLOTH to remove the dust/pollution from insulator.

(ii) No water, detergents, any solvents and abrasive material should be used for cleaning as use of such material leads to deterioration of electrical properties causing failure.

(C) Precautions:

Please note that purpose of cleaning of Composite Insulator is only removal of dust/pollutants or any other deposition that adversely affects the electrical properties of Composite Insulators. Hence care should be taken that during dry cleaning the insulator should not be rubbed excessively to make it bright.

Handling of composite insulator:

Since the composite insulators have silicon rubber as a component, they are much more flexible and fragile than the solid core porcelain insulators. Thus special care needs to be taken during their handling. In this regard, an instruction no. TI/IN/0013, Rev-0 or latest with effect from Dec, 2005 has been issued by RDSO which should be strictly followed.

Testing of Insulators before Installation:

To weed out the insulators which may develop defect due to various reason beyond Railways control, each insulator to be tested for routine tensile load test at site/depot before installation as per RDSO's SMI No. TI/MI/0042 (12/08), Rev 0.

Following Check List may be followed for maintenance of 25 kV Porcelain & Composite Insulators

1) OHE DEPOT

S.No.	Instructions	Reference	Remarks
1.	Whether on insulators pre-installation tests has been carried	SMI No. TI/MI/0042	

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	out?		
2.	Whether handling instruction for composite insulators followed?	RDSO Instruction No. TI/IN/0013	
3.	Whether ESDD measurement has been carried out?	RDSO SMI No. TI/MI/040, Rev-0.	
3.1	If yes, whether appropriate creepage distance insulators used in the area where ESDD is more than 0.3 mg/cm ²	Railway Board's letter No. 2002/EEM/161/21 Vol. II dt 30.09.2020.	
3.2	Whether stone pelting area has been identified?		
3.3	If yes, whether composite insulators installed/used in stone pelting area?		
4.	Whether make, type, batch & Location wise record of insulators has been maintained?	-	
5.	Whether latest List of Failure Prone insulators Identified by Railway Board/RDSO is available?	RDSO letter No. TI/OHE/INS/GEN/13 dated 20.02.2013.	
6.	Whether any action plan has been prepared to replace the Failure Prone and EPDM/EVA based insulators?		
7.	Replace the Failure Prone and EPDM/EVA based insulators within target period.	RDSO letter No. TI/OHE/INSCOM/BHEL/08 dated 16.07.2008.	
8.	Whether RDSO instruction is being followed in case of failure of insulator?	RDSO Instruction No. TI/IN/0007, Rev-0.	
9.	Whether Anti climbing arrangement used in monkey menace area?	RDSO Maintenance Instruction No. TI/MI/0056	
3) During weekly Foot-Patrolling following shall be checked:			
S.No.	Instructions	Reference	Remarks
1.	Chipped or shed damaged insulators	Clause 20322 of ACTM VOL- II Part I	
2.	Whether equalizing plate is tilted		
3.	Free movement of auto tensioning device.		
4.	Bird nests and pieces of stray wire likely to cause short circuits and branches of trees likely to infringe the OHE.		

5.	Availability of bonds and earth connections		
6.	Any other abnormal/unusual situation e.g. deposition of dust on insulator, shed damage etc.		

4) Special Checks (once in three months)

S.No.	Instructions	Reference	Remarks
1.	Whether Section insulators on the main lines such as at neutral sections and Passenger yards cleaned?	Clause 20325 of ACTM VOL- II Part I	
2.	Whether badly chipped or even slightly cracked insulators (Shed tear or sheath damage in case of composite) replaced?		

5) Pre-monsoon checks

S.No.	Instructions	Reference	Remarks
1.	Whether one time cleaning of all type Insulators (Porcelain & composite) in polluted zone to prevent excessive tripping and failures during initial monsoon rains done?	Clause 20325 of ACTM VOL- II Part I and RDSO SMI No. TI/MI/0053	
2.	Whether record of locations of damaged insulators, missing locking devices like nuts, washers and pin, burnt out fittings, deflected strings, damage to protective coatings, cracked insulators (Shed tear or sheath damage in case of composite) has been recorded and rectified?		
3.	Whether Bird droppings, Bird nests, dense spider webs, kites with threads hanging on the insulator string have been recorded and rectified?		
4.	Whether condition of insulators specially that of section - Insulators at major yards having mixed type of traction checked?		

6) Annual Maintenance

S.No.	Instructions	Reference	Remarks
1.	Whether cleaning of all insulators (Porcelain & Composite) have been done?	Clause 20326 of ACTM VOL- II Part I	
2.	Whether all insulators has been carefully checked for cracks and broken (Shed tear or sheath damage in case of composite) sheds?		
3.	Whether insulators with any sheds broken or having any crack on the Core (Shed tear or sheath damage in case of composite) have been replaced?		
4.	Whether cleaning of insulators of Section Insulator Assembly done?		
5.	Whether chipped or cracked insulators (Shed tear or sheath damage in case of composite) of Section Insulator Assembly replaced?		

Modular Cantilever if used, its maintenance schedule shall be based on the OEM recommendations. Periodicity of its maintenance should be six monthly initially.

(t) FITTINGS: AOH schedule must be carried out by inspection car. During the schedule, fittings are not generally dismantled, but all fittings which are found defective must be replaced.

a) Contact wire parting at RRA location: -

- i) Special drive should be launched to identify locations where RRA clamp sides are not having curvature.
- ii) Provide correct RRA clamp, i.e. RRA Clamp having curvature on both sides.
- iii) Check for cracks/damages of contact wire and replace contact wire piece during RRA clamp replacement or otherwise.
- iv) Ensure stagger as per drawing (both contact wire and catenary wire have the same stagger).
- v) Provide correct RRA dropper length as per drawing. Dropper is in single piece.
- vi) Ensure proper gradient, relative gradient of contact wire.
- vii) Ensure correct Raised register Arm Tube (RRT) length as per drawing.

viii) Railway should ensure provision of RRA clamp (RI No. 1371-3) made of SGCI as per RDSO drawing no. ETI/OHE/P/1370-1, Mod-J in each overlaps locations in place of RRA clamp made of MCI (Drawing No. ETI/OHE/P1370-1, Mod E).

ix) Inner diameter of RRA clamp should be measured before installation. The inner diameter should be equal to 13mm.

b) Installation of Ending Clamp as per RDSO drawing for Catenary wire, feeder wire and large span wire:

- i) Position of Joint cone with respect to ending clamp body: Joint cone is shown touching Ending clamp body.
- ii) Position of inner and outer strands of conductor with respect to joint cone / Ending clamp body / Joint socket: strands are not touching ending clamp body and have a gap of about 2mm. strands are just beyond the joint socket.
- iii) Position of collar of joint socket and Ending clamp body are not touching body each other and have a gap.
- iv) All sub-assemblies mentioned in respective drawings of ending clamps for Catenary Wire, Feeder Wire and Large Span Wire stamped with part no. During assembly it is to be ensured that correct part no is used as per respective drawings.

SN.	Assembly	Drawing No.	Sub Assembly	Drawing No.	Part No.
1	Catenary Ending Clamp (65mm ²)	ETI/OHE/P/1120	Catenary Ending Clamp Body	ETI/OHE/P/1121	1121
			Catenary Joint Cone	ETI/OHE/P/1094	1094
			Catenary Joint Socket	ETI/OHE/P/1092	1092
2	Feeder Ending Clamp (150 mm ²)	ETI/OHE/P/1130	Feeder ending clamp body	ETI/OHE/P/1131	1131
			Feeder joint cone	ETI/OHE/P/1104	1104
			Feeder joint socket	ETI/OHE/P/1102	1102
3	Large Span Wire ending Clamp (130 mm ²)	ETI/OHE/P/1140	Feeder ending clamp body	ETI/OHE/P/1131	1131
			Large Span Wire joint cone	ETI/OHE/P/1143	1143
			Feeder joint socket	ETI/OHE/P/1102	1102

Note: 1. Note carefully the part numbers used for different assemblies.

2. There have been failures when wrong joint cone has been used.
3. This should be understood from drawings and physical appearance.

(u) **OHE inspection:** RDSO issued limits & tolerances in erection with respect to structure erection drawings parameters in new Electrification works vide TI/MI/0049 should be followed.

