

Addendum & Corrigendum Slip No. 12 to the Technical Specification No. ETI/PSI/118 (10/93) for 21.6/30.24MVA, ONAN/ONAF, 220 or 132 or 110 or 66/27kV Single Phase Traction Power Transformer

1.0 The A&C slip no. 10 of Technical Specification No. ETI/PSI/118 (10/93) was issued on 21.08.2012. In the A&C slip no. 10, the Off Circuit tap Changer and Fire Extinguishing System are categorized under Customer Hold Point (CHP) for carrying out stage inspection of these accessories before fitment in Traction Power Transformer under prototype test; however this A&C slip does not include the details regarding tests to be conducted during the CHP as Factory Test. The same has been detailed in this A&C Slip No. 12 with standard format. Tests to be conducted on the Off Circuit tap Changer (OCTC) during CHP are also being included in this A&C slip no. 12.

2.0 Tests to be conducted during CHP of the Off Circuit Tap Changer (Factory Test)

2.1 Visual and dimensions check: Visual and dimensions check of the complete Motor Drive unit (MDU) of the Off Circuit tap Changer shall be carried out as per the approved drawings.

2.2 Mechanical Endurance test: The off circuit tap changer shall be fully assembled and subjected for 1000 operations from end to end positions without any failures.

At the minimum voltage of 93.5V DC : 250 operations.
At the maximum voltage of 121V DC : 250 operations.
At the rated voltage of 110V DC : 500 operations.

2.3 Contact resistance Measurement: Contact resistance at every tap position shall be measured before and after endurance test. Contact resistance shall be less than 2 milli ohm.

2.4 Operation check of the tap changer with drive mechanism: The Off circuits tap changer (OCTC) and the respective Drive mechanism shall be checked for 2 complete cycle of operation - The operation shall be smooth without any abnormal sound.

2.5 HV Test on auxiliary Circuit. All auxiliary circuits shall be subjected to a separate source AC withstand test of 2kV for 1 minute between all live terminals and the frame/earth. - Equipment should withstand the test.

2.6 Pressure test:

(i) For in tank type tap changer: Pressure test on top head cover shall be conducted at 12 PSI for six hour.

(ii) For out tank type tap changer: Pressure test of oil compartment shall be conducted at 12 PSI for six hours.

At the end of the test no pressure drop/leakage shall be observed.

2.7 Snap Action: Once the tap changing operation has been initiated it must be completed automatically (snap action) even after failure of 110 V DC supply. It shall be verified by giving a tap change command and immediately tripping the 110V DC MCB in Motor Drive Unit.

2.8 Manual Operation: Five complete raise and lower operation shall be verified with manual handle.

2.9 Type tests reports: Type tests reports of the tap changer of the type tests specified in the Traction Transformer Specification shall be submitted. Type test report shall have following tests:

(i) Temperature rise test of contacts.

- (ii) Mechanical endurance test.
- (iii) Milli - volt drop test.
- (iv) Short circuit current test.
- (v) Dielectric test
- (vi) Auxiliary circuit Insulation tests

3.0 Tests to be conducted during stage Inspection (CHP) of Nitrogen Injection Fire Prevention and Extinguishing system (Factory Test):

- 3.1 Visual Inspection: Visual examination of the NIFPES equipment i.e. Fire Extinguishing Cubicle, Control box, Signal Box, Transformer Conservator Isolation Valve, Fire Sensing components, Fire survival cables, Fire Retardant Low Smoke cables shall be made with reference Clause 5.0 of Annexure-I of A&C Slip No. 10 to RDSO's specification ETI/PSI/118 (10/93) and approved drawings.
- 3.2 Functional Test: Following functional tests on the Fire Extinguishing Cubicle and Control Box of NIFPES shall be carried out by activating the signals through test panel/test rig for NIFPES. The testing shall be done at 121V, 110V & 93.5V DC supply (+110%, 100% & 85%) separately. After each test system shall be reset so that system shall be ready for next test.

