

# ANNEXURE TO PI 140610603

(RDSO SPECIFICATION FOR NIFPES)

Spec No. TI/SPC/PSI/TRNPWR/3200

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## Annexure-1

### Technical Specifications for Nitrogen Injection Fire Prevention and Extinguishing System (NIFPES) for Oil Filled Transformer.

#### 1.0 SCOPE:

The scope of this specification covers design, engineering, supply, testing at works before dispatch; erection, testing and commissioning and performance demonstration of "Fire prevention and extinguishing system by nitrogen injection method". The necessary civil work which will be required for construction of oil soak pit for the storage of oil coming out from the transformer and plinth for Fire Extinguishing Cubicle (FEC) is outside the scope of this specification. However, laying of oil pipe, nitrogen pipe, electrical cables, control boxes, extinguishing cubicle, nitrogen cylinder, necessary valves, fire detectors and other equipments & accessories required for erection, testing, commissioning and performance demonstration of the complete fire protection system is in the scope of the NIFPES manufacturer. It will be the responsibility of the transformer manufacturer to coordinate with the supplier of the Fire Protection System for all the arrangements for the complete erection, testing, commissioning and performance tests.

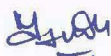
#### 2.0 GENERAL DESCRIPTION:

- 2.1 Nitrogen Injection system shall be used to prevent the transformer explosion and possible fire, in the case of internal fault and such acts as a fire preventer. In certain cases, tank explosion cannot be prevented and transformer oil catches fire. In such cases and also in the event of fire by external causes, it shall acts as fire fighting system. In either way it shall protect the transformer and eliminate or minimize the post fire damages. Thus, the system shall be suitable for protecting the transformer tank from explosion and also transformer, OCTC/OLTC and cable box from fire.
- 2.2 The system shall drain a pre-determined quantity (at least 10% by volume) of the of oil from the tank top through outlet valve to reduce the tank pressure and inject nitrogen gas at predetermined pressure from the lower side of the tank through inlet valves to create stirring action and reduce the temperature of top oil surface below flash point to extinguish the fire.
- 2.3 The system shall consist of following major components:
  - a) Fire Extinguishing Cubicle (FEC) placed on a plinth at about 5-10 meter away from the transformer.
  - b) Control box placed in the control room.
  - c) Transformer Conservator Isolation valve (TCIV) in the conservator pipe.
  - d) Fire Detectors to be provided on the tank cover.
  - e) Signal box fitted on the transformer tank side wall.

#### 3.0 Details of Major System components:

##### 3.1 Fire Extinguishing Cubicle (FEC): Fire Extinguishing Cubicle shall have the following:

- 3.1.1 Nitrogen gas cylinder with pressure reducer or pressure regulator. Necessary gauges shall be provided to monitor the nitrogen cylinder pressure as well as nitrogen injection pressure. Also, provision shall be provided for indication in the control box if the cylinder pressure reduced than specified pressure. Pressure reducer or pressure regulator and gauges used shall have IP-65 protection.
- 3.1.2 The nitrogen gas cylinder should contain 10 cubic meter gas at pressure of 150kg/cm<sup>2</sup> up to 60,000 liters oil capacity of transformer.
- 3.1.3 The nitrogen shall be contained within the cylinder and released from the cylinder valve only upon activation of fire protection system. No used bottle should be accepted. Proper approvals and certificates should be provided with each cylinder. NIFPES manufacturer to ensure to provide the cylinders having the PESO (Petroleum and Explosive safety Organisation) certificates. Nitrogen purity shall be 99.99%.



- 3.1.4 Pressure monitoring switch for back-up protection for nitrogen release as redundancy to first signal of oil draining commencement for Nitrogen release shall preferably be provided.
- 3.1.5 Oil drain pipe with mechanical quick drain valve.
- 3.1.6 Electro mechanical control equipments for oil drain and pre- determined regulated nitrogen release.
- 3.1.7 Limit switches for monitoring of the system.
- 3.1.8 Isolation valves for oil drain and nitrogen injection pipe with necessary flanges shall be provided on top of the Fire Extinguishing Cubicle (FEC) for connecting oil drain and nitrogen injection pipes with transformer.
- 3.1.9 Fire Extinguishing Cubicle (FEC) shall have LED light and heater with thermostat. FEC should have IP 55 protection.
- 3.1.10 Oil drain pipe extension of suitable sizes for connecting pipes to oil pit.
- 3.1.11 Individual mechanical locking arrangement for nitrogen release as well as oil drain to avoid unnecessary operation during maintenance and/or testing of transformer and /or system.

