



BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

NEW DELHI

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				W.O. No	83006		
CUSTOMER	TAMIL NADU TRANSMISSION CORPORATION LIMITED						
PROJECT	400/230-110 KV Substation at Anikadavu						

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

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Section – 1
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SECTION - 1

**SCOPE, TECHNICAL REQUIREMENTS, TECHNICAL QUALIFYING REQUIREMENT
AND BILL OF MATERIAL**

SECTION 1
SCOPE, TECHNICAL REQUIREMENTS, TECHNICAL QUALIFYING REQUIREMENT
AND BILL OF MATERIAL

1.1 SCOPE

- 1.1.1 This specification covers the design, engineering, manufacture, inspection and testing at Contractor's and/ or his Sub-Contractor's works, proper packing for transportation, delivery (FOR destination), handling, erection, testing & commissioning at site of '**Nitrogen Injection Fire Prevention System**' for 315 MVA and 200 MVA Transformers at **400/230-110 KV SUB STATION at Anikadavu** 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 Prevention 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. In case of any 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 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.**
- 1.1.6 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.
- 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 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.
- 1.1.10 **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.*

1.1.11 The specification comprises of following sections :

- Section-1: Scope, Technical requirements, Technical Qualifying Requirement & Bill of Material
- Section - 2 : Customer Specification
- Section - 3 : General Technical Requirements
- 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 : TANTRANSO

Name of the Project : 400/230-110 KV Anikadavu Substation

1.1.12 The term 'Customer' or 'Owner' appearing in this specification shall refer to **M/s. TANTRANSO [M/s. Tamil Nadu Transmission Corporation Limited]**, the term 'Purchaser/Employer' shall refer to Bharat Heavy Electricals Ltd. (**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 PREVENTION SYSTEM REQUIREMENT

Sl. No.	Description of Transformer on which Nitrogen Injection Fire Prevention System is to be fitted	Unit	Quantity
1.	315 MVA, 3 Phase 50 C/S, 400 / 230 / 33 KV YNaod11 Auto Transformer	Nos.	03
2.	200 MVA, 3 Phase 50 C/S, 400 / 110 / 33 KV YNaod11 Auto Transformer	Nos.	02
TOTAL			05

1.4 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, as detailed in Clause 3 above.

1.5 DESIGN CRITERIA

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'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 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). 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.

Anything major left out in the BOM shall be clearly highlighted/ brought to purchaser's notice and to be listed in the Technical Deviation Sheet as a part of the Technical Offer.

1.6.1 Scope of supply

- a. The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, General and Special Conditions of Contract, Technical Specifications, and Drawings.
- b. 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.
- c. 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.
- d. 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.
- e. 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.
- f. 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.

Bidder shall 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 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.

- 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.
 - g. Oil drain pipe extension of suitable size for connecting pipes to oil pit.
 - h. Limit switch for pressure switch/ sensor.
- 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 mm² to be used or connecting signal box mounted on transformer 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 mm² 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 (25 X 3 mm or 50 X 6 mm or 75 X 10 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 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).***

1.6.2 SCOPE OF SERVICES

1.6.2.1 CIVIL WORKS : NO CIVIL WORKS are envisaged in the scope of Contractor. All Civil Works including Construction of foundation and plinth for fire extinguishing cubicle, Construction of RCC / Brick Oil Pits and other Civil Work required for complete and successful installation of Nitrogen Injection System is excluded from the Scope of Bidder and is in BHEL Scope.

However during Detailed Engineering Stage on BHEL's request, the Bidder is required to furnish requisite data, drawings etc. which is specific to its system and is required by BHEL for executing Civil Works like pipe support, construction of Oil Pit, Foundation and Plinth for FE Cubicle,

1.6.2.2 Erection, Testing & Commissioning (ETC) requirements

- a) The scope of ETC shall include erection of equipment / material at site (Material will be unloaded and stored by BHEL / BHEL appointed Contractor and will be issued to Bidder at the Stores for starting erection) including fabrication, equipment/ system testing and commissioning of the entire system.
- b) Laying and termination of piping between transformer, 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 Prevention System:

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

1.7 Provisions with Transformer for installation of Nitrogen Injection Fire Prevention System :

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

- a. Oil drain opening with pipe, flange and manual gate valve at about 100 - 150 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 - 200 mm 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. Any other requirement for modification needed in the Transformer 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 for purpose of successful and complete installation of Nitrogen Injection Fire Prevention System.

