

## **SECTION - FIRE PROTECTION SYSTEM**

### **I. TECHNICAL SPECIFICATION FOR PORTABLE TYPE FIRE EXTINGUISHERS.**

#### **1.0 SCOPE:**

1.1 This specification provides for manufacture, inspection and testing before dispatch, packing and delivery for destination of firefighting equipments required for 400,220KV, 110KV & 66KV substations.

a) Pressurized water type.

b) Dry chemical powder type.

c) CO<sub>2</sub> Type extinguisher.

d) Mechanical foam type (Back pack /wheel /Trolley mounted fire extinguishers).

e) GI Buckets.

f) Steel stand for Buckets.

1.2 The firefighting equipments shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of offer and purchaser shall have the power to reject any work or material, which in his judgment, is not full accordance there with. All the extinguishers offered by the bidder shall be of reputed make and shall be ISI marked.

#### **2.0 MATERIAL, DESIGN, WORKMANSHIP AND CONSTRUCTION:**

2.1 The fire fighting equipments shall be suitable for outdoor use.

2.2 The portable fire extinguishers shall be complete with handle, bracket, trolley (wherever necessary) and other connected accessories. The bracket design shall be such that the extinguisher can be easily removed during the fire emergency.

2.3 Front of the portable fire extinguishers shall be clearly marked with the type of extinguisher capacity, contents and shall have the instructions for operating the extinguishers on its body itself.

2.4 In case, of GI buckets, suitable stand hooks shall be provided for keeping 4 Nos. at a place. The buckets shall be secured at a height of 0.9 Mtrs

and above ground level. The buckets shall be enamel painted (RED) with the contents indicated on each bucket.

- 2.5 Reputed makes of various fire extinguishers shall be offered which is subject to approval of the purchaser. All extinguishers shall be approved by the National standards Institution.
- 2.6 All the portable extinguisher shall be of freestanding type and shall be capable of discharging freely and completely in upright position.
- 2.7 All extinguishers shall be supplies with initial charge and accessories as required.
- 2.8 Portable type extinguishers shall be provided with suitable clamps for mounting on walls or columns.
- 2.9 The container holding the extinguisher shall be corrosion free and suitable for indoor & outdoor application. All extinguishers shall be painted with durable enamel paint of fire red colour conforming to relevant Indian standard.
- 2.10 Pressurization of water type fire extinguishers shall either be done by compressed air or by using gas cartridge. Both constant air pressure and the gas pressure type shall conform to IS 15683:2006. Both these extinguishers shall be ISI marked.
- 2.11 Dry chemical powder type portable extinguishers shall conform to IS 15683:2006.
- 2.12 Carbon Dioxide type portable extinguishers shall conform to IS: 15683:2006 and Carbon Dioxide type trolley mounted extinguishers shall conform to IS: 2878.
- 2.13 Wheel /Trolley mounted fire extinguishers of 50 litre capacity Mechanical foam type shall conform to IS: 13386
- 2.14 The steel stand for hanging buckets shall conform to relevant IS standards.

### **3.0 TEST:**

- 3.1 All type tests and routine/ acceptance tests shall be conducted as per relevant IS.

### **3.2 TYPE TESTS:**

3.2.1 Type tested Portable type Fire extinguishers shall be offered. The type test reports shall not be older than ten (10) years as on the last date of submission of bid.

**a) For Portable type Fire extinguishers manufactured in India:**

- i. The type tests on indigenous equipment for which testing facility is available in India, should have been conducted in any independent laboratories approved by the Government or the laboratories accredited by the National accreditation body of the country like Central Power Research Institute (CPRI), Electrical Research and Development Association (ERDA), etc.
- ii. The type tests on indigenous equipment, for which testing facility is not available in India, should have been conducted in a laboratory of foreign country accredited by National accreditation body of that country.
- iii. The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of NABL accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.

**b) For Portable type Fire extinguishers manufactured Abroad:**

- i. Type tests on imported equipment should have been conducted in an Indian Laboratory or foreign laboratory accredited by National accreditation body of the country where the Type test has been conducted.
- ii. The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.  
In case of in-house type tested imported equipment of foreign OEM, the term “Purchasing Utility” covers the foreign Utility who has purchased that equipment

#### **4.0 PAINTING:**

Each fire extinguisher shall be painted with durable enamel paint of fire red colour conforming to relevant Indian Standards.

