BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
TRANSMISSION BUSINESS GROUP, NOIDA

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TITLE				NAME	**AR**	**SKS**	**SKS**
NITROGEN INJECTION FIRE PROTECTION SYSTEM				DATE	08/05/18	08/05/18	08/05/18
				GROUP	**TBEM**	W.O. No	**86009**
CUSTOMER	**TAMILNADU TRANSMISSION CORPORATION LTD (TANTRANSCO)**						
PROJECT	**765/400KV AIS SUB STATION AT ARIYALUR**						
STATION	**ARIYALUR, TAMILNADU**						

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SECTION 1
SCOPE, TECHNICAL REQUIREMENTS AND TECHNICAL QUALIFYING REQUIREMENT

1.1 SCOPE

1.1.1 This specification covers the Design, Engineering, manufacture, inspection and testing at Contractor's and/ or his Subcontractor's works, transportation & delivery (FOR destination), handling, erection, testing & commissioning at site of **Nitrogen Injection Fire Protection System [NIFPS] for 500 MVA Transformers and 80 MVAR Reactors at Ariyalur Site** as mentioned in different sections of this specification. (Unloading and Storage at Site is excluded from the scope of Bidder)

1.1.2 The Nitrogen Injection fire Protection System shall be designed, erected & commissioned in accordance with Standards and regulations as mentioned in SECTION 2 of this Specification pertaining to Customer Specification.

1.1.3 The requirement(s) specified under 'SECTION 2, SECTION 3, SECTION 4' and 'SECTION 5' of this specification shall be considered as part of this Specification. ***In case of any ambiguity / dispute between various sections, requirements of Section-2 i. e. Customer Specification shall prevail except cable size (12CX1.5 sqmm.) considered in section-1 for connecting transformer/reactor signal box to control box & control box to fire extinguishing cubicle.*** In case of any other ambiguity between various Sections, the same shall be spelt out clearly and Clause wise in the Technical Deviation Sheet.

1.1.4 It shall be the responsibility of successful bidder to obtain necessary approval(s) /clearance(s) from statutory organization(s) / authority(s) wherever applicable for the equipment / system / sub-system(s) under the scope specified herein.

1.1.5 **The Contract shall be on lump-sum basis for the package. Within the scope of the contract, no variation shall be admissible to the Contractor so far the input remains unchanged. In case of change in scope after award of the contract, the additions/ deletions to the scope shall be settled on the basis of mutually agreed rates.**

1.1.6 It is not the intent to specify herein all the details of 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 the required duties in a manner acceptable to Purchaser/ Owner, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgment is not in full accordance herewith.

1.1.7 The bidder shall be deemed to have understood completely all the tender drawings and documents and quoted accordingly. Contract shall be on lump sum basis for the package. Within the scope of the contract, no variation shall be admissible to Contractor so far the inputs remain unchanged.

1.1.8 The bidder has to note carefully the parameters, estimated capacities of equipment indicated and the tender drawing in the specification are only for 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.

1.1.9 **Deviation:** Any deviation or variation from the Scope requirement and/or intent of this specification shall be clearly defined clause wise with respect to the specification under relevant **Deviation Schedule** 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.*

1.1.10 The specification comprises of following sections :

Section -1 : Scope, Technical requirements, Technical Qualifying Requirement
Section - 2 : Customer Specification
Section - 3 : General Technical Requirement and Title Block
Section - 4 : Guaranteed Technical Particulars and List of Drawings
Section - 5 : Enclosures to Specification.

The equipment is required for the following projects:

Name of the Customer: **TAMILNADU TRANSMISSION CORPORATION LTD (TANTRANSCO)**

Name of the Project: **765/400KV AIS SUB STATION AT ARIYALUR**

1.1.11 The term 'Customer' or 'Owner' appearing in this specification shall refer to **M/s. TAMILNADU TRANSMISSION CORPORATION LTD (TANTRANSCO)**, the term 'Purchaser/Employer' shall refer to **BHEL** and the term 'Contractor' shall refer to the **Successful Bidder**.

1.2 TECHNICAL REQUIREMENTS

As per Customer Specification mentioned in Section-2.

1.3 LIST OF NITROGEN INJECTION FIRE PROTECTION SYSTEM REQUIREMENT AT ARIYALLUR SUB STATION

Sl. No.	Description of Transformer / Reactor on which Nitrogen Injection Fire Protection System is to be fitted	Unit	Quantity
1.	500 MVA 765/400/33 kV, 1-Ph Auto Transformer (TBEA Make)	Nos.	06
2.	80 MVAr 765 kV, 1-Ph Reactor (CGL/BHEL Make)	Nos.	18

1.4 TYPE OF FIRE PROTECTION REQUIRED

Complete independent Nitrogen injection fire protection system for each of 6 Nos. 500 MVA 765 kV Transformer, TBEA make & 18 Nos. 80 MVAR 1 Phase 765 kV Reactor, CGL/BHEL make.

Each transformer shall have total Oil quantity approximately 85KL and each reactor shall have total Oil quantity approximately 35KL.

1.5 DESIGN CRITERIA

The **NITROGEN INJECTION FIRE PROTECTION 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 PROTECTION 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 Specification shall be satisfied by the contractor in totality.

1.6 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. The scope of the work under the contract shall be deemed to include all such items, which although not specifically mentioned in the bid documents and/or in the bidder's proposal, but are required to make the equipment/system complete for its safe, efficient, reliable and trouble free operation, unless the same is specifically excluded from the Bidder's scope of work.