Height of Contact Wire: This shall be checked at every structure and at mid-span for regulated OHE. A pre- determined sag in the contact wire of 50 mm at mid-span on a 72 m span should exist on the open routes. Height of contact wire at level crossings shall not be less than 5.50 m.

Stagger : Stagger in tangent track shall be to the left and to the right of the alternatively, not exceeding 200 mm on either side of the centre line of the track, except where otherwise specified in Structure Erection Drawings. Stagger for in-running OHE shall not be more than 300 mm at the mast/structure on the outside of curves except in case of overlap spans and also at the turn-outs. Stagger of contact wire at mid-span in transition portion of the curves shall be within 200 mm.

Gradient of Contact Wire: On both side of overline structures, tunnels and level crossings, the gradient of contact wire shall be in accordance with the approved profile.
Contact wire Gradient should be 2mm/m & Relative gradient should be 1mm/m.

Clearances: The live metallic caps of insulators on out of run wires shall be at least 2m away from adjacent earthed mast/structure (other than the OHE structure). The distance of these insulators shall be 3m from the bracket supporting the OHE in case of insulated overlaps. Clearance of 2m shall normally exist from nearest point of two adjacent elementary sections except at the section insulators. Where clearance of 2m is not available, it shall be not less than the minimum long duration electric clearance of 250 mm. Whenever the OHEs of two elementary sections cross one another, necessary cut in insulators shall be provided.

Bonding: Earthing and Bonding of Every mast/structure supporting OHE as well as platform structures, foot over bridges etc. shall be checked properly.

Power Line Crossings: High voltage transmission line crossings across the tracks shall be checked against the approved plan authorizing the crossing, particularly the clearance between the OHE and the guard wires, duly recording the results individually. If the crossing is not in accordance with the approved plan, the Supply

Authority should be contacted immediately and the infringements should either be removed or necessary relaxation be obtained from PCEE and Electrical Inspector to the Railway.

6.5 POH OF OHE (Para 20329 of ACTM Volume-II , Part - I): The aim of POH of OHE is to ensure that all major defects are rectified, contact wire if worn-out is replaced, ATD POH/Replacement is done etc. The aim of POH is to recondition and restore the installation in the condition it was when it was first commissioned, whereas preventive maintenance has for its objective to take care of the wear and tear during normal service and forestalling possible failures by regular inspection and prompt attention. The POH should be thorough and cover every part of the installation. The work involved during POH is somewhat greater in scope than the pre-commissioning tests, since after years of service many parts would have suffered wear and tear, of which necessary adjustments will have to be made or repairs done to make good the wear, or the irreparable items replaced. For programming POH, the entire section in each Division should be divided into smaller sections. All POH work should be done under the direct supervision of SSE/JE.

The object of POH is to make a thorough inspection of the OHE and to replace such of the worn- out or damaged parts by those, which have been reconditioned earlier in the maintenance depots and kept ready. The parts removed are sent to the maintenance depots for dismantling, thorough examination, re-conditioning if possible and re-assembly for use again as required.

Periodicity: Existing periodicity of POH of OHE after 8 years with 3 IOH in between after every 2 years. POH after every 6 years in coastal and saline area with 2 nos. IOH in between after every 2 years.

For 160 kmph POH of OHE should be initially 4 years with 2 IOH after every two year as due to increase in speed and tension mechanical and electrical stresses in assets will increase.

Checks to be performed

In addition to the items detailed under annual maintenance, the following items should be attended to during POH:

(a) Masts, portals and cantilever supports:

- i. At least one complete cantilever assembly per 10 track-km (this may be modified by PCEE if considered necessary) should be removed and taken to the, workshop for dismantling and detailed examination of various components after

thorough cleaning. This test check would reveal the extent to which other cantilever assemblies have to be examined.

- ii. All regulating equipment should be replaced by previously overhauled ones and the removed equipment should be sent to the workshop for overhaul.
- iii. As the bracket is articulated, check the position with reference to the axis of the mast. The position will vary with temperature and distance from anti-creep. The register arm and steady arm should as far as possible be in the same plane as the bracket.
- iv. Check adjustments of cantilever assemblies, their slope and displacements at every structure for compliance with the 'as erected' SEDs.

(b) Catenary and Contact Wires:

- (i) Dismantle all jumper connections, clean the conductors, (with emery paper in case of copper or bronze conductors and metallic brush in case of aluminium conductors) clips etc. If the pieces show signs of overheating, this may be because either they are not tightened properly or the clips are deformed and contact surface is insufficient. In the latter case they should be replaced. In case of the contact wire, it is the groove that has to be cleaned with either a fine metallic brush or emery paper. The use of scraper or file is forbidden. Replace frayed or damaged jumpers.
- (ii) Remove kinks if noticed.

(c) Insulated and Un-insulated Overlaps:

- (i) Check the position of contact wire respect to tracks to comply with SEDS.
- (ii) Ensure that insulators of anchoring wires are crossing the plane of OHE in correct position as per plan.
- (d) **Over-line Structures:** Check the height and gradient of the contact wire and tally the same with 'as erected'.

(e)Tunnels:

- (i) Check the height and gradient of the contact wire and clearances and adjust as per SED.
- (ii) 100 per cent OHE fittings in tunnels should be replaced with new or previously over-hauled fittings and the removed fittings taken to the Workshop for detailed examination.

(f) **Turn outs:** Every turnout all three type of movement (i-Main line to main line, ii- Main line to turn out, iii- Turnout to main line) shall be possible and should be checked during maintenance under power block. It is most critical item of OHE.

Check the position of the contact wires with respect to the track for compliance with SED.

(g) **Overhead Cross-feeders and 25 kV Feeders:**

(i) Examine wires for frayed strands, overheating, pinching or corrosion, especially at suspension clamps and PG clamps. Tighten junction sleeves.

(ii) While tightening PG clamps ensure that all joints are properly coated with Vaseline.

(iii) Check tension in wires and adjust if necessary.

(iv) Other overhead wires such as bypass feeders and earth-wires should be inspected. The insulator attachments should be dismantled, overhauled and put back in position. The insulators should be cleaned at the same time.

(h) **Rehabilitation of OHE**

For Rehabilitation of OHE components, Railway Board letter No. 2002/ACII/2/10 Vol II dated 29.11.2019 should be referred. PCEE may decide the assemblies to be replaced after a special drive for condition monitoring.

6.6 SPECIAL CHECKS

Gantry: Periodicity for maintenance- **Annual** (Railway Board letter No.2020/EEM/161/1 Vol. II dated 21.09.2020) with checking of following:

(i) Checking of gantry conductors, drop jumpers, PG clamps with thermo vision camera quarterly under the supervision of SSE

(ii) Cross feeder for the first Track should be replaced by connecting jumper directly from gantry mast using standard out rigger arrangement. It will reduce two cross feeders if connected to nearest track OHE.

Thermal Imaging: Temperature of OHE component rises due to traffic load, loose contacts, component under mechanical strain, excessive wear etc. Maintenance

Instruction on Identification of defects on traction installation using thermo-vision camera and preventive action as per **SMI No. TI/MI/0055 Rev. 0**. Should be followed.

Periodicity: Periodicity of Thermal imaging inspection of OHE will be quarterly.

Current collection with OLIVIR G (Para 20324 of ACTM Vol. II-Part-I):

It is necessary to carry out periodic tests to detect points at which contact between the contact wire and pantograph is unsatisfactory resulting in sparking. Such current collection tests are performed at night. This test is conducted by OLIVIR-G equipment which can be fixed on loco focusing the pantograph and data of the sparking locations can be downloaded after the completion of inspection.

The current collection tests as above should be carried out by the depot-in-charge (SSE or JE) quarterly over his entire section. The DEE(TrD)/ ADEE (TrD) should accompany the depot-in-charge during such tests alternately so as to cover their sections once in 3 months respectively. DEE (TRD) should accompany the depot-in-charge so as to cover his jurisdiction once a year.

The form in which a record is to be maintained is indicated in para 20348.

Vide Rly Bd. Letter's no. 2013/Eect(G)/148/1 Dated 10.05.2019, periodicity of Current Collection with OLIVIR-G to be Half Yearly.