Functional Tests on the Fire Extinguishing Cubicle and Control Box of NIFPES				
Test Voltage Volt				
SN	TESTS	Procedure	Requirement	Observation
1.	System On	Switch on Power Supply	(i) System ON Indicating Lamp should glow (ii) Healthy condition lamp should glow	
2.	In Service	Oil drain valve lever in horizontal Condition	In service indication should glow	
3.	Out of service/Under maintenance	(i) Oil drain valve lever in vertical Condition (ii) Insert Oil drain locking pin in Fire Extinguishing Cubicle (iii) Insert Nitrogen injection locking pin in Fire Extinguishing Cubicle (iv) Selector Switch in OFF position	➤ In all conditions or any one condition (to be checked separately) concerned Indicating lamp should glow ➤ Audio Alarm should also activate	
4.	Transformer Conservator Isolation Valve (TCIV) open	Make TCIV Switch of the test panel in the 'OFF' position.	➤ TCIV open Indication should glow ➤ TCIV close Indication should OFF	
5.	Transformer Conservator Isolation Valve (TCIV) closed	Make TCIV Switch of the test panel to 'ON' position.	➤ TCIV closed Indication should glow ➤ TCIV open Indication should OFF ➤ Audio Alarm should activate	

6.	Fire detector Activation	(i) Activate the signal on test panel	<ul style="list-style-type: none"> ➤ Fire detector trip Indication lamp should glow. ➤ Healthy condition Indication lamp should go OFF ➤ Audio Alarm should activate 	
		(ii) Deactivate the signal on test panel	<ul style="list-style-type: none"> ➤ Healthy condition Indication lamp should turn ON ➤ Fire detector trip Indication lamp should go OFF. 	
7.	Bucholz relay trip	(i) Activate the signal on test panel	<ul style="list-style-type: none"> ➤ Bucholz relay trip Indication lamp should glow. ➤ Healthy condition Indication lamp should OFF ➤ Audio Alarm should activate 	
		(ii) Deactivate the signal on test panel	<ul style="list-style-type: none"> ➤ Healthy condition Indication lamp should turn ON ➤ Bucholz relay trip Indication lamp should go OFF. 	
8.	Oil drain valve open.	Open Oil Drain Valve in Fire Extinguishing Cubicle Manually. (Oil drain valve lever in vertical condition)	<ul style="list-style-type: none"> ➤ Oil drain valve open Indication lamp should glow. ➤ Healthy Condition Indicating lamp should OFF ➤ Audio Alarm should activate 	
9.	Oil drain valve closed	Close Oil Drain Valve in Fire Extinguishing Cubicle Manually. (Oil drain valve lever in horizontal condition)	<ul style="list-style-type: none"> ➤ Healthy Condition Indication lamp should ON. ➤ Oil drain valve closed Indication lamp should glow. 	
10.	Extinction in progress	Operate nitrogen release device in Fire Extinguishing Cubicle manually.	<ul style="list-style-type: none"> ➤ Extinction in progress Indication lamp should glow. ➤ Healthy condition Indication lamp should OFF ➤ Audio Alarm should activate 	
11.	Gas Inlet valve closed	Close nitrogen release device in Fire Extinguishing Cubicle manually	<ul style="list-style-type: none"> ➤ Healthy condition Indication lamp should ON ➤ Gas Inlet valve closed Indicating lamp should glow. 	
12.	Nitrogen Gas Cylinder	Adjust contact on manometer below	<ul style="list-style-type: none"> ➤ Cylinder pressure low Indication lamp should 	Record Specified

	pressure low (Nitrogen Gas leaking)	the specified pressure.	<p>glow.</p> <ul style="list-style-type: none"> ➤ Healthy condition Indication lamp should OFF ➤ Audio Alarm should activate 	pressure kg/mm ²
13.	Differential relay trip/ Over Current Relay (OCR) Trip/ Restricted Earth Fault (REF) relay trip	(i) Activate the trip signal on test panel	<ul style="list-style-type: none"> ➤ Relay trip Indicating lamp should glow. ➤ Healthy condition Indication lamp should OFF ➤ Audio Alarm should activate 	
		(ii) Deactivate the trip signal on test panel	<ul style="list-style-type: none"> ➤ Healthy condition Indication lamp should turn ON ➤ Relay trip Indicating lamp should go OFF. 	
14.	Pressure Relief valve (PRV) Trip	(i) Activate the signal on test panel	<ul style="list-style-type: none"> ➤ PRV trip Indicating lamp should glow. ➤ Healthy condition Indication lamp should OFF ➤ Audio Alarm should activate 	
		(ii) Deactivate the signal on test panel	<ul style="list-style-type: none"> ➤ Healthy condition Indication lamp should turn ON ➤ PRV trip Indicating lamp should go OFF. 	
15.	HVCB Open	Activate HVCB 'ON' signal on test panel	No Change	
16.	LVCB Open	Activate LVCB 'ON' signal on test panel	No Change	
17.	HVCB Open & LVCB Open (Transformer trip)	(i) Activate both 'HVCB' & 'LVCB' ON signal on the test panel	<ul style="list-style-type: none"> ➤ Transformer Isolation indicating lamp should glow. ➤ Healthy condition Indication lamp should OFF ➤ Audio Alarm should activate. 	
		(ii) Reset both signals	<ul style="list-style-type: none"> ➤ Healthy condition Indication lamp should turn ON ➤ Transformer Isolation indicating lamp should go OFF. 	
18.	DC Supply fail	Switch OFF DC Supply to Control Box	<ul style="list-style-type: none"> ➤ DC Supply Fail indication should glow ➤ Audio Alarm should activate 	