Since the contract shall be on lumpsum basis, separate unit rate of any items ie. cable, pipes or any associated accessories shall not be acceptable in the tender bid. Hence you may consider the sufficient quantity of each item for making the system safe, efficient, reliable and trouble free operation as per the input provided to you.

1.6.1 Scope of supply

Each set of NIFPS for transformer/reactor shall consist of mainly following items:

1. Supply and Installation of Fire extinguishing Cabinet with base frame as per Customer Specification and Approved Drawings.
2. Supply and Installation of Control box to be installed in control room on the cable trench with necessary mounting and fixing arrangement on the frame (back to back two tier type to suit site condition) as per Customer Specification and Approved Drawings.
3. Supply and Installation of Signal box as per Customer Specification and Approved Drawings
4. Supply and Installation of Pre-stressed non-return valve (PNRV)/ high speed pneumatically operated ball valve (POBV) as per Customer Specification and Approved Drawings.
5. Supply and Installation of Fire detectors as per Customer Specification and Approved Drawings including necessary Cabling arrangement for Fire Detector with FS Cable of suitable size, cable trays and any other items required for its mounting.
6. Supply and laying of FRLS cable of size 12C X 1.5 mm^2 in existing trenches along with Cable Trays of necessary sizes 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 as per Customer Specification and Approved Drawings. Quantity of cable should be considered as per outdoor trench layout drawing furnished in this specification.
7. Supply and laying of FRLS cable of size 4C X 1.5 mm^2 in existing trenches along with Cable Trays of necessary sizes as per Customer Specification and Approved Drawings. Quantity of cable should be considered as per outdoor trench layout drawing furnished in this specification.
8. Supply and Installation of Oil drainpipe of suitable size for connection between outlet valves provided on transformer / Reactor tank and flange provided on top of FE cubicle as per Customer Specification and Approved Drawings.
9. Supply and Installation of Oil drainpipe of suitable size for connection between oil drainpipe bottom (in FE cubicle) to the oil pit as per Customer Specification and Approved Drawings.
10. Supply and Installation of Nitrogen injection pipe of suitable size for connection between inlet openings on transformer / Reactor tank and flange provided on top of FE cubicle as per Customer Specification and Approved Drawings.
11. Supply and Installation of pipe of suitable size for support to oil drain as per Customer Specification and Approved Drawings.

a. The Bidder shall quote as per special instructions, General and Special Conditions of Contract, Technical Specifications, and Drawings.
b. The whole cost of complying with the provisions of the Contract shall be included in the lumpsum quoted price by bidders in the price schedule.
c. Miscellaneous items like hardware, fixtures etc. shall be deemed to be included in the lumpsum price.

12. LIST OF MANDATORY SPARES

The following mandatory spares may be supplied under one Set:

a) **1 No**. filled nitrogen cylinder for Transformer
b) **1 No**. filled nitrogen cylinder for Reactor
c) **1 Set** of hose pipes with fittings for Transformer
d) **1 Set** of hose pipes with fittings for Reactor
e) **6 Nos.** complete fire detectors alongwith sensors and other accessories.

Prices of above mandatory spares shall deemed to be included in the lumpsum price of one set as per price schedule to be filled by bidders.

Bidder s*hall note the following:*

- BHEL shall lay single feeder for 220V DC 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, 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 signalling 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, marshalling cabinets in control room, cabinets for fixation of control boxes etc. are under the scope of Bidder.
- FE Cubicle shall comprise of Fire extinguishing Cabinet with base frame, consisting of:

a. Nitrogen Gas cylinder of sufficient capacity with pressure regulator and manometer with sufficient number of adjustable NO contacts.
b. Oil Drain Assembly
c. Mechanical release device for oil drain and nitrogen release.
d. Limit switches for monitoring the systems
e. Panel lighting
f. Flanges on top of the panel for connecting oil drain and nitrogen injection pipes for transformer / Reactor.
g. Oil drain pipe extension of suitable size for connecting pipes to oil pit.
h. Limit switch for pressure switch/ sensor.

- 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 signalling 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
- Deferential relay trip
- PRV/RPRR trip
- Transformer trip
- System Out of service
- Auto/Manual/ Off
- Lamp test
- Visual / Audio Alarm

- Signal box will be terminating cable connections from PRV/ pressure sensor, PNRV/POBV, fire detectors and circuit breaker trip signal.
- Pre-stressed non-return valve (PNRV)/ high speed pneumatically operated ball valve (POBV) shall be provided with sufficient number of NC contacts for remote alarm indication and with visual position indicator.
- Fire detectors will rated for heat sensing at 141°C or suitable temperature recommended by the manufacturer and each will fitted with two nos. PG 13.5 size cable glands.
- FRLS cable of size 12C X 1.5 mm^2 to be used or 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.
- FRLS cable of size 4C X 1.5 mm^2 to be used 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.
- Cable trays, if required, of suitable size as per the type of Cable used along with 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 (50 X 8 mm or 75 X 12 mm) 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.
- ***Bidder shall consider sufficient tools and tackles, which shall be brought to site for erection & commissioning purpose (to be returned after completion of work).***

1.6.2 SCOPE OF SERVICES

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

Any minor Civil Work, supply of Inserts and Foundation Bolts required if any, required for complete and successful installation of Nitrogen Injection System is in the scope of Contractor and is deemed to be included in the quoted prices.

1.6.2.2 Erection, Testing & Commissioning (ETC) requirements

a. The scope of ETC shall include erection of equipment /material at site including fabrication, equipment/ system testing and commissioning of the entire system.

Fabrication of MS Structure support to mount the control boxes in two tier arrangement in control room on trench in control room

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. 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.