Current collection with OLIVIR G for 160 kmph train operation.	<p>Periodicity of Current Collection to be quarterly along with following.</p> <ul style="list-style-type: none"> • Olivir -G Video should be seen on computer for checking the pantograph passes over turnout, crossover, IOL, UIOL. Its video based findings should also be necessarily recorded in appropriate registers and preventive maintenance done timely.
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Olivir-G can be used for identifying hard spots/ hot spots on contact wire, current collection performance, OHE-Pantograph mechanical interaction.

Bi-Metallic Clamps- These should be checked by thermo vision camera for signs of overheating once **in 3 months**.

Earth Connections: Apart from general inspection of bond and earthing connections during foot-patrolling, all such connections should be specially checked for continuity and soundness of connections once in six months. Particulars of all earthing connections (other than structure bonds) should be entered in a Register station-wise for each section and the dates of six-monthly inspection entered therein (see Para 20349).

Cross Feeder & Along Feeder:

- (i) Examine wires for frayed strands, overheating, pinching or corrosion, especially at suspension clamps and PG clamps. Tighten junction sleeves.
- (ii) While tightening PG clamps ensure that all joints are properly coated with Vaseline.
- (iii) Check tension & sag in feeder wires and adjust if necessary.
- (iv) Other overhead wires such as bypass feeders and earth-wires should be inspected. The insulator attachments should be dismantled, overhauled and put back in position. The insulators should be cleaned at the same time.
- (v) The, clearances to road and rail crossings should be checked with respect to approved plans.

Structure Number Plate:

Retro reflective structure number plate shall be provided as per Railway Board letter No. 2001/Elect (G)/170/1 Pt dated 07.05.2012 .Retro Reflective number plate may be provided at additional masts if required, by Zonal Railway, as per Rly Board"s letter No. 2001/Elect(G)/170/1 Pt dated 18.10.2012.

Jumpers

Proper attention to jumpers during scheduled maintenance is, very important. Jumpers, particularly continuity jumpers, with broken strands should be invariably replaced, failing which the reduced cross-section may cause overheating and eventual failure. Broken strands are most likely at the point of entry into PG clamps, possibly due to sharp edges in the clamp. PG clamps should have properly rounded off edges to prevent the cutting of strands. The clamps should be checked for signs of overheating and proper tightness. G jumper size should be 160 sq. mm.

Bird Menace – For Prevention from Bird Menace on Traction installation (OHE, PSI), **SMI NO. TI/MI/050 Rev. 1** Should be followed.

Monkey Menace - For Prevention from Monkey Menace on Traction installation (OHE,PSI), **SMI NO. TI/MI/050 Rev. 2** Should be followed.

Pre Monsoon Checks- For Pre and post Monsoon precaution for traction Installation SMI No. **TI/MI/0053 Rev. 0** should be followed.

6.6 The tightening torque for fasteners of various sizes as per Annexure 2.08 (Para 22015 and 20304 of ACTM Volume II, Part I) is given below:

TORQUE FOR VARIOUS SIZES OF BOLTS IN kg.m

Bolt Size	Nominal	Steel	Stainless Steel
10	58	4.73	5.91
12	84.3	8.25	10.31
14	115	13.14	16.42
16	157	20.61	25.61
18	192	28.18	35.23
20	245	39.96	49.95

7.0 Equipment required for condition monitoring:

(i) Thermo - Vision Camera:

Thermo Vision Camera is a device that forms an image using infrared radiation, similar to a common camera that forms an image using visible light. It is a non-contact device which detects infrared radiations and converts it into electronic signals which is then processed to produce a thermal image on a video monitor and perform temperature calculations. It measures infrared (IR) energy and convert the data to images corresponding to the temperature.



**Thermal image showing over heated loose connection
with temperature chart**

In AC Traction sub-station, SP, SSP, thermal scanning will cover: i) All joints connections, terminations, jumpers, PG clamps of incoming switch yard and outgoing switch yard. ii) Transformer bushing connections. iii) Bus bar joints iv) LA, CT, PT connections from bus bar and terminals v) HV side bi-polar Isolators, single pole Isolators contact and bus bar. vi) Connections to buried rail vii) Auxiliary transformer HT connections viii) Cross feeder and drop jumpers and PG clamps ix) Transformer radiator valves. x) Central cable connections in Control Room and Control Boxes of breakers transformer, CT & PT connections.

In AC OHE, thermal scanning will cover: i) All types of jumpers (drop jumpers, C jumpers, turn out jumpers, G jumpers, potential equalizing Jumpers, Anti-theft jumpers, Feeder jumpers, jumpers between Isolator & OHE), All OHE connectors (PG Clamps, Suspension Clamp, Catenary & Contact wire Splices etc.) provided in Contact wire, Catenary wire, Feeders, Negative Feeders, all type of jumpers .

(ii) Anemometers:

Wind speed measurement system (Anemometers) should be installed at locations (TSS/SP/SSP) which are prone to traffic disruption due to heavy winds. Analog Electrical signal of wind speed data shall be interfaced with RTU at concerned switching post so that wind speed alarm is available at MMI of TPC Desk for TPC to take suitable action to open the feeder circuit breaker of the affected zone accordingly, if required. During stormy whether there is instruction for controlling of Trains as per G & SR. Based on the measurement of wind, TPC shall advise section controller who will advise concerned station master and loco pilots to take appropriate action as per G & SR.

(iii) Olivir G:

The OLIVIR-G detects Over Head Equipment (OHE) spark using a video camera. The hardware unit consist of a GPS receiver which track the current position of the locomotive in which the 'OLIVIR-G' is mounted. The OLIVIR mate RT software supplied with the unit identity sparks in real time and save them as images with locations, at the same time continuous video film is also recorded in hard drive. These images can be analyzed to recognize the type of spark (mega pixel) with their locations

RDSO specification no. TI/SPC/OHE/OLIVIR/0051 (or latest) for Overhead line Inspection with Video Recording System for Current collection Test should be referred.

(iv) High Speed Cameras:

High Speed Cameras can be used for monitoring and inspection of pantographs, breakage or any deformation slightest damage or wear and tear of carbon strip precisely and at high speed.

(v) OHE Recording Cum test car for measurement up-to 160 kmph:

Presently, NETRA car is being used for recording & testing of OHE parameters (stagger, dia of contact wire, height & contact force, voltage, gradient) at speed 110kmph.

The OHE parameter recording cum-test car is required to measure and record various parameters i.e. Stagger of contact wire, Height of contact wire, Thickness of contact wire, Gradient of the contact wire, Setting Distance/Implantation, Contact Force etc. of OHE in static/ dynamic conditions under live and non-live conditions of OHE, at speed of 0-160 km/h when coupled to a train/locomotive.

Non-self-propelled OHE parameters recording and testing car (Specification No. TI/SPC/OHE/NETRA/0143 -03/2022) is being planned to consist of LHB Platform upto speed 160kmph for Indian Railways.

(vi) MRI system:

Contact less overhead line diagnostic and measuring equipment can be installed on any type of railway Vehicle for measurement of height, stagger and gradient.

8.0 Particulars of records to be maintained in regard to OHE maintenance are given below (Para 20349 ACTM Vol. II, Part-I and ACS 10 & 13 of ACTM):

1. Daily Report of OHE Maintenance to be submitted by the Supervisor in-charge of field work to JE. This should be in proforma No. 03-1 appended.
Register for Foot-Patrol Reports: The reports regarding foot-patrolling (para 20322) should be entered by the Technician in a Register to be maintained for the purpose by each Section Supervisor. The Register shall be generally as shown in proforma No. 03-2 appended.
2. Cantilever Assembly Maintenance Register as per proforma No. 03-3. This should be maintained by each depot/sub-depot.
3. Register of Contact Wire Thickness Measurements: This Register shall be maintained in proforma No. 03-4.
4. Register of Clearance under over line Structures as per proforma No. 03-5.
5. Register of Earth Resistance Measurement as per proforma No. 03-6.
6. Register of Current Collection Tests shall be maintained in proforma No. 03-7.
7. Register of Regulating Equipment shall be maintained by each depot/sub-depot for its jurisdiction. This Register should have a page allotted for each Regulating Equipment. Particulars of adjustments carried out, amount of catenary and contact wire cut etc. shall be recorded in this Register, indicating the dates on which these items of work have been done, as per Proforma No. 03-10.
8. Register for Isolator Switches shall be maintained by each depot/sub-depot indicating dates on which the isolators have been Inspected and the details of work carried out, as per Proforma No. 03-11.
9. Register for Turn outs and Cross-overs shall be maintained by each depot/sub-depot. This should indicate the dates on which each turn out/cross-over has been checked for adjustment and particulars of work done, as per Proforma No. 03-12.
10. Register of Vulnerable Foundations: This should contain details of checks carried out on foundations at vulnerable locations, such as on over bridges, embankments susceptible to erosion etc., as per Proforma No. 03-13.
11. Register for Feeder Lines shall be maintained by concerned depots/sub-depots to indicate particulars of patrolling of 25 kV feeder lines and maintenance carried out on such feeder lines.

