



**BHARAT HEAVY ELECTRICALS LIMITED**  
**TRANSMISSION BUSINESS ENGINEERING MANAGEMENT**  
 NEW DELHI

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<b>TITLE</b>				<b>DATE</b>	11.12.2013	12.12.13	12.12.13
<b>Nitrogen Injection Fire Prevention System</b>				<b>GROUP</b>	TBEM		
				<b>W.O. No</b>	83006		
<b>CUSTOMER</b>	<b>TAMIL NADU TRANSMISSION CORPORATION LIMITED</b>						
<b>PROJECT</b>	<b>400/230-110 KV Substation at Anikadavu</b>						

<u>List of Contents</u>	<u>No. of Pages</u>
Cover Sheet	01
Section 1 Intent, System Requirement, Design Criteria and Scope	07
Section 2 Equipment Specification	08
Section 3 Project Details & General Technical Requirement Appendix – A (NO DEVIATION Certificate) Appendix - B (Bidder's Undertaking for Type Tests to be furnished with offer)	(07 + 01 + 01)
Section 4 Guaranteed Technical Particulars & List of Drawings	05
Section 5 Enclosures to Specification	05

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## SECTION 1 -

### INTENT, SYSTEM REQUIREMENT, DESIGN CRITERIA AND SCOPE

#### 1.0.0 INTENT OF SPECIFICATION

- 1.1.0 This specification covers the design, manufacture, inspection and testing at Contractor's and/ or his Sub-Contractor's works, proper packing for transportation, delivery (FOR destination), unloading, storage and handling at site, erection, testing & commissioning of '**Nitrogen Injection Fire Prevention System**' at **400/230-110 KV Substation at Anikadavu of TANSTRANSCO.**
- 1.2.0 The system shall be designed, erected & commissioned in accordance with **TAC, NFPA** or any other guidelines of international repute applicable for the system.
- 1.3.0 Various technical requirements are laid down in Section-1, Section-2 & Section-3 of this specification. In the event of any contradiction w.r.t. other sections of this specification, requirements of Section 1 shall prevail.
- 1.4.0 The Bidder to note carefully that the parameters, estimated capacities of equipment indicated under this specification or in the tender drawings are only for the guidance of the Bidder. The system shall be designed as per relevant standards/ codes and exact capacities and quantities are to be estimated by the Bidder. All such estimations and design calculations shall be submitted for Purchaser's approval.
- 1.5.0 **The Contract shall be Unit Rate based on the BOQ furnished by BHEL for the package. Addition/ deletion in quantities during contract stage shall be settled on the basis of unit rates, quoted by the bidders in their respective bids.**
- 1.6.0 The Contract shall be on unit rate basis for the quantities furnished by BHEL. During contract stage, quantities of various items of BOQ may vary to any extent and same rates will be applicable so far the resultant variation in total contract value is within  $\pm 20\%$ . Variations beyond  $\pm 20\%$  shall be negotiated mutually.
- 1.7.0 The term '**Owner**' appearing in this specification shall refer to **M/s. TANTRANSO [M/s. Tamil Nadu Transmission Corporation Limited]**, the term '**Purchaser**' shall refer to Bharat Heavy Electricals Ltd. (**BHEL**) and the term '**Contractor**' shall refer to the **successful Bidder.**
- 1.8.0 In case of any deviation, the bidder shall indicate clause-wise deviations with respect to the specification separately in the '**Schedule of Deviation**' given as Annexure-1 in Section-5 of this specification. *Deviations in any other form including clarifications / assumptions / etc will not be considered and it will be construed that the bid conforms strictly to the specification.*

#### 2.0.0 QUALIFYING REQUIREMENT FOR THE BIDDER

The qualified manufacturer should have manufactured, Type tested and supplied at least 50% of the required quantity of similar equipment of same or high capacity to Electricity Boards/Power Utilities in India in any one year during the last five years. The same should have been in satisfactory operation for a minimum period of two years as on date of technical bid opening ,which is 05/4/13 for Anikadavu substation.

Further the qualified manufacturer should also have type tested the equipments in a period of not less than 5 years as on date of technical bid opening, which is 05/4/13 for Anikadavu substation from Government / Government recognized laboratories confirming to latest IS/IEC only.

***This Date shall be applicable for any criteria pertaining to Type Test Qualification / Technical Qualification where reference is made to date of Tender opening.***

### **3.0.0 TYPE OF FIRE PREVENTION REQUIRED**

Nitrogen injection fire prevention system for 3 Nos. 315 MVA, 3 Phase 50 C/S, 400 / 230 / 33 KV YNaod11 Auto Transformer and 2 Nos. 200 MVA, 3 Phase 50 C/S, 400 / 110 / 33 KV YNaod11 Auto Transformer at Anikadavu Site.

### **4.0.0 DESIGN CRITERIA**

4.1.0 The **NITROGEN INJECTION FIRE PREVENTION SYSTEM** shall prevent tank explosion and fire during internal faults resulting in an arc where tank explosion will normally take 3-4 seconds after arc generation and also extinguishes the external oil fires on Transformer / Reactor's top cover due to Tank explosion and/or external failures like bushing fires, OLTC fires and fires from surrounding equipments.

The **NITROGEN INJECTION FIRE PREVENTION SYSTEM** shall protect the oil filled Transformer / Reactor against explosion fire that may emanate internally ( during internal fault etc) and / or externally (such as failure of condenser bushing of the transformer / Reactor under subject, other source of equipment etc). It should be fully automatic and shall require minimum maintenance and practically no running cost.

All the requirements regarding supplies, provisions of control, interlocks, indications, annunciations, alarms etc, stipulated in Section-2 shall be satisfied by the contractor in totality.