3.2 **Control box:** Control Box shall have the following provisions:

- 3.2.1 Control Box should be microprocessor based compatible to be interfaced with existing RTU for Railway Traction SCADA system. For communication with SCADA, Control Box shall have provision for interfacing with RTU through RS485 over MODBUS protocol. Following indications of NIFPES are to be interfaced with SCADA:
  - NIFPES active in prevention mode.
  - NIFPES active in extinguishing mode.
  - Status of NIFPES i.e. in Auto/Manual/OFF position.
  - NIFPES system is healthy
- 3.2.2 Control box shall have activating, monitoring devices and line faults indicators. It should have audio visual alarm indication and push button switches for test response.
- 3.2.3 Following minimum indications (LED type) shall be provided on the Control Box.

SN	Indication	Colour	SN	Indication	Colour
a)	System On	Green	b)	LV Circuit Breaker Open	RED
c)	Oil Drain Valve Closed	Green	d)	HV Circuit Breaker Open	RED
e)	Nitrogen Injection Valve Closed	Green	f)	Differential Relay Trip	RED
g)	System Healthy	Green	h)	Restricted Earth fault Relay Trip	RED
i)	TCIV Open	Green	j)	Overcurrent Relay Trip	RED
k)	System out of Service	RED	l)	Bucholz Relay trip	RED
m)	TCIV Closed	RED	n)	Pressure Relief Valve Trip	RED
o)	Oil Drain valve open	RED	p)	Fire Detector Trip	RED
q)	Extinction in progress	RED	r)	DC supply fail	RED
s)	Nitrogen Cylinder Pressure Low	RED	t)	AC Supply fail	RED
u)	Auto operation failed	RED			

3.2.4 Other provisions on the Control Box.

SN	Description
a.	Push Button for lamp test
b.	Mode Selection Switch, Auto/Manual/OFF
c.	Extinction Release (manual operation) Push Button
d.	Audio Alarm

- 3.3 **Transformer Conservator Isolation valve (TCIV):** TCIV to be fitted in the conservator pipe line, between conservator and buchholz relay to block oil passage to isolate conservator tank oil. Thus, prevent escalation of fire at the time of the activation of NIFPES. It shall also have electrical signal for monitoring the status and a transparent window for visual inspection of the status of valve.

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- 3.4 Fire Detectors: Fire detectors shall be specially designed to generate an electrical signal to the NIFPES system after sensing higher temperature. Fire detectors are to be fixed on transformer tank top cover and Off Circuit Tap Changer/On load tap change for sensing fire.
- 3.5 Signal box: Signal Box shall be provided for terminating cable connections from fire detectors and TCIV.
- 3.6 Signal Box, Control Box & FEC should be vermin proof and cable glands (as required) shall be provided for terminating cables.

**4.0 OPERATIONAL CONTROLS:** Following mode of control shall be provided for the activation of NIFPES.

- 4.1 Automatic control in fire prevention and fire extinction modes after receipt of the system activating signals.
- 4.2 An electrical push button on control box for activating the NIFPES. This push button should be covered under glass to avoid false pressing.
- 4.3 An electrical push button in the Fire Extinguishing Cubicle (FEC) for activating the NIFPES.
- 4.4 Manual operation form Fire Extinguishing Cubicle (FEC) in case of DC supply fails.