1.8 EXCLUSIONS

- 1.8.1 Supply of BUCHHOLZ relay.
- 1.8.2 Supply of GI flat for earthing of equipments.
- 1.8.3 Unloading and Storage at Site.
- 1.8.4 Construction of Safety Wall / fire wall for Transformer.
- 1.8.5 Any Trench Related work for lying of Cables in Switchyard.
- 1.8.6 Set of Gate valves needed for Transformer Package i. e. 25 NB Gate valves for Nitrogen Injection openings at a distance of about 50 - 200 mm from Bottom Plate and 150 NB Gate valve for Oil Drain on top about 100 - 150 mm below top cover.

(Apart from the Valves mentioned in Clause 1.8.6, all other Valves related to exclusively to Nitrogen Injection System in line with the Bill of Material, are to be included in Bidder's offer).

1.9 TECHNICAL QUALIFYING REQUIREMENT

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.

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.

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 / Customer approval within 1 week of P.O. placement.

1.12 DRAWING AND DOCUMENTATION

All drawings, data, design calculations & printed erection, operation & maintenance manual and other documents will be submitted by the Contractor within 2 weeks after placement of order for customer approval.

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. Not with standing above technical specifications any additions be incorporated for correct operating of nitrogen injection fire prevention system without extra cost.

1.14 BILL OF MATERIAL - As per following sheets from Page no. 8 to 11.

BILL OF MATERIAL FOR NITROGEN INJECTION FIRE PREVENTION SYSTEM FOR ANIKADAVU

Sl. No.	Item Description	Unit	Quantity
1.	Supply and Installation of Fire extinguishing Cabinet with base frame as per Customer Specification and Approved Drawings.	SET	05
2.	Supply and Installation of Control box to be installed in control room as per Customer Specification and Approved Drawings.	Nos.	05
3.	Supply and Installation of Signal box as per Customer Specification and Approved Drawings.	Nos.	05
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.	Nos.	05
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.	Nos.	60

Sl. No.	Item Description	Unit	Quantity
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.	Mtrs.	1300
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.	Mtrs.	400
8	Supply and Installation of Oil drainpipe of suitable size for connection between outlet valve provided on transformer / Reactor tank and flange provided on top of FE cubicle as per Customer Specification and Approved Drawings.	Mtrs.	60
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.	Mtrs.	30
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.	Mtrs.	90

Sl. No.	Item Description	Unit	Quantity
11	Supply and Installation of pipe of suitable size for support to oil drain as per Customer Specification and Approved Drawings.	Mtrs.	60
12	MANDATORY SPARES		
12.1	Filled Nitrogen Cylinder	No.	01
12.2	Hose Pipes with fittings	Set	01
12.3	Linear Heat Detector	Meters	25
12.4	Fire Detectors	Nos.	06

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

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SECTION 2 -

CUSTOMER 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

~~22.0~~ 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.

~~23.0 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~~

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

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SECTION - 3

GENERAL TECHNICAL REQUIREMENTS

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:

SECTION	CLAUSE NO. / PAGE NO.	STATEMENT OF DEVIATION / VARIATIONS / EXCEPTIONS

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 -----

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Contractor : Bharat Heavy Electricals Limited

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SECTION - 4

GUARANTEED TECHNICAL PARTICULARS AND LIST OF DRAWINGS

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

GUARANTEED TECHNICAL PARTICULARS N₂ 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 100MVA transformer	
	- Dimension	
	- Weight	
	- Nitrogen cylinder capacity	

