भारत सरकार, रेल मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

सत्यमेव जयते

कर्षण संस्थापन निदेशालय
TRACTION INSTALLATION DIRECTORATE

Special Maintenance Instruction for
CONTACT WIRE AND ASSOCIATED FITTINGS
SMI No. TI/MI/0037 Rev.3

		हस्ताक्षर/Signature
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SPECIAL MAINTENANCE INSTURCTIONS (SMI) FOR CONTACT WIRE AND ASSOCIATED FITTINGS

1. OBJECTIVE:

In order to achieve high reliability and zero defect OHE and to ensure effective checks on the maintenance works. To specify maintenance procedures for arresting contact wire/catenary wire parting cases. These instructions are supplementary and are to be read in conjunction with the procedures already laid down in the ACTM-Vol. II(Part –I) Paras 20320 to 20330. It is applicable for 1x25 kV traction system.

2. BACKGROUND

2.1 For proper upkeep & maintenance of OHE, the maintenance procedures laid down in ACTM are quite exhaustive. The sequence of checks rights from foot patrolling to POH level ensures detection & rectification of defects in the initial stages itself." POH of OHE , once in 8 years, is aimed at restoration of OHE to the same condition as it was during commissioning. But, based on the reports of OHE parting case due to various reasons affecting the reliability, issuance of these special maintenance instructions has become necessary to cover few items explicitly.

2.2 The analysis has indicated that significant number of cases of OHE parting are attributed to the opening of silver brazed joints and at PG clamp locations. Few cases of parting of contact wire/catenary wire have occurred at ending clamp fitting also. During analysis of cases of parting of contact wire, it has been observed that the opening of silver brazed joints is not age related and majority of cases have occurred in known polluted areas. Regarding replacement of PG clamps during POH, decision was taken in XXII MSG (RTD) meeting held at CORE/ALD on 7/8.2.2000.

2.3 Regarding the failures of silver brazed joints, it is experienced that

- The silver brazed joints do not fail suddenly.
- Initially the tip of the joint opens and the jointing surface is exposed to atmosphere. The joint gradually looses its strength due to displacement of silver with its oxides. Fast corrosion of silver brazed joints take place in the environment having SO2 gases with moisture and aerated aqueous NH3/ammonium salts.

2.4 The maintenance instructions given in this SMI are supplementary to the one given in the ACTM.

2.5 Necessary record keeping of PG Clamp / Ending Clamp & its location etc. in line of proforma given in ACTM for other items, especially, if it is replaced before its schedule replacement time period shall be ensured.

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2.6 As per the As per the Railway Board letter no. 2013/Elect(G)/148/1 dated 10.05.2019 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 IOH in between after every 2 years.

1. **PROCEDURE FOR ARRESTING FAILURES OF SILVER BRAZED JOINTS ON CONTACT WIRE:** contact wire may part due to opening of silver brazed joints. The silver brazed joints are sensitive to pollutions. It is, therefore, recommended that such contact wire should be identified through ultrasonic testing and should be replaced by Continuous cast copper contact wire.

Maintenance instructions:

1. Check by **inspection car once in three months** in identified polluted areas/sections in which repeated failures have taken place.
2. The jointed contact wire in the ***"identified polluted areas" shall be replaced with joint –less contact wire drawn out of continuous cast copper wire rods*** at the earliest opportunity on programmed basis.

2. **PROCEDURE FOR CHECKS ON OHE PG CLAMPS:**

Maintenance instructions:

a) Visual Inspection: **Once a year**
b) All the OHE PG clamps at the jumper location shall be replaced during POH of OHE.
c) -During AOH, ensure that the nuts & bolts at PG clamps are neither too tight nor too loose. Tighten to the prescribed torque as mentioned in Annexure 2.08 of ACTM Volume II, Part I) (Annexure A attached)
d) After tightening the PG clamps ensure that all joints are properly coated with thin layer of Vaseline/ Petroleum jelly.
e) **Select the correct PG clamp for provision in various conductors as given below:**

Sr. No.	*RDSO Drg No.*	*Description*	*RI (No.)*	*Description*	*Small groove*	*Large groove*	*To be used for the location*
1	ETI/OHE/P/1030-2	Contact wire	1031-2	Contact wire	i) Contact (107) or	i) Feeder (150) or	G Jumper

