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No. TI/PSI/CBINT/POLICY/17

Dated, the 13th September, 2017

To,

The Chief Electrical Engineer,

- (i) Central Railway, Station Building, Mumbai CST - 400 001.
- (ii) Eastern Railway, Fairlie Place, Kolkata-700 001.
- (iii) East Central Railway, Hajipur-844 101.
- (iv) East Coast Railway, Bhubaneswar-751 023.
- (v) Northern Railway, Baroda House, New Delhi - 110 001.
- (vi) North Central Railway, Allahabad-211 015.
- (vii) North Eastern Railway, Gorakhpur-273 012.
- (viii) North Frontier Railway, Mailgaon - 781 011.
- (ix) North Western Railway, Jaipur - 302 017.
- (x) Southern Railway, Park Town, Chennai- 600 003.
- (xi) South Central Railway, Railnilayam, Secunderabad-500 371.
- (xii) South Eastern Railway, Garden Reach, Kolkata-700 043.
- (xiii) South East Central, Railway, Bilaspur-495 004.
- (xiv) South West Railway, DRM's Office, Hubli-580 028.
- (xv) Western Railway, Churchgate, Mumbai-400 020.
- (xvi) West Central Railway, Jabalpur- 482 001.
- (xvii) Central Organisation for Railway Electrification, Nawab Yusuf Road, Allahabad- 211000.

Sub: Maintenance Instruction (MI) for maintenance of 25 kV Vacuum Circuit Breaker & Interrupter.

To standardise the maintenance practices and improve the reliability of Traction System, RDSO has prepared Maintenance Instruction No. TI/MI/0054 for 25kV Vacuum Circuit Breakers & Interrupters. A copy of Maintenance Instruction is enclosed herewith.

This is for your kind information and necessary action please.


(A. K. Sharma)
(Director -PSI)

For Director General (TI)

Encl: As stated above.

Copy to: The Secretary (Electrical), Railway Board, Rail Bhawan, New Delhi - 110001 - For kind information.

Government of India



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Ministry of Railways

Research Designs & Standards Organisation

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MAINTENANCE INSTRUCTION NO. TI/MI/0054

Maintenance Instructions

for

25kV Vacuum Circuit Breakers and Interrupters

of

Indian Railways Traction System

	Prepared By	Checked By	Approved By
Signature	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
Date	13/09/2017 SSE/SSWR	13/09/2017 ADE/TI	13-09-2017 DTI-PSE

ISSUED BY
RESEARCH DESIGNS & STANDARDS ORGANISATION,
TRACTION INSTALLATION DIRECTORATE
MANAKNAGAR, LUCKNOW-226011

1. Scope:

This Maintenance Instruction covers the procedure for maintenance of 25kV Vacuum Circuit Breakers and Interrupters used in Indian Railway Traction System.

2. Background:

For proper upkeep & maintenance of Circuit Breaker and Interrupter, the existing maintenance practices are based on the ACTM and different supplier manuals. Due to repeated failures of 25kV Vacuum Circuit Breaker and Interrupters a meeting has been held at RDSO, Lucknow on 20.09.2016 between RDSO, Zonal railways and 25kV Circuit Breaker and Interrupter manufacturers. In the meeting it was decided that RDSO shall prepare and issue a standard Maintenance Instruction for 25kV Vacuum Circuit Breaker and Interrupter covering all aspects of Storage, Pre-commissioning and maintenance.

3. References:

SN	Standard
1.	AC Traction Manual – Volume II, Part-I
2.	M/s ALIND Erection and Testing Manual for Vacuum Circuit Breaker and Interrupter.
3.	M/s BHEL Erection and Testing Manual for Vacuum Circuit Breaker and Interrupter.
4.	M/s Megawin's Instruction manual for Circuit Breaker.