### **5.0.0 SCOPE OF SUPPLIES & SERVICES**

The requirements mentioned under this clause are **indicative** for the system. Any other item/ service, which is not specifically mentioned herein but required to complete the work for safe and sound operation of system shall be supplied and installed by the contractor at **NO EXTRA COST** to the purchaser.

Anything major left out in the BOQ shall be clearly highlighted/ brought to purchaser's notice in the Bid itself.

### **5.1.0 SCOPE OF SUPPLY**

- i. The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, General and Special Conditions of Contract, Technical Specifications, and Drawings.
- ii. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Purchaser and valued at the rates and prices bid in the priced Bill of Quantities.

- iii. A rate or price shall be entered against each item in the priced Bill of Quantities. The cost of Items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.
- iv. The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the priced Bill of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.
- v. General directions and descriptions of work and materials are not necessarily repeated nor summarized in the Bill of Quantities. References to the relevant sections of the Contract documentation shall be made before entering prices against each item in the priced Bill of Quantities.
- vi. Miscellaneous items like hardware, fixtures etc. shall be deemed to be included under the relevant BOQ items and bidders shall consider the same while quoting for BOQ items.

#### 5.1.1 BILL OF MATERIAL OF NITROGEN INJECTION SYSTEM

Sl. No.	Item Description	Unit	Qty.
1	<p>Fire extinguishing Cabinet with base frame, consisting of:</p> <ol style="list-style-type: none"> <li>a. Nitrogen Gas cylinder of sufficient capacity with pressure regulator and manometer with sufficient number of adjustable NO contacts.</li> <li>b. Oil Drain Assembly</li> <li>c. Mechanical release device for oil drain and nitrogen release.</li> <li>d. Limit switches for monitoring the systems</li> <li>e. Panel lighting</li> <li>f. Flanges on top of the panel for connecting oil drain and nitrogen injection pipes for transformer / Reactor.</li> <li>g. Oil drain pipe extension of suitable size for connecting pipes to oil pit.</li> <li>h. Limit switch for pressure switch/ sensor.</li> </ol>	SET	05
2	Control box to be installed in control room for monitoring system operation, automatic controls and remote operations. Control box should be complete with DC-DC converter for audio-visual alarm, indicating lights, switches, push buttons etc. suitable for tripping and signaling on 220V DC supply. The control box is to be installed in the control room of the substation based on control room lay out and feasibility. Necessary cables, cable laying, marshaling cabinets in control room, cabinets for fixation of control boxes etc are under the scope of Bidder.	Nos.	05

3	Signal box for terminating cable connections from PRV/ pressure sensor, PNRV/POBV, fire detectors and circuit breaker trip signal.	Nos.	05
4	Pre-stressed non-return valve (PNRV)/ high speed pneumatically operated ball valve (POBV) with sufficient number of NC contacts for remote alarm indication and with visual position indicator.	Nos.	05
5	Fire detectors rated for heat sensing at 141°C or suitable temperature recommended by the manufacturer and each fitted with two nos. PG 13.5 size cable glands.	Nos.	60
6	Fire survival cables of size 4C X 1.5 mm <sup>2</sup> for connecting fire detectors and other signals on transformer / Reactor top cover to terminals in Signal Box.	Mtrs	200
7	FRLS cable of size 12C X 1.5 mm <sup>2</sup> for connecting signal box mounted on transformer / Reactor to Control Box in the station control room, Relay Panel to Control Box and Control Box to FE Cubicle.	Mtrs.	1300
7.1	FRLS cable of size 4C X 1.5 mm <sup>2</sup> for connecting PNRV / POBV to signal box, AC supply to FE Cubicle, AC & DC supply to Control Box, interconnection of AC & DC supply and connections in Relay Panel.	Mtrs.	400
8	Piping along with supports & fittings between transformer / Reactor, FE cubicle and oil drain pit		
8.1	Oil drainpipe connection between outlet valve provided on transformer / Reactor tank and flange provided on top of FE cubicle.	Mtrs.	60
8.2	Oil drainpipe connection between oil drainpipe bottom (in FE cubicle) to the oil pit.	Mtrs.	30
8.3	Nitrogen injection pipe connection between inlet openings on transformer / Reactor tank and flange provided on top of FE cubicle.	Mtrs.	90
8.4	50N pipe for support to oil drain	Mtrs.	60
9	Mandatory Spares		
9.1	Filled Nitrogen Cylinder	No.	01
9.2	Hose Pipes with fittings	Set	01
9.3	Linear Heat Detector / Fire Detectors	Meters / Nos	25 / 06

**NOTE: - Following items pertaining to Nitrogen injection system at each site are excluded from Bidder's Scope and are in BHEL scope.**

1. Set of Gate valves needed for Transformer / Reactor Package i. e. 25 NB Gate valves for Nitrogen Injection openings, Oil Drain Valve on top about 100 - 150 mm below top cover

(150 NB Gate valve). (Valves related to exclusively to Nitrogen injection system in line with above mentioned BOQ, Clause 5.1.1, are to be included in Bidder's offer)

2. BUCHHOLZ relay.

Bidder shall note the following:

- BHEL shall lay single feeder for 220VDC upto control box in station control room. Bidder shall terminate this feeder in his control box and make his own arrangements to extend this supply elsewhere, if required.
- Cable trays, if required, shall be provided to contractor on free issue basis, however necessary hardware for fixing the same on walls or elsewhere shall be included by the bidders in their offers.
- Earthing of various equipment under his scope of supply shall be in contractor's scope, however GI flat (25X3mm or 50x6 or 75x10mm) shall be provided by BHEL on free issue basis. Bidders shall furnish their tentative requirements in their respective bids.
- Bidders shall consider only reputed makes of equipments. All makes shall be subjected to acceptance of final customer. No additional price implication shall be made to BHEL on account of non-acceptance of proposed makes during contract stage.
- Bidder shall consider following items also while quoting:
  - i. Cable glands, lugs, marker, and cable ties etc. for termination of power and control cables.
  - ii. Fixing hardware for mounting various equipments in the system and cable trays etc.
  - iii. Standard tools & tackles required for operation & maintenance of the system. (The list of tools required shall be furnished in the bid.)
  - iv. Civil work for FE cubicle plinth and pipe support.
- ***Bidder shall also furnish a list of tools and tackles, which shall be brought to site for erection & commissioning purpose (to be returned after completion of work) and shall not constitute 'Supply' items under the contract. If such list is not furnished, the items shall be construed to be part of scope of supply.***

## **5.2.0 SCOPE OF SERVICES**

**5.2.1 CIVIL WORKS:** The following shall be in the scope of Contractor:

- a. Construction of foundation and brick housing for fire extinguishing cubicle and painting the same on inside & outside. The housing shall have RCC roof.
- b. Any other civil work involved in the system.
- c. Any damage caused to civil works during ETC work of the equipment/ system shall be made good to the original finish by the Contractor at no extra cost to the Purchaser.

## **5.2.2 Erection, Testing & Commissioning (ETC) requirements**

- a) The scope of ETC shall include receipt of material at site, safe unloading, storage and handling of equipment/ material at site, erection of equipment /material at site including fabrication, equipment/ system testing and commissioning of the entire system.

- b) Laying and termination of piping between transformer / Reactor, FE cubicle and drain pit along with supports and fittings.
- c) Laying and termination of power and control cables for the equipment under the scope this specification.
- d) Laying & fixing of cable trays on walls or elsewhere, if required.
- e) Earthing of all the system components (equipments) to the nearest earth mat riser of the Owner / Purchaser.
- f) The contractor shall arrange all machinery -tools & tackles and consumables required for erection of the system.
- g) Contractor shall ensure that sufficient quantity of commissioning spares is made available for timely completion of commissioning of the system. The contractor shall furnish a list of commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the Contractor.
- h) Construction water and 415 V power shall be made available by purchaser at one point. Contractor shall be required to make own arrangement for taking supplies from there.
- i) It is the responsibility of the successful Bidder to obtain necessary approval/ clearance from statutory organizations wherever applicable for the equipment/ systems under the scope specified.
- j) The contractor shall train engineers of Purchaser/ Owner so that they are fully conversant with both electrical and mechanical part of the package.
- k) The contractor shall furnish the operation and maintenance manual for the system. The draft O&M manual shall be submitted within 4 weeks after award of contract.

The O&M manual shall contain the following information:

- i) Description of the system and equipment with design particulars
- ii) Scheme of operation for prevention of tank explosion and fire protection alongwith a flowchart showing sequence and time of operation of various devices of the system.
- iii) Instruction for installation, operation, maintenance and repair at site.
- iv) Recommended inspection practices and inspection schedule.
- v) List of Recommended Spares.
- vi) Ordering information for all replaceable parts.

## **6.0.0 EXCLUSIONS**

- 6.1.0 Supply of necessary cable trays for laying power and control cables, wherever required.
- 6.2.0 Supply of
  - i. Set of Gate valves
  - ii. BUCHHOLZ relay
- 6.3.0 Supply of GI flat for earthing of equipments.
- 6.4.0 Modifications on Transformer / Reactor :
  - a. Oil drain opening with pipe, flange and manual gate valve at about 120 mm below the top cover.

- b. Nitrogen Injection openings with suitable size of pipe with flanges and manual gate valves on tank sides at about 50 - 200mm from the bottom plate.
- c. Flanges on conservator pipe between buchholz relay and conservator tank for fixing PNRV/ POBV.
- d. Provision for temperature and pressure sensors if required.
- e. Supply and welding of fire detector bracket on top cover.
- f. Supply and welding of brackets for fixing signal box at a suitable location on top cover or tank side wall.

**Bidder shall confirm adequacy of the above arrangements on transformer / Reactor with Scope of supply i. e. items of supply are included in their offer or not. Any other requirement for modification needed in the Transformer / Reactor Design shall be brought out clearly in the bid itself. Bidder shall also indicate sizes of various openings and valves mentioned above, separately for Transformers / Reactor with Ratings as mentioned in the Specification. Also, relevant drawings for recommended / desired size of Fire Detector Brackets, Brackets for fixing Signal Box, Flanges, Gate Valves etc. along with any other information as may be necessary shall be provided by Bidder to make necessary modifications on Transformer / Reactor.**

#### **7.0.0 Inspection & Testing**

All the equipments shall be inspected prior to dispatch in line with relevant IS, approved GTP/ drawing and technical specification, BHEL/ customer approved QAP.

#### **8.0.0 HANDING & TAKING OVER**

It is the responsibility of Contractor to maintain the system till it is handed over to the owner.

Pre commissioning tests shall be carried jointly with the purchaser's representative prior to handing over the system. Notwithstanding above technical specifications any additions be incorporated for correct operating of nitrogen injection fire prevention system without extra cost.



**Project : 400/230-110 KV Anikadavu Substation**  
**Customer : Tamil Nadu Transmission Corporation Limited.**  
**Contractor : Bharat Heavy Electricals Limited.**

**TB-364-552-101**  
**Section – 2**  
**Rev – 00**

**SECTION 2 -**

**EQUIPMENT SPECIFICATION**

Refer CUSTOMER Specification enclosed herewith as part of Section - 2.