## **II. NITROGEN INJECTION FIRE PREVENTION AND EXTINGUISHING SYSTEM (NIFPES) FOR OIL FILLED TRANSFORMER - SPECIFICATION**

### **1.0 SCOPE**

The scope of supply shall cover design, engineering, manufacture, assembly and testing at works, packing/dispatch, supervision of erection, testing & commissioning of Nitrogen Injection Fire Prevention & Extinguishing System (NIFPES) complete with all fittings and accessories at site for Transformers upto 220kV Voltage class. However, NIFPES with Arc sensor (if applicable) shall be considered for Transformers upto 100MVA rating, 220kV Voltage class.

#### **1.1** The scope of supply shall also include the following for the NIFPES:

- a. Power and Control Cable: FRLS cable/FS cable/Special cable (screened cable) from ACDB, Transformer, Control & relay panel, SCADA/SAS cabinet etc. to NIFPES signal Box, control box, FEC, fittings and accessories.
- b. Suitable piping arrangement along with required accessories from transformer to NIFPES panels/Oil soak pit.

#### **1.2** It is not the intent to specify completely herein all details of the design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing in continuous commercial operation up to supplier's guarantee in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment, is not in accordance therewith. The equipment offered shall be complete with all components necessary for effective and trouble free operation. Such component shall be deemed to be within the scope of supplier's supply irrespective of whether those are specifically brought out in this specification and/ or the commercial order or not.

### **2.0 GENERAL**

### **DESCRIPTION**

#### **2.1** Nitrogen Injection Fire prevention & Extinguishing System (NIFPES) designed for oil Transformers shall prevent tank explosion and the fire during internal faults resulting in an arc where tank explosion will normally take few milli seconds after arc generation and also extinguish the external fires on Transformer top cover due to tank explosion and / or external failures like bushing fires, OLTC fires and fire from surrounding equipments. It should be fully automatic and shall require

minimum maintenance and practically no running cost.

- 2.2** On activation of the system, a pre-determined quantity (10% by volume) of oil from the tank top through outlet valve shall be drained to reduce the tank pressure, isolate conservator tank oil 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. On operation, the quantity of oil removed from the tank shall be such that adequate amount of oil shall remain to cover active part (ie., core coil assembly).
- 2.3** The NIFPES system shall extinguish the fire within reasonable time of system activation & within 30 seconds (maximum) of commencement of Nitrogen injection.
- 2.4** Transformer isolation shall be an essential pre-condition for activating the system.
- 2.5** The system shall consist of following equipments.
- a) Fire extinguishing cubicle (FEC) placed on a plinth at about 5-10 metres away from the Transformer or placed next to the fire wall if fire wall exists.  
The FEC shall be connected to the top filter valve level of Transformer oil tank for depressurization of tank and to the oil pit (capacity is approximately equal to 10% of total volume of oil in Transformer tank) from its bottom through oil pipes. The FEC should house a pressurized nitrogen cylinder (s) with a valve fitted on top of it so that Nitrogen gas shall contain within the cylinder. Unless the system is activated, Nitrogen gas shall not be allowed to be released from the cylinder. Nitrogen Injection outlet from Fire Extinguishing Cubicle is connected at the Nitrogen Injection inlets available at Transformer main tank.
  - b) Required number of Arc sensors (if applicable) shall be provided.
  - c) Control box/Panel placed in the control room.
  - d) Transformer Conservator Isolation Valve (TCIV) in the conservator pipe between the conservator tank and Buchholz relay. Backup valve may be provided to the main valve, if necessary. These backup valves could be operated on the same principle or by a different principle as the main valve.
  - e) Required number of Fire detectors/Linear heat detectors on the tank top cover specially designed to generate signals after sensing higher temperature.

- f) Signal box fitted on the tank top or tank side wall for terminating signals from Fire detectors/LHD, Arc sensors (if applicable), TCIV and for cable for connecting to control box.
- g) On line functional testing facility of the system.
- h) Cable connections are to be provided from signal box to the control box, from control box to FEC and from TCIV/tank mounted protection devices/Arc sensors (if applicable) to signal box. Linear Heat Detector/Fire detectors/Arc sensors (if applicable) placed on the top of Transformer tank to be connected to the signal box by Fire survival cables. Control box is also to be connected to control and relay panel in control room for receiving system activation signals.