**5.0 SYSTEM ACTIVATING SIGNALS:**

- 5.1 Transformer isolation shall be an essential pre-condition for activating the system.
- 5.2 In activation of auto mode, NIFPES system should also give a command to isolate the Traction Power Transformer through Master trip relay or circuit breaker (HV and LV side in series) before oil depressurization and nitrogen injection.
- 5.3 System operation in auto mode: In auto mode, there shall be two modes of operation of Fire protection system i.e. Fire prevention mode and Fire Extinction Mode. The inputs to be used for the activation of the system are as below:

Mode of operation	Inputs to be used for activation of NIFPES:
Fire Prevention Mode	For activation in Prevention Mode any one of the following two options shall be accepted:
	<b>Option 1</b> <ul style="list-style-type: none"> <li>• Signals from both HV and LV Circuit Breakers for open condition</li> <li>• Differential Relay <b>OR</b> Over Current Relay <b>OR</b> Restricted Earth fault relay.</li> <li>• Buchholz Relay <b>OR</b> Pressure relief valve.</li> </ul> <p><u>Description:</u> The NIFPES should be activated only after the receipt of both HV &amp; LV circuit Breaker open signals <b>AND</b> signal for activation of any one or more of the three i.e. Differential, Over Current, Restricted Earth fault relay <b>AND</b> signal for activation of any one or more of the Buchholz Relay, pressure relief valve.</p>
	<b>Option 2</b> <ul style="list-style-type: none"> <li>• Signals from both HV and LV Circuit Breakers for open condition</li> <li>• Differential Relay <b>OR</b> Over Current Relay <b>OR</b> Restricted Earth fault relay.</li> <li>• Pressure relief valve.</li> </ul> <p><u>Description:</u> The NIFPES should be activated only after the receipt of both HV &amp; LV circuit Breaker open signals <b>AND</b> signal for activation of any one or more of the three i.e. Differential, Over Current, Restricted Earth fault relays <b>AND</b> signal for activation of pressure relief valve.</p>
Fire Extinction Mode	<ul style="list-style-type: none"> <li>• Signals from both HV and LV Circuit Breakers for open condition</li> <li>• Fire Detector</li> <li>• Differential relay <b>OR</b> Over Current relay <b>OR</b> Restricted Earth fault relay</li> </ul>

**OR Pressure relief valve OR Buchholz Relay**

Description: The NIFPES should be activated only after the receipt of both HV & LV circuit Breaker open signals **AND** signal for activation of fire detector **AND** signal for activation of any one or more of the these i.e. Differential, Over Current , Restricted Earth fault relays, Buchholz Relay, Pressure relief valve.

5.4 System operation in manual electrical mode: This operation shall be active when selector switch on control box is in manual mode.

5.4.1 From Control Box available at control room

- A push button on the control Box should be provided for activation the system.
- The operating personnel should ensure that the HV & LV breaker are open.

5.4.2 From Fire Extinguishing Cubicle (FEC) available at 5-10 meter from the transformer

- A push button on the Fire Extinguishing Cubicle (FEC) to be provided for activation the system.
- The operating personnel should ensure that the HV & LV breaker are open.

5.5 System operation in manual mechanical mode i.e. in case of Sub- Station DC supply failure

- System shall have provision for manually oil draining and Nitrogen injection form the Fire extinguishing cubicle. The procedure for manual mechanical operation should be provided in the FEC in both Hindi and English.
- The operating personnel should ensure that the HV & LV breaker are open.

5.6 The NIFPES manufacturer should provide the warning information on the Control Box and FEC that "Ensure HV & LV breaker are open before operating in Manual mode" in Hindi and English both.

**6.0 OTHER REQUIREMENTS FOR SYSTEM INSTALLATION:**

- 6.1 Oil drain and nitrogen injection openings with gate valves (of suitable size) on transformer tank at suitable locations.
- 6.2 Flanges with dummy piece in Conservator pipe between Buchholz relay and conservator tank for fixing TCIV.
- 6.3 Suitable Fixtures (as required) on transformer top cover for mounting fire detectors, required valves to enable operation of the system.
- 6.4 Support/frame on tank side wall for mounting signal box.
- 6.5 Spare potential free contacts for system activating signals i.e. Differential relay, Over Current relay, Restricted Earth Fault Relay, Buchholz relay, Pressure relief valve, HV Circuit Breaker Open, LV circuit Breaker open, Transformer Isolation (master trip relay) and fire detector trip.
- 6.6 Pipe connections between transformer to Fire Extinguishing Cubicle (FEC) and Fire Extinguishing Cubicle to oil pit. The pipes shall be of galvanized iron material.
- 6.7 Cabling on transformer top cover for fire detectors, interconnection cabling between Signal box to Control Box and Control Box to Fire Extinguishing cubicle. The cabling should be suitably done for proper functioning of the system.
- 6.8 In order to place the fire Extinguishing Cubicle, plinth shall be constructed as per the drawing provided by the manufacturer.
- 6.9 In order to collect the drained oil upon activation of the system, oil-pit should be constructed with a capacity of not less than 10% of the total transformer oil volume. To achieve speedy drain of oil, the oil drain piping should have minimum bend and shall be directly terminated in to oil drain pit.
- 6.10 All other consumables necessary for operation of complete system.