19.	System test for prevention mode (Auto mode)	<p>a) Activate following signals:</p> <ul style="list-style-type: none"> i. HVCB & LVCB Open ii. Differential relay/ Over Current relay/ Restricted Earth Fault relay trip iii. Pressure Relief Valve trip 	<ul style="list-style-type: none"> ➤ TCIV should close ➤ Oil Drain valve should open ➤ Nitrogen gas should release ➤ Audio Alarm should activate. ➤ Following Indication lamps should glow <ul style="list-style-type: none"> -Prevention Mode ON -TCIV close -Oil drain valve open -Nitrogen Gas release ➤ Healthy Condition Indication lamp should go OFF. 	
		<p>b) Activate following signals:</p> <ul style="list-style-type: none"> i. HVCB & LVCB Open ii. Any other logic/safety equipment to be used which has got the prior approval of RDSO before manufacturing. 	<ul style="list-style-type: none"> ➤ TCIV should close ➤ Oil Drain valve should open ➤ Nitrogen gas should release ➤ Audio Alarm should activate. ➤ Following Indication lamps should glow <ul style="list-style-type: none"> -Prevention Mode ON -TCIV close -Oil drain valve open -Nitrogen Gas release ➤ Healthy Condition Indication lamp should go OFF. 	
20.	System test for Extinction mode (Auto mode)	<p>Activate following signals:</p> <ul style="list-style-type: none"> i. HVCB & LVCB Open ii. Fire Sensing Component trip iii. Bucholz relay trip 	<ul style="list-style-type: none"> ➤ TCIV should close ➤ Oil Drain valve should open ➤ Nitrogen gas should release ➤ Audio Alarm should activate. ➤ Following Indication lamps should glow <ul style="list-style-type: none"> -Prevention Mode ON -TCIV close -Oil drain valve open -Nitrogen Gas release ➤ Healthy Condition Indication lamp should go OFF. 	
21.	System test for Extinction mode in REMOTE MANUAL Electrical mode on Control Box	<p>Activate following signals:</p> <ul style="list-style-type: none"> i. Mode Selection switch in manual mode ii. Press Manual Extinction Operation Push Button to ON in control cubicle. 	<ul style="list-style-type: none"> ➤ HVCB & LVCB should Open ➤ TCIV should close ➤ Oil Drain valve should open ➤ Nitrogen gas should release ➤ Audio Alarm should activate. ➤ Following Indication lamps should glow 	

			<ul style="list-style-type: none"> -Prevention Mode ON -TCIV close -Oil drain valve open -Nitrogen Gas release ➤ Healthy Condition Indication lamp should go OFF. 	
22.	System test for Extinction mode in Local manual control on Fire Extinguishing Cubicle (To be used in case of d.c. supply failure)	To be done on Fire Extinguishing Cubicle i. Push lever for Oil drain. ii. Push Lever for Nitrogen gas release.	<ul style="list-style-type: none"> ➤ Oil Drain valve should open ➤ Nitrogen gas should release 	
23.	Panel Lighting	Switch on 240V AC supply in fire extinguishing cubicle	Panel Lights should be in working condition.	
24.	High voltage test to be separately done on Control Box and Signal Box	i. Apply 2kV AC for 1 minute between terminal bar and Box body	Should withstand.	
25.	Communication with SCADA	Check for the Digital Input/ Output provided on NIFPES system for communicating with SCADA.	➤ The Control Box shall be compatible to be interfaced with SCADA.	

3.3 Functional Test of Transformer Isolation Conservator Valve (TCIV):

SN	Test	Procedure	Requirement	Observation
1.	Leakage Test	i. Fill the oil in TCIV ii. Apply pressure of 12 PSI for 6 hours.	There should no leakage from TCIV body	
2.	Flow rate test	i. Mount TCIV with approx. 3 degree inclination on test jig ii. Switch ON oil Pump iii. Increase oil flow rate gradually	<ul style="list-style-type: none"> ➤ TCIV should close at minimum 60 Liter/min flow reading observed in flow meter. ➤ Normally open (NO) contacts should close 	
3.	Reset test	i. Reset the TCIV handle in the normal position.	Close contact should become open	
4.	High voltage test	ii. Apply 2kV AC for 1 minute between terminals and body	TCIV should withstand.	