**2.6** The bidder shall furnish the complete details including bill of materials of the NIFPES offered. The list of all accessories including FRLS & Fire Survival cables, pipes, valves, sensors, control cubicle, Nitrogen gas cylinder, etc. shall be listed out and furnished.

### **3.0 OPERATION**

### **CONTROLS**

- 3.1** Mal-functioning of the NIFPES could lead to interruption in power supply. The supplier shall ensure that the system will not malfunction for any reasons whatsoever. To achieve this objective, the supplier shall plan out scheme of activating signals which should not be too complicated to make the system inoperative in case of actual need.
- 3.2** The system shall be provided with automatic controls for fire prevention and fire extinction and to prevent the explosion of Transformer. Besides, remote electrical push button control on control box, local manual control in the fire extinguishing cubicle shall be provided.
- 3.3** Suitable Logic shall be used for activating the system under prevention mode/fire extinguishing mode. The exact logic for system activation shall be finalized during detailed engineering.
- 3.4** Depressurisation of the system shall happen by draining oil through drain valve. The Nitrogen Injection shall cause stirring of Transformer oil and should immediately drop the temperature of top oil below flash point to extinguish fire within a minimum possible time and shall limit the damages of overheated parts affected by short circuit. Nitrogen injection should continue for sufficient time, which will further cool the Transformer and prevent any recombustion.
- 3.5** Fire protection back up system shall be provided to function in case if all Transformer electrical protections leading to breaker trip or if all sensors

have failed during the incident, by the conventional nitrogen fire extinguishing method.

- 3.6** On initiation of the NIFPES system on detection of fire, if the circuit breakers fail to trip/trip-relay fails to operate, suitable audible alarm should be generated so as to call the attention of the operator to trip the breakers manually and simultaneously initiating nitrogen injection system/oil drain as applicable.
- 3.7** The manual operating system shall be used only in case the automatic system fails to operate and hence the arrangement for manual operation shall be provided in a box both in control cubicle & FEC and shall be accessible only after breaking the glass/ protective cover on this box to avoid accidental operation of it.
- 3.8** The system shall be of automatic operation and in addition, remote push button control (manual) through control box and manual local control in fire extinguishing cubicle are to be provided.
- 3.9** Manual Mode (Local / Remote-Electrical)  
Tripping of all circuit breakers (on HV & LV side) associated with the Transformer is the pre-requisite for activation of system.
- 3.10** Manual Mode (Local- Mechanical)  
Tripping of all circuit breakers (on HV & LV side) associated with the Transformer is the pre-requisite for activation of system. The system shall be designed to be operated manually in case of failure of power supply to the system.
- 3.11** There shall be interlock to prevent activation of the system if the Transformer is not electrically isolated.
- 3.12** There shall also be provision for isolating the system during maintenance and/or testing of the Transformer.
- 3.13** During the initiation / activation of the system, for prevention of tank explosion or for fire protection, the oil from the conservator tank should be isolated, by action of TCIV.
- 3.14** Fire fighting system shall be compatible to **station SCADA/SAS**.

#### **4.0 TECHNICAL**

#### **PARTICULARS:**

- 4.1** The contractor 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, number of Arc sensors (if applicable) etc. and get approval from KPTCL.

- 4.2** Facility shall be provided to test the system when the Transformer is in service, without actually draining the oil and injecting Nitrogen.
- 4.3** 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.
- 4.4** Owner shall provide two distinct station auxiliary DC feeders for control purposes. The system shall work on station DC supply with voltage variation of +10% & -15%. The control box of fire protection system shall have facility to receive these feeders for auto changeover of supply. It shall be the supplier's/manufacture's responsibility to further distribute power to the required locations. In case auxiliary DC power supply requirement is different than the station auxiliary DC supply, then all necessary DC-DC convertors shall be provided by the supplier/manufacture.

**4.5 Typical technical parameters of NIFPES System are as follows:**

a	Fire extinction period from commencement of nitrogen injection	30s (Max.)
b	Fire detector's/Linear heat detector's heat sensing temperature	130 ±2°C or suitable temperature recommended by the manufacturer.
c	Transformer Conservator Isolation Valve setting for normal operation (Valve should not close) to ensure no obstacle for Transformer breathing.	40 Ltrs/Min. (as applicable)
d	Transformer Conservator Isolation Valve setting for operation during abnormal flow of oil due to rupture/explosion of tank or bursting of bushing/oil drain during system operation.	60 Ltrs/Min.(Minimum) (as applicable)
e	Capacity of nitrogen cylinder	10m <sup>3</sup> gas at pressure of 150kg/cm <sup>2</sup> upto 60,000 litres oil capacity of