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**7.0 DATA SHEET:**

SN	Item	Requirements
1.	Fire Extinction period on commencement of Nitrogen injection	Maximum 30 seconds
2.	Fire detectors heat sensing temperature	130 ± 2° C
3.	Heat sensing area	800 mm radius
4.	Power Source: Control Box. Fire extinguishing cubicle for lighting and heater	110 V DC (+10% & -15%) 240 V AC
5.	Nitrogen Cylinder	As per IS:7285 (Part – 2)
6.	Capacity of Nitrogen Cylinder	10m <sup>3</sup> gas
7.	Pressure of Nitrogen filling	150kg/cm <sup>2</sup>
8.	Oil Drain gate valve	Size : 80 mm, 01 No.
9.	Nitrogen Injection valve	Size: 25mm, 04 numbers, 02 each on HV & LV side
10.	Colour of cubicles & Nitrogen Injection pipes	Shade 538 of IS: 5
11.	Degree of protection of FEC	IP 55
12.	Sheet of FEC, Control Box & Signal Box	Steel sheet of thickness not less than 2mm

**8.0 Cabling:**

- 8.1 Fire survival cables, able to withstand 750 °C, 1.5 mm sq. with necessary no. of Conductors for connection of fire detectors in parallel shall be used (if applicable). The test certificates for the cables shall be submitted.
- 8.2 Fire retardant low smoke (FRLS) cable 1.5 mm sq. with necessary no. of Conductors for connection between transformer signal box/ marshaling box to control box and control box to fire extinguishing cubicle shall be used.
- 8.3 Fire retardant low smoke (FRLS) 1.5 mm sq. with necessary no. of Conductors for connection between Control and Relay panel to Control Box, Control box to DC supply source, Control box to AC supply source and fire extinguishing cubicle to AC supply source, signal box /marshaling box on transformer shall be used.

**9.0 PREVIOUS EXPERIENCE FOR QUALIFYING SUPPLIER:**

The supplier shall have a minimum experience of two years in the design, manufacturing, erection, testing and commissioning of nitrogen injection fire prevention and extinguishing system on power transformers of 21.6MVA or higher MVA. At least 2 sets of the system shall be in successful operation for a minimum period of the 2 years in order to meet the criteria. The supplier shall furnish the details of NIFPES supplied by them so far, giving order reference, name and address of the customer, indicating the dates of commissioning as well as performance certificate of successful and satisfactory operation for minimum two years from the customers.

**10.0 TESTS****10.1 TYPE TESTS**

- 10.1.1 Type test report of the NIFPES system: Type test report of the NIFPES system shall be submitted to RDSO along with the design/drawing documents. The system shall be tested by a NABL accredited recognized laboratory. Type test report submitted shall have used the input required for the operation of NIFPES as in RDSO specification. The fire extinction period mentioned in the report shall meet the requirements of this specification.




10.1.2 Type test report of Fire detector: Type test report of the Fire Detector shall be submitted to RDSO along with the design/drawing documents. The Fire detector shall be tested by a NABL accredited recognized laboratory. The heat sensing temperature and area mentioned in the report shall meet the requirements of this specification.

## 10.2 FACTORY TEST

The factory test of the NIFPES at the works of NIFPES manufacturer shall be conducted as per the format mentioned at Para 13.0 of NIFPES specification.

## 10.3 PERFORMANCE TEST

Performance test of the complete system shall be carried out after complete erection at site by the supplier's representative. These tests shall include simulation and verification of the response the complete system without actual draining of the oil and injection of the nitrogen gas. In addition to above, additional tests as required necessary shall be conducted.

