

Maintenance Instruction No. TI / MI / 00038 (REVISION II)**MASTER COPY****मूल प्रति**

IR,eso t,rs

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

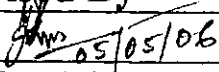

Maintenance Instruction and Test Schedule
for
Traction Power Transformers

(This supersedes earlier Maintenance Instruction No. TI / MI / 00038 – Rev. I)

Dated MAY - 2006

ISSUED BY

TRACTION INSTALLATION DIRECTORATE
RESEARCH DESIGNS & STANDARDS ORGANISATION, MANAK NAGAR,
LUCKNOW – 226011.

	Revised By	Approved By
Signature	 05/05/06	
Designation	ADE – 1 / TI	Director- IV / TI

Page 1 of 6		Effective from 05.05.2006	Inspection & test schedule for Traction Power Transformer		TI/MI/00038 Rev.II
S. No.	Periodicity	Items to be inspected / tested	Inspection / testing	Action required / acceptance norms	Remarks

-1	Monthly	Tank, radiators, Conservator, bushing, oil level indicator, gauges.	Examine for crack, dirt, & deposits and leakage.	Clean the dust & deposits with dry cloth. In case of crack/leakage replace /attend.	-----
A-2	Monthly	Oil level in OIP condenser bushing	Check oil level with reference to the oil level indicator	In case of sealed bushing, if no oil/less than minimum level indication, take shut down. Measure Tan - Delta & capacitance and compare the test values recorded earlier. In case of oil filled bushing if any leakage is observed, the same shall be attended.	Max. allowable Tan Delta and capacitance is 0.007 and 110% of the factory set value respectively.
A-3	Monthly	Dehydrating breather	Breather to be checked for choking due to insect build /grime. Check the intactness of gasket and colour of the active agent. Check oil level in the oil cup.	In case breather is choked, remove the dirt etc. In case gasket is damaged, replace the same. If Silica gel is pink, replace it with dry Silica gel and recondition the old Silica gel, make up oil if required, if the Silica gel is too wet check the BDV of transformer oil.	In case BDV is less than 50 kV, filter the oil till it reaches 50 kV.
A-4	Monthly	Check maximum temperature of transformer oil on dial indicator and reset indicator.	Compare it with the previous values.	Abnormal change in the temperature shall be further investigated.	It is suggested to use Infrared thermometer / thermo vision Camera for detecting any abnormal temperature rise.
A-5	Monthly	Buchholz Relay	Check for gas collection if any.	In case gas is collected the same shall be sent for DGA.	Test result shall be compared with RDSO guideline for DGA refer Annex. 2.04 of ACTM Vol II, Part I.
A-6	Monthly	Heater in marshalling box.	Check for proper functioning.	In case not working, the connection shall be checked and rectified.	-----
A-7	Monthly	Oil level in conservator (MOLG).	Check as per transformer oil temperature (OTI).	If low, top up with the filtered oil and examine transformer for leakage.	-----
A-8	Monthly	All external connection.	Check visually that all connection are normal without any discolourisation due to local heating	In case of any sign of heat, clean and tighten the bolts and nuts.	----

Page 2 of 6	Effective from 05.05.2006	Inspection & test schedule for Traction Power Transformer			TI/MI/00038 Rev.II
S. No.	Periodicity	Items to be inspected / tested	Inspection / testing	Action required / acceptance norms	Remarks

B-1	Half yearly	Do all the test / schedule as indicated in schedule 'A'.				
B-2	Half yearly	Test oil sample with oil test kit	Test for BDV and acidity	Compare and take action as indicated in enclosed ANNEXURE-I	Sample shall be taken from moving oil.	
B-3	Half yearly	IR of winding and Polarization Index (PI) with 2.5 kV or 5 kV megger for: HV-LV, HV-E, LV-E	Insulation resistance is to be measured for 10 sec, 60 sec and 600 sec for HV-LV, HV- E and LV- E. Calculate PI (Polarization Index) by the IR ratio of R60/R10 and R600/R60.	Insulation resistance values shall be compared with the last recorded value and there shall not be wide variation. Ambient temp & oil temp (OTI) shall be recorded. Compare PI values with values at the time of commissioning/ last recorded.	Care shall be taken to ensure bushings are clean and free from moisture and temperature on which IR is recorded shall also be noted and compared. Ensure that transformer is disconnected from other associated equipment. In case of doubt, Tan-Delta of winding shall be done to confirm healthiness of winding.	
				PI		Insulation condition.
				< 1.0 1.0 – 1.1 1.1 – 1.25 1.25 – 2.0 > 2.0		Dangerous Poor Questionable Satisfactory Good
				If PI value is less than 1.1, oil shall be filtered. In case the value does not improve even after filtration periodic overhauling shall be under taken.		
B-4	Half yearly	Alarm and tripping devices.	Check for proper functioning	Rectification/replacement in case found defective	-----	
B-5	Half yearly	Check PRD/ Explosion vent for any damage and presence of oil.	Connection of PRD/Explosion vent and its operation shall be checked.	The reason for operation of PRD/Explosion vent shall be investigated. In case of damage of PRD the same shall be replaced with new PRD.	-----	