Project : 400/230-110 kV Anikadavu Substation
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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.	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

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SECTION - 5

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 3 **Layout Plan of 400/230-110 KV Anikadavu Substation**

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
---------	-------------------------	--

-
- 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-----

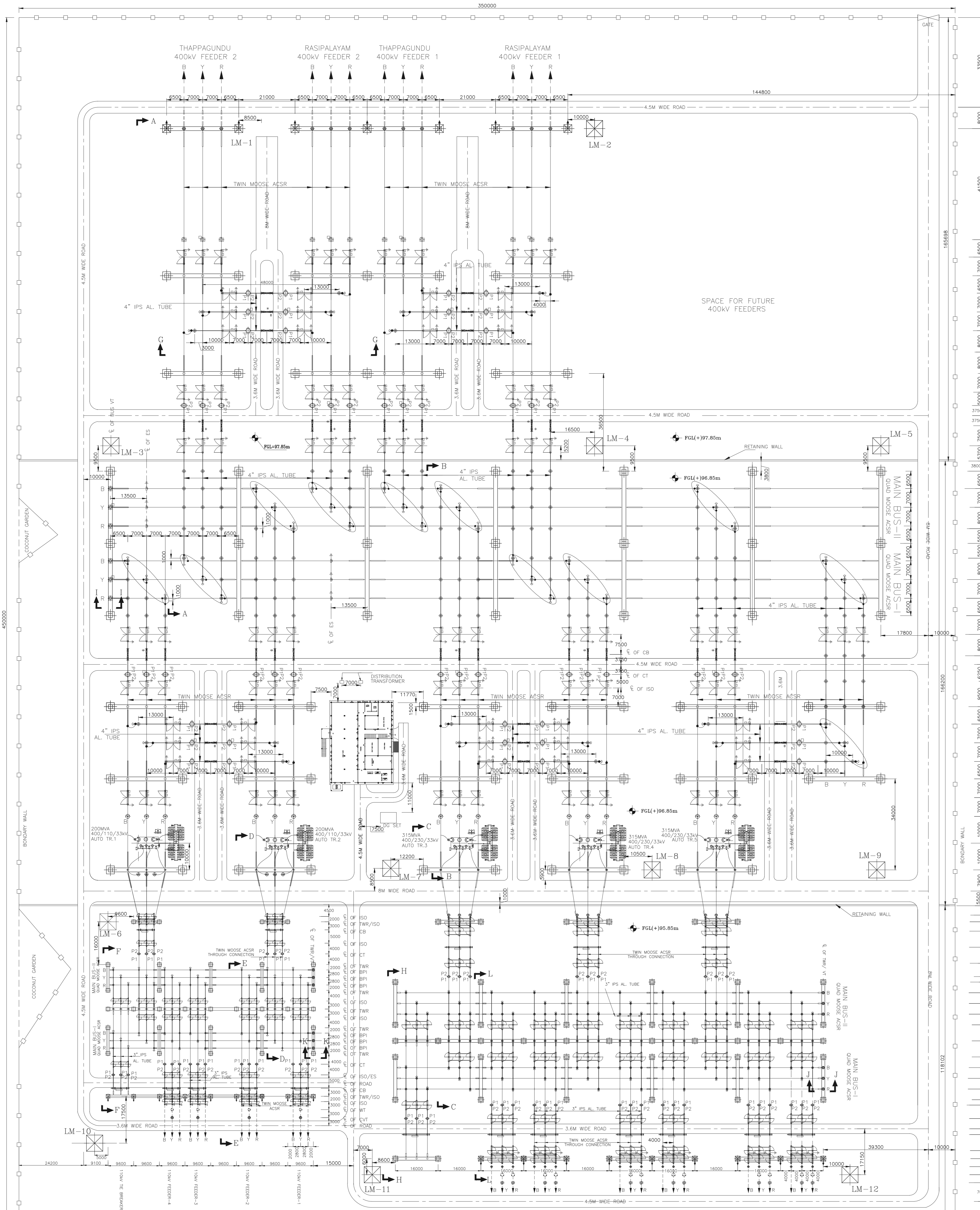
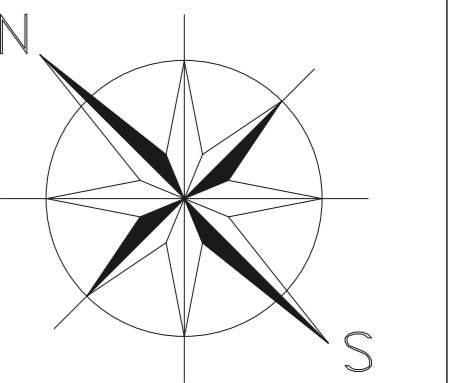
Designation-----