## 11.0 DRAWINGS AND MANUALS

11.1 Detailed layout drawing along with the equipment drawings to be given in the tender along with complete bill of materials. After awarding of contract, detailed dimensional drawing of the system complete bill of materials including location and size of plinth for cubicle and recommended capacity of oil soak- pit shall be submitted for purchaser's approval. After approval 10 (ten) sets of all above drawings and 5 (five) sets of operation and maintenance instruction manual shall be submitted for purchaser's use.

11.2 Following test certificates/details shall also be submitted during the approval of drawings of NIFPES.

- i. Type, make, and quantity of Fire Sensing Component being used with Railway Transformer.
- ii. IP-65 protection certificate of the pressure reducer or pressure regulator and pressure gauges provided in the FEC.
- iii. IP-55 protection certificate of Fire Extinguishing Cubicle (FEC).
- iv. Type, make and quantity of the fire survival cable and test report of the cable reflecting withstand temperature (if applicable).
- v. Type and make of the FRLS cable of 1.5mm sq. along with Cable Manufacturer's Test Certificate.
- vi. Type test reports as mentioned in the Para 10.1.1 & 10.1.2.
- vii. Experience certificates as mentioned in Para 9.0.
- viii. The copy of Manual of NIFPES.
- ix. The purity certificate of Nitrogen of 99.99% purity for each cylinder.

## 12.0 SPARES:

One spare nitrogen gas filled cylinder filled with 10m<sup>3</sup> gas at 150 Bar and one set of the installed no. of fire detector shall be provided in addition to additional other recommended spares. The list of recommended spares is to be submitted along with the tender.

## 13.0 FORMAT FOR THE FACTORY TEST

13.1 Visual Inspection: Visual examination of the NIFPES equipment i.e. Fire Extinguishing Cubicle, Control box, Signal Box, Transformer Conservator Isolation Valve, Fire detectors, Fire survival cables (if applicable), and Fire Retardant Low Smoke cables shall be made as per the approved drawings and requirements mentioned in the clause no. 3.0 of this NIFPES spec.

13.2 Functional Test: Following functional tests on the Fire Extinguishing Cubicle and Control Box of NIFPES shall be conducted. 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.



Test Voltage ..... Volt				
SN	TESTS	Procedure	Requirement	Status
1.	System On	Switch on Power Supply	<ul style="list-style-type: none"> <li>➤ System ON Indicating Lamp should glow</li> <li>➤ System Healthy Indicating lamp should glow</li> </ul>	
2.	Lamp test	Push lamp test button	<ul style="list-style-type: none"> <li>➤ All indication lamps should glow.</li> </ul>	
3.	Out of service/Under maintenance	<ul style="list-style-type: none"> <li>➤ Insert Oil drain locking pin in Fire Extinguishing Cubicle</li> <li>➤ Insert Nitrogen Injection locking pin in Fire Extinguishing Cubicle</li> <li>➤ Selector Switch Auto/manual /OFF in OFF position</li> </ul>	<ul style="list-style-type: none"> <li>➤ In all conditions or any one condition (to be checked separately) system out of service, Indicating lamp should glow</li> <li>➤ System Healthy indicating lamp should go OFF.</li> </ul>	
4.	Transformer Conservator Isolation Valve (TCIV) open	TCIV put in open condition	<ul style="list-style-type: none"> <li>➤ TCIV open Indication should glow</li> <li>➤ TCIV close Indication should OFF</li> </ul>	
5.	Transformer Conservator Isolation Valve (TCIV) closed	TCIV put in close condition.	<ul style="list-style-type: none"> <li>➤ TCIV closed Indication should glow</li> <li>➤ TCIV open Indication should OFF</li> <li>➤ Audio Alarm should activate</li> </ul>	
6.	Oil drain valve open.	Open Oil Drain Valve in Fire Extinguishing Cubicle Manually.	<ul style="list-style-type: none"> <li>➤ Oil drain valve open Indication lamp should glow.</li> <li>➤ System Healthy Indicating lamp should OFF</li> <li>➤ Audio Alarm should activate</li> </ul>	
7.	Oil drain valve closed	Close Oil Drain Valve in Fire Extinguishing Cubicle Manually.	<ul style="list-style-type: none"> <li>➤ System Healthy Indication lamp should ON.</li> <li>➤ Oil drain valve closed Indication lamp should glow.</li> </ul>	
8.	Extinction in progress	Operate nitrogen release device in Fire Extinguishing Cubicle manually.	<ul style="list-style-type: none"> <li>➤ Extinction in progress Indication lamp should glow.</li> <li>➤ System Healthy Indication lamp should OFF</li> <li>➤ Audio Alarm should activate</li> </ul>	
9.	Nitrogen Injection valve closed	Close nitrogen release device in Fire Extinguishing Cubicle manually	<ul style="list-style-type: none"> <li>➤ System Healthy Indication lamp should ON</li> <li>➤ Nitrogen Injection valve closed Indicating lamp should glow.</li> </ul>	
10.	Nitrogen Gas Cylinder pressure low	Adjust manometer below the specified pressure.	<ul style="list-style-type: none"> <li>➤ Cylinder pressure low Indication lamp should glow.</li> <li>➤ System Healthy Indication lamp should OFF</li> <li>➤ Audio Alarm should activate</li> </ul>	
11.	Differential relay trip	Activate the signal at potential free contact of Differential Relay trip on terminal bar	<ul style="list-style-type: none"> <li>➤ Differential Relay trip Indicating lamp should glow.</li> <li>➤ System Healthy Indication lamp should OFF</li> <li>➤ Audio Alarm should activate</li> </ul>	