	Rev D	parallel clamp large		parallel clamp large part	ii) Catenary (65) or iii) Small jumper (50)	Large jumper (105)	
2	ETI/OHE/P/1030-3 Rev A	Parallel clamp (157-65/107/150)	1031-3	Contact wire parallel clamp part	i) Contact wire 150 sqmm or ii) contact wire 107 sqmm, iii) catenary wire 65sqmm or iv) jumper 50 sqmm	i) Jumper 157 sqmm	Drop Jumper to contact and Drop Jumper to catenary
3	ETI/OHE/P/1040-2 Rev E	Contact wire parallel clamp small	1041-2	Contact wire parallel clamp part small	i) small jumper 50 sqmm or ii) catenary 65 sqmm	i) Contact wire 107 or ii) catenary wire 65	i) C jumper ii) F jumper iii) AT jumper
4	ETI/OHE/P/1040-3 Rev B	Parallel clamp (90/50)	1041-3	Parallel clamp part (90/50)	i) Small jumper 50 sqmm	i) 19/2.50 mm galvanized steel wire Φ12.5 (Anticreep wire)	Small jumper to anticreep wire
5	ETI/OHE/P/1050-2 Rev D	Parallel clamp (150-105-150)	1051-2	Parallel clamp part (150-105-150)	i) Large Jumper 105 sqmm or ii) feeder 150 sqmm	i) feeder 150	Cross feeder to feeder
6	ETI/OHE/P/1050-3 Rev A	Parallel clamp (150/160)	1051-3	Parallel clamp part (150/160)	i) HDBC CROSS FEEDER 150 sqmm	i) Large Jumper 160 sqmm	Cross feeder to drop jumper

f) Conductor and PG clamp contact surface for preparation may be cleaned by non-metallic scrubber rather than scratch brushing to remove the oxide.

g) When installing the clamp ensure that both conductor size and conductor material is compatible with the duty for which the clamp is designed.

h) Checking of ***PG clamps with thermos-vision camera half yearly in normal section and quarterly in polluted areas and first sub-sector of TSS***. The frequency of thermo vision may be revised with the approval of PCEE of the ZRs

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

j) During AOH, open and clean the PG clamp and shift it to other location from the location where it was erected earlier to prevent the failure. Whenever nuts & bolts are opened during AOH or POH, ***ensure that washer is changed every time***.

k) Particular care should be taken when joints are made between two dissimilar metals like Aluminium and copper. ***Special bimetallic fittings should be used*** in such cases to prevent electrolytic corrosion. Connections should be such as to produce no strain on the equipment.

Note: If any crack detected Replace the fitting with a new fitting and carry out the necessary adjustment. The released fitting will not be re-used.

3. <u>PROCEDURE FOR CHECKS ON CONTACT WIRE ENDINGS CLAMP FITTINGS AS PER RDSO's DRG. NO. ETI/OHE/P/1110-2</u>

<u>Maintenance Instructions</u>

a) Visual Inspection: **Once a year.**

b) During AOH Check any melting marks/slippage/cracks. In case of cracks or melting marks/slippage/cracks replace the existing fittings.

c) 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.

d) If the integrity of the fitting is doubtful, possibility shall be explored to conduct Dye Penetrant test during AOH or on need basis . Dye Penetrant test shall be conducted to ensure absence of cracks and surface defects. The procedure and acceptance standard shall be as per IS : 3658.

e) Check contact wire ending clamp and ensure that any slipping of contact wire has not taken place. Take corrective action in case of contact wire slipping.

f) In order to watch the slippage of wire from the fittings, Red Fluroscent tape may be applied adjacent to the fittings for prevention of failure.

g) Check the position of the contact wire bent portion and it should be leaning towards to wedge.

h) Ensure the availability of correct length of snap head pin, punched washer and intactness of split pin.

i) Binocular with phone clip and tripod , low light night vision, waterproof light weight to be procured to see the ending clamp and record of photographs shall be kept

j) All the contact wire ending clamps shall be ***replaced once in 16 years or alternate POH, whichever is earlier,*** with a new fittings and carry out necessary adjustment.

k) Check for rusting / corrosion /deformation /breakage of all the components. If these are observed, then the defective components should be replaced.