12. Register of Critical Implantation: The annual check of Implantation at critical locations (para-20306) shall be recorded in this Register as per Proforma No. 03-8.
13. Register of Level Crossings: This should contain dates on which height of contact wire at Level Crossings as well as that of the height gauges at Level Crossings have been checked. See Proforma No. 03-14.
14. Register of Splices as referred to in para 20310 as per Proforma No. 03-15.
15. Register of OHE Break-downs: Each depot/sub-depot should maintain particulars of OHE break-downs occurring in its jurisdiction in Proforma No. 03-9. For each break-down a page should be allotted. Reference to detailed reports submitted should also be given to facilitate investigations subsequently.
16. Register for Thermal Imaging of Electrical Junctions.
17. Register for PTFE Neutral section
18. Register for section insulator assembly
19. Register for power line crossings
20. Register for pantograph joint inspection
21. Register for maintenance of assets
22. Register for Tools and Plants checking
23. Register for Live line tower wagon checking
24. Register for maintenance of 25 kV feeder
25. Register for maintenance of AEC & BEC.

Registers may also be maintained for any other additional items in the proforma prescribed by PCEE.

The Supervisor of the depot/sub-depot will be held responsible for ensuring that these registers are maintained up-to-date. Officers and Senior Supervisors during their inspections should scrutinize these registers and initial a few important entries.

9.0 OHE Maintenance Schedule in Brief is given below:

SN	Equipment / Name of Activity	Existing Periodicity as per ACTM & Railway Board letter No. 2020/EEM/161 /1Vol-II dated 21.09.2020 & 2013 /Elect(G)/148/1 dated 10.05.2019.	Proposed Periodicity for 160 kmph train operation	Justification
1.	Foot Plate Inspection by Supervisor ACTM Para 20320 Annex 3.01	CEE of zonal railway may decide periodicity as per local condition.	PCEE of zonal railway may decide periodicity as per local condition.	-
2.	Foot Plate by officers Sr.DEE, DEE,ADEE ACTM Para 20320 Annex 3.01	CEE of zonal railway may decide periodicity as per local condition.	PCEE of zonal railway may decide periodicity as per local condition.	

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3.	Foot patrolling by technician Para 20322 of ACTM Volume-II, Part-I	Annexure 3.03 (Para 20349 of ACTM Vol. II, Part-I) Fortnightly for open routes and weekly for sub urban section.	Annexure 3.03 (Para 20349 of ACTM Vol. II, Part-I) 10 days for open routes and weekly for sub urban section. Monthly Schedule of Inspection as given below <table><tr><td>SSE-In charge</td><td>SSE(Sectional)</td><td>JE</td></tr><tr><td>Entire section in year</td><td>Entire section in 4 months</td><td>Entire section in 2 months</td></tr></table>	SSE-In charge	SSE(Sectional)	JE	Entire section in year	Entire section in 4 months	Entire section in 2 months	It is necessary to maintain the OHE in perfect condition through proper checks on its geometry and all parameters adopted in the design.
SSE-In charge	SSE(Sectional)	JE								
Entire section in year	Entire section in 4 months	Entire section in 2 months								
4.	Single Cantilever Para 20961 of ACTM Volume-II, Part-I	IOH of Single Cantilever after every Two Years	Annual	Cantilever will be subjected to more vibration at higher speed						
5.	Cantilever Assembly POH Para 20329 of ACTM Volume-II, Part-I	To be dispensed with. However, rusty cantilever must be replaced or painted.	To be dispensed with. However, rusty/worn-out cantilever must be replaced or cold galvanized in AOH	After gaining experience, periodicity may be reviewed.						
6.	AOH of OHE with 02 or more cantilever,	Annual	Annual	After gaining experience,						

	UIOL,IOL,T/O, X/o, feeder jumper, G-Jumper, Droppers Isolators, RRA Clamps Para 20326 of ACTM Volume-II, Part-I			periodicity may be reviewed .
7.	POH Para 20329 of ACTM Volume-II, Part-I	POH after 8 years with 3 IOH in between after every 2 years. POH after every 6 years in costal and saline area with 2 IOH after Every 2 year.	POH after 4 years with 3 AOH after every year.	Due to increase in tension & speed mechanical and electrical stresses in assets will also increase.
8.	AOH of ATD Para 20326 of ACTM Volume-II, Part-I	Annual	Annual	After gaining experience, periodicity may be reviewed .
9.	POH of ATD Para 20329 of ACTM Volume-II, Part-I	POH after 8 years with 3 IOH in between after every 2 years. POH after every 6 years in costal and saline area	POH after 4 years with 3 AOH after every year.	Due to increase in tension ATD will be subjecte

		with AOH in between after Every year.		d to more mechanical stresses.
10.	Gantry	<p>Annual Gantry maintenance retained with checking the following:</p> <p>(i)Checking of gantry conductors, PG clamps with thermo vision camera half yearly under the supervision of SSE</p> <p>(ii) Cross feeder for the first Track should be replaced by connecting jumper directly from gantry mast using standard out rigger arrangement. It will reduce two cross feeders if connected to nearest track OHE.</p>	<p>Annual Gantry maintenance retained with checking the following:</p> <p>(i)Checking of gantry conductors, drop jumpers, PG clamps with thermo vision camera quarterly under the supervision of SSE</p> <p>(ii) Cross feeder for the first Track should be replaced by connecting jumper directly from gantry mast using standard out rigger arrangement. It will reduce two cross feeders if connected to nearest track OHE.</p>	<p>After gaining experience, periodicity may be reviewed .</p>

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11.	TURNOUT/C ROSSOVERS CEDE/NCR letter No. EL/TRD/NCR /Gatiman dated 19.11.18	Annual	Annual with following checks: 1. At obligatory mast vertical gap between main line and turn out contact wire is to be maintained between 50 to 60mm. 2. At 5m distance from obligatory mast, gap is to be maintained at 50 mm. 3. At 10m distance from obligatory mast, gap is to be maintained between 40mm to 50mm. 4. Track separation is to be kept between 290mm to 550mm. Mast should be changed if track separation is less than 290mm. 5. Span length of turnout location reduced during increasing track separation. 6. From main line to loop line "take off" may be maintained in between 720 to 750mm.	-do-
12.	Thermal Imaging Para 20321 of ACTM Volume-II, Part-I	Half Yearly	Quarterly	OHE will draw more current due to increase in speed, number of trains in the section.
13.	Current Collection with Oliver G	Half yearly along with following: Olivir –G Video should be seen on computer for checking the pantograph	Quarterly along with following: Olivir –G Video should be seen on computer for checking the pantograph passes over turnout, crossover, IOL, UIOL. Its video based findings should also be necessarily recorded in appropriate registers and preventive	After gaining experience, periodicity may be reviewed

		passes over turnout, crossover, IOL, UIOL. Its video based findings should also be necessarily recorded in appropriate registers and preventive maintenance done timely.	maintenance done timely.	.
14.	Short Neutral Section Para 20312 of ACTM Volume-II, Part-I	<p>Annual along with following</p> <ul style="list-style-type: none"> Cleaning of SNS insulator: Preferably cleaning of SNS insulator shall be done annually for normal/non-polluting section. For polluted section cleaning shall be done half yearly. In addition, visual check or under power block, cleaning of insulator should be done if locomotive is passing with VCB ON condition. Measurement 	<p>Quarterly along with following</p> <ul style="list-style-type: none"> Cleaning of SNS insulator: Preferably cleaning of SNS insulator shall be done quarterly for normal/non-polluting section. For polluted section cleaning shall be done half yearly. In addition, visual check or under power block, cleaning of insulator should be done if locomotive is passing with VCB ON condition. <p>Adjustment of SNS during change of track layout (gradient, curve, implantation, height etc.) should be ensured.</p>	OHE will be subjected to more vibration & wear in contact wire side insulating rod.

		<p>of parameters: Measurements should be divided into power block and without power block as divided by the Railway.</p> <ul style="list-style-type: none"> • Adjustment of SNS: Preferably should be done annually along with the measurement. • All Railways should take appropriate decision based on the local conditions. • Adjustment of SNS during change of track layout (gradient, curve, implantation, height etc.) should be ensured. 		
15.	Section Insulator	Annual	Annual	After gaining experience, periodicity may be reviewed .

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15.	Tower wagon checking	Half yearly for normal routes and quarterly for suburban routes.	Quarterly	After gaining experience, periodicity may be reviewed.
16.	25kV Feeder Wire Para 20325 of ACTM Volume-II, Part-I	Annual	Annual	-do-
17.	Spring type ATD	-	As per OEM guidelines	-do-
18.	Contact wire condemning diameter & Contact wire Gradient. Para 20309 of ACTM Volume-II, Part-I	Replacement of the contact wire when it has worn to a thickness of 8.25 mm. Contact wire Gradient 3mm/m & Relative gradient 1.5mm/m.	The replacement of the contact wire when it has worn to a thickness of 8.42 mm . Contact wire Gradient 2mm/m & Relative gradient 1mm/m.	Factor of safety reduced due to increase in tension.
19.	Isolator Para 20326 of ACTM Volume-II, Part-I	Annual	Annual	After gaining experience, periodicity may be reviewed.
20.	Current Carrying Droppers and its	-	Annual with following checks: 1. Wear and tear of fittings 2. Strand cutting	After gaining experience,

	fitting		3. Tightening of nut and bolts.	periodicity may be reviewed .
10.0 Maintenance Schedule in brief for PSI is given below:				
SN	Equipment/ Name of activity	Existing Periodicity as per ACTM & relevant Rly Board Letter No. (if any)	Proposed Periodicity	Justification
1.	General	<ul style="list-style-type: none"> Fortnightly Maintenance (ACTM Para 20225) Half Yearly Maintenance (ACTM Para 20239) Yearly Maintenance (ACTM Para 20243) 	<ul style="list-style-type: none"> Fortnightly Maintenance (Same as specified in ACTM Para 20225 for Sub Station. Also the inspection of SP/SSP is also to be conducted on the lines of substation) Half Yearly Maintenance (ACTM Para 20239) Yearly Maintenance (ACTM Para 20243) 	The SP/SSP is also provided with Autotransformer, Control & Relay Panel and Circuit Breaker.
2.	Battery	<ul style="list-style-type: none"> Fortnightly Maintenance (ACTM Para 20226) Quarterly Maintenance (ACTM Para 20235) Yearly Maintenance (ACTM Para 20250) 	<ul style="list-style-type: none"> Fortnightly Maintenance (ACTM Para 20226) Quarterly Maintenance (ACTM Para 20235) Yearly Maintenance (ACTM Para 20250) 	---
3.	Battery charger	<ul style="list-style-type: none"> Quarterly Maintenance (ACTM Para 20235) Yearly 	<ul style="list-style-type: none"> Quarterly Maintenance (ACTM Para 20235) Yearly Maintenance (ACTM Para 20250) 	

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		Maintenance (ACTM Para 20250)		
4.	Bonding & Earthing	<ul style="list-style-type: none"> Monthly Maintenance (ACTM Para 20227) Yearly maintenance (ACTM Para 20245) 	<ul style="list-style-type: none"> Monthly Maintenance (Same as specified in ACTM Para 20227 for Sub Station. Also the inspection of SP/SSP is also to be conducted on the lines of substation The mid-point earthing connection of Autotransformer to be checked visually) Yearly maintenance (Same as specified in ACTM Para 20245. Also these tests to be made applicable for SP/SSP also.) 	The SP/SSP is also provided with Earth mat.
5.	Traction Power Transformer	<ul style="list-style-type: none"> Monthly Maintenance (ACTM Para 20230) Half Yearly Maintenance (ACTM Para 20240) 	<ul style="list-style-type: none"> Monthly Maintenance (ACTM Para 20230, to be made applicable for Autotransformer along with Traction transformer. The temperature reading of FOS (Fibre optic sensor) also to be noted in the register. Further point no. 4 of this Para may be read as "Check silica-gel breather. Traction Transformer have silica gel whose colour changes from orange to dark green as it absorb moisture. If the silica-gel is too wet, check di-electric strength of transformer oil") Half Yearly Maintenance (ACTM Para 20240 to be made applicable for 	<p>Autotransformer has been included.</p> <p>Autotransformer has been included. The Traction</p>

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		<p>20240)</p> <ul style="list-style-type: none"> Yearly maintenance (ACTM 20246) Para Overhauling (ACTM 20254) Para 	<p>Autotransformer along with Traction Transformer. The midpoint earthing of Auto transformer shall be checked for its intactness.</p> <p>The operation of fan which has been provided for ONAF operation and operation of pump for OFAF mode also to be checked along with indication at RTCC panel).</p> <ul style="list-style-type: none"> Yearly maintenance (ACTM Para 20246. Also the mentioned inspection to be done for Auto transformer also). The Maintenance instruction no. TI/MI/0038 Rev.2 or latest -Inspection test schedule for traction power transformer shall also be followed. Overhauling (ACTM Para 20254. Also the mentioned inspection to be done for Auto transformer also). The Maintenance instruction no. TI/MI/0039 Rev.2 or latest- Maintenance Instruction for Overhauling of Traction Transformer shall also be followed. 	transformers are with ONAN/ONAF/OFAF mode.
6.	Circuit Breaker	<ul style="list-style-type: none"> Monthly Maintenance (ACTM 20231) Para Overhauling 	<ul style="list-style-type: none"> Monthly Maintenance (ACTM Para 20231) Overhauling (ACTM Para 20254) Specified in Annexure 	

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		(ACTM Para 20254) • Specified in Annexure 2.06 and annexure 2.07 (Para 20223(6)) of ACTM Volume-II, Part-I.	2.06 and annexure 2.07 (Para 20223(6)) of ACTM Volume-II, Part-I. • The Maintenance instruction no. TI/MI/0054 or latest - Maintenance Instruction and Test schedule for 25 kV Vacuum circuit breaker and Interrupter shall also be followed.	
7.	Isolator	• Monthly Maintenance (ACTM Para 20232) • Half Yearly Maintenance (ACTM Para 20241) • Yearly maintenance (ACTM Para 20247)	• Monthly Maintenance (ACTM Para 20232) • Half Yearly Maintenance (ACTM Para 20241) • Yearly maintenance (ACTM Para 20247)	
8.	Bus Bar, Clamp & Connectors	• Monthly Maintenance (ACTM Para 20233) • Yearly maintenance (ACTM Para 20248)	• Monthly Maintenance (ACTM Para 20233, Further, thermal imaging camera should be used for checking the temperature at joints, nut-bolts, bus connections, clamp etc.) • Yearly maintenance (ACTM Para 20248)	
9.	Auxiliary Transformer	• Quarterly Maintenance (ACTM Para 20238)	• Quarterly Maintenance (ACTM Para 20238)	

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10.	PTs & CTs	<ul style="list-style-type: none"> Quarterly Maintenance (ACTM Para 20236) Yearly maintenance (ACTM Para 20251) 	<ul style="list-style-type: none"> Quarterly Maintenance (ACTM Para 20236) Yearly maintenance (ACTM Para 20251) 	
11.	Lightening Arrester	<ul style="list-style-type: none"> Yearly maintenance (ACTM Para 20244) 	<ul style="list-style-type: none"> Yearly maintenance (ACTM Para 20244) 	
12.	Control & Relay Panel	<ul style="list-style-type: none"> Monthly Maintenance (ACTM Para 20234) Half Yearly Maintenance (ACTM Para 20242) Yearly Maintenance (ACTM Para 20249) 	<ul style="list-style-type: none"> Monthly Maintenance (ACTM Para 20234, C&R panel has also been provided at SP/SSP) Half Yearly Maintenance (Same as specified in ACTM Para 20242. Further point no. 4 of this Para may be read as "Check LCD display and relay setting of numerical protection relays") <p>Yearly Maintenance (ACTM Para 20249, some points modified as below:)</p> <p>20249(1):</p> <p>Same as specified in ACTM However, the referred Para 20221 is deliberated as under- 20221(1,2&3)- Same as specified in ACTM 20221(4)-Same as specified in ACTM, except the Guidelines for setting of relays shall be shared</p>	C&R panel has also been provided at SP/SSP.