		Transformer tank and 20m <sup>3</sup> gas at pressure of 150kg/cm <sup>2</sup> above 60000 litres oil capacity of Transformer tank or as recommended by the supplier/manufacturer.
f	Power supply 1. For Control Box	110V DC (for 110kV and 66kV Sub-station)/220V DC (for 400kV & 220kV Sub-station)
	2. For Fire extinguishing cubicle for lighting	230V AC
g	Nitrogen cylinder	PESO approved
h	Colour of cubicles & Nitrogen injection & oil drain pipes	Shade 538 of IS: 5

## **5.0 DETAILS OF MAJOR SYSTEM COMPONENTS AND OTHER REQUIREMENTS FOR SYSTEM INSTALLATIONS.**

NIFPES system shall broadly consist of the following components. However, all other components which are necessary for fast, reliable and effective working of the system shall be deemed to be included in the scope of supply.

### **5.1 SYSTEM EQUIPMENT:**

#### **5.1.1 Fire extinguishing cubicle (FEC):**

**5.1.1.1** The Cubicle Frame shall be made of CRCA sheet of 2 mm (minimum) thick complete with the base frame, painted inside and outside with shade 538 of IS:5. It shall have hinged split doors fitted with high quality tamper proof lock. The doors, removable covers and panels shall be gasketed all round with neoprene/EPDM gaskets. The degree of protection shall be IP55. FEC shall have LED light and heater with thermostat. FEC should be weather & vermin proof and cable glands (as required) shall be provided for terminating cables.

**5.1.1.2** The following items shall be provided in the Cubicle.

- a) Nitrogen gas cylinder of sufficient capacity with pressure regulator & manometer along with gas transmitters for remote gas pressure display and sufficient number of adjustable NO contacts.

The Nitrogen gas cylinder should be of sufficient capacity considering the actual quantity of the transformer oil. The pressure of the gas filled in the cylinder should be of 150kg/cm<sup>2</sup>. The capacity of the cylinder should be decided by the NIFPES manufacturer in consultation with transformer manufacturer. The capacity of cylinder should be mentioned on the cylinder for reference of KPTCL.

The nitrogen shall be contained within the cylinder and released from the cylinder through an operating valve only upon activation of fire protection system. No used cylinders should be provided. NIFPES manufacturer shall ensure to provide the cylinders having the PESO (Petroleum and Explosive safety Organization) certificates. Nitrogen gas purity shall be 99.99 percentage.

- b) Nitrogen gas cylinder fitted with Solenoid Valve & Pressure Sensor for cylinder pressure monitoring
- c) Solenoid Valve fitted on the cylinder should have Mechanical over ride function
- d) Pressure Sensor for Nitrogen Leak monitoring which shall also do the function of Backup protection for Nitrogen Injection.
- e) Nitrogen injection pipes shall be made of stainless steel.
- f) Nitrogen flow regulator is desirable to regulate the flow of nitrogen during injection depending on the capacity of the Transformer.
- g) Safety pressure relief valve is required near the Nitrogen regulator.
- h) Provision shall be made to monitor both Nitrogen injection pressure as well as cylinder pressure.
- i) Oil Drain Assembly – Oil drain pipe with mechanical quick drain valve.
- j) Electro mechanical control equipment for draining of oil of predetermined volume and injecting regulated volume of nitrogen gas.
- k) In case of emergencies when DC failure occurs or failure of electromagnet occurs, there should be provision for manual operation both for initiating oil draining and nitrogen injection.
- l) Back up pressure switch which could operate during fall in static pressure of oil in oil drain pipe is required as an alternate device to initiate nitrogen injection during failure of limit switch which is supposed to trigger nitrogen injection.
- m) Alarm shall be provided for any oil leakage through the drain valve in FE cubicle during steady state condition of the Transformer by sensing the oil leakage.
- n) Limit switches for monitoring of the systems.
- o) Limit switch for pressure switch / sensor.