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

- LAYOUT PLAN FOR 400/230-110 KV ANIKADAVU SUBSTATION –
DRAWING NO. TB-0-364-316-002 REV. 03**



400kV BILL OF QUANTITY (MAIN EQUIPMENT)

S.L.	ITEM DESCRIPTION	SYMBOL	QTY.	SPARE QTY.	SUPPORT STRUCTURE TYPE
1.	315 MVA, 3 PHASE 50Hz, 400 /230/33 KV YNd11, AUTO TRANSFORMER	[Symbol]	03	--	NA
2.	200 MVA, 3 PHASE 50Hz 400/110/33 KV YNd11, AUTO TRANSFORMER	[Symbol]	02	--	NA
3.	400 KV, 3150 A, 63KA/1S OUTDOOR SF6 BREAKER 1Φ & 3Φ RE-CLOSING WITHOUT PRE INSERTION RESISTOR	[Symbol]	06	--	PIPE/LATTICE
4.	400 KV, 3150 A, 63KA/1S OUTDOOR SF6 BREAKER 1Φ & 3Φ RE-CLOSING WITH PRE INSERTION RESISTOR	[Symbol]	06	01	PIPE/LATTICE
5.	420 KV, 3000A, 63KA/1S, 5 CORE SINGLE PHASE CURRENT TRANSFORMER	[Symbol]	54	02	LATTICE
6.	390 KV LIGHTNING ARRESTER	[Symbol]	27	02	PIPE
7.	400 KV 4400pF SINGLE PHASE CVT	[Symbol]	18	02	PIPE
8.	400 KV, 3150 A, 63KA/1S HCB ISOLATOR WITH DOUBLE EARTH SWITCH	[Symbol]	09	01	PIPE/LATTICE
9.	420 KV, 3150 A, 63KA/1S HCB ISOLATOR WITH SINGLE EARTH SWITCH	[Symbol]	28	--	PIPE/LATTICE
10.	420 KV BUS EARTH SWITCH (SINGLE PHASE).	[Symbol]	06	--	PIPE/LATTICE
11.	420 KV BUS POST INSULATOR	[Symbol]	167	--	PIPE/LATTICE

230kV BILL OF QUANTITY (MAIN EQUIPMENT)

S.L.	ITEM DESCRIPTION	SYMBOL	QTY.	SPARE QTY.	SUPPORT STRUCTURE TYPE
1.	245 KV, 2000A, 40KA/3S OUTDOOR SF6 BREAKER 1Φ & 3Φ RE-CLOSING	[Symbol]	10	--	PIPE/LATTICE
2.	245 KV, 2000 A, 40KA/3S, 5 CORE SINGLE PHASE CURRENT TRANSFORMER	[Symbol]	30	--	PIPE/LATTICE
3.	245 KV, 2000 A, 40KA/3S HDB ISOLATOR WITH SINGLE EARTH SWITCH	[Symbol]	06	--	PIPE/LATTICE
4.	245 KV, 2000 A, 40KA/3S HDB ISOLATOR WITHOUT EARTH SWITCH	[Symbol]	41	--	PIPE/LATTICE
5.	216 KV LIGHTNING ARRESTER	[Symbol]	09	--	PIPE
6.	230 KV SINGLE PHASE 3 CORE BUS VT	[Symbol]	06	--	PIPE
7.	230 KV 4400pF SINGLE PHASE CVT	[Symbol]	12	--	PIPE
8.	230 KV, 0.5 MH, 2000A WAVE TRAP	[Symbol]	04	--	PIPE
9.	230KV BUS POST INSULATOR	[Symbol]	118	--	PIPE/LATTICE
10.	230 KV UNDER HUNG SOLID CORE INSULATOR	[Symbol]	39	--	NA

110kV BILL OF QUANTITY (MAIN EQUIPMENT)

S.L.	ITEM DESCRIPTION	SYMBOL	QTY.	SPARE QTY.	SUPPORT STRUCTURE TYPE
1.	132 KV, 2000A, 40KA/3S OUTDOOR SF6 BREAKER (AND OPERATED 3Φ RE-CLOSING)	[Symbol]	07	--	PIPE/LATTICE
2.	132 KV, 2000 A, 40KA/3S, 5 CORE SINGLE PHASE CURRENT TRANSFORMER	[Symbol]	21	--	PIPE/LATTICE
3.	132 KV, 2000 A, 40KA/3S HDB ISOLATOR WITH SINGLE EARTH SWITCH	[Symbol]	04	--	PIPE/LATTICE
4.	132 KV, 2000 A, 40KA/3S HDB ISOLATOR WITHOUT EARTH SWITCH	[Symbol]	28	--	PIPE/LATTICE
5.	96 KV LIGHTNING ARRESTER	[Symbol]	06	--	PIPE
6.	110 KV SINGLE PHASE 3 CORE BUS VT	[Symbol]	06	--	PIPE
7.	110 KV 6600pF SINGLE PHASE CVT	[Symbol]	04	--	PIPE
8.	110 KV, 0.5 MH, 2000A WAVE TRAP	[Symbol]	04	--	PIPE
9.	132KV BUS POST INSULATOR	[Symbol]	56	--	PIPE/LATTICE
10.	132 KV UNDER HUNG SOLID CORE INSULATOR	[Symbol]	27	--	NA

MINIMUM CLEARANCE (AS PER IS AND IE RULES) AND SPACING	400kV	230kV	110kV
MINIMUM CLEARANCE PHASE TO PHASE (P-P)	4000	2100	1100
MINIMUM CLEARANCE PHASE TO EARTH (P-E)	3500	2100	1100
PHASE TO PHASE SPACING	7000	4000	2800
PHASE TO EARTH SPACING	4750	2100	1100
MINIMUM SECTION CLEARANCES (SC)	6500	5000	4000
TO NEAREST PART OF AN INSULATOR SUPPORTING LIVE CONDUCTOR(NOT AT EARTH POTENTIAL)	2550	2550	2550
HEIGHT OF TUBE / COND. CENTER LINE OF FIRST LEVEL FROM PLINTH LEVEL	8000	5500	4600
CREEPAGE DISTANCE	25 mm/kV	25 mm/kV	25 mm/kV

NOTES :-

- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
- SYSTEM PARAMETERS

S. NO.	DESCRIPTION	UNIT	400	230	110
1.	NOMINAL SYSTEM VOLTAGE	kV	400	230	110
2.	HIGHEST SYSTEM VOLTAGE	kV	420	245	132
3.	BASIC IMPULSE LEVEL	kVp	1425	1050	550
4.	POWER FREQUENCY WITHSTAND	kVrms	630	460	230
5.	SWITCHING IMPULSE WITHSTAND VOLTAGE	kVrms	1050	--	--
6.	CREEPAGE DISTANCE (MINIMUM)	mm/kV	25	25	25
7.	SYSTEM FAULT LEVEL	KA/Sec	63/1	40/3	40/3
- CONDUCTOR DETAIL

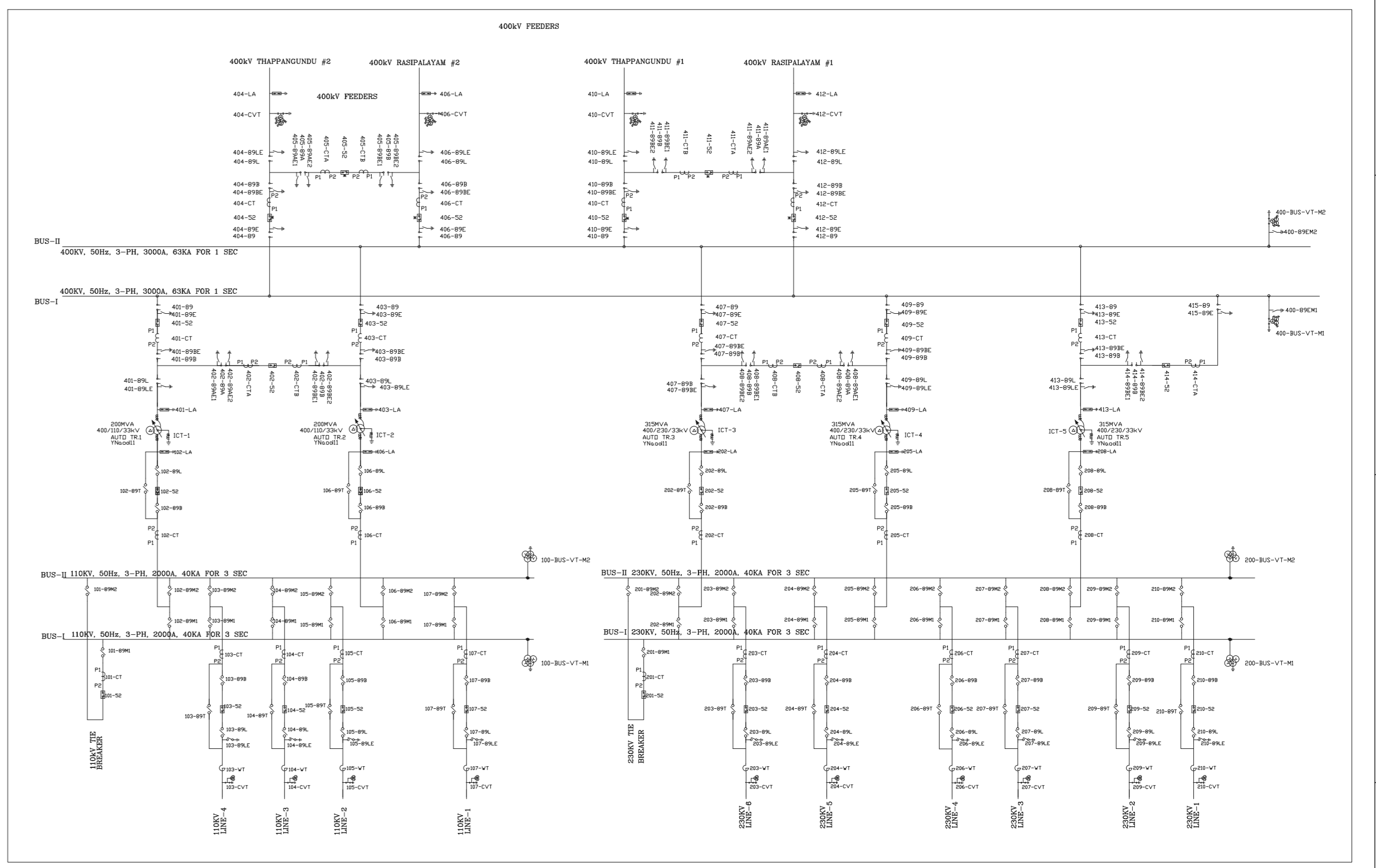
S. NOS.	DESCRIPTION	400kV	230kV	110kV
1.	MAIN BUS AND BUS COUPLER BAY	QUAD ACSR MOOSE	QUAD ACSR MOOSE	QUAD ACSR MