



TRANSFORMER ENGINEERING DEPARTMENT

BHEL, JHANSI

ANNEXURE TO INDENT No.:
WO. NO.: 71832A17200

140670083

Rev. 00
DATE: 04-05-2017

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SPECIFICATION OF NITROGEN INJECTION TYPE FIRE PROTECTION SYSTEM

Nitrogen injection type fire prevention & extinguishing system with flow sensitive conservator isolation valve shall be provided for 160 MVA 220/132/33 kV Auto Transformers.

- 1) **Nitrogen Injection Fire Protection System (NIFPS)** shall be designed to prevent explosion of transformer tank and the fire during internal faults resulting from arc and also to extinguish the external oil fires on transformer/ reactor due to tank explosion and/or external failures like bushing fires, OLTC fires and fire from surrounding equipments, etc. The system shall work on the principle of Drain & stir. On activation, it shall drain a pre-determined quantity of oil from the tank top through drain valve to reduce the tank pressure, isolate conservator tank oil and inject nitrogen gas at high pressure from the bottom side of the tank through inlet valves to create stirring action and reduce the temperature of oil below flash point to extinguish the fire. The quantity of oil removed from the tank shall be such that adequate amount of oil shall remain to cover active part, i.e. core coil assembly even after stoppage of oil drain. Electrical isolation of transformer shall be an essential pre-condition for activating the system. The NIFPS shall conform to NEPA 70 Standard titled "Fire Protection of transformers and transformer vaults" and Tariff Advisory Committee (TAC) regulations .
- 2) **OPERATIONAL CONTROLS:** The system operation shall be fully automatic and activate from the required fire and other trip signals. In addition to automatic operation, remote operation from control room/ remote centre and local manual control in the fire extinguishing cubicle shall also be provided. System shall operate on following situations.
- 3) **PREVENTION OF TRANSFORMER EXPLOSION AND FIRE:** To prevent transformer explosion and fire in case of an internal fault, signals given by operation of Electrical protection relays and tripping of circuit breaker of transformer and operation of either Buchholtz relay, or pressure relief valve (PRV) **alongwith Rapid Pressure Rise Relay (RPRR) shall be used to activate the system and logic for RPRR for system activation should include for operation of Electrical protection relays and tripping of circuit breaker of transformer.** The exact logic for system activation shall be finalized during detailed engineering.
- 4) **FIRE PROTECTION:** In case of fire, sensed by fire detectors, the system shall be activated only after electrical isolation of the transformer, confirmed by breaker trip. If the fire detection is not associated with any other fault, the system activation shall be only manual. Manual operation switch shall be provided in the control room/ remote control centre with a cover to avoid accidental operation of it.
- 5) **OPERATION OF SYSTEM:** On receiving activation signal, the following shall take place:
 - i. Open the quick opening drain valve to drain the top layer oil
 - ii. Shut off the conservator isolation valve to prevent flow of oil from the Conservator tank to the main tank.
 - iii. Open the Nitrogen regulator valve to inject Nitrogen into the transformer tank to create stirring of oil.



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There shall be interlock to prevent activation of the system if the transformer is not electrically isolated. There shall also be provision for isolating the system during maintenance and/or testing of the transformer.

- 6) **TECHNICAL PARTICULARS:** The supplier shall be responsible for the design of the complete system and shall submit the drawings and design calculations for the number of fire detectors, pipe sizing of drain pipe and Nitrogen injection pipe, Nitrogen cylinder capacity, number of injection points, etc. and get approval from BHEL/MPPTCL. Facility shall be provided to test the system when the transformer is in service, without actually draining the oil and injecting Nitrogen. The Nitrogen regulator valve shall be designed in such a way that the Nitrogen shall not enter the transformer tank even in case of passing/ leakage of valve. The system shall work on station DC supply. MPPTCL shall give two distinct DC feeders in control. The control box of fire protection system shall have facility to receive these feeders for auto change over of supply. It shall be the contractor's responsibility to further distribute power to the required locations.

Following indications and alarms shall be provided in the cubicle as well as in control box:-

- Nitrogen cylinder pressure indication.
- Nitrogen cylinder pressure low.
- Fire in Transformer/ Reactor.
- Oil drain started.
- Conservator oil isolation valve closed.
- Nitrogen injection started.

7) **DETAILS OF SUPPLY & WORK FOR SYSTEM EQUIPMENTS AND OTHER RELATED ACTIVITIES:**

The scope of supply shall include the following items, any other items required for safe & trouble free operation of the system and the scope of works include complete earthwork (i.e. excavation, backfilling etc.), scope of supply also includes services to be availed by the purchaser for erection and commissioning of NIFPS at EHV sub-stations of MPPTCL in MP. , civil work with civil material for the entire open/ buried piping for the fire protection system, construction of safety wall, construction of oil pits with provision of oil storage tank of MS and pipe supports for open/ buried, entrenched and over ground piping. The system design shall also conform to TAC/NFPA norms

- (i) Fire extinguishing cubicle with base frame and containing at least the following:

- Nitrogen gas cylinder of sufficient capacity with pressure regulator and manometer with sufficient number of adjustable NO contacts.
- Oil Drain Assembly including oil drain pipe extension of suitable size for connecting pipes to oil pit.
- Mechanical release device for oil drain and nitrogen release.
- Limit switches for monitoring of the systems.
- Panel lighting.
- Flanges on top of the panel for connecting oil drain and nitrogen injection pipes for transformer.
- Limit switch for pressure switch/sensor.
- Pressure indicators for Nitrogen pressure in the cylinder and after Nitrogen regulator.
- Rapid Pressure Rise Relay (RPRR) FOR NIFPS System

- (ii) Control box to be installed in the control room of the station for monitoring system operation, automatic control and remote operation, with alarms, indication light, switches, push buttons, audio signal, suitable for tripping and signaling.