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			<p>separately. 20221(5)-Same as specified in ACTM.</p> <p>20221(6)</p> <p>(a) Same as specified in ACTM (b) Test operation (if test button facility available) or by injecting of operating input with secondary injection test kit to confirm that the relays do operate the trip circuits in the manner prescribed. These tests should be carried out by at least at the level of AEE once in a year for all relays. Simultaneously visual checks on relay connections, condition of the trip battery, trip and alarm circuits, LCD display and also the dust-tightness of protective covers wherever applicable should be made. Numerical type relays where sealing cover is not provided, to avoid the unauthorized changes in relay settings, secured pass word protection is to be used by competent authority as decided by user Railway. (c) & (d) Same as specified in ACTM (e) Not applicable</p> <p>20249 (2): same as</p>	
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			specified in ACTM	
13	SCADA system	Specified in ACTM Para 20429	<p>Preventive Maintenance at RCC:</p> <p>(a) Monthly Maintenance:</p> <ul style="list-style-type: none"> • Check for satisfactory working of RCC machines. • Check Change over from main to stand by & vice versa. • Check that all the reports are logging properly. • Check that logging in event list and Alarm list is proper. • Delete unnecessary log files in all computers. • Up date Anti virus Software if required. • Check that printers are working properly. • Checking of LAN cables, connectors etc. • Check functioning of UPS by switching off the main power supply for 15 minutes duration. • Check functioning of projector/display wall. <p>(b) Yearly Maintenance:</p> <p>In addition to daily, monthly maintenance schedules cleaning of Cable Trays, dust accumulated under PC tables shall be done using vacuum cleaners. The earthing of RCC equipment must be checked.</p> <p>(c) Maintenance of UPS & Battery at RCC:</p> <p>Maintenance shall be carried out as per</p>	

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			<p>maintenance manual given by UPS & Battery Set supplier separately. In this connection Annual capacity test and Ah efficiency test of battery shall be carried out as preventive maintenance measures as per manufacturer's recommendation.</p> <p>Preventive Maintenance at RTU:-</p> <p>(a) Quarterly Maintenance</p> <ul style="list-style-type: none"> • Cleaning of dust inside RTU. • Visual Checks for any abnormality • General Connection tightness. • Ensure free movement and proper working of contactors. • Measure earth resistance of earth pit provided for RTU. <p>Note: The specific maintenance instructions issued by the respective suppliers of SCADA systems should also be followed.</p>	
14.	Pre Monsoon Check	Specified in ACTM Para 20253	Same as Specified in ACTM Para 20253	
	Schedule of Monthly Inspection	Specified in Annexure 2.01 (Para 20202, 20223) of ACTM Volume-II, Part-I.	Same as specified in Annexure 2.01 (Para 20202, 20223) of ACTM Volume-II.	

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Check List for inspections	Specified in Annexure 2.02 (Para 20223) of ACTM Volume-II, Part-I.	<p>Details Specified in Annexure 2.02 (Para 20223) of ACTM Volume-II, Part-I to be modified as below:</p> <p>1.0 - Same as specified in ACTM</p> <p>2.0- Same as specified in ACTM</p> <p>3.0- Same as specified in ACTM</p> <p>4.0- (a) Same as specified in ACTM</p> <p>(b) Interrupter should be read as "circuit breaker and interrupter".</p> <p>(c) Same as specified in ACTM</p> <p>(d) Same as specified in ACTM</p> <p>(e) Same as specified in ACTM</p> <p>(f) Along with existing point 1 & 2, new point number 3 should be added as Buried rail connection.</p> <p>(g) Same as specified in ACTM</p> <p>(h) New para (h) added as Auto transformer wherein the following to be checked.</p> <p>1. OTI and WTI temperature – present and maximum readings.</p> <p>2. Oil level in conservation tank</p> <p>3. For abnormal humming.</p> <p>4. Colour of silica gel.</p> <p>5. For leakage of oil on transformer body, conservator tank, oil drain valve and radiator.</p>	<p>Circuit Breakers are also provided at Switching stations.</p> <p>Autotransformers have been provided as Switching Stations.</p>
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Note:

1. All relevant paras of ACTM should be read in conjunction with schedule maintenance of the equipment mentioned above.

2. The latest Instruction/ Special Maintenance Instruction issued from time to time should be strictly followed for the equipment installed and commissioned in the TSS/SSP/SP.

11. References:

(i) ACTM Volume-II, Part I

(ii) Instruction TI/IN/0042- OHE GUIDELINES FOR ZONAL RAILWAYS FOR INCREASING SPEED POTENTIAL TO 160KMPH ON NDLS-HWH (INCLUDING KANPUR-LUCKNOW) & NDLS-BCT (INCL. VADODARA- AHMEDABAD) ROUTE

(iii) Rly Bd's. Letter no. 2013/Eect(G)/148/1 dated 10.05.2019

(iv) UIC 791-1

Annexure 3.01
(Para 20301,2,4)
20320

SCHEDULE OF MONTHLY INSPECTIONS

SN	Nature of Inspection	SR.DEE	DEE	ADEE	SSE-In charge	SSE(Sec tional)	JE*
1.	Locomotive Cab	1	1	2	2	2	2
2.	OHE Inspection Car	1	2	3	4	4	6
3.	Foot patrolling	0	0	0	Entire section in year	Entire section in 4 month	Entire section in 2 month

4.	OHE Depot	1	2	4	4	-	-
5.	Station	1	1	2	4	4	4
6.	Night Inspection	-	1	1	2	2	2
7.	Office Inspection	1	1	1	1	-	-

Notes:

- i. These Inspections are the minimum quantum per month.
- ii. In respect of Supervisory Staff, the inspections pertain to their respective jurisdiction.
- iii. Brief checklists of items to be broadly covered are indicated at Annexure 3.02. Detailed maintenance schedules prescribed should also be kept in view.
- iv. Quota of Inspections by HQ officers may be laid down by PCEE

Annexure 3.02

(Para 20302)

CHECK LIST FOR INSPECTIONS

1.0 OHE Depots & Subordinate Offices

(a)OHE Depots

1. Staff grievance register.
2. Quarter register.
3. Attendance registers.
4. Availability of all drawing (latest), SWRs with latest correction slips.
5. Cleanliness of depot.
6. Upkeep of Stores.
7. Stock position of stores.

8. Upkeep of wiring train, OHE Inspection car, ladders, tools etc.

b) Subordinate office:

1. Attendance registers.
2. Compliance of audit & account Inspection notes.
3. Compliance of Officer's inspection notes.
4. Test & Trial report.
5. Latest drawings & specifications.
6. Planning & progress of section

2.0 Station

a) SWR

1. SWRs and its Appendix G with latest correction slips.
2. Display of traction working diagram and its correctness at SM room & cabins.
3. Traction Key Board and key register for its proper maintenance.
4. Knowledge of traction working of SM/ASM on duty.
5. Validity of the competency certificate of SM/ASM.
6. Availability of Hand Gloves for isolator operations and Power block collars.

b) CLS Board in SM room/cabin

1. AT standby supply.

c) Isolator.