~~requirements calibration etc normally required for Auto Transformer oil and winding temperature gauges to be supplied with.~~

~~NOTE - Supplier shall guarantee the performance requirement for a period of not less than 2 years for the above system.~~

## ~~2.2~~ FIRE PREVENTION SYSTEM BY INJECTING NITROGEN GAS

1. All the transformers shall be provided with fire prevention system by injecting Nitrogen gas.
2. Technical specification
  - 2.1. The fire prevention system shall protect the oil filled power/auto transformer against explosion fire that may emanate internally ( during internal fault etc) and /or externally (such as failure of condenser bushing of the transformer under subject, other source of equipment etc).
  - 2.2. The system may be an integral part of the transformer and of leak proof.
  - 2.3. The system shall be of automatic operation in sensing and taking Prevention measures in protecting the transformer whenever internal/external fire risk arises.
  - 2.4. The fire fighting equipment/ system shall operate normally on automatic mode.  
Additional facilities for remote/local control and manual operation shall also be provided with separate annunciation and indication in control room.
  - 2.5. The tenderer shall indicate the maintenance and testing schedules required. Practically maintenance free system is preferred.
  - 2.6. Inter locks shall be provided to prevent mal-operation.
  - 2.7. The scope of this specification is for complete design, engineering, shop testing, supply and installation and commissioning of system for prevention of fire & explosion of Auto Transformers as indicated by TANTRANSCO.
  - 2.8. The materials shall be manufactured as per Indian/ International Standards as applicable.
  - 2.9. The tenderer may furnish the detailed working of the system offered meeting the requirement of national/ international requirement for fire prevention. Necessary literatures, pamphlets, brochures etc required may also be enclosed along with tender offer.

2.10. Any modifications required in the transformer must be minimal and other related civil works may be indicated and this shall also be under the scope of installation.

2.11. The design, material, construction, manufacture, inspection, testing, commissioning and performance of equipment supplied shall comply with all currently applicable statues, regulations and safety codes. Deviations, if any, from the specification/ standards shall clearly be explained.

2.12. The scope of supply shall include all apparatus such as control boxes, piping, cabling, detectors, valves, control, necessary cabinets etc., to make it fully operational.

2.13 Control box to be fixed in control room, with monitoring and mechanical releasing devices for automatic control/local operation with alarms, indication lights, switches, push buttons, audio signals suitable for tripping and signaling shall operate on 230 V AC supply. The control box must be installed in the control room of the substation as indicated by TRANTRANSCO based on control room lay out and feasibility. Necessary cables, cable laying, marshaling cabinets in control room, cabinets for fixation of control boxes etc are under the scope of tenderer.

2.14. The tenderer must demonstrate the system commissioned is totally leak proof (Nitrogen and oil).Necessary visual indications must be provided.

### 3.0. BRAND NAMES:

The specific reference in these specifications and documents to any material by trade name, make or catalogue number shall be construed as establishing standard of quality and performance and not as limiting competition. However, bidders may offer similar equipment provided it meets specified design standards and performance requirements and the purchaser's approval.

### 4.0. Schematic of the System.

The Transformer Explosive and Fire Prevention System shall be a stand alone dedicated system for oil filled transformer. It shall have a fire extinguishing Cabinet placed on a plinth near the transformer. The Cabinet shall be connected to the transformer oil tank (near its top) and to the oil pit (of capacity approx. equal to 10% for transformer oil tank) from its bottom through oil pipes with gate valves and properly routed considering safety aspect.

The Cabinet shall house a pressurized nitrogen cylinder connected to the transformer oil tank (near its bottom). Cable connections are to be provided from the signal box placed on the transformer to the control box in the control room and from the control box to the Cabinet.



3) Tripping of all connected breakers  
(As a Pre-requisite for initiation of system activation).

b) For Extinguishing of Fire:

- 1) Linear Heat / Fire Detector
- 2) Buchholz Relay paralleled with Pressure Relief valve or RPRR (Rapid Pressure Release Relay)
- 3) Tripping of all connected breakers  
(As a Pre-requisite for initiation of system activation).

## 7.2. Manual Mode

Tripping of all connected breakers is a Pre-requisite for initiation of system activation.

In this mode, the Drain & Stir system should work in manual mode. The activation must be operated from the Control Box by switching the key from "automatic mode" to "manual mode", selecting a dedicated button to the manual activation. This leads to the opening of the Quick Depressurization Valve and injection of nitrogen 20 seconds later.

## 8.0. Cabinet:

It shall be made of 3 mm thick steel frame, painted dark red from inside and outside with hinged split doors fitted with high quality tamper proof lock. The protection of the cabinet should be IP55. The cabinet shall be complete with the base frame and the following:

- multiplication of connections
- Oil drain pipe with mechanical quick drain valve
- Electro mechanical 220VDC control equipment for oil drain with (protection IP20)
- Pre-determined regulated nitrogen flow reducer to release the Nitrogen
- Limit switches and monitoring for the system
- Flanges on top panel for connecting oil drain and nitrogen injection pipes for transformer
- Panel lighting (CFL Type)
- Oil Drain pipe extension of suitable sizes for connecting pipes of oil pit
- Antiseismic mechanical protection
- All electrical cables inside panel must be routed and channeled with cover.

## 9.0. Cylinder:

The Nitrogen gas cylinder should be of 50 / 60 Liters capacity and should be filled at a pressure of 200 / 150 Bars with falling pressure electrical contact

manometer. Such cylinder with such capacity should have been already handled and delivered successfully by the supplier.

Additionally:

- The Nitrogen Cylinder valve shall be of IP 67 protection
- The Nitrogen shall be contained within the cylinder and released from the Cylinder Valve only upon activation of the Drain and Stir system (to avoid any possible leakage due to a multiplication of non IP 67 connections)
- Nitrogen purity shall be equal or above 99,99%
- Proper approvals and certificates should be available with the cylinder

#### 10. Draining valve:

The Depressurization / Draining operation should be conducted (release of constrained oil through the butterfly valve) in no more than 0.2 seconds (time to have the Depressurization valve released totally) so as to allow an efficient depressurization process at the required moment.