1.6.2.3 Installation & pre-commissioning test of Nitrogen Injection Fire Protection System:

After installation the system pre-commissioning tests shall be carried out jointly with customer/BHEL before the system is put in service.

1.7 Provisions with Transformer / Reactor for installation of Nitrogen Injection Fire Protection System:

Following provisions shall be provided by BHEL with each Transformer / Reactor for installation of Nitrogen Injection Fire Protection System:

-Oil drain opening with pipe, flange and manual gate valve at about 100 - 150 mm below the top cover.

-Nitrogen Injection openings with suitable size of pipe with flanges and manual gate valves on tank sides at about 50 - 200 mm from the bottom plate.

-Flanges on conservator pipe between Buchholz relay and conservator tank for fixing PNRV/ POBV.

-Provision for temperature and pressure sensors if required.

-Supply and welding of fire detector bracket on top cover.

-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. Any other requirement for modification needed in the Transformer / Reactor Design shall be brought out clearly in the bid itself. Bidder shall also provide relevant drawings for recommended / desired size of Brackets for mounting Fire Detectors, Brackets for fixing Signal Box etc. along with any other information as may be necessary to make required modifications on Transformer / Reactor for purpose of successful and complete installation of Nitrogen Injection Fire Protection System.

1.8 EXCLUSIONS

1.8.1 Construction of foundation and plinth for fire extinguishing cubicle. However the necessary details and drawings shall be furnished by contractor.

1.8.2 Construction of RCC / Brick Oil Pits near Transformer/Reactor (No MS tank is envisaged)

1.8.3 Supply of BUCHHOLZ relay.

1.8.4 Supply of GI flat for earthing of equipments.

1.8.5 Unloading and Storage at Site.

1.8.6 Construction of Safety Wall / fire wall for Transformer and Reactor.

1.8.7 Any Trench Related work for lying of Cables in Switchyard.

1.8.8 Set of Gate valves needed for Transformer / Reactor Package i. e. 25 NB Gate valves for Nitrogen Injection openings at a distance of about 50 - 200 mm from Bottom Plate and 150NB Gate valve for Oil Drain on top about 100 - 150 mm below top cover.

(Apart from the Valves mentioned in Clause 1.8.8, all other Valves related to exclusively to Nitrogen Injection System in line with scope of supply, are to be included in Bidder's offer).

1.9 TECHNICAL QUALIFYING REQUIREMENT

The Bidder is required to meet the pre-qualification requirement for NIFPS as per criteria stipulated below:

The manufacturer for supply of N2 injection fire protection system must have tested product witnessed by representative of any central/state govt. utilities /Govt. approved lab. Also the test should have been performed within 10 (Ten) years from date of techno-commercial bid opening. Bidder should submit copy of test report alongwith bid.

This test report shall cover atleast the following:

i) Functional Test for Fire Extinguishing Cubicle and Control Box for Oil drain & Nitrogen gas release by simulation method

ii) Live demonstration test

Also Bidder should have designed, manufactured, supplied, installed & commissioned NIFPS for 400KV or above rating equipments (transformer/reactor) at any central/state govt. utilities and should be in successful operation for atleast one year before the techno commercial bid opening date.

Bidder should have also supplied and successfully executed similar job having order value not less than Rs. 187 lakh during last 10 (Ten) years from techno-commercial bid opening date.

In support of the same, the bidder shall submit Purchase order / Work order copy, completion / commissioning certificate and one year performance certificate from the customer for meeting qualifying requirement.

Note: Bidder's offer will be technically acceptable subject to final acceptance of vendor by ultimate customer as approved supplier.

1.10 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.

Testing, demonstration and installation and commissioning of all the units of *Transformer Fire prevention system (By injecting nitrogen gas devices) shall be carried out at the site in presence of TANTRANSCO/BHEL representatives and necessary training shall also be arranged for TANTRANSCO staffs.*

1.11 QUALITY PLAN

The contractor shall carry out contract works in accordance with sound quality management principles which shall include such as controls which are necessary to ensure full compliance to all requirements of the specification & applicable international standards. These quality management requirement shall apply to all activities during design, procurement, manufacturing, inspection, testing, packaging, shipping, inland transportation, storage, site erection & commissioning. Contractor shall submit detailed Quality Plan for BHEL / TANTRANSCO approval.

1.12 DRAWING AND DOCUMENTATION

All drawings, data, design calculations & printed erection, operation & maintenance manual and other documents will be submitted by the Contractor as per activity schedule filled up by contractor during bidding stage.

1.13 HANDING AND 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 / Owner's representative prior to handing over the system. Any additions/correction required for suitable operation of nitrogen injection fire prevention system before handing over to customer shall be done by contractor without any extra cost to BHEL.

1.14 Bidder shall quote under the following heads:

Sl. No.	Item Description	Unit	Quantity
1.0	Supply of Nitrogen Injection Fire Prevention System (NIFPS) for 500MVA, 1-phase, 765kV transformer including all associated accessories, pipes, cables etc. as per technical specification	Sets	06
2.0	Erection, Testing & Commissioning of complete NIFPS for 500MVA, 1-phase, 765kV transformer including all associated accessories, pipes, cables etc. as per technical specification	Sets	06
3.0	Supply of Nitrogen Injection Fire Prevention System (NIFPS) for 80MVAr, 1-phase, 765kV Reactor including all associated accessories, pipes, cables etc. as per technical specification	Sets	18
4.0	Erection, Testing & Commissioning of complete NIFPS for 80MVAr, 1-phase, 765kV Reactor including all associated accessories, pipes, cables etc. as per technical specification	Sets	18
5.0	Supply of Mandatory Spares as per technical specification, section-1, clause 1.6.1.12	Set	01

SECTION - 2

CUSTOMER SPECIFICATION

35.0 FIRE PREVENTION SYSTEM BY INJECTING NITROGEN GAS (NIFPS)

35.1. All the transformers shall be provided with fire prevention system by injecting Nitrogen gas.

35.2 Technical specification

35.2.1. 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).