3.4 Functional test on Fire Sensing Component:

SN	Test	Procedure	Requirement	Observation
1.0	Heat Sensing Temperature & Heat Sensing area	<p>i. The fire sensing component shall be placed in an isothermal enclosure of minimum 800 mm radius.</p> <p>ii. Minimum 04 nos. of temperature sensor shall be placed at 800 mm radii from the fire sensing component.</p> <p>iii. The temperature of the isothermal enclosure shall be increased gradually.</p>	The temperature of the all the temperature sensors shall be $140\pm 2^{\circ}\text{C}$ when the fire sensing component activates.	

3.5 Live demonstration test in Auto Fire Extinguishing Mode:

3.5.1 Procedure:

- (i) The Fire Sensing component shall be mounted on the Transformer tank.
- (ii) All the necessary pipe connections shall be made between Transformer Tank to Switchyard Cubicle.
- (iii) The Control Box and Signal Box should also be connected.
- (iv) Digital Storage Oscilloscope shall be used for the measurement of activation time of system. Following Inputs shall be connected to the different channels of storage Oscilloscope.
 - (a) Fire sensing component activation
 - (b) Oil drain valve latch activation
 - (c) Nitrogen valve open (Nitrogen Injection started)
 - (d) Nitrogen valve closed (Nitrogen injected)
- (v) The NIFPES System shall be made ON.
- (vi) The Bucholz Relay Trip and HVCB & LVCB Trip Signal shall be activated by test panel.
- (vii) The Transformer Oil Temperature shall be raised up to 140 ± 2 degree Celsius.

3.5.2 Observations:

- (i) At 140 ± 2 degree Celsius the system should activate.
- (ii) Oil Drain started.
- (iii) Nitrogen should be injected after a preset duration.
- (iv) Following Indications has been turned ON:
 - (a) Oil Drain valve open
 - (b) Nitrogen gas release
 - (c) Audio Alarm activated
 - (d) Extinction in Progress
 - (e) System ON
 - (f) LVCB & HVCB Trip

- (g) Buchholz Relay trip
- (h) Fire Detector ON
- (i) Healthy Condition Indication lamp should be OFF.

(v) Temperature measurement:

	After System activation (Post cooling)
Oil Temperature	
Tank temperature	

3.5.3 Calculation of time with graphs saved in Digital Storage Oscilloscope

- (i) Oil Drain Valve Opening time (T1) =
Time of Fire sensing component activation – Oil Drain valve latch activation
- (ii) Time taken for Fire Extinction on commencement of Nitrogen Injection (T2) =
Time of Nitrogen Injection Valve open – time of nitrogen Injection valve close
- (iii) Total time Period for Fire Extinction on system activation up to post cooling (T3) =
Oil Drain Valve Opening time (T1) + Preset Nitrogen Injection delay (decided by NIFPES manufacturer) + Time taken for Fire Extinction on commencement of Nitrogen Injection (T2)

Results:

SN	Fire extinction period	Requirement	Observation
1.	On commencement of Nitrogen Injection	Maximum 30 seconds	(T2)= seconds
2.	On system activation up to post cooling	Maximum 3 minutes	(T3)= seconds

3.6 In addition to the tests at the works of NIFPES manufacturer, following test certificates/details shall also be submitted during inspection of NIFPES:

- i. Type, make, and quantity of Fire Sensing Component being used with actual Railway Transformer.
- ii. IP-65 protection certificate of the pressure reducer from international or a national testing body (NABL accredited recognized laboratory).
- iii. Type, make and quantity of the fire survival cable (750°C, 1.5 mm sq.) used for connection of fire sensors/detectors and test report of the cable reflecting withstands temperature.
- iv. Type and make of the FRLS cable 1.5mm sq. used for connection among transformer signal box/marshaling box/control box/fire extinguishing cubicle along with Cable Manufacturer’s Test Certificate.
- v. Type test report of the NIFPES along with the response time. Type test report shall be of system tested by international or a national testing body (NABL accredited recognized laboratory). NABL certificate of the testing agency shall also be submitted.
- vi. Customer’s Performance certificate for at least 2 sets of the system which has been supplied and has been in operation for a minimum period of two years. The certificate shall be verified with issuing authority.
- vii. The copy of Manual of NIFPES.
- viii. The purity certificate of Nitrogen of 99.99% purity for each cylinder.
- ix. Necessary calculation regarding adequacy of the number of cylinders provided and nitrogen release pressure for the operation of the NIFPES system in actual Railway Transformer.