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		Deactivate the signal.	<ul style="list-style-type: none"> <li>➤ Healthy condition Indication lamp should turn ON</li> <li>➤ Differential Relay trip Indicating lamp should go OFF.</li> </ul>	
12.	Over Current Relay (OCR) Trip	Activate the signal at potential free contact of OCR trip on terminal bar	<ul style="list-style-type: none"> <li>➤ OCR trip Indicating lamp should glow.</li> <li>➤ System Healthy Indication lamp should OFF</li> <li>➤ Audio Alarm should activate</li> </ul>	
		Deactivate the signal.	<ul style="list-style-type: none"> <li>➤ System Healthy Indication lamp should turn ON</li> <li>➤ OCR Relay trip Indicating lamp should go OFF.</li> </ul>	
13.	Restricted Earth Fault (REF) relay trip	Activate the signal at potential free contact of REF trip on terminal bar	<ul style="list-style-type: none"> <li>➤ REF trip Indicating lamp should glow.</li> <li>➤ System Healthy Indication lamp should OFF</li> <li>➤ Audio Alarm should activate</li> </ul>	
		Deactivate the signal.	<ul style="list-style-type: none"> <li>➤ System Healthy Indication lamp should turn ON</li> <li>➤ REF Relay trip Indicating lamp should go OFF.</li> </ul>	
14.	Pressure Relief valve (PRV) Trip	Activate the signal at potential free contact of PRV trip on terminal bar	<ul style="list-style-type: none"> <li>➤ PRV trip Indicating lamp should glow.</li> <li>➤ System Healthy Indication lamp should OFF</li> <li>➤ Audio Alarm should activate</li> </ul>	
		Deactivate the signal.	<ul style="list-style-type: none"> <li>➤ System Healthy Indication lamp should turn ON</li> <li>➤ PRV trip Indicating lamp should go OFF.</li> </ul>	
15.	Bucholz Relay Trip	Activate the signal at potential free contact of Bucholz Relay trip on terminal bar	<ul style="list-style-type: none"> <li>➤ Bucholz Relay trip Indicating lamp should glow.</li> <li>➤ System Healthy Indication lamp should OFF</li> <li>➤ Audio Alarm should activate</li> </ul>	
		Deactivate the signal.	<ul style="list-style-type: none"> <li>➤ System Healthy Indication lamp should turn ON</li> <li>➤ Bucholz Relay trip Indicating lamp should go OFF.</li> </ul>	
16.	HVCB Open	Activate the signal at potential free contact HVCB Open on terminal bar	HVCB open indication should glow	
		Deactivate the signal	HVCB open indication should off	
17.	LVCB Open	Activate the signal at potential free contact LVCB Open on terminal bar	LVCB open indication should glow	
		Deactivate the signal.	LVCB open indication should off	
18.	Fire Detector Trip	Activate the signal at corresponding potential free contact on terminal bar	<ul style="list-style-type: none"> <li>➤ Fire detector trip Indication lamp should glow.</li> <li>➤ System Healthy Indication lamp should go OFF</li> <li>➤ Audio Alarm should activate</li> </ul>	
		Deactivate the signal.	<ul style="list-style-type: none"> <li>➤ Healthy condition Indication lamp should turn ON</li> </ul>	

