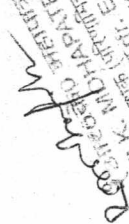


Research Designs and Standard Organization
(Traction Installation Directorate)

Addendum Corrigendum Slip No.10 (August, 2012) to technical specification No.ETI/PSI/118 (10/93) for
21.6/30.24 MVA, ONAN/ONAF, 220 or 132 or 110 or 66/27 kV single phase traction power transformer,
is based on the above as under

S.No.	Clause No.	Description	As amended
1.	Annexure - I	Nitrogen Injection Fire Prevention and Extinguishing System for oil Filled Transformer.	Added new Annexure - I Nitrogen injection fire prevention and extinguishing system for oil filled transformers provided for more than 10 MVA in line with IE Rule 2003 clause No.64. TECHNICAL SPECIFICATIONS FOR NITROGEN INJECTION FIRE PREVENTION AND EXTINGUISHING SYSTEM FOR OIL FILLED TRANSFORMER 1.0 GENERAL DESCRIPTION: Nitrogen injection fire protection system designed for oil filled transformers shall prevent tank explosion and the fire during internal faults resulting in an arc, where tank explosion will normally take few seconds after arc generation and also extinguish the external oil fires on transformer top cover due to tank explosion and /or external failures like bushing fires, OLTC fires and fire from surrounding equipment's. The system shall drain a pre- determined quantity of oil from the tank top through outlet valve to reduce the tank pressure and inject nitrogen gas at high 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. Conservator tank oil shall be isolated during bushing bursting, tank explosion and oil fire to prevent aggravation of fire. Transformer isolation shall be an essential pre-condition for activating the system. The system shall be designed to operate automatically. However it shall be designed for manual operation, in case of failure of power supply.


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The system shall consist of following equipment.

1. Fire extinguishing cubicle placed on a plinth at about 5-10 meter away from the transformer.
2. Control box placed in the control room.
3. Necessary valves in the conservator pipe.
4. Suitable fire sensing components to be provided preferably in/on the tank cover.
5. Signal box suitably placed.

2.0 SCOPE:

The scope of this specification covers design, engineering, supply, testing at works before dispatch; erection, testing and commissioning and performance demonstration of "fire protection 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 extinguishing cubicle 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 equipment & accessories required for erection, testing, commissioning and performance demonstration of the complete fire protection system is in the scope of the tenderer. It will be the responsibility of the tenderer, i.e. 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. Notwithstanding the technical specifications and requirements mentioned herewith any modification can be incorporated for correct operation of nitrogen injection fire protection system without extra cost. The full details of the same are required to be submitted to RDSO for approval, when first unit is implemented on a transformer of specific make & rating.

3.0 OPERATIONAL CONTROLS:

The system shall be provided with automatic control for fire prevention and fire extinction. Besides automatic control remote electrical push button control on control box and local manual control in the fire extinguishing cubicle shall be

provided. The fire protection system will take signal from HV / LV circuit breaker.

4.0 SYSTEM ACTIVATING SIGNALS:

4.1 Transformer Isolation shall be an essential pre-condition for activating the system. Provision shall be provided to isolate the Traction Power Transformer through Master trip relay or circuit breaker (HV and LV side in series) before Nitrogen Injection and after oil depressurization.

4.2 There shall be two modes of operation of Fire protection system i.e. Fire Prevention Mode & Fire Extinction Mode. In these mode the safety equipment to be involved are tabulated blow. The logic of their operation shall be finalised during design approval.

Mode of Operation	Safety Equipment to be used
Fire Prevention Mode	• Differential relay/ Over Current/ Restricted earth fault relay. • Pressure relief valve.
Fire Extinction Mode	• Fire sensing components • Buchholz relay

5.0 SYSTEM EQUIPMENT:

5.1 Fire Extinguishing Cubicle (FEC), placed on plinth at about minimum 5 meter away from the transformer shall consist of:

5.1.1 Nitrogen gas cylinder with pressure reducer /regulator and falling pressure electrical contact manometer.

5.1.2 Oil drain pipe with mechanical quick drain valve.

5.1.3 Electro mechanical control equipment for oil drain and pre-determined regulated nitrogen release.

5.1.4 Pressure monitoring switch for backup protection, Pressure reducer with solenoid Valve in the cabinet for operation of nitrogen gas release which will be IP - 65 protected and leak proof for nitrogen release.

5.1.5 Limit switches for monitoring of the system.

5.1.6 Flanges on top panel for connecting oil drain and nitrogen injection pipes for

transformer.

5.1.7 Panel lighting

5.1.8 Oil drain pipe extension of suitable sizes for connecting pipes to oil pit.

5.1.9 The Nitrogen gas cylinder should be of sufficient (not less than 50 litre)

capacity and should be filled at a pressure of not less than 150 bars with falling pressure electrical contact manometer. Suitable design measures to prevent leakage of gas to be taken.