Page 3 of 6		Effective from 05.05.2006		Inspection & test schedule for Traction Power Transformer		TI/MI/00038 Rev. II
S. No.	Periodicity	Items to be inspected / tested	Inspection / testing	Action required / acceptance norms	Remarks	

C-1	Yearly	Do all the test / schedule as indicated in schedule 'B'.				
C-2	Yearly	Transformer tank, bushings, tap changer, radiator and connection joints.	Infrared temperature scanning.	Infrared temperature scanning is to be done preferably at the time of full load to find any over heating.	The IR scan results shall be compared with previous results.	
C-3	Yearly	OIP Condenser Bushing.	Test for Tan-Delta, Capacitance and IR (Shearing bridge may be used for tan delta & capacitance)	a) Compare with earlier value for IR in case sharp fall consult manufacturer. b) Max. allowable Tan-Delta is 0.007. c) Max. allowable capacitance 110% of the factory test result. In case of deviation plan for replacement.	Bushings shall be cleaned for dust and moisture. Test shall be done on sunny day.	
C-4	Yearly	Gasket joints for transformer.	Tighten the bolts evenly to avoid uneven pressure in case of leakage only.	In case of leakage the same shall be attended.	Tightening of the bolts has to be done in proper sequence.	
C-5	Yearly	Rod gap setting of bushing.	Check rod gap setting as per makers drawing	Adjust it in case required.	----	
C-6	Yearly	Oil filled bushing (not hermetically sealed)	Test for BDV and acidity.	In case low BDV & high Acidity, filter / replace oil as per supplier catalogue.	----	
C-7	Yearly	Test oil in transformer.	Test oil as per the enclosed ANNEXURE-I, referring Annexure 2.03 B of ACTM , Vol II, Part I	The oil sample shall be tested for those values conform to IS: 1866 - 2000. In case the oil values do not meet the requirement, action will be taken as indicated.	In case of requirement, oil shall be replaced with new oil. Refer enclosed ANNEXURE-I giving Annexure 2.03 B of ACTM, Vol II, Part I (as per latest IS: 1866-2000)	
C-8	Yearly	Dissolved gas analysis (DGA) on oil.	Oil sample shall be taken for DGA as per RDSO guide line at Annexure 2.04 of ACTM, Vol II, Part I.	Test result shall be compared with the RDSO guideline and action taken accordingly.	Refer Annexure 2.04 of ACTM , Vol II, Part I. In case of abnormal DGA values in the past, DGA test has to be done more frequently i.e. every six months.	

Page 4 of 6		Effective from 05.05.2006		Inspection & test schedule for Traction Power Transformer		TI/MI/00038 Rev.II
S. No.	Periodicity	Items to be inspected / tested	Inspection / testing	Action required / acceptance norms	Remarks	
C-9	Yearly	Working of Tap changer switch.	Move the Tap setting switch up and down full range so that by self-wiping action good contacts are ensured.	Set the tap finally at the correct position.	----	
C-10	Yearly	Relays, alarm & their circuits.	Examine relay and alarm contacts, their operation and fuses etc. check relay accessories.	Clean the components and replace contacts and fuses if necessary. Change the relay setting if necessary.	----	
C-11	Yearly	Control boxes & Terminal boxes/cable	Check water tightness of boxes & terminal boxes.	If required replace gasket.	-----	
C-12	Yearly	Temperature Indicators.	Pockets, holding thermometer shall be checked.	Oil to be replenished if required.	----	
C-13	Yearly	Dial type oil gauge.	Check pointer for free movement.	Adjust if required.	----	
C-14	Yearly	Earth resistance.	Measure earth resistance and record with ohmmeter.	Take suitable action if earth resistance is high.	----	
C-15	Yearly	Buchholz Relay.	Check for operation and measure the insulation resistance by 500 V Megger and continuity test for contacts with test Lock Screw set at 5 ⁰	(i) Values of IR shall not be less than 20 megaohm. (ii) On continuity test relay shall operate.	----	
C-16	Yearly	Voltage ratio test with Wheat stone – bridge, Voltmeter-Ammeter.	Precautions to be taken as per normal practice being followed for measurements with Wheat stone - bridge	Compare the trends of the Ratio with reference to pre commissioning/ factory value/ earlier test.	Test should not be done for verifying exact ratio. The sudden variation in ratio from the last measured value shall call for further investigation.	
C-17	Yearly	Winding resistance test with Wheat stone bridge Voltmeter - Ammeter.	The test conducted on principal tap by applying DC current. The measured value shall be converted to 75 ⁰ C for conversion.	Compare the value with the pre-commissioning /factory test values. Deviation in absolute value shall be less than +/- 5%of precommissioning or factory set value.	This test shall be last test on winding to avoid DC flux remaining in core resulting erroneous value in the other test.	

Page 5 of 6		Effective from 05.05.2006		Inspection & test schedule for Traction Power Transformer		TI/MI/00038 Rev.II
S. No.	Periodicity	Items to be inspected / tested	Inspection / testing	Action required / acceptance norms	Remarks	

D-1	After every 05 year	Repeat all the tests as indicated in Schedule 'C'.				
D-2	After every 05 year or when needed.	Painting of transformer tank, conservator, radiators and other exposed parts.	Clean the exposed parts thoroughly.	Transformer tank and other parts shall be painted with epoxy and polyurethane paints as per A&C slip no. 8 to the RDSO specification no. ETI/PSI/118 (10/93).	In case of previous enamel paints, the Repainting may be carried out after 3 years polluted area. In case of previous epoxy and polyurethane paints the repair painting may be carried out after 5 years.	
D-3	After every 05 year	Pipe work.	-----	In case of any misalignment the pipe shall be realigned and joint made.	----	
D-4	After every 03 to 05 year	Test oil in transformer.	Measure the inhibitor content in the oil. In the new oil it has to be within 0.25 – 0.30 % by total weight of oil.	If the inhibitor content in the oil reduces to 0.15 %, it should be re-inhibited by adding required amount of DBPC.	----	
D-5	After every 05 year	Magnetizing Current Test with Voltmeter, Ammeter and Lamp.	To be done by applying 230 V ac supply preferably on LV side with series lamp.	Compare the value with respect to pre commissioning value. Any abnormal increase to the order of 50 times indicates that there is a fault inside.	Ensure that the comparison is done to the value taken at LV side only.	
D-6	After every 05 year	Winding resistance test with Wheatstone bridge Volt meter, Ammeter.	The test conducted on principal tap by applying DC current. The measured value shall be converted to 75° C for conversion.	Compare the value with the pre-commissioning /factory test values. Deviation in absolute value shall be less than +/- 5%of precommissioning or factory set value.	This test shall be last test on winding to avoid DC flux remaining in core resulting erroneous value in the other test.	
D-7	After every 05 year or when needed	Impedance test with Voltmeter, Ammeter.	Test to be conducted on principal tap applying 230 V single phase ac to the HV side with LV side shorted and calculate V/I and convert to percentage impedance.	Compare the value with respect to pre-commissioning value, any deviation beyond 5% calls for further analysis.	Any deviation beyond 2% from the earlier values shall be considered for keeping watch on the transformer.	
E.	After 10-12 years. POH	Periodic overhaul.	Over all inspection of active parts after lifting of bell tank and replacement of gasket with new gasket.	In case of internal fault or once in 10 years.	Periodic overhaul shall be done as per schedule for periodic overhaul vide TI/MI/00039 Rev1	

ANNEXURE-I

Annexure 2.03B

(Para 20207) of ACTM Vol.II Part-I

(The values from latest IS: 1866-2000 has been taken while ACTM table is having the values from IS: 1866-1983)

APPLICATION AND INTERPRETATION OF TESTS ON TRANSFORMER OIL IN SERVICE

SL. No.	Tests	Value as per IS: 1866-2000 permissible limits	To be re-conditioned	To be replaced.
	2.	3.	4.	5.
1.	Electric strength (Breakdown voltage) Below 72.5 kV 72.5 kV and less than 145 kV 145 kV and above	Min. 30 kV 40 kV 50 kV	Less than the value specified in column 3	--
2.	Specific resistance (Resistivity) Ohm-cm at 90 °C	Above 1×10^{12}	Between 0.1×10^{12} to 1×10^{12}	Below 0.1×10^{12}
3.	Water content Below 145 kV Above 145 kV	Max. 40 ppm 20 ppm	Greater than the value specified in column 3	--
4.	Dielectric dissipation factor, Tan delta at 90 °C	0.2 or less	--	Above 0.2
5.	Neutralisation value mg KOH/ g of oil.	0.3 or less	--	Above 0.3
6.	Interfacial tension N/ m	0.015 or more	--	Below 0.015
7.	Flash point in °C	140 or more	125 and above but below 140	Below 125
8.	Sludge	Non- detectable, Results below 0.02% by mass may be neglected	Sediment	Perceptible sludge
9.	Dissolved Gas Analysis (DGA)	Refer Annexure 2.04 of ACTM Vol.II Part-I		