			➤ Fire detector trip Indication lamp should go OFF.	
19.	DC Supply fail	Switch OFF DC Supply to Control Box	➤ DC Supply Fail indication should glow ➤ Audio Alarm should activate	
20.	AC Supply fail	Switch OFF AC Supply to Control Box	➤ AC Supply Fail indication should glow	
21.	System test for prevention mode (Auto mode)  (Logic mentioned at d, e, f is not applicable, if NIFPES manufacturers are providing the NIFPES as per the option 02 as mentioned in the specification, Para 5.3.)	a) Activate the following signals at potential free contacts on terminal bar i. HVCB & LVCB Open ii. Differential relay Trip iii. Pressure Relief Valve trip  b) Activate the following signals at potential free contacts on terminal bar i. HVCB & LVCB Open ii. REF Trip iii. Pressure Relief Valve trip  c) Activate the following signals at potential free contacts on terminal bar i. HVCB & LVCB Open ii. OCR Trip iii. Pressure Relief Valve trip  d) Activate the following signals at potential free contacts on terminal bar i. HVCB & LVCB Open ii. Differential relay Trip iii. Bucholz relay trip  e) Activate the following signals at potential free contacts on terminal bar i. HVCB & LVCB Open ii. REF Trip iii. Bucholz relay trip  f) Activate the following signals at potential free contacts on terminal bar i. HVCB & LVCB Open ii. OCR Trip iii. Bucholz relay trip	➤ Oil Drain valve should open ➤ Nitrogen gas should release ➤ Audio Alarm should activate. ➤ Following Indication lamps should glow - Oil drain valve open - Extinction in progress - Corresponding Indication of system activating signals ➤ System Healthy Indication lamp should go OFF.	
22.	System test for Extinction mode (Auto mode)	a) Activate the following signals at potential free contacts on terminal bar i. HVCB & LVCB Open ii. Fire Detector trip iii. Bucholz relay trip  b) Activate the following signals at potential free contacts on terminal bar i. HVCB & LVCB Open ii. Fire Detector trip iii. PRV trip	➤ Oil Drain valve should open ➤ Nitrogen gas should release ➤ Audio Alarm should activate. ➤ Following Indication lamps should glow - Oil drain valve open - Extinction in progress - Corresponding Indication of system activating signals ➤ System Healthy Indication lamp should go OFF.	

		<p>c) Activate the following signals at potential free contacts on terminal bar</p> <p>i. HVCB &amp; LVCB Open</p> <p>ii. Fire Detector trip</p> <p>iii. Differential relay trip</p> <p>d) Activate the following signals at potential free contacts on terminal bar</p> <p>i. HVCB &amp; LVCB Open</p> <p>ii. Fire Detector trip</p> <p>iii. REF trip</p> <p>e) Activate the following signals at potential free contacts on terminal bar</p> <p>i. HVCB &amp; LVCB Open</p> <p>ii. Fire Detector trip</p> <p>iii. OCR trip</p>		
23.	System test for manual Electrical from Control Box	<p>Activate following signals:</p> <p>i. Mode Selection switch in manual mode</p> <p>ii. Press Manual Extinction Operation Push Button on control Box.</p>	<p>➤ Oil Drain valve should open</p> <p>➤ Nitrogen gas should release</p> <p>➤ Audio Alarm should activate.</p> <p>➤ Following Indication lamps should glow</p> <p>-Oil drain valve open</p> <p>-Extinction in progress</p> <p>➤ System Healthy Indication lamp should go OFF.</p>	
24.	System test for manual Electrical from Fire Extinguishing Cubicle (FEC)	<p>Activate following signals:</p> <p>i. Mode Selection switch in manual mode</p> <p>ii. Press Manual Extinction Operation Push Button on Fire Extinguishing Cubicle.</p>	<p>➤ Oil Drain valve should open</p> <p>➤ Nitrogen gas should release</p> <p>➤ Audio Alarm should activate.</p> <p>➤ Following Indication lamps should glow</p> <p>- Oil drain valve open</p> <p>- Extinction in progress</p> <p>➤ System Healthy Indication lamp should go OFF.</p>	
25.	System test for Extinction mode Manual mechanical (To be used in case of d.c. supply failure)	<p>To be done on Fire Extinguishing Cubicle</p> <p>i. Push lever for Oil drain.</p> <p>ii. Push Lever for Nitrogen gas release.</p>	<p>➤ Oil Drain valve should open</p> <p>➤ Nitrogen gas should release</p>	
26.	Panel Lighting	<p>➤ Switch on 240V AC supply in fire extinguishing cubicle</p> <p>➤ Open Door of fire extinguishing cubicle</p>	Panel Lights should be in working condition when door is open	
27.	Heater operation	Switch on the heater in Fire extinguishing cubicle	Heater should be in working condition	
28.	High voltage test to be separately done on Control Box and Signal Box	Apply 2kV AC for 1 minute between terminal bar and Box body	Should withstand.	