5.1.10 The nitrogen valve shall have IP-65 protection. The nitrogen shall be contained within the cylinder and released from the cylinder valve only upon activation of the fire protection system. Nitrogen purity shall 99.99%.

5.1.11 Proper approvals and certificates should be provided with each cylinder. No used nitrogen bottle will be accepted.

5.2 Control box with activating, monitoring devices and line faults indicators to be placed in control room. It should have audio visual alarm indication and push button switches for tests response.

5.3 Necessary valves to be fitted in the conservator pipe line, between conservator and buchholz relay operating mechanically on transformer oil flow rate with electrical signal for monitoring.

5.4 Suitable fire sensors to be fixed on transformer tank top cover and Off Circuit Tap Changer for sensing fire.

5.5 Signal box to be fixed on transformer side wall for terminating cable connections from sensors and Conservator shutter / signal box to be suitably placed.

5.6 All other consumables necessary for operation of complete system.

5.7 Control Box should be microprocessor based and compatible to be interfaced with existing RTU for Railway Traction SCADA system available at the control room. For communication Control box shall have provision for interfacing with SCADA in this regards details Digital Input & Output required for operation monitoring through SCADA should be furnished.

6.0 OTHER REQUIREMENTS FOR SYSTEM INSTALLATION:

	2/3 6.1 Oil drain and nitrogen injection openings with gate valves on transformer tank at suitable locations. 6.2 Flanges with dummy piece in conservator pipe between Buchholtz relay and conservator tank for fixing. 6.3 Brackets on transformer top cover for sensing equipment, valves to enable operation of the system. 6.4 Spare potential free contacts for system activating signals i.e. differential relay, buchholz relay, pressure relief valve, transformer isolation (master trip relay). 6.5 Pipe connections between transformer to fire extinguishing cubicle and fire extinguishing cubicle to oil pit. 6.6 Cabling on transformer top cover all sensors to be suitably connected for reliable fire sensing and inter cabling between signal box to control box and control box to fire extinguishing cubicle. 6.7 Plinth for fire extinguishing cubicle. Oil pit with capacity as 10 % of total oil quantity of transformer. 7.0 TECHNICAL DETAILS: Fire Exinction period <table> <tr> <td>On commencement of Nitrogen injection:</td><td>Maximum</td><td>30</td></tr> <tr> <td>seconds.</td><td></td><td></td></tr> <tr> <td>On system activation up-to post cooling :</td><td>Maximum</td><td>3 minutes</td></tr> <tr> <td>Heat sensing temperature :</td><td>140 $\pm$2° C</td><td></td></tr> <tr> <td>Heat sensing area :</td><td>800 mm radius</td><td></td></tr> <tr> <td>Setting for operation to isolate conservator :</td><td>Min. 60 ltr. per minute</td><td></td></tr> </table> Power Source: <table> <tr> <td>Control Box</td><td>:</td><td>110 V DC</td></tr> <tr> <td>Fire extinguishing cubicle for lighting</td><td>:</td><td>240 V AC</td></tr> </table> 8.0 CABLING: 8.1 Fire survival cables, able to withstand 750 $^{\circ}$C, 1.5 mm sq. with necessary no. of Conductors for connection of fire detectors in parallel shall be used. The test Certificates for the cables shall be submitted.	On commencement of Nitrogen injection:	Maximum	30	seconds.			On system activation up-to post cooling :	Maximum	3 minutes	Heat sensing temperature :	140 $\pm$ 2 $^{\circ}$ C		Heat sensing area :	800 mm radius		Setting for operation to isolate conservator :	Min. 60 ltr. per minute		Control Box	:	110 V DC	Fire extinguishing cubicle for lighting	:	240 V AC	
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8.2	Fire retardant low smoke (FRLS) cable 1.5 mm sq. with necessary no. of conductors for connection between transformer signal box/ marshalling box to control box and control box to fire extinguishing cubicle shall be used.
8.3	Fire retardant low smoke (FRLS) cable 1.5 mm sq. with necessary no. of conductors for connection between control box to DC supply source and fire extinguishing cubicle to AC supply source, signal box/ marshalling box to 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 protection system on power transformers of similar or higher rating. At least 2 sets of the system shall be in successful operation for a minimum period of the 2 years. The supplier shall furnish the details of nitrogen injection fire protection systems 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 Type test reports including that for detectors along with declared response time as per test approval certificate letter shall be submitted along with the tender. The system shall be tested by international or a national testing body (NABL accredited recognized laboratory. Tariff Advisory Committee (TAC's) approval, if any, shall be submitted with the tender.
10.2	FACTORY TEST Tests will be carried out on individual equipment of the system and the total system in the supplier's workshop in presence of purchaser's representative.
10.3	PERFORMANCE TEST