1. Locking arrangements.
2. Correct alignment of blade tip in the fixed pole contact jaws.
3. Correct matching & alignment of arcing horns.

d) General

1. Fire extinguishers, sand/water buckets, Respiration chart, First Aid Box, Tools & Plants.

2. Working of TPC phones & emergency telephone sockets.

3. History sheets of various equipments.

3.0 Cab Inspection

a) Condition of OHE

1. Flashed/damaged insulators
2. Displaced fittings & droppers
3. Balance weight in reference to upper & lower limits marked on masts.
4. Number plates, warning board for rusting & tightness.
5. AT : Oil leakage and deposits of pollutants on insulators

b) Obstruction to OHE:

1. Birds' nests
2. Tree branches near OHE.

c) Cab equipments

1. Focusing of head lights & flasher light.
2. Voltage on loco voltmeter at FP & SP locations.

d) Driving technique of Driver

1. Exchange of signals with station staff.
2. DJ opening & closing at neutral section.
3. Observation of caution orders.

e) Night Inspection

1. Incidence of sparking from the rear cab of locomotive.
2. Other items as above.
3. Observe any glow in the OHE connection with Equipment or jumpers at SSP, SP, Isolators.

4.0 Inspection with OHE Inspection Car

a) Mast, portals and cantilever supports.

1. Structures and galvanized tubes for rust & chipping off galvanization.
2. Cracks on steady arm & register arm.

b) Contact & \Catenary wires

1. Kinks & twists on contact wire.
2. Broken strands on catenary wire.
3. PG clamps, Jumpers, **current carrying droppers.**
4. Contact wire wear at selected locations.
5. Height and stagger at selected locations.

c) Section insulators

1. Flash or hit marks on and adjustment of runners.
2. Level of assembly & alignment.
3. Chipped/cracked insulator.

d) Turn -out

1. Stagger of both the OHES.
2. With Inspection Car running on loop line, check up if the-main line OHE passes smoothly under the pantograph.
3. With Inspection car running on main line, check up if the loop OHE passes smoothly under the pantograph.

4. Turn out parameters**e) Overlaps:**

1. Height and stagger of OHE in the overlap section.
2. Whether normal minimum clearance of 500mm is available between the two OHEs in an insulated overlap and 200mm in the case of uninsulated overlap.

3. Check up whether lifting of out-of-run contact wire is correct.

(f) Overline structures

1. Horizontal & vertical clearances.
2. Flash marks underside of the structures.
3. Gradient of contact wire on either side.
4. Insulation on catenary wire under the structure.

(g) Level Crossing.

1. Height & gradient of contact wire.

(h) Regulating Equipment:

1. X-Y values with temperature.
2. Free movement of counter weights.
3. Lubrication of pulley and other moving parts.
4. Stainless Steel wire rope for opening of strands, broken or rusted strands.

Annexure 3.03

(Para 20321)

FOOT PATROL DIARY

DEPOT.....

JURISDICTION

NAME

	ITEMS OF OBSERVATION	OBSERVATIONS	
		SECTION	SECTION

		DATE	DATE
FOUNDATIONS	1.	DAMAGED OR CRACKED	
	2.	SINKING OR TILTED	
	3.	WATER COLLECTION AROUND FOUNDATION	
	4.	SIDE EARTH FILLING REQUIRED.	
	5.	TOP OF FOUNDATION NOT CLEAR.	
OHE MASTS AND PORTALS	1.	MAST DEFLECTED TOWARDS TRACK.	
	2.	MAST DEFLECTED AWAY FROM TRACK.	
		Other than those already under observation & thus painted with yellow band.	
	3.	HIT MARK OR DAMAGE TO MAST.	
	4.	NUMBER PLATE MISSING	
	5.	NUMBER PLATE DAMAGED.	
	6.	HRL/IMP NOT PAINTED.	
ANCHOR	1.	NUT, CHECKNUT OR LOCK PLATE· PIN MISSING FROM ANCHOR BOLT.	
	2.	-DO - GUY ROD.	
	3.	ANCHOR BOLT RUSTING.	
CKE T AS SE MB	1.	BRACKET INSULATOR DAMAGED.	

	2.	STAY INSULATOR DAMAGED.		
	3.	9-TONNE ANCHOR INSULATOR DAMAGED.		
	4.	ANY OTHER DEFECT NOTICED.		
SECTIONS INSULATOR	1.	ABNORMAL WEAR ON RUNNERS.		
	2.	CORE INSULATOR VERY DIRTY.		
	3.	CORE INSULATOR HAVING FLASH MARKS/DAMAGED.		
REGULATING EQUIPMENT	1.	'Y' DISTANCE IS ABNORMAL		
	2.	MOVEMENT OF B.W. NOT FREE.		
	3.	SS ROPE OVER-RIDING ON THE DRUM GROOVES.		
	4.	SS ROPE STRANDS FOUND CUT.		
	5.	WHETHER EQUALISING PLATE IS TILTED.		
AUX. TRANS FOR CLS SUPPLY	1.	DROP OUT FUSE FOUND FALLEN.		
	2.	SOUNDNESS OF EARTH CONNECTION.		
OHE SPAN	1.	SPAN CURRENT CARRYING DROPPERS, ABNORMALLY OUT OF PLUMB.		
	2.	SPAN DROPPERS DAMAGED.		
	3.	ANY ABNORMALITY IN RESPECT OF JUMPERS.		
	4.	DAMAGE TO CATENARY STRANDS.		
	5.	CHECKNG OF PG CLAMPS		

	6.	EXCESSIVE SAGGING OR HOGGING OF CONTACT WIRE.		
ISOLATOR	1.	ISOLATOR NO. PLATE MISSING.		
	2.	ISOLATOR LOCK MISSING/DAMAGED.		
	3.	ANY SIGNS OF SPARKING/ OVERHEATING		
AEC, BEC & 25kV Negative Feeder	1.	VISUAL INSPECTION OF CONNECTION OF AEC & BEC WITH MAST AND PORTALS		
	2.	DAMAGE TO FEEDER WIRE STRAND		
	3.	DAMAGE TO AEC		
	4.	Check tension & sag in feeder wires and adjust if necessary. Checking of clearances to road and rail crossings should be checked with respect to approved plans.		
GENERAL CHECKING	1.	DANGER AND CAUTION BOARDS		
	2.	HT. GAUGES AT LEVEL X-ING.		
	3.	EMERGENCY SOCKETS FOUND DAMAGED/ OUT OF ORDER.		
	4.	EARTHING OF OLS/PLATFORM SHEDS ETC.		
	5.	BONDS FOUND DISCONNECTED/MISSING.		
	6.	PROTECTIVE SCREENS ON FOB/ROB.		
	7.	TREE BRANCHES NEAR OHE.		
	8.	BIRD NESTS AND PIECES OF STRAY WIRE.		
	9.	DEFECT IN TRANSFORMER SECONDARY NEUTRAL CONNECTION TO RAIL AT FP.		

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	10.	SIGNS OF HEAVY SPARKING WHEN LOCO PASSES		
	11.	GENERAL CONDITIONS OF SWITCHING STATIONS ON ROUTE.		
	12.	MINOR DEFECTS RECTIFIED IF ANY DURING PATROLLING.		
	13.	MAJOR DEFECTS NOTICED		

Signature of Lineman

Foot Patrolled

Date:

Signature of station masters/ Yard masters/ Cabin master with date and time

Checked by

SSE/JE/ELC (OHE)

Annexure 3.4
(Para 20349)

Annexure A

PROFORMA 03-1

Date

1. Power Block in sub-sector/Elementary Section :

Time asked

Time received

Time returned

Remarks

2. Staff utilized

Skilled

Semi skilled

Unskilled

3. Details of work carried out in Power block:

	Type of work	Locations	Staff/ Supervisor
3.1	Cleaning of Insulator-ST, BT & 9-T		
3.2	Section Insulator		
3.3	OHE checking and adjustment		
3.4	Height & stagger of contact wire		
3.5	Dia of contact wire measured		
3.6	Clearance checked at locations		
3.7	Insulated overlaps locations		
3.8	ATD locations		

4. General Report on OHE of section. Preventive actions suggested_____

5. Report on catenary / jumper damage in the section. Preventive actions suggested_____

6. Details of work carried out under Non-power block

	Type of work	Locations	Staff/ Supervisor
6.1	Muff cleaned		
6.2	BEC/Bond checking		

6.3	Rail level & Implantation checked		
6.4	Repainting of R/L and implantation		

7. Report of foundation/muff conditions, leaning of masts. Preventive actions suggested_____

8. Report on changes in RL/implantations. Preventive actions suggested_____

Station Sup.