4. Storage:

- 4.1 The Circuit Breaker/Interrupter shall be stored in packed/supplied condition only.
- 4.2 The packed case should be kept on raised ground to prevent accumulation of rain water in storage area and submergence of units and should be covered with water proof tarpaulins.
- 4.3 If the Circuit Breaker/Interrupter has been supplied in fully assembled condition (ALIND Make) the same shall be stored in assembled vertical position only.
- 4.4 Special care shall be taken during handling of Interrupting chamber and Support Insulator.
- 4.5 Manufacturer manual may also be followed for additional requirements.
- 4.6 Vacuum Circuit Breaker/Interrupter should not be stored for longer periods.

5. Pre Commissioning Tests: Following tests shall be carried out before commissioning (energisation) of the Vacuum Circuit Breaker/Interrupter.

- 5.1 Vacuum Integrity of vacuum bottle shall be carried out i.e. One minute dry power frequency withstand voltage test at 55kV/76kV/95kV (as per supplier manual).
- 5.2 Ensure that Interrupting chamber and Support Insulator as well as control Cubicle are aligned properly.

5.3 Measurement of Insulation resistance using a 2.5/5kV Megger between Lower Terminal & earth and Upper terminal & Lower terminal. The measured values shall be as per supplier manual.

	M/s BHEL	M/s Alind	M/s Megawin
Between open terminals	10,000 Mega ohm	5,000 Mega ohm	50 Mega ohm
Between lower terminal to Earth	10,000 Mega ohm	5,000 Mega ohm	50 Mega ohm

5.4 Measurement of Contact resistance between upper and lower terminal. The measured values shall be as per supplier manual.

- M/s BHEL – Max. 80 micro ohms
- M/s ALIND – Max. 50 micro ohms
- M/s MEGAWIN – Max. 100 micro ohms

5.5 The AC and DC connections should be made as per approved drawing.

5.6 Measurement of spring charging time in seconds (for spring type mechanism).

5.7 Perform Manual Operations before energisation.

5.8 Inspection of working of interlock.

5.9 Visual Observation of Porcelain Insulator for any crack/damage.

5.10 Earthing connection has been made properly.

5.11 Check silica gel granules should be blue in colour.

5.12 Door has been properly fixed and door gasket is placed properly so that no moisture/vermin ingress takes place.

5.13 No foreign material (wire, tool etc.) are left on or inside the equipment.

5.14 No moisture should be available in the control cubicle.

5.15 Ensure that heater is in healthy condition.

5.16 Ensure that Capacitor Tripping Device (CTD) in the Circuit Breaker cubicle has been set at 85+/- 3V.

5.17 If stored for longer period (for more than one year), the moisture may ingress in the pole unit housing so it should be specially checked for any type of moisture ingress. BHEL make units come with prefilled nitrogen at 0.5kg pressure in the pole unit.

5.18 Manufacturer manual may also be followed for additional requirement (if any).

5.19 Measurement of open/close timing, travel, dynamic contact resistance etc using circuit breaker Analyser.

5.20 Check function of anti-pumping in Circuit Breaker.

5.21 Corresponding Isolator Interlock Operation to be checked.

6. Tools required for the maintenance:

In addition to normal maintenance tools following special tools may also be required for maintenance of Vacuum Circuit Breaker and Interrupters.

6.1 Circuit Breaker/Interrupter Analyser for the measurement of Timing, Travel and Contact Resistance. RDSO vide letter no. TI/PSI/DCRM/POLICY/12 dated

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17.07.2012 has circulated a tentative specification to railway for the equipment.

- 6.2 2.5kV/5kV Insulation Tester.
- 6.3 Electronic Multimeter to measure coil resistance and auxiliary contact resistance.
- 6.4 High pot tester for Power frequency withstands Voltage Test (up to 95 kV).
- 6.5 The Manufacturer specified lubricants for lubrication.

7. Maintenance schedule

As Every Manufacturer has different Operating Mechanism therefore few of the check points, given in the table, will be applicable for a particular make/type only. For detailed procedure of settings, replacing and typical manufacturer Manuals shall be followed.

The maintenance schedule has been categorised in monthly, yearly and Six Year Schedule as detailed below.

7.1 Monthly Schedule:

The points to be checked in monthly inspection are tabulated below:

SN	Items to be checked	Inspection/Testing	Action Required
1.	Porcelain Insulator	Visual Inspection for any Crack/Damage/Cleanliness	Surface should be cleaned after shout down permission.
2.	Control Box	Moisture/ Rain Water Condensation	On the Heater if moisture is observed.
3.	Condition of open/close indication	Observe Visually	If indication not found then check and correct it
4.	Spring Charge Indication	Observe Visually	If indication not found then check and correct it
5.	Counter Reading	To be noted	
6.	Top/Bottom Terminal	Check for overheating signs over terminals.	Confirm it by thermal imaging/contactless thermometer and tighten the terminals, if found loose, after taking shutdown.
7.	Colour of Silica Gel	Check the colour of silica gel.	Replace silica gel if colour changes from Deep blue to white/pink colour.
8.	Control Voltage	Control Voltage is at required voltage	
9.	Unusual Sound	Check for any unusual sound during in Electrically & Manually operation.	

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7.2 Annual Inspection:

All the monthly inspection points shall be applicable in yearly inspection along with the points tabulated below:

SN	Items to be checked	Inspection/Testing	Action Required
1.	Moving and sliding Parts	Check for lubricant	Lubricate if required (only supplier recommended lubricant)
2.	Contact wear indication	Check for contact wear mark on the steel stem of pull rod in closed condition.	If wear mark not seen then contact worn off and require Vacuum Bottle replacement.
3.	Speed Regulator	Inspection for free movement	
4.	Reduction gear	Oil Leakage/abnormal Sound	Replace the unit if abnormal sound observed
5.	Travel and Wipe characteristics	Check the value of wipe and travel are as per manufacturer	Correct as per suppliers instruction Manual
6.	Fasteners of Motor Limit Switch and Auxiliary Switches	Tightness of the fasteners and terminal screws, split pins/snap pins etc.	Tighten/locking to be done if found loose.
7.	Tightness of Hardware	Inspect for any looseness.	Tight if found loose.
8.	Pole Part of VCB and VI	Insulation Resistance Measurement shall be measured by 2.5/5kV Megger and shall be as per OEMs specified value <ul style="list-style-type: none"> • Between Open Terminals (BHEL-min 5000 MΩ) (ALIND-min 5000 MΩ) (Megawin-min 50 MΩ) • Between Lower Terminal and earth (BHEL-min 5000 MΩ) (ALIND-min 5000 MΩ) (Megawin-min 50 MΩ) 	If found less than supplier specified investigate the insulating rod and Porcelain.
9.	Operating Coil resistance Measurement	Resistance is under suppliers specified limits. (M/s BHEL - 43+/- 5%)	Change the coil if not under limits
10.	Closing (at 85%) and tripping (at 70% of rated Voltage i.e. 110VDC) operation Check	If not operate	Change the coil
11.	Closing Time	Should be less than 150ms (VCB)	

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		Should be less than 120ms (VI) or As per supplier specified	
12.	Tripping Time	Less than 80ms (VCB) Less than 90ms (VI)	
13.	Open/Close Operation	Operate 10 electrically and 10 manually operations.	
14.	Contact resistance	Contact resistance of main contacts shall be measured by micro ohm meter and shall be as per OEMs specified value. <ul style="list-style-type: none"> • M/s Megawin- Max. 100 micro ohms. • M/s BHEL – Max. 80 micro ohms • M/s ALIND - Max. 50 micro ohms 	
15.	Anti-pumping	Functioning of Anti-pumping to be checked.	
16.	CTD	Functioning of Capacitor tripping device to be checked.	
17.	Interlock	Checking the interlock with DPI	
18.	Door Gasket	Door Gasket should be checked, if necessary replaced	

7.3 Six Yearly Inspection:

The entire Monthly and yearly inspection points shall be applicable in six yearly inspections along with the points tabulated below:

SN	Items to be checked	Inspection/Testing	Action Required
1.	Healthiness of Vacuum Bottle/power frequency test	Equipment shall withstand 55kV/76kV/95kV power frequency voltage (as specified by supplier) applied across its contacts in open condition.	Replace the bottle if not withstand.
2.	Slow opening and Closing	After all the inspection slow opening and closing shall be done.	Observe normal operation.

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