- p) Butterfly valve with flanges on top of the panel for connecting oil drain and nitrogen injection pipes for Transformer.
- q) Isolation valves for oil drain pipe and Nitrogen injection pipe are to be provided in the fire extinguishing cubicle for accommodating testing of the system for different logics.
- r) Provision for testing on live Transformers to ensure healthiness at all times.
- s) Oil drain pipe extension of suitable sizes for connecting pipes to oil pit.
- t) Indication glass window shall be provided for visual inspection of Nitrogen gas pressure, Oil leakages/seepages in FE cubicle
- u) All equipments/devices shall be provided with identification label along with description pasted on top/bottom of respective equipment/device.
- v) Logic for system activation in prevention & extinguishion mode and operation instruction plate shall be provided inside the FE cubicle.
- w) Panel lighting (LED type)
- x) Following minimum indications shall be provided in the FE cubicle.
  - i. Nitrogen cylinder pressure low.
  - ii. Oil drain started.
  - iii. TCIV valve closed.
  - iv. Nitrogen injection started.
  - v. DC supply fail.
  - vi. Oil drain valve closed.
  - vii. Gas inlet valve closed.

**Note:** Oil drain mechanism & associated accessories may or may not be a part of the FEC as per the design of NIFPES manufacturer.

### **5.1.2 Control box:**

**5.1.2.1** Control box shall be installed in the control room of the station for monitoring system operation, automatic control and remote operation, with alarms, indication lamps, switches, push buttons, audio signal suitable for tripping and signaling on 110V DC supply for 110kV & 66kV Sub-stations and 220V DC supply for 220kV & 400kV Sub-stations.

**Note:** The minimum working voltage shall be 110V DC. The operating voltage of all the relays used in the system shall be minimum of 110V DC.

**5.1.2.2** The control box shall be vermin proof and cable glands (as required) shall be provided for terminating cables.

**5.1.2.3** Any sensing relays if provided shall be placed in the control box.

**5.1.2.4** Following minimum **indications and alarms** shall be provided in the control box.

- a. System in service.
- b. System out of service.
- c. Oil drain valve open.
- d. Gas inlet valve open.
- e. TCIV open.
- f. Extinction in progress.
- g. Oil drain valve closed.
- h. Gas inlet valve closed.
- i. TCIV valve closed.
- j. Oil drain started.
- k. Nitrogen injection started.
- l. LV Circuit Breaker open.
- m. HV Circuit Breaker open.
- n. Differential relay trip.
- o. Bucholz relay trip.
- p. Pressure relief valve trip.
- q. Fire detector trip.
- r. Arc sensor relay operated (if applicable).
- s. NIFPES system in Auto mode.
- t. NIFPES system in manual mode.
- u. NIFPES in OFF position.
- v. NIFPES active in prevention mode.
- w. NIFPES active in extinguishing mode.
- x. Oil leakage through Drain valve in FE cubicle.
- y. Nitrogen gas leakage in the FE cubicle.
- z. Nitrogen cylinder pressure low.
- aa. DC supply fail.
- bb. AC supply fail.

**5.1.2.5** Potential free contacts for the above shall be provided and duly wired upto the TB's for Alarm/indication/status for SAS. Any additional requirement during Engineering/execution shall be provided.

**5.1.2.6** Provision for indication of N2 cylinder pressure shall be made and 4-20mA signals (Gas transmitters) shall be provided for display of N2 cylinder pressure in the Control box.

**5.1.2.7** Other provisions on the Control Box/panel.

- a. Push Button for lamp test.
- b. Mode selection switch - Auto/Local/OFF.
- c. Extinction Release (manual operation) Push Button.
- d. Audio Alarm.

**Note:**

- 1. The NIFPES manufacturer should provide the following warning information on the control box & FEC: “ Ensure HV & LV breaker are open before operating in manual mode”.
- 2. Suitable schematic diagram plates made of stainless steel or anodized Aluminium with black lettering and lines shall be fixed on the inside surface of the Control Box and FEC Cubicle.

**5.1.3 Transformer Conservator Isolation Valve (TCIV) :**

TCIV shall be fitted in the conservator pipe line, between conservator and Buchholz relay and shall operate for isolating the conservator during abnormal flow of oil due to rupture/explosion of tank or bursting of bushing including tank depressurization during system operation. The valve will not isolate conservator during normal flow of oil during filtration or filling or refilling. Locking plates shall be provided with handle for pad locking to ensure no movement of valve position during service and filter position. It shall have proximity switch for remote alarm and indication glass window for visual inspection similar to Buchholz glass inspection window for physical checking of the status of valve. The TCIV shall be of the best quality as malfunctioning of TCIV could lead to serious consequences. The closing of TCIV means stoppage of breathing of Transformer. Fire survival cable connecting TCIV shall be terminated in Signal box.