29.	Communication with SCADA	Control Box shall have provision for interfacing with RTU through RS485 over MODBUS protocol	The NIFPES manufacturer should verify the MODBUS protocol at their works or submit a declaration by an RDSO approved SCADA vendor that, the NIFPES system has been verified by them for communication with RTU through RS485 over MODBUS protocol	
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### 13.3 Functional Test of Transformer Isolation Conservator Valve (TCIV):

SN	Test	Procedure	Requirement	
1.	Leakage Test	Immerse the TCIV in the oil and fill the inlet pressure as 4 kg/ cm <sup>2</sup> for 6 hours.	There should no leakage from TCIV body	
2.	TCIV Close 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"> <li>➤ TCIV should close at flow rate specified by manufacturer.</li> <li>➤ Flap closing shall be visible through transparent glass inspection window.</li> <li>➤ Normally open (NO) contacts should close</li> </ul>	
3.	Reset test	Reset the TCIV handle in the normal position.	<ul style="list-style-type: none"> <li>➤ Close contact should become open</li> <li>➤ Flap opening shall be visible through transparent glass inspection window.</li> </ul>	
4.	High voltage test	Apply 2kV AC for 1 minute between terminals and body	TCIV should withstand.	

### 13.4 Functional Tests of Fire detector:

- 13.4.1 The test report of the fire detector shall be submitted. The test report shall be of NABL accredited recognized laboratory. The operating temperature and the heat sensing area mention in the report shall be as per the requirement mentioned in this specification.
- 13.4.2 The NIFPES manufacturer submit the declaration that the same make and model/design of the Fire detector shall be supplied of which has been tested at the third party laboratory.

### 13.5 Live demonstration test in auto fire extinguishing mode:

#### 13.5.1 Procedure:

- (i) The Fire Detector shall be mounted on the Transformer tank.
- (ii) The Fire Extinguishing Cubicle, Control box, Signal box, Test panel, oil pit with all necessary pipes and cable connections shall be connected with transformer tank.
- (iii) The NIFPES System shall be made ON.
- (iv) Ignite the transformer tank oil to catch fire.
- (v) The Bucholz Relay or PRV Trip and HVCB & LVCB open Signal shall be activated by test panel.

#### 13.5.2 The time from the system active to fire quenched shall be measured by stop watch.

#### 13.5.3 Observations:

- (i) Due to fire, the fire detector shall be activated and give input to control panel.
- (ii) Oil Drain started.
- (iii) Nitrogen should be injected after a preset duration.
- (iv) Following Indications has been turned ON:

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a)	Oil Drain valve open	b)	Buchholz Relay trip or PRV Trip
c)	Extinction in progress	d)	Fire detector trip
e)	Audio Alarm activated	f)	LVCB open
g)	HVCB open	h)	Nitrogen cylinder pressure low

13.5.4 Results:

SN	Fire extinction period	Requirement	Observation
1.	On commencement of Nitrogen Injection	Maximum 30 seconds	(T2)= .....seconds

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