#### 11. Control Box

Control Box to be fixed in control room of substation as indicated by TRANTRANSCO based on control room lay out and feasibility, for monitoring system operation, automatic control and remote operation, with following alarms indication, light switches, push buttons, audio signal, suitable for tripping and signaling on 220 DC supply

- System on
- Conservator shutter valve open
- Oil drain valve closed
- Gas inlet valve closed
- Shutter valve closed
- Fire Detector / Linear heat detector Trip
- Fire Detector/heat detector faulty
- Oil drain valve open
- Extinction Mode activated
- Cylinder pressure low
- Differential relay trip
- PRV/RPRR trip
- Transformer trip
- System Out of service
- Auto/Manual/ Off
- lamp test
- Visual / Audio Alarm

## 12. Shutter Valve

Shutter valve is to be fitted in the conservator pipe line between conservator & Buchholz relay. It shall have the proximity switch for remote alarm, indication and with visual position indicator.

## 13. Fire Detectors / Linear Heat Detectors

The System shall be provided with (Water Proof/Weather Proof) Heat Detector /Fire detector across the transformer oil tank & OLTC. The heat/fire detectors shall be rated for 138°C/141C for sensing. The Heat/Fire Detector should have been tested by the supplier and the performance should have been certified by a proper Agency accredited in India. A proper certificate and report should have been issued.

## 14. Signal Box

It shall be fitted on the transformer with cable connections from Shutter & fire detectors and for further connection to the control box.

## 15. Cables

All the cables are under the scope of tenderer. Fire survival cables, able to withstand 750°C, 4core x 1.5 Sq.mm for connection of fire detectors in parallel shall be used.

Fire retardant low smoke (FRLS) cable 10 core x 1.5 mm Sq. for connection between transformer signal box/marshalling box to control box and control box to fire extinguishing cubicle shall be used. Fire retardant low smoke (FRLS) cable 4 core x 1.5 Sq.mm for connection between the Control box to DC supply source and fire extinguishing cubicle to AC supply source, signal box/marshalling box to pre-stressed Shutter valve connection on transformer shall be used.

## 16. Pipes

Pipes, complete with connections, flanges, bend tees etc., Shall be supplied by tenderer along with the system.

## 17. Other items

- a) Oil drain and nitrogen injection openings with gate valves on transformer tank at suitable locations.
- b) Heat/ fire detectors brackets on transformer top cover.
- c) Pipe connections between transformer to fire extinguishing cubicle and fire extinguishing cubicle to oil pit.
- d) Cabling on transformer top cover for fire/heat detectors to be connected in parallel and inter cabling between signal box to control box and control box to fire extinguishing cubicle.
- e) Gate valves on oil drain pipe & nitrogen injection pipe should be able to withstand full vacuum. A non-return valve shall also be fitted on nitrogen injection pipe between transformers & gate valve.

- f) The cabinet shall be painted with post office red color (Shade 538 of IS-5). All the exposed parts i.e., pipes, supports, signal box etc. shall be painted with enameled paint.

#### 18. Mandatory Spares

The following mandatory spares may be supplied along with recommended mandatory spares if any, for the entire system at free cost:

- a) 1 No. filled nitrogen cylinder
- b) 1 set of hose pipes with fittings.
- c) 25 meters. Of linear heat detector/ 6nos. fire detectors

#### 19. Interlocks.

It shall be ensured that once the system gets activated, all the connected breakers shall not close until the system is actually put in OFF mode.

#### 20. Technical Particulars

##### 20.1 Fire Extinction Period

On commencement of Nitrogen Injection : Maximum 20 seconds

From the moment of system activation to : Maximum 30-45 minutes

Complete cooling.

"Linear Heat Detector" / Fire Detector

heat sensing temp : 138°C / 141°C

Shutter valve setting for operation : Minimum 60ltr. Per minute

Capacity of Nitrogen Cylinder : 50 /60 liter water capacity and shall hold minimum 10 cubic meter gas at 200 /150 bar pressure.

Control Box : 220V DC

Fire extinguishing cubicle for lighting : 230 V AC

#### ~~32.0~~ FITTINGS AND ACCESSORIES

The fittings and accessories, mentioned in this specification, are only indicative and any other fittings which are generally required for satisfactory operation of the transformer are deemed to be included.

#### ~~33.0 CENTRE OF GRAVITY~~

~~The centre of gravity of the assembled transformer shall be low and as near the vertical center line as possible. The transformer shall be stable with~~



## SECTION 3

### GENERAL TECHNICAL REQUIREMENTS

#### 3.0 Foreword

The provision under this section is intended to supplement general requirements for the materials, equipment and services covered under other sections.

#### 3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

- a) Customer : M/s Tamil Nadu Transmission Corporation Limited  
b) Project Title : 400/110 KV Substation at Thappagundu & 400/230/110 KV Substation at Anikadavu  
c) Transport facilities : Road/Rail  
d) Site location : THAPPAGUNDU IN THENI DISTRICT, MADURAI REGION & ANIKADAVU IN TIRUPPUR DISTRICT, COIMBATORE REGION

The following system parameters shall prevail:

Nominal system voltage	400 kV	230kV	110 kV
Highest system voltage	420 kV	245kV	132 kV
Frequency	50 Hz	50 Hz	50 Hz
Minimum creepage	25mm/kV	25mm/kV	25mm/kV
System Earthing	Effectively Earthed	Effectively Earthed	Effectively Earthed

#### SITE CONDITIONS

- 3.1.1 Ambient Temperature  
a) Ambient air temp. (max.) : 50 deg C  
B) Max Temp. for design : 50 deg C  
b) Ambient air temp. (min.) : 20 deg C  
c) Max, Daily average ambient air temp. : 45 deg C  
d) Max. yearly average ambient air temp. : 32 deg C
- 3.1.2 Max. humidity : 100% Max.
- 3.1.3 Average thunder storm days per annum : 50
- 3.1.4 Average rainy days per annum : 90
- 3.1.5 Average Annual rainfall : 1000 mm

- 3.1.6 No. of months during which tropical monsoon condition prevail: 5  
3.1.7 Max, wind Pressure : 150kg/sqmm  
3.1.8 Max wind speed : 39m/s  
3.1.8 Altitude above MSL : 1000 m

However for design purpose, ambient temperature should be considered as 50° C and relative humidity as 100%.