Signature_____

Dated_____

Designation_____

Annexure B

PROFORMA 03-2

Register for Foot Patrol Report

Section _____

S N	Locatio n	Defec t	Categor y (A or B)	Dat e	Notice d by	Supervisor remarks			Date attende d
						Name/Sig n	Dat e	Action propose d with PDC	

Category 'A'- means defect related to safety and train operation

Category 'B'- All other excluding A

Annexure C**PROFORMA 03-3****Tower wagon/ Cantilever Assembly Maintenance Register**

KM _____

Section _____

S N	Loc atio n	Typ e of loc atio n	No. of cantil ever s	Attention				Insu. Make batch			CW		Clea ranc e	Co ndi tio n of fitti ngs	Staff / Supe rviso r	Rem arks
				Dat e of che ckin g	W or k do ne	Sc h/ Un sc h	Du e Da te.	9 T	S T	B T	H t .	S t.				

Annexure D**PROFORMA 03-4****Record of Contact Wire Wear and splices****03-04 & 03-15 merged**

S N	Type of location (specify if stop signal/ hard spot location/ tunnel/R OB/FOB/ L.x gate or any other location)	Loca tion no.	At support		AT MID SPAN		Dt. Of pro visi on of CW spli ce	Obse rvati on	No. of cate nary stra nds out	Dt. of prov. Of caten ary splice	St aff / Su p.	Re m ar ks
			Thic kne ss	Wear since last chec k	Thick ness	Wear since last chec k						

Annexure E

PROFORMA 03-5

Register for Features of overline structure

FOB/ROB.....

Between Location.....

Station/Section.....

Line no.	Date	Span	Rail Level	Contact Wire Height at ends and mid way	Clearance		Features Present						Sup/Staff	Remarks
					EN D1	EN D2	Crossing	Pipes	Protective screen	Cautions Board	Earthing	Pr. of-False Cat		

Annexure**PROFORMA 03-6****Register of Earth Resistance Measurements**

Station.....

Nearest Location.....

Earth Pit No.....

Sl..	Date of	Resistance in	Over all	Initials of	Remarks
No.	Test	Ohms	Resistance	Supervisors	if any,

Note - 1. Half page to be allotted for Each pit.

2. Earth test should be carried out on a dry day preferably in March/April once a year.

Annexure F

PROFORMA 03-7
Record of current collection test

Date

Time

Done by

Train No.

From _____ To _____

Section

Location	Category			Corrective action	Dt. Of corrective action	Supervisor/Staff	Remarks
	Heavy	Medium	Light				

Annexure G

PROFORMA 03-8

(03-8 & 03-13 merged)

Record of Implantation & Foundation

Section _____

SN	Location no.	Date of checking	Foundation type	Type of soil	Implantation		Step distance	HRL mark height above RL	Amount of leaning at CW level		Amount of leaning at 1.85 m above HRL		Reason for leaning	Action taken	Supervisor/Staff	Remark
					As per SED	Actual			Towards track	Away from track	Towards track	Away from track				

Note: One page in the register to be allotted for each location

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PROFORMA 03-9

..... RAILWAY

..... DIVISION

TRACTION DISTRIBUTION SECTION

Register of Break-downs/ Accidents involving OHE

1. Date of accident/break-down
2. Station
3. OHE Locations affected
4. Details of damages
5. Probable cause
6. Brief description and remedial action taken
7. Reference to detailed reports sent
8. Remarks, if any

Note :- One page in the register to be allotted for each case.

PROFORMA 03-10

..... RAILWAY

..... DIVISION

TRACTION DISTRIBUTION SECTION

Regulating Equipment

Location no. _____ Section: _____ Elementary section _____

Sl. No .	Date of Checkin g	Tensio n length m	Noted Value			Adjustme nt require		Date of Adjustme nt	Adjustment done			Tem p °C	Final value		Whe the r grease d	Whether replaceme nt of ATD done with the overhauled one	Signatur e of SSE/ JE	Remark s
			Tem p °C	X/ mm	Y m m	X/ mm	Y mm		By turn buckl e	Wire cut			Xm m	Y m m				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

(N.B.- One page to be allotted for each ATD location)

PROFORMA 03-11

..... RAILWAY

..... DIVISION

TRACTION DISTRIBUTION SECTION

Isolator Switches

Isolator Switch no. _____ Section/ Station: _____

SN	Location	Particular of isolator Switch	Elementary section connected	Date checked	Condition	Particulars of Work done, if any	Remarks
1	2	3	4	5	6	7	8

(NB - Half page to be allotted for each switch)

Performa 03-12

RAILWAY
DIVISION
TRACTION DISTRIBUTION BRANCH
Turnout and Cross Overs

TURNOUT/CROSSOVER NO.-----

SECTION/STATION-----

S.N	Description		Std. value	Measured value			
1	Particulars of Turnout/crossover(Give the number i.e.1:8½ , 1:12 etc.)		-	-	-	-	-
2	Section		-	-	-	-	-
3	Location No.		-	-	-	-	-
4	Date Checked		-	-	-	-	-
5	Type of Arrangement - Crossed type/Overlap type		-	-	-	-	-
6	Height of Contact Wire above rail level at support at Obligatory Structure	Main Line Contact Wire (mm), (H)					
		Turnout Contact Wire (mm)	H+50 *				
7	Turnout span (m)	54 (Max) Span length of turnout location reduced during increasing track separation.					

8	Height of Contact Wire in Overlapping Zone	Mainline Contact Wire (mm) (H1)					
		Turnout Contact Wire (mm)	H 1+(50-60) *				
9	Stagger of Contact Wire at Obligatory Structure	Mainline Contact wire (mm) Turnout Contact wire(mm)	200 max. 300 max.				
10	Sag of section insulator of Turnout/Crossover		Zero				
11	Movement of tower wagon from mainline to turnout a) Take off b) Point of take off (in m from O/S)		720 mm to 750 mm from centre line of pantograph ---				
12	Movement of tower wagon from turnout to mainline a)Take on b) Point of take on (in m from O/S)		720 mm to 750mm from centre line of pantograph ---				
13	Stagger of section insulator at turnout/crossover		+/- 100 mm				

14	Track separation at the location of section insulator (m) (a) Runners towards the centre of turnout (b) Runners away from the centre of turnout		1.65 Min 1.45 Min				
15	Condition of ATD of turnout/mainline OHE		Free to move				
16	Length of pipe provided in hex tie rod of limiting device to bridge redundant length of hex tie rod.		As per SMI No. TI/MI/003 5 Rev.1				
17	Setting distance (implantation) of obligatory structure (m)		3.0 Min				
18	Track separation at obligatory structure (mm)		290 to 550				
19	Distance of 'G' jumper from obligatory structure (m)		5.6				
20	Length of 'G' jumper. (m)		4.0				
21	Deviations from SEDs						
22	Adjustments done ,if any						
23	Remarks						
24	Name of supervisor and designation						
25	Signature of Supervisor						

*** In case of overlap type arrangement.**

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As per CEDE/NCR letter no. EL/TRD/NCR/Gatimaan dated 19.11.2018 following checks should also be carried out:

- (i) At obligatory mast vertical gap between main line and turn out contact wire is to be maintained between 50 to 60mm.
- (ii) At 5m distance from obligatory mast, gap is to be maintained at 50 mm.
- (iii) At 10m distance from obligatory mast, gap is to be maintained between 40mm to 50mm.

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(Proforma 03-13) merged with 3-08

(Proforma 03-14)

..... RAILWAY

..... DIVISION

TRACTION DISTRIBUTION SECTION

Level Crossing Gates

S.No.	Location of level X-ing	Line	Date of checking	Height of Contact wire	Condition of height gauge	Height of Height gauges from road level	Availability of 25 kV danger boards & Public caution boards at height gauge	Whether manned or un-manned, If manned Availability of staff warning board and electric shock treatment board at gate lodge	Remarks
1	2	3	4	5	6	7	8	9	10

(Half page for each level crossing)

(Proforma 03-15) merged with 3-04