**5.1.4 Fire detectors/Linear heat detectors (LHD) :**

- 5.1.4.1** Fire detectors/LHD shall be specially designed to generate an electrical signal to NIFPES system after sensing higher temperature.
- 5.1.4.2** Required number of Fire Detectors / Linear Heat Detectors rated for heat sensing at  $130 \pm 2$  deg C or suitable temperature recommended by the manufacturer shall be provided.
- 5.1.4.3** Linear Heat Detector (LHD) shall be laid on Transformer cover with conduit in such a way that the conduit wall will be touching the Transformer cover to enable Heat Sensing by conduction. LHD shall be connected with signal box/control box.

**5.1.4.4** NIFPES supplier shall specify the replacement/maintenance plan of fire detectors/LHD used in the system in their operation & maintenance manual of NIFPES.

**5.1.4.5** NIFPES manufacturer to ensure that the sensor used during testing in third party testing lab, NIFPES live demonstration testing & actual installation at site should be same.

**5.1.5 Arc sensors (if applicable):**

Required number of Arc sensors (if applicable) shall be provided.

Arc sensors, if provided, Transformer isolation command shall be initiated by the NIFPES system within maximum of 3 cycles of occurrence of internal fault. However, the system shall not electrically isolate the Transformer from power supply for through faults.

**5.1.6 Signal box.**

Signal box shall be provided for terminating cable connections from Arc sensors (if applicable), Transformer Conservator Isolation Valve, Fire detectors/LHD, etc. The degree of protection shall be IP55. Signal box shall be weather & vermin proof and cable glands (as required) shall be provided for terminating cables.

**5.1.7 Mandatory spares to be supplied with the NIFPES**

- |  |        |
|--|--------|
| a. Cylinder filled with Nitrogen of required capacity per transformer    | 1No.   |
| b. Fire detectors per transformer  | 3 Nos. |
| c. Arc sensors (if applicable) per transformer                           | 3 Nos. |
| d. Regulator assembly per sub-station                                    | 1 No.  |
| e. Linear Heat Sensing cable of required length (if any) per transformer |        |

**5.2 ARRANGEMENTS REQUIRED ON TRANSFORMER TANK:**

**5.2.1** Oil drain opening with pipe flange and manual gate valve at about 120mm below the top cover.

**5.2.2** Nitrogen injection openings with suitable size of pipe with flange and manual gate valve on tank sides at about 50- 200mm from the bottom plate.

**5.2.3** Flanges with dummy piece in the conservator pipe between buchholz relay and conservator tank for fixing TCIV .

**5.2.4** Provision for Pressure sensors, Temperature Sensors or any other sensors if required.

- 5.2.5** Suitable fixtures (as required) on transformer top cover for mounting fire detectors/LHD.
- 5.2.6** Suitable provisions for mounting of any sensors (if required) shall be provided on the Transformer top cover/Tank.
- 5.2.7** Supply and welding of the brackets for fixing signal box at a suitable location on top cover or tank side wall.  
Guidelines be given for Transformer manufacturers to make arrangements on new Transformer during tank fabrication.
- 5.2.8** Pipe connections between Transformer, fire extinguishing cubicle and oil pit. The pipes shall be of galvanized iron material.
- 5.2.9** Oil drain pipe of suitable size for connection between outlet valve provided on the Transformer tank and the flange provided on FE cubicle top.
- 5.2.10** Oil drain pipe of suitable size for connection between oil drain pipe bottom (in FE cubicle) to the oil pit. To achieve speedy drain of oil, the oil drain piping should have minimum bends and shall be directly terminated in to oil drain pit.
- 5.2.11** Nitrogen injection pipe of suitable size for connection between inlet openings on Transformer tank and flange provided on FE cubicle top. The pipes shall be of galvanized iron material.
- 5.2.12** Any other item required for satisfactory operation of the system is in the scope.
- 5.2.13** The **Scheme of operation** of prevention of tank explosion and fire protection, along with a flow chart, along with time of operation of various devices shall be furnished. The same shall be engraved on a plate and fixed in the FE cubicle and control box.

## **6.0 CABLING:**

- 6.1** Connecting sensors, fire detectors/LHD, TCIV and other signals on Transformer top cover and terminals in signal box, using fire survival (FS) Copper cable of size 4 core, 1.5 mm<sup>2</sup> is in the scope of NIFPES supplier.
- 6.2** Connecting signal box mounted on Transformer and control box placed in the control room, as well as control box and FE cubicle using Fire retardant & low smoke (FRLS) Copper cable of size 10 core /12 core 1.5 mm<sup>2</sup> is in the scope of NIFPES supplier.

## **7.0 DEVIATION FROM TECHNICAL SPECIFICATION**



The tenderer shall furnish the details of deviation/ modification proposed by him to improve overall performance of the system. The deviation if any shall be brought in the tender clause wise.

## **8.0 PACKING & DELIVERY:**

**8.1** The vendor shall arrange transportation of all equipment from the point of manufacture to the Site. The arrangements shall include, but not be limited to, hiring adequate capacity of wagon, determination of routes, determination of required permits, payment of required taxes & duties and notification to the Owner.

**8.2** The vendor shall take care of the weight limitation on transport and handling facility at site. In the later case, necessary arrangement shall be ensured by the contractor to take care of pressure drop of nitrogen and storage till completion of oil filling during erection. A gas pressure testing valve with necessary pressure gauge and adaptor valve shall be provided.

## **9.0 Tests:**

### **a. Type tests:**

The supplier/manufacturer/Contractor shall furnish type test reports of FEC, Signal box, Fire detector/LHD, Arc sensors (if applicable). The type test reports shall not be older than ten (10) years as on last date of submission of bid.

The supplier/manufacturer/contractor shall also furnish Functional test report of NIFPES system.

### **b. Factory test:**

Functional verification of NIFPES shall be conducted in presence of KPTCL officials at the works of NIFPES manufacturer.

### **c. Pre-commissioning test:**

Pre-commissioning tests of the complete system shall be carried out after complete erection at site jointly with the purchaser's representative. It shall be ensured that the interfacing of NIFPES with SCADA/SAS has been completed. These tests shall include simulation and verification of the response of the complete system without actual draining of the oil and injection of the Nitrogen gas. These tests shall be witnessed by the KPTCL officials.

## **10.0 Drawings and Manuals:**

Detailed layout drawing along with the equipment drawings and complete bill of materials shall be submitted to KPTCL through transformer for approval.

**11.0** Following tests certificates /details shall also be submitted by the NIFPES supplier/manufacturer/contractor.

- a. Self-certification of compliance of the NIFPES requirements by the NIFPES manufacturer.
- b. Type, make and quantity of Fire detector being used.
- c. Degree of protection certificate of Fire Extinguishing Cubicle (FEC), Signal box & Control box.
- d. Type, make and quantity of the fire survival cable along with cable manufacturer's test certificate.
- e. Type and make of the FRLS cable along with cable manufacturer's Test certificate.
- f. Type test reports as mentioned under Cl. No. 9.0
- g. A copy of Manual of the NIFPES.
- h. The purity certificate of Nitrogen gas of 99.99 percentage purity.

**12.0 PERFORMAMCE GUARANTEE:**

The equipment offered shall be guaranteed for satisfactory performance for a period as specified in the bid document.

**13.0 Modification on the Transformer:**

**13.1** No modification on the transformer shall be allowed which affects its performance (i.e. efficiency, losses, heat dissipation ability, etc.), safety, life, etc or it's any other useful parameter. This requirement shall be of paramount importance and shall form the essence of the contract.

**13.2** In any case, performance of transformer should not be affected in any manner by having the NIFPES.

**13.3** All pipes should be washed/rinsed with transformer oil. If any damage is done to the transformer and /or any connected equipment during installation & commissioning full recovery therefore shall be effected from the NIFPES supplier.

**14.0 GUARANTEED TECHNICAL PARTICULARS FOR FIRE PROTECTION/PREVENTION SYSTEM FOR TRANSFORMER.**

**14.1** Name of Manufacturer and country of origin.

**14.2** Reference standards:

**14.3** Details of system equipments.

- a) FEC
  - Dimensions

- Weight.
- Degree of protection.
- Capacity of Nitrogen cylinder.
- Pressure of Nitrogen filling.
- Minimum distance of F.E. Cubicle from the Transformer.
- Method of mounting.
- Whether the following items are provided in F.E. Cubicle?  
If so furnish make, type & other details
  - Contact manometer
  - Pressure Regulator
  - Oil release unit
  - Gas release unit
  - Oil drain assembly
  - Pressure/Limit switches
  - No. of contacts and spares contacts (NO & NC)
- b) Oil Drain valve at FEC cubicle end and transformer end.
  - Make
  - Type
  - Size
  - Material
- c) Nitrogen injection valve at FEC cubicle end and transformer end.
  - Make
  - Type
  - Size
  - Quantity Required
  - Material
- d) Oil drain pipe
  - Size
  - Length
  - Material
- e) Nitrogen injection pipe
  - Size
  - Length
  - Number of openings in the Transformer tank
  - Material
- f) Control box
  - Dimensions
  - Weight
  - Type and thickness of sheet steel
  - Details of components provided in the control box

- Control voltage.
  - Method of mounting
  - Whether audio & visual alarms provided ?
  - Degree of protection.
- g) Transformer Conservator Isolator Valve (TCIV) (Main /Backup)
- Make
  - Type
  - Location
  - Whether suitable for pipe of size 80mm dia.
  - No. of contacts and spare contacts (NO & NC)
- h) Arc Sensor (if applicable)
- Make
  - Type
  - Location
  - Quantity required
  - Method of fixing
  - Lux level setting range
  - Operating temperature
  - Operating Voltage
  - Degree of protection
  - No. of contacts & spare contacts (NO & NC).
- i) Fire Detectors/ Linear Heat Detectors.
- Make.
  - Type
  - Quantity required
  - Method of fixing
  - Effective Heat sensing area
  - Temperature recommended for effective heat sensing.
  - Number of contacts NO/NC.
- j) Signal box
- Make
  - Type
  - Location
  - Method of mounting.
  - Degree of protection.
- k) Cabling
- Fire survival cable
    - Make
    - No. of cores
    - size.

- Fire Retardant Low smoke
  - Make
  - No. of cores
  - size.
- l) Pipe works
  - Oil drain pipe between Transformer & FEC
    - Size
    - Material
  - Oil drain pipe between FEC & Oil pit
    - Size
    - Material
  - Nitrogen injection pipe between FEC & Transformer
    - Size
    - Material

**14.4 Time of operation**

	Transformer      Tank Explosion Prevention	Fire Protection
a. For system activation		
b. For reduction of pressure in the tank/ for extinction of fire, by nitrogen release		

**14.5** Whether details of literature/manual/ drawings furnished.

**14.6** Details of Pre-commissioning tests to be conducted.

**14.7** Any other technical details not covered above.

### **III. TECHNICAL SPECIFICATION FOR ADDRESSABLE TYPE FIRE DETECTION AND ALARM SYSTEM:**

#### **1.1 Micro Processor based fire alarm control panel.**

- i. The Microprocessor based addressable type intelligent fire detection and alarm system (FDAS) shall consist of central processing units(CPU), various man machine interface module communication system, microprocessor based fire alarm control panel.
- ii. The computer aided microprocessor based addressable fire alarm panel shall be software controlled automatic system and shall provide necessary programmed functions and various controls, Cross zoning should be implemented in the software before raising any alarm from any detector. The Fire alarm control panel shall have facility to process the input signals and also have facility to control all the input data received from addressable analogue type detectors/addressable interface unit.
- iii. The panel shall identify open circuit short circuit earth fault, removal or failure of detectors, components or connection failure as a fault and shall provide a fault warning and indication. In addition, the system shall show all the below said items in LED- system Power indicator, System common alarm, System common Trouble, System common supervisory, System common monitor, System Ground fault, System CPU fault, System Disabled, System Test point(s), System Reset, System Alarm Silence switch.
- iv. Fire alarm control panel shall have main processor board with necessary with loop modules for detector loops, alarm output modules for external hooter/ lamp, control output modules for various control functions through relay contacts and communication module for interacting with CPU.
- v. The Panel shall monitor each device on every scan and give a fault signal for any of the following conditions within 30 seconds.  
Detector removed.  
Address unit removed.  
Incorrect device type  
Faulty calibration or sensitivity.
- vi. Fire alarm control panel shall have facility to process the input signals and also have facility to control all the input data received from addressable analogue type detectors/addressable interface unit located in various loop at different locations.
- vii. Addressable analogue Detectors/manual call point and required field devices in the various areas shall be connected to fire alarm panels by

Class A wiring to the loop module. However, the number of such detectors per loop shall be minimum to 125 detectors.

- viii. The detectors, manual call point, modules, LED indicators etc. can be connected to the fire alarm control panel through inbuilt addressable interface unit in the addressable loop.