35.2.2. The system may be an integral part of the transformer and of leak proof.

35.2.3. The system shall be of automatic operation in sensing and taking Prevention measures in protecting the transformer whenever internal/external fire risk arises.

35.2.4. 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.

35.2.5. The tenderer shall indicate the maintenance and testing schedules required. Practically maintenance free system is preferred.

35.2.6. Inter locks shall be provided to prevent mal-operation.

35.2.7. 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.

35.2.8. The materials shall be manufactured as per Indian/ International Standards as applicable.

35.2.9. The tenderer may furnish the detailed working of the system offered meeting the requirement of national/ international requirement for fire prevention. Necessary literatures, pamphlets, broachers etc required may also be enclosed along with tender offer.

35.2.10. 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.

35.2.11. 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.

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

35.2.13 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 signalling 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, marshalling cabinets in control room, cabinets for fixation of control boxes etc are under the scope of tenderer.

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

35.3.0. 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.

35.4.0. 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.

Heat detecting/Fire detecting system placed in transformer is to be connected in parallel to the signal box. The signal box shall be connected to a Shutter valve fitted between the conservator tank and Buchholz relay. Control box is also to be connected to the relay panel in the control room for system activation signals.

35.5.0. Operation

On receipt of all activating signals, the drain of a pre-determined quantity of oil commences thus removing high temperature top oil layer. After a time gap depending on the scenario, the nitrogen is injected inside the tank at a pre-fixed rate from the storage cylinder, stirring the oil thus bringing the temperature of oil down. Nitrogen occupies the top space created by oil drained out and acts as an insulting layer between the tank oil & fire, if any on top cover. Shutter valve blocks oil flow from conservator tank thus fully isolating transformer and preventing aggravation of fire.

35.6.0 Performance Requirement of the System

The system for prevention of fire and explosion of Auto Transformers shall act as fire preventer by preventing transformer oil tank explosion and possible fire in case of internal faults. In the event of fire by external causes such as bushing fires, OLTC fires fire from surrounding equipment etc., it shall act as a fast & effective fire fighter. The Drain and Stir system shall accomplish its role as fire preventer using nitrogen and extinguisher without employing water and / or carbon dioxide.

35.7.0. Activation

Mal-functioning of fire prevention / extinguishing system is their major shortcoming which leads to interruption in power supply. The supplier shall ensure that the chances of malfunctioning and leak of the Drain and Stir system is practically nil. To achieve this objective, the supplier shall work out his scheme of activating signals which will preventing mal-operation, should not be too rigorous to make the operation of the Drain and Stir system impracticable in case of actual need. Following electrical signals shall be provided in series for activating the system.

35.7.1 Auto Mode:

The system should activate upon reception of the following signals.

a) For prevention of Fire : 1) Differential Relay Operation
2) Pressure Relief valve or RPRR (Rapid Pressure Release Relay)
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).

35.7.2. 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.

35.8.0. Cabinet:

It shall be made of 3 mm thick steel frame, painted darn 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
- Anti sesmic mechanical protection
- All electrical cables inside panel must be routed and channelled with cover.

38.9.0. 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

35.10. 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.

35.11. 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 signalling 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
- Deferential relay trip
- PRV/RPRR trip
- Transformer trip
- System Out of service
- Auto/Manual/ Off
- lamp test
- Visual / Audio Alarm

35.12. 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.

35.13. 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.

35.14. Signal Box

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

35.15. 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.

35.16. Pipes

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

35.17. 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 colour (Shade 538 of IS-5). All the exposed parts i.e., pipes, supports, signal box etc. shall be painted with enamelled paint.

35.18. 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 each for Transformer and reactor
b) 1 set of hose pipes with fittings. each for Transformer and reactor
c) 6nos. fire detectors

35.19. 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.

35.20. Technical Particulars

Fire Extinction Period

On commencement of Nitrogen Injection : Maximum 30 seconds

From the moment of system activation to Complete cooling. : Maximum 30 minutes

Fire Detector heat sensing temp : 138°C / 141°C

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

Shutter valve setting for normal condition: 40 litre per minute
(Valve should not close)

Capacity of Nitrogen Cylinder : 10 m^3 gas at pressure of 150 kg/cm^2 up to 60000 litres oil capacity of transformer tank and 20 m^3 gas at pressure of 150 kg/cm^2 up to 60000 litres oil capacity of transformer tank.

Control Box : 220V DC

Fire extinguishing cubicle for lighting : 230 V AC

CONDITIONS FOR NIFPS GIVEN ANNEXURE-A.

1. Testing, demonstration and installation and commissioning of all the units of Transformer Fire prevention system (By injecting nitrogen gas devices) shall be carried out at the site in presence of TANTRANSCO representatives and necessary training shall also be arranged for TANTRANSCO staffs.
2. The breaker status required for the NIFPS system shall be wired from direct CB aux contacts.
3. Two DC sources shall be provided with DC changeover scheme for NIFPS system operation.
4. Direct contacts of respective protection signals shall be wired for NIFPS system operation.
5. System shall protect Transformer along with OLTC and the system shall operate in automatic, remote and manual mode in the event of power failure.
6. System shall have interlock to ensure operation of system only after transformer electrical isolation to avoid Nitrogen injection in energised transformer.
7. System shall have mechanical interlocking arrangement for nitrogen injection as well as oil drain to avoid unnecessary operation during maintenance or testing of the transformer or testing of NIFPS system.
8. Pressure monitoring switch for back up protection for nitrogen release as redundancy to first signal of oil draining commencement of nitrogen release shall be provided.
9. System shall have individual mechanical release devices and provision for oil drain and Nitrogen release to operate manually in case of DC supply failure.
10. The panel construction shall be meet NIFPS specification requirement.
11. The LED lamp shall be provided for cubicle illumination.

SECTION- 2

SECTION - 3

GENERAL TECHNICAL REQUIREMENT AND TITLE BLOCK

SECTION – 3

GENERAL TECHNICAL REQUIREMENTS

3.0 FOREWORD

The provisions under this section are intended to supplement general requirements for the materials, equipment's 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 : 765/400KV AIS SUB STATION AT ARIYALUR

c) Transport facilities : Road/Rail

Physical and other parameters:

3.1.1 Location of the substation

3.1.2 Nearest Railway station : Tindivanam
Railway : Southern Railway

3.1.3 Meteorological data

(i)	Atmosphere	: Polluted
(ii)	Maximum ambient temperature	: 50ºC
(iii)	Minimum ambient temperature	: 20ºC
(iv)	Maximum daily average a***m***bient air temperature	: 45º C
(v)	Maximum yearly average ambient air temperature	: 32º C
(vi)	Maximum Humidity (%)	: 100%
(vii)	Average thunder storm days per annum	: 50
(viii)	Average rainy days per annum	: 65
(ix)	Average annual rainfall (mm)	: 750 mm
(x)	No. of months during which tropical monsoon condition prevail	: 3
(xi)	Maximum wind pressure	: 150 Kgf/Sqmm

(xii) Altitude above MSL : <1000M

(xii) Basic Wind Speed : **39 m/s (Zone -2)**

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

3.1.4 System Parameter

SL No	Description of parameters	765kV System	400 KV system
1.	System operating Voltage	765kV	400kV
2.	Maximum operating voltage of the system(rms)	800kV	420kV
3.	Rated Frequency	50HZ	50
4.	Number of Phases	3	3
5.	Rated Insulation Levels (i)Full wave impulse withstand voltage.(1.2 to 50 micro sec) (ii)Switching impulse withstand voltage(250/2500 micro sec) dry and wet. (iii) One minute power frequency dry withstand voltage (rms)frequency dry withstand voltage (rms)	 2100kVp 1550kVp 830kV	 1550kVp 1050kVp
6.	Corona extinction voltage	508kV	320kV
7.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz at 508 kV rms for 765kV,and 266kV rms for 400kV system	2500 microvolts	1000 microvolts
8.	Minimum creepage distance (25mm/kV)	20000 mm	10500 mm
9.	Rated short circuit current for 1 sec. Duration	50kA	63kA
10.	System neutral earthing	Effectively earthed	Effectively earthed

11.	Seismic acceleration	0.3g horizontal	0.3g horizontal
12.	Plinth level of switchyard	500mm above FGL	500mm above FGL

3.1.5 AUXILIARY POWER SUPPLY:

Auxiliary electrical equipment's maintenance equipment's etc., shall be suitable for operation on the following supply system.

3 phase AC Supply	415V, 3 phase 4 wire 50 Hz, neutral grounded AC supply -10% to +10%, frequency +/- 5%
1 phase AC supply	240V, single phase, 50 Hz neutral grounded AC supply
DC supply	220, 2 wire DC supply + 10% to –15%, Ungrounded 48V, 2 wire DC supply , Positively earthed

3.2 GENERAL REQUIREMENT

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

3.2.1 The bidder shall also furnish drawings for the following:

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

3.2.2 GENERAL:

The bidder 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.

Any other items not specifically mentioned in the specification but which are required for erection of materials/equipment under the scope of work, testing and commissioning are deemed to be included in the scope of the specification unless specifically excluded.

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/equipment is furnished. The Technical specification contained herein for the materials are for the guidance of the tenderer.

The bidders are requested to procure the equipment's/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

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

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

3.4 STANDARD:

The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

The equipment to be furnished under this specification shall conform to latest issue with all amendments (as on the date of bid opening) of standards specified in each section.

The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other.
The Bidder shall also note that list of standards presented in this specification is not complete. Whenever necessary the list of standards shall be considered in conjunction with specific IS/IEC. When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

3.5 TYPE TEST:

The Type Test for all the equipments/materials used for this project should have been conducted in any approved Government/Govt. recognized laboratories conforming to latest IS/IEC. The above type test certificates should accompany the drawings of the materials equipments, duly signed under seal by the Institution, who have issued the type test certificate. The above type test should have been conducted not earlier than 5 years, subject to no change in design as on the originally scheduled date of technical bid opening i.e. **30.09.2016**

In case the type tests were conducted earlier than 05 (Five) years prior to the originally scheduled date of bid opening, the contractor shall repeat these test (s) at no extra cost to the purchaser (BHEL).

The original type test certificates shall be furnished for verification on request.
TANTRANSCO/BHEL reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative at no extra cost.
Non furnishing of type test certificates by the tenderers, will be liable for rejection.

3.6 MATERIALS AND WORKMANSHIP:

All the materials shall be of the best class and capable of satisfactory operation in the tropics with humid atmosphere conditions. Unless otherwise specified, they shall conform to the requirements of the appropriate ISS/IEC. The workmanship shall be of the best grade and the entire construction in accordance with the best modern practice.

The equipment shall be designed to facilitate inspection and repairs and to ensure satisfactory operation under atmosphere condition prevailing at site and under such sudden variation of load and voltage as may be met with under working conditions in the system including those due to faulty synchronizing and short circuit within the rating of the apparatus.

The design shall incorporate every reasonable precaution and provision for the safety of all those concerned in the operation and maintenance of the equipment.

All the equipment's should operate without undue vibration and with the least practicable amount of noise.

3.7 **INSPECTION** :

The inspection may be carried out by the TANTRANSCO/BHEL at any stage of manufacture. The supplier shall grant free access to TANTRANSCO's/BHEL representative at a reasonable time when the work is in progress. The TANTRANSCO/BHEL shall have access at all times to the works and all other places of manufacture/fabrication, where the equipments are being manufactured/fabricated and the bidder shall provide TANTRANSCO's/BHEL representative all facilities for unrestricted inspection of the works, raw materials, manufacture of all the accessories and for conducting necessary tests.

Inspection and acceptance of any equipment under this specification by the TANTRANSCO/BHEL shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective. The supplier shall keep the TANTRANSCO/BHEL informed in advance, about the manufacturing programme so that arrangement can be made for inspection.

The TANTRANSCO/BHEL, reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

The correct grade and quality of steel shall be used by the supplier. To ascertain quality of steel, the TANTRANSCO/BHEL may at his discretion get the material tested at an approved laboratory.

The bidder shall take an account the fabrication wastage while quoting the rates. The Employer will not accept any liability in connection with the wastage of steel during fabrication or otherwise. Steel shall be procured exclusively from the main producers. However, sections not rolled by main produces can be procured from reroller, provided rerolling of structural steel section is done rom billets/ingots of tested quality. Rerolled sections are duly tested as per relevant standards. Supplier should obtain approval of list of primary producers of Steel and Zinc before Proto assembly.

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.

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:
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.

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.

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 PRE COMMISSIONING TESTING (if applicable) :-

On completion of erection of equipment's and before charging each item of equipment's shall be thoroughly cleaned and inspected jointly by the TANTRANSCO and the BHEL for correctness and completeness of installation and acceptability for charging leading to initial

pre commissioning test. The pre commissioning testing to be carried all equipment's in the presence of BHEL/ TANTRANSCO. Necessary tools, testing kits to be arranged by the Supplier.

3.10 DOCUMENTATION: All drawings shall conform to relevant international standards Organization (ISO) specification. All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in S.I. units.

3.11PAINTING, GALVANISING:

All interiors and exteriors of all metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter and the surfaces treated by phosphating (e.g. seven tank phosphating sequences).

All metal surfaces exposed to atmosphere shall be given, in addition to the treatment, two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limits specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling. All external paintings shall be as per shade **No.697/631 of IS-5**.
Paint inside the metallic housing shall be of anti-condensation type and the paint on outside surfaces shall be suitable for outdoor installation.

All components shall be given adequate treatment of climate proofing as per **IS: 3202** so as to withstand corrosive and several service conditions.

All ferrous parts including all sizes of nuts, bolts, support channel structures, etc. as also the mechanism housing shall be hot dip galvanized conforming to latest version of IS : 2629 or epoxy painted. Spring washers shall be electro-galvanised.

All members of the structure members shall be hot dipped galvanised with a zinc coating of **610 gms. per square metre** . Galvanising shall be done after a work is completed, except that the nuts may be tapped or rerun after galvanization. The zinc coating shall be smooth, clean, of uniform thickness and free from defects. The preparation for galvanising itself shall not adversely affect the mechanical properties of the coated materials. The employer shall be at liberty to have the samples of zinc used, test checked in any laboratory at his own cost and reject the particular supply if it is below standard.

All galvanised material shall withstand test as per IS 2633-1972 or any other equivalent standard.The zinc used for galvanising fabricated material shall be of high grade Electrolytic zinc of 99.99% purity.

All nuts and pins shall be adequately locked. Nuts, bolts and pins used inside the transformer and tap-changer compartment where gaskets are not used shall be provided with spring washers or locknuts. Where galvanizing is specified, it shall be applied by the hot dipped process or by electro-galvanizing process and for all parts, other than steel wires, shall consist of a thickness of

zinc coating equivalent to not less than 610gm of zinc per square meter of surface. The zinc coating shall be smooth, of uniform thickness and free from defects.

3.12 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible, shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

3.13 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

3.14 FUNGI-STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

3.15 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.

3.16 RATING PLATES, NAME PLATES AND LABELS:-

The equipment's shall be provided with a rating plate or plates marked with but not limited to following data whatever needs to that particular equipment's.

(a) Manufacturer's name or trade mark.
(b) Serial number and type design making it possible to get all relevant information from the manufacturer.
(c) Year of manufacture.
(d) Rated voltage
(e) Rated insulation level.
(f) Rated frequency
(g) Rated Normal current.
(h) Rated short circuit breaking current
(i) First pole to clear factor
(j) Rated duration of short circuit
(k) Rated auxiliary D.C. supply voltage of closing and opening devices.
(l) Rated pressure of SF6 gas for operation and interruption.
(m) Rated out of phase breaking current.
(n) Rated supply voltage of auxiliary circuit.
(o) Rated supply frequency of auxiliary circuits.
(p) Purchase Order Number and Date.

The rating plate shall be visible in position of normal service and installation.
The rating plate shall be weather proof and corrosion proof.

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/labels shall also be submitted.

3.17 EARTHING:

The operating mechanism housing, control cabinets, support structure etc. shall be provided with two separate earthing terminals suitable for bolted connection to 50x8mm mild steel flat to be provided for connection to station earth mat.
Circuit breakers, LA, Isolator, CVT, CT, BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat of Size 75X12 mm. Control panels, Relay panel, outdoor marshalling boxes, Junction boxes, Lighting panels and distribution board shall be provided with two grounding pads, for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earth wire.

3.18 TERMINAL BLOCKS AND WIRING

Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All Inter-phase and external connections to equipment or to control cubicles will be made through terminal blocks.

Terminal blocks shall be 1100 V grade and have continuous rating to carry the maximum expected current on the terminals. Those shall be of moulded piece complete with insulated barriers stud type terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be non-disconnecting stud type equivalent to Elmex type CATM4, Phoenix cage clamp type of Wedge or equivalent. The Insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

Terminal block for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

The terminal shall be that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally. The conducting part in contact with cable shall preferably be tinned or silver plated however

Nickel plated copper or zinc plated steel shall also be acceptable. The terminal blocks shall be of extensible design. The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

The terminal blocks shall be fully enclosed with removable covers of transparent, non-deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

All circuits except CT circuits :	Minimum of 2 nos. of 2.5 sq.mm.copper flexible.
All CT circuits :	Minimum of 4 nos. of 2.5 sq.mm, copper flexible.

The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live. At least 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

There shall be a minimum clearance of 250mm between the first bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm. The Supplier shall furnish all wire, conduits and terminals for the necessary inter-phase electrical connection (where applicable) as well as between phases and common terminal boxes or control cabinets.

All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publications, in both longitudinal and transverse modes. The supplier shall also provide all necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment.

TB sizes for incoming power supply shall be informed/confirmed during drawing approval stage.

3.19 **CONTROL CABINETS, JUNCTION BOXES, TERMINALS BOXES AND MARSHALLING BOXES FOR OUTDOOR EQUIPMENTS**

All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS-5039, IS-8623 or IEC-439, as applicable and the clause given below.

Control cabinet, Junction boxes, Marshalling boxes & Terminal boxes shall be made of sheet steel. Sheet steel used shall be at least 2.0 mm thick cold rolled or 2.5 mm hot rolled. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

Cabinet /boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of gaskets shall be such that it does not get damaged/cracked during the operation of the equipment.

All door, removable covers and plates shall be gasketed all around with suitably profiled Neoprene /EPDM gaskets. The gasket shall be tested in accordance with approved quality plan. The quality of gasket shall be such that it does not get damaged /cracked during the years of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth, straight and reinforced if necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate projecting at least 150 mm above from the base of the Marshalling Kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland. The gland shall project at least 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required.

3.20 SPACE HEATERS

The heater shall be suitable for continuous operation at 240 V AC supply voltage and shall be provided with on – off switch and fuse shall be provided for heater.

One or more adequately rated, thermostatically connected heaters shall be supplied to prevent condensation in any compartment.

3.21 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.

3.22 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.

3.23 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.

3.24 LIST OF DRAWINGS AND DOCUMENTS :

The drawings for the equipments provided by the TANTRANSCO shall be followed strictly by the bidder while designing. For the rest of the equipments, the design is in the scope of the bidder and the same got approved by the TANTRANSCO.

The bidder shall furnish One sets of relevant descriptive and illustrative published literature pamphlets and the following drawings/documents for preliminary study along with the offer.

(i) General outline drawings showing dimensions and shipping weights,quantity of insulating media , etc.

(ii) Sectional views showing the general constructional features of the circuit breaker including operating mechanism, arcing chambers, contacts with lifting dimensions for maintenance.

(iii) Schematic diagrams of breaker offered for control supervision and re- closing.

(iv) Structural drawing, design calculations and loading data for support structures.

(v) Foundation drilling plan and loading data for foundation design.

(vi) The Type Test Reports

(vii) Bill of materials shall be furnished along with drawings.

The supplier shall, within 1 weeks of placement of order submit Six sets of final version of all the above drawings for BHEL/TANTRANSCO's approval. The TANTRANSCO shall communicate its comments/approval on the drawings to the supplier within reasonable period. The Supplier shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for TANTRANSCO's approval within two weeks from the date of comments.. However the drawing approval does not absolve the supplier from complying with the terms of the specification.

The following should be supplied to each consignee circle along with the initial supply of equipment's ordered.

1) Five copies of printed and bound volumes of operation, maintenance and erection manual in English along with the copies of approved drawings and type test reports etc.
2) Three sets of manuals detailed in item (1) shall be supplied to the TANTRANSCO/BHEL with in one week from the date of approval of drawings.
3) The spares for the Equipment's ordered under the scope of the Contract should also be supplied to the consignee circle along with initial supply of the breakers.
4) It should be noted that if the above conditions are not fulfilled the initial payment will not be released.

3.25 **QUALITY ASSURANCE PLAN:**

The bidder shall invariably furnish following information along with his offer. (i) Statement giving list of important raw materials including but not limited to:

(a) Contact material
(b) Insulation
(c) Porcelain
(d) Sealing material
(e) Contactor, limit switches, etc. in control cabinet.

Name of sub-supplier for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials in presence of bidder's representative, copies of test certificates.

(ii) Information and copies of test certificates as in (i) above in respect of bought out accessories.
(iii) List of areas in manufacturing process, where such inspections are normally carried out for quality control and details of such tests and inspections.
(iv) Special features provided in the equipment to make it maintenance free.
(v) List of testing equipment available with the Bidder for final testing of breakers vis-à-vis, the type, special, acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly brought out in the relevant schedule i.e. schedule of deviations from specified test requirements.

The supplier shall submit following information to the TANTRANSCO.

1) List of raw materials as well bought out accessories and the names of sub-suppliers selected from those furnished along with offer.
2) Type test certificates of the raw material and bought out accessories.
3) Quality assurance plan (QAP) withhold points for TANTRANSCO inspection. The quality assurance plan and hold point shall be discussed between the employer and supplier before the QAP is finalized.

The supplier shall submit the routine test certificates of bought out items and raw material, at the time of

routine testing of the fully assembled breaker.

3.26 **TEMPERATURE RISE:**

The maximum temperature attained by any part of the equipment when in service at site under continuous full load conditions and exposed to the direct rays of the sun shall not exceed 30 deg. Cover an ambient of 50 deg. C limits specified in relevant IEC. When the standard specify the limit of temperature rise these shall be exceeded when corrected for the difference between ambient temperature at site and that specified in the approved specifications. No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

3.27 **FITTINGS AND ACCESSORIES:**

Following is a partial list of some of the major fittings and accessories to be furnished by contractor as an integral part of the equipment.

Operation mechanism housing complete with:

(a)Locking arrangement.

(b)Heaters equipped with automatic thermostatic control and control switch. (c) Cable glands.

(d) Local/Remote change over switch.

(e) Operation Counter.

(f) Terminal Blocks.

(g) Control switches to cut off control power supply.

(h) MCCBs/MCBs are required with permanent identification marks for protection of D.C. circuits and A.C. circuits.

(i)Two earthing terminals.

3.28 PACKING AND FORWARDING:

The equipment shall be packed in crates suitable for vertical/horizontal Transport, as the case may be and suitable to withstand handling transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit due to improper and inadequate packing and handling. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc., shall be provided. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.

The supplier shall provide such packing of the goods as is required to prevent their damage or deterioration during transit to their final destination as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit to their final destination as indicated in the Contract and exposure to extreme temperatures, salt and precipitation etc., during transport and open storage. Packing case size and weights shall be taken into consideration wherever

appropriate, the remoteness of the 'goods' final destination and absence of heavy mechanized handling facilities, at all points in transit.

The packing, marking and documentation within and outside the package shall comply strictly with such special requirements as shall be expressly provided for in the Contract or in any subsequent instructions issued by BHEL.

3.29 SPECIFICATION FOR NITRYL BUTYL RUBBER

The gaskets are to be used in tanks exposed to Transformer mineral oil/SF6 at about 110° C.

1. Hardness should be Shore A 70 ± 5.
2. Tensile Strength should be min. 10.8N/sq.mm (Minimum)
3. Elongation strength should be 270% (Minimum)

3.30 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 BHEL/TANTRANSCO. 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 BHEL/TANTRANSCO 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 below mention Title block for Submission of Documents.

Title Block

Customer	**M/s Tamil Nadu Transmission Corporation Limited**
Project:	**765/400KV Air Insulated substation Ariyalur**
Contractor	**BHEL**

3.31 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

Drawings, GTP, Type Test Reports and List of Past Supplies. Drawings & Documents submitted at the time of offer shall be subject to review at contract stage.

3.31 DOCUMENTATION SCHEDULE

Following Documentation schedule to be followed per project.

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	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.

SECTION - 4

GUARANTEED TECHNICAL PARTICULARS AND LIST OF DRAWINGS

SECTION 4

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 TRANSFORMERS/REACTOR

GUARANTEED TECHNICAL PARTICULARS N_2 INJECTION SYSTEM		
(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	
	TECHNICAL PARTICULARS OF NITROGEN INJECTION FIRE EXTINGUISHING	
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 500MVA 765kV Transformer / 80MVAr, 765kV Reactor	
	- Dimension	
	- Weight	
	- Nitrogen cylinder capacity	
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 MINIMUM BASIC DRAWINGS / DOCUMENTS TO BE SUBMITTED DURING DETAILED ENGINEERING

In this section, the List of system drawings & documents that are required to be generated is furnished. The numbers to be accorded against each drawing in List of drawings is also given below.

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

1.	Interconnection diagram with RPRR of PNT Fire System
2.	Details of Control Box of PNT Fire system with RPRR
3.	Details of Fire extinguishing Cubicles
4.	Details of TCIV and mounting flanges for TCIV (PNRV) of PNT Fire system
5.	Details of Valve position with pressure switch in FEC of PNT Fire system
6.	Details of Plinth for Fire extinguishing cubicle of PNT Fire system with safety wall.
7.	Details of signal box and logic diagram for operation of PNT Fire system
8.	Details of Oil tank for PNT Fire system
9.	Guaranteed Technical Particulars.
10	Manufacturing quality plan

SECTION - 5

SCHEDULE TO BE FILLED BY BIDDER AND ENCLOSURES TO SPECIFICATION

SECTION 5

ENCLOSURES TO SPECIFICATION

Schedule 1 Format of **Schedule of Deviations**
(to be submitted by Bidder at Tender Stage)

Schedule 2 Format of **Details of contact persons (technical & commercial)**
(to be submitted by Bidder at Tender Stage)

SCHEDULE – I

SCHEDULE OF TECHNICAL DEVIATION

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

Section	Clause No./ Page No.	Statement of deviation/ Variations/Exceptions

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

Date

Signature of the authorized representative of Bidder

Name ----------

Designation ----------

Company seal----------

SCHEDULE - II

DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Date

Signature of the authorized representative of Bidder

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.