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- (iii) Conservator isolation valve which shall be flow sensitive and shut off when the flow in the pipe is more than the flow expected in the permissible normal operating conditions. It shall be provided with position indicator remote alarm indication.
- (iv) Required number of fire detectors to be located in strategic locations.
- (v) Flow Sensitive Conservator Isolation Valve
- (vi) All controls, alarms, panels, cables, cable trays (if required), junction boxes etc.

8) INSTALLATION AND PRE-COMMISSIONING TEST: After installation the system pre-commissioning tests shall be carried out jointly with the MPPTCL representative before the system is put in service.

9) In order to restrict the supply of oil in case of a fire in transformer, provision shall be made to isolate the conservator oil from the main tank.

10) A valve which shall be flow sensitive and shut off when the flow in the pipe is more than the flow expected in the permissible normal operating conditions. This valve shall be located in the piping between the conservator and the buchholz relay and shall not affect the flow of oil from and to the conservator in normal conditions.

11) When the flow from conservator to main tank is more than the normal operating conditions, the valve shall shut off by itself and will have to be reset manually. It shall be provided with valve open/close position indicator along with alarm indication in control room during closing operation of valve.

12) The necessary switches shall be provided in cooler control cabinet / common marshalling box for manual open / close operation of the valve.

13) Following Test Certificates shall be required along with each NIFPS System

Ref. Std.	Test-certificates required
TAC/NEPA norms	1. Lamp test 2. Out of Service 3. Transformer Conservator Insulator Valve (TCIV) open 4. Transformer Conservator Insulator Valve (TCIV) closed 5. Fire Detector trip 6. Buchholz Relay trip 7. Differential Relay trip 8. PRV trip 9. RPRR trip 10. Transformer trip 11. D.C. fail etc..

14) NIFPS system shall be offered along with complete catalogue, manuals & drawings.

15) Size & capacity of Oil sump/ pit, MS Tank for Nitrogen Injection Fire Protection System shall be submitted along with offer.



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GUARANTEED TECHNICAL PARTICULARS

NOTE : TECHNICAL PARTICULARS TO BE FILLED-IN BY BIDDER WHICH WILL BE READ AT THE TIME OF BID OPENING (It may be carefully noted that filling/reply of each and every clause described below is a must).

Sr. No.	Particulars	
	Details of system equipments for NIFPS	
A	Fire Extinguishing Cubicle (FEC) of NIFPS	
1	Dimensions (LXBXH) mm	
2	Weight kG	
3	Capacity of Nitrogen cylinder	
4	Number of cylinders	
5	Pressure of Nitrogen filling	
6	Minimum distance of FE cubicle from the transformer	
7	Method of mounting	
8	Whether the following items are provided in FE cubicle. If so furnish make, type & other details.	
9	Contact manometer	
10	Pressure Regulator	
11	Oil Release Unit	
12	Gas release unit	
13	Oil drain assembly	
14	Pressure /limit switches	
15	No of contacts & spare contacts (NO & NC)	
16	Oil drain valve (above FEC)	
17	Make	
18	Type	
19	Size	
20	Type of metal	
21	Nitrogen Injection Valve (above FEC)	
22	Make	
23	Type	
24	Size	
25	Oil drain pipe	
26	Size	
27	Length	
28	Number of openings in the transformer tank	
29	Material	



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B	Control Box of NIFPS	
1	Dimensions (LXBXH) mm	
2	Weight	
3	Type & Thickness of sheet steel	
4	Details of components provided in the control box	
5	Control voltage	
6	Method of mounting	
7	Whether audio and visual alarms provided?	
C	Transformer Conservator Isolation Valve of NIFPS	
1	Make	
2	Type	
3	Location	
4	Whether suitable for pipe of size 80mm dia	
5	No of contacts & spare contacts (NO & NC)	
6	Padlocking provision	
D	Detectors of NIFPS	
1	Make	
2	Type	
3	Quantity required	
4	Method of fixing	
5	Effective heat sensing area	
6	Temperature recommended for effective heat sensing	
7	Number of contacts NO/NC	
8	Necessity and Condition of Refilling	
E	Whether approved by Tariff Advisory Committee of India	
F	Power Supply of NIFPS	
1	Control box	
2	FEC (lighting)	
3	Extinction period	
4	On system activation	
5	On commencement of Nitrogen injection	
G	FEC suitable for capacity of NIFPS	
1	Dimensions (LXBXH) mm	
2	Weight	
3	Nitrogen cylinder capacity	
H	Control Box of NIFPS	
1	Dimensions (LXBXH) mm	
2	Weight	



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I	Detectors of NIFPS		
1	Heat sensing temperature		
2	Time of Operation	Transformer Tank Explosion Prevention	Fire Extinction
a	For system activation		
b	For reduction of pressure in Tank by Nitrogen release		
3	Any other technical details not covered above		

- NOTE :**
- 1 Particulars of all items may please be furnished clearly.
 - 2 In case of descriptive literature give page and paragraphs reference clearly.

SIGNATURE
WITH SEAL OF BIDDER