### **AUXILIARY POWER SUPPLY**

3 phase AC Supply	415V, 3 phase 4 wire 50 Hz, neutral grounded AC supply -15% to +10%
1 phase AC supply	240V, single phase, 50 Hz neutral grounded AC supply
DC supply	220, 2 wire DC supply + 10% to –15% 48V, 2 wire DC supply

### **3.2 GENERAL REQUIREMENT**

**3.2.0 ALL THE EQUIPMENTS /MATERIALS TO BE SUPPLIED SHOULD BE IN ACCORDANCE WITH RELEVANT LATEST / AMMENDED ISS /IEC, WHETHER IT HAS BEEN SPECIFICALLY MENTIONED IN THE SPECIFICATION OR NOT”.**

3.2.1 The supplier shall also furnish drawings for the following:

All EQUIPMENTS and type of clamps, fitting hardware, insulators, bus bar. These designs/ drawing shall be got approved by the BHEL/TANTRANSCO before commencing the manufacture / construction / erection and are to be as per latest IS.

#### **3.2.1 GENERAL:**

- 3.2.1.1 The bidders shall be fully responsible for providing all equipment, materials system and services specified or otherwise which are required to complete the construction and successful commissioning of the substation in all respects.
- 3.2.1.2 Any other items not specifically mentioned in the specification but which are required for erection of materials/equipments under the scope of work, testing and commissioning are deemed to be included in the scope of the specification unless specifically excluded.
- 3.2.1.3 All items shall be supplied as per schedule and as specified in the relevant Indian standard of latest revision. The Technical specification of the main materials/equipments is furnished. The Technical specification contained herein for the materials are for the guidance of the tenderer.

3.2.1.4 The Tenderers are requested to procure the equipments/materials/component only from reputed /qualified manufacturer as per Technical requirement stipulated in Section - I of Technical specifications. Approval of make of item shall be taken up by vendor from TANTRANSCO himself.

### **3.3 SPECIFIC REQUIREMENT**

**3.3.1** The Supplier shall furnish make/manufacturer, catalogues, engineering data, and technical information, design documents, drawings etc., fully in conformity with the technical specification and get approval from competent authority before commencement of any work.

**3.3.2** All steel materials, other than materials for earthing should be of galvanized if not specified.

### **3.4 SPECIFIC TECHNICAL REQUIREMENTS: / Drawing submission**

The successful bidder shall submit all drawings and documents as per clause no. 3.29 along with the list of drawings within 7 days after placement of order to BHEL.

### **3.5 STANDARD:**

The goods supplied under this contract shall conform to the standards mentioned in the Technical Specifications and when no applicable standard is mentioned, to the standard specified by the Institution of Central / State Government or internationally recognized Institutions shall be applicable and such standards shall be the latest issued by the concerned institution.

### **3.6 TEST CERTIFICATE:**

Copies of all test certificates relating to material to be procured by the Supplier for the works shall be forwarded to BHEL.

### **3.7 Inspection clause :**

**3.7.1** The BHEL/TANTRANSCO or his representative shall have the right to inspect and/or test the goods /works to confirm their conformity to the supplier. BHEL/TANTRANSCO shall notify the supplier in writing of the identity of any representatives authorized for these purposes.

The inspections and tests may be conducted on the premises of the supplier or his Sub vendor at the point of delivery and /or at the goods' final destination. Where tests are conducted in the premises of Supplier, all reasonable facility and assistance including access to drawings and production data shall be furnished at no charge to the BHEL.

Should any inspected or tested goods fail to conform to specifications, the BHEL/TANTRANSCO may reject them and the supplier shall either replace the rejected goods or make all alterations necessary to meet specification requirements free of cost to the BHEL/TANTRANSCO within one week of intimation.

The BHEL/TANTRANSCO's right to inspect, test and where necessary reject the goods after the goods; arrival at the site, shall in no way be limited or waived by reason of the goods having been previously inspected. Tested and passed by the BHEL/TANTRANSCO or his representative prior to the goods dispatch.

**3.7.2** Not less than 15 (Fifteen) days advance intimation shall be given about the quantity of materials that will be ready for inspection by the officers of TANTRANSCO/ BHEL/Third agency authorized by the Corporation. The materials should not be dispatched without instruction from the Corporation.

### **3.8 GUARANTEE:**

**3.8.1** The supplier shall guarantee that the goods under the Contract are new, unused of the most recent or current models and incorporated all recent improvements in design and materials unless provided otherwise in the Contract. The supplier shall further guarantee that the goods supplied under this Contract shall have no defects arising from design, materials or workmanship, installation and erection, if that may develop under normal use of the supplied goods. The supplier shall also guarantee the performance of the works executed by him including the performance of all the materials/goods supplied by him.

**3.8.2** BHEL shall promptly notify supplier in writing of any claims arising under guarantee in respect of goods. Upon receipt of such notice, the supplier shall, with all reasonable speed, repair or replace the defective works or parts thereof, free of cost at site. All the expenses towards transportation of defective parts to supplier's works and of repaired/replaced parts to site shall be borne by the Supplier.

**3.8.3** If the Supplier, having been notified, fails to remedy the defects within 14 days, the BHEL will proceed to take such remedial action as may be necessary, at the supplier's risk and expenses. All expenses in this regard will be recovered from Supplier.

### **3.9 DEGREE OF PROTECTION**

The supplier shall propose following Degree of protection for those equipment/Items for which the degree of protection has not been specified in the specification for the approval of BHEL/TANTRANSCO. The decision of BHEL/TANTRANSCO shall be final. The

enclosures of the Control Cabinets, Junction boxes and Marshalling boxes panels etc to be installed shall be provided with degree of protection as detailed here under:

- a) Installed outdoor: IP-55
- b) Installed indoor in air conditioned area: IP-42
- c) Installed in covered area IP:52
- d) For LT switchgear (AC & DC distribution Boards): IP-54

The degree of protection shall be in accordance with IS:13947, ( Part-1)/IEC-947(Part-1). Type test report/or degree of protection test on each type of the box shall be submitted for approval.

### **3.10 RATING PLATES, NAME PLATES AND LABELS**

Type or serial number together with details of the loading conditions under which the item of the substation in question has designed to operate and such diagram plates as may be required by the BHEL/TANTRANSCO. The rating plate for each equipment shall be according to IEC requirements.

Alternately two separate plates one with Hindi and other with English inscriptions may be provided.

During approvals drawings of Rating/name plates/lables shall also be submitted.

### **3.11 DELIVERY OF GOODS AND DOCUMENTS RELATED THERETO:**

Delivery of goods shall be made by the supplier in accordance with the terms specified by the BHEL in its schedule of requirements.

### **3.12 INCIDENTAL SERVICES:**

The Supplier is required to provide any or all the services broadly outlined in the Technical specification. Any other minor incidental service related to the scope of work like providing necessary assistance whether specifically mentioned or not must be carried out by the Supplier at his own cost. All tools, Tackles Plant etc., required for completion of above works shall be brought by the Supplier.

### **3.13 DISCREPANCIES BETWEEN DRAWING AND SPECIFICATION:**

Should there be any discrepancy between the specifications and/or schedule of prices and/or drawings or any inconsistency, error or omission in either of them, reference must be made to the BHEL/TANTRANSCO for an explanation and the Supplier will be held responsible for any errors that may occur in the work through neglect of this precaution. The explanation of the BHEL/TANTRANSCO shall be final and binding on the Supplier.

### **3.14 APPROVAL PROCEDURE**

The scheduled dates for the submission of drawings as well as for, any data/information to be furnished by the Employer would be as per the following schedule. The supplier

shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer. The following schedule shall be followed generally for approval.

i.	First Submission	7 days after LOI/PO
ii.	Approval/comments/by employer on Initial submission	Reasonable time
iii.	Resubmission	Within 7 days (whenever from date of comments required) Including both ways postal time.
iv.	Approval or comments	Within 2 weeks of receipt of resubmission.
v.	Furnishing of distribution copies	2 weeks from the date of last approval.

**Note:** The supplier may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

The title block of drawings shall contain the following information incorporated in all contract drawings. Please refer enclosed sheet for details of Title block.

### 3.15 TITLE BLOCK

Following Title Blocks to be used in drawings at the time of drawing approvals

#### For Thappagundu

Customer	M/s Tamil Nadu Transmission Corporation Limited
Project:	400/110 KV Substation at Thappagundu
Contractor	BHEL

#### For Anikadavu

Customer	M/s Tamil Nadu Transmission Corporation Limited
Project:	400/230-110 KV Substation at Anikadavu
Contractor	BHEL

**3.16 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER**

- 1) Drawings
- 2) Guaranteed Technical Particulars
- 3) Type Test Reports
- 4) List of Part Supplies with rating

**Drawings & Documents submitted at the time of offer shall be subject to review at contract stage.**

**3.17 DOCUMENTATION SCHEDULE**

**Following Documentation schedule to be followed per project.**

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
				Prints	CDs
1	Drawings and Data Sheets	1	7	10	5
2	Drawings "As Built "	-	-	10	
3	Type Test Reports	1	7	10	
4	Erection Manuals	-	7	10	
5	Operation and Maintenance Manuals	-	7	10	
6	Manufacturing Quality Plan	-	7	10	
7	Field Quality Plan	-	7	10	
8	Inspection Test Reports	-	7	10	

**Note:** Drawings will also be submitted in CD/DVD in Latest AUTOCAD-2004 or Later version or any other CAD package along with conversion files for all major items.

Final Documentation shall be submitted in bound volumes with details of Customer & Project etc. written on top.

**APPENDIX-A**

**SCHEDULE OF TECHNICAL DEVIATION**

The following are the deviations/variations/exceptions from the specification:

<b>SECTION</b>	<b>CLAUSE NO. / PAGE NO.</b>	<b>STATEMENT OF DEVIATION / VARIATIONS / EXCEPTIONS</b>

In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract is deemed to be in compliance with the specification.

If there is NIL deviation, even then the format to be filled as **NIL DEVIATION**

**Note:** Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

Place

Signature of the authorized representative of

Date

Bidder's name .....

Designation .....

Company seal .....



**APPENDIX-B**

**BIDDER'S UNDERTAKING FOR TYPE TEST REPORTS**

Bidder shall take type test report, MQP, and drawing approval from TANTRANSCO without any commercial / delivery implication to BHEL. In case type test reports are not acceptable to customer due to any technical reason, the same shall be conducted free of cost.

Place Signature of the authorized representative of  
Bidder 'name-----  
Date  
Designation-----  
Company seal -----

**SECTION 4**

**GUARANTEED TECHNICAL PARTICULARS & LIST OF DRAWINGS**

Schedule 1 **Schedule of Guaranteed Performance & other Technical Particulars of Nitrogen Injection Fire Protection System**

Schedule 2 **List of Drawings**

**Schedule 1**

**SCHEDULE OF GUARANTEED PERFORMANCE AND OTHER TECHNICAL PARTICULARS OF NITROGEN INJECTION FIRE PROTECTION SYSTEM FOR PREVENTION OF FIRE & EXPLOSION OF AUTO TRANSFORMERS**

<b>GUARANTEED TECHNICAL PARTICULARS N<sub>2</sub> INJECTION SYSTEM</b>		
(Bidder should indicate the guaranteed technical data of all equipments/materials)		
1	Name of manufacturer, Address and country of origin	
2	Applicable Reference standards	
3	Details of system equipments	
	a. Fire extinguishing cubicle	
	i) Dimensions	
	ii) Weight	
	iii) Capacity of Nitrogen cylinder	
	iv) Pressure of Nitrogen filling	
	v) Minimum distance of FE cubicle from the transformer	
	vi) Method of mounting	
	vii) Whether the following items are provided in FE cubicle. If so furnish make, type & other details	
	- Contact manometer	
	- Pressure regulator	
	- Oil release unit	
	- Gas release unit	
	- Oil drain unit	
	- Pressure / limit switches	
	- No. of contacts & spare contacts(NO & NC)	
	viii) Oil drain valve	
	- Make	
	- Type	
	- Size	
	- Type of metal	
	ix) Nitrogen Injection valve	
	- Make	
	- Type	
	- Size	
	- Quantity required	
	x) Oil Drain pipe	
	- size	
	- Length	
	- Material	
	xi) Nitrogen Injection pipe	

	- size	
	- Length	
	- Number of openings in the transformer tank	
	- Material	
	b) Control Box	
	i) Dimensions	
	ii) Weight	
	iii) Type & Thickness of sheet steel	
	iv) Details of components provided in the control box	
	v) Control voltage	
	vi) Method of mounting	
	vii) Whether audio and visual alarms provided?	
	c) Pre-stressed non-return valve/Pneumatically operated ball valve (Main/Backup)	
	i) Make	
	ii) Type	
	iii) Location	
	iv) Whether suitable for pipe of size 80mm dia	
	v) No. of contacts & spare contacts (NO & NC)	
	d) Fire detectors	
	i) Make	
	ii) Type	
	iii) Quantity Required	
	iv) Method of Fixing	
	v) Effective head sensing area	
	vi) Temperature recommended for effective heat sensing	
	vii) Number of contacts NO/NC	
4	Necessity and condition of re-filling	
5	Drawings/ literature enclosed with the offer	
6	Whether approved by TAC of India	
	<b>TECHNICAL PARTICULARS OF NITROGEN INJECTION FIRE EXTINGUISHING</b>	
1	Power Supply	
	- Control Box	
	- Fire extinguishing cubicle	
2	Fire extinction period	
	On system activation	
	On commencement of nitrogen injection	
3	Fire extinguishing cubicle suitable for 100MVA transformer	
	- Dimension	
	- Weight	
	- Nitrogen cylinder capacity	

**Project : 400/230-110 KV Anikadavu Substation**  
**Customer : Tamil Nadu Transmission Corporation Limited.**  
**Contractor : Bharat Heavy Electricals Limited.**

**TB-364-552-101**  
**Section – 4**  
**Rev – 00**

4	Control Box	
	- Dimension	
	- Weight	
5	Fire detectors	
	- Heat sensing temperature	
6	From the moment of system activation to complete cooling	
7	On commencement of Nitrogen Injection	
8	"Heat/Fire Detector" heat sensing temp	
9	Shutter valve setting for operation	
10	Other Technical Particulars	

Date :

SIGNATURE OF BIDDER

Place :

SEAL

## **Schedule 2**

### **LIST OF DRAWINGS**

*In this section system drawings that are required to be generated is furnished herewith. List of drawings and numbers to be accorded is also given below.*

*The list furnished here is tentative and additional documents may be required during detailed engineering.*

1.	General Arrangement of Fire System	TB-DRG-364-552-111
2.	Interconnection Diagram of Fire System	TB-DRG-364-552-112
3.	General Arrangement for Pipe Connection of Fire System	TB-DRG-364-552-113
4.	Details of Plinth for Fire Extinguishing Cubicle	TB-DRG-364-552-114

**SECTION 5**

**ENCLOSURES TO SPECIFICATION**

Schedule 1 **Schedule of Deviations**

Schedule 2 **Details of contact persons (Technical & Commercial)**

Schedule 3 **List of Drawings Attached**

**SCHEDULE – 1**

**SCHEDULE OF TECHNICAL DEVIATION**

The following are the deviations / variations / exceptions from the specification:

---

Section	Clause No./ Page No.	Statement of deviation/ Variations/Exceptions
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- 
- 1) Certified that the following are the only deviations from the specification ( for the equipment and the systems being offered)
  - 2) In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract is deemed to be in compliance with the specification.
- 
- 3) If there is NIL deviation, even then the format to be filled as **NIL DEVIATION**
  - 4) Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

Place \_\_\_\_\_ Signature of the authorized representative of Bidder

Name -----

Date \_\_\_\_\_ Designation -----

Company seal-----



**SCHEDULE - 2**

**DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL**

---

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Signature of the authorized representative of Bidder

Date

Name-----

Designation-----

Company seal -----

Note: Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

**SCHEDULE - 3**

**LIST OF DRAWINGS ATTACHED**

1. **LAYOUT PLAN OF THE SUB-STATION AT ANIKADAVU –  
DRAWING NO. TB-0-364-316-002 REV. 00**