Note: If any crack detected Replace the fitting with a new fittings and carry out the necessary adjustment .The released fitting will not be re-used.

4. **Procedure for Checks on:**

a) ***Catenary Wire Ending Clamp fittings as per RDSO's Drawing No. ETI/OHE/P/1120.***

b) ***Feeder Wire Ending Clamp fittings as per RDSO's Drawing No. ETI/OHE/P/1130.***

c) ***Large Span wire Ending Clamp fittings as per RDSO's Drawing No. ETI/OHE/P/1140***

All sub-assemblies mentioned in given drawing of ending clamps for Catenary Wire, feeder wire & Large span wire should be stamped with their respective part numbers. During assembly it is to be ensured that correct part no is used as per respective drawings.

Sr No.	Checks on clamps as per drawing	Part No.	Colour coding
1	Catenary Wire (ETI/OHE/P/1120)	1121, 1094, 1092	Nil
2	Feeder Wire (ETI/OHE/P/1130)	1131, 1104, 1102	White
3	Large Span wire (ETI/OHE/P/1140)	1131, 1143, 1102	RED

Maintenance Instructions

a) Visual Inspection –**Once a year**

b) 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.

c) In order to watch the slippage of wire from the fittings, RED Fluorescent tape may be applied adjacent to the fittings for prevention of failure.

d) If the integrity of the fitting is doubtful, possibility shall be explored to conduct DPT test during AOH or on need basis .Dye Penetrant test shall be conducted to ensure absence of cracks and surface defects. The procedure and acceptance standard shall be as per IS : 3658.

e) Position of Joint cone with respect to ending clamp body: Joint cone is shown touching Ending clamp body.

f) 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.

g) Position of collar of joint socket and Ending clamp body are not touching body each other and have a gap.

h) Ensure the availability of correct length of snap head pin, punched washer and intactness of split pin.

i) Binocular with phone clip and tripod , low light night vision, waterproof light weight to be procured to see the ending clamp and upkeep of record photographs.

j) All the catenary wire, large span wire & feeder wire ending clamps fittings ***shall be replaced once in 16 years or alternate POH, whichever is earlier*** with a new fittings and carryout necessary adjustment.

Note: If any crack detected Replace the fitting with a new fittings and carry out the necessary adjustment. The released fitting will not be re-used.

5. **PROCEDURE FOR CHECKS ON CONTACT WIRE SPLICE AS PER RDSO'S DRAWING NO. ETI/OHE/P/1080 REV. A & ETI/OHE/P/1080-1 REV. B**

Maintenance instructions:

a) **Visual Inspection: At every foot patrolling**

b) The fittings shall be carefully visually examined for cracks, other casting defects and abnormalities. If these are found the fitting shall be replaced immediately.

c) If the integrity of the fitting is doubtful, possibility shall be explored to conduct DPT test during AOH or on need basis .Dye Penetrant test shall be conducted to ensure absence of cracks and surface defects. The procedure and acceptance standard shall be as per IS : 3658.

d) Check to see if any slipping of the ends of two contact wires has been taken place. When viewed through the top window, there should be no gap between the two contact wire ends. If gap is found on the splice shall be released & contact wire ends shall be butt together by loosening the SS studs & then tightening the studs.

e) Tightness of stainless steel studs shall be checked. If found loose they should be tightened. Over – tightening of the stainless steel studs of contact wire splice fittings is harmful. Tightening should only be done to the extent possible with a standard spanner. No extra leverage by means of a pipe etc. should be used.

Note:-Replace the contact wire splice during once in 16 years or alternate POH, whichever is earlier with the new splice. Released splice shall not be reused.

6. **PROCEDURE FOR CHECKS ON INSULATOR END CONTACT WIRE ENDING CLAMP RI No. 6160 AND RUNNER END CONTACT WIRE ENDING CLAMP RI No. 6150 OF SECTION INSULATOR ASSEMBLY TO DRG. NO. ETI/OHE.P/6100 REV. B.**

Maintenance Instructions:

a) **Visual Inspection: At every foot patrolling.**

b) The fittings shall be carefully examined for cracks, other casting defects and abnormalities. If these are found the fitting shall be replaced immediately.

c) If the integrity of the fitting is doubtful, possibility shall be explored to conduct DPT test during AOH or on need basis .Dye Penetrant test shall be conducted to ensure absence of cracks and surface defects. The procedure and acceptance standard shall be as per IS : 3658.

d) Check to see if any slipping of contact wire has taken place. If the slipping has taken place the contact wire shall be set right after releasing the load on section insulator assembly & loosening the stainless steel studs. The stainless steel studs shall then be tightened.

Note:-Replace the ending clamps once in 16 years or alternate POH, whichever is earlier with the new ending clamps. Released ending camps shall not be reused.

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References:

1. Railway Board letter no. 2013/Elect(G)/148/1 dated 10.05.2019.
2. Zonal Railway's comments whichever acceptable and approved have been incorporated in SMI
3. ACTM-Vol. II(Part –I) Paras 20320 to 20330.
4. Annexure 2.08 of ACTM Volume II, Part I. (attached as annexure A)
5. RDSO's letter no. TI/OHE/FTGFE/16 dated 20.05.2021.
6. Referred SMI
   a) TI/MI/0051 (Maintenance Instruction for Installation of Ending Clamp as per RDSO Drg No. ETI/OHE/P/1120, ETI/OHE/P/1130 and ETI/OHE/P/1140 for catenary wire, feeder wire and Large Span wire respectively for 25 kV AC traction on Indian Railways)

Annexure:A

TORQUE FOR VARIOUS SIZES OF BOLTS IN kg.m

Bolt Size	Nominal Stress	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

Annexure-B

Tabular summary of all components inspection

SN	Component	Visual Check	AOH Activity	Thermo-vision	Replacement periodicity	Additional Checks	Extra Precautions
1	PG CLAMPS	Once a year	Tighten bolt as per IS req. Shift the PG clamp by 1 metre Replace washer Provide thin layer of vaseline	Half yearly and quarterly for polluted area.	At every POH	Examine wires for frayed strands, overheating. Use bimetallic strip if change of materials	If crack detected, replace the PG clamps
2	CONTACT WIRE ENDINGS CLAMP FITTINGS	Once a year	Check any melting marks/slippage/cracks Check for slipping Provide red fluroscent tape adjacent to fitting Bent portion of contact wire shall lean towards wedge Check for rusting, corrosion		16 years or Alternate POH, whichever is earlier	Released fitting not to be re-used Check intactness of split pin and availability of snap pin head	If possible DPT to be done as per IS - 3658.
3	CATENARY WIRE ENDING CLAMP FITTING	Once a year	RED Fluorescent tape may be applied adjacent to the fittings		16 years or Alternate POH, whichever is earlier	Ensured that correct part no is used as per respective drawings Check intactness of split pin and availability of snap pin head	DPT on need basis
4	FEEDER ENDING CLAMP FITTING	Once a year	RED Fluorescent tape may be applied adjacent to the fittings		16 years or Alternate POH, whichever is earlier	Ensured that correct part no is used. Check intactness of split pin and availability of snap pin head	DPT on need basis
5	LARGE SPAN WIRE ENDING CLAMP FITTING	Once a year	RED Fluorescent tape may be applied adjacent to the fittings		16 years or Alternate POH, whichever is earlier	Ensured that correct part no is used. Check intactness of split pin and availability of snap pin head	DPT on need basis
6	CONTACT WIRE SPLICE	Every foot patrolling inspection	Visually examined for cracks, other casting defects and abnormalities. No gap in contact wire Check for slipping Check Tightness of SS bolt .		16 years or Alternate POH, whichever is earlier	Released splice not to be re-used.	DPT on need basis
7	INSULATOR END CONTACT WIRE ENDING CLAMP and RUNNER END CONTACT WIRE ENDING CLAMP	Every foot patrolling inspection.	Be carefully examined for cracks, other casting defects and abnormalities. Check for slipping SS bolt shall be tighten as per prescribed torque.		16 years or Alternate POH, whichever is earlier	Released fitting not to be re-used	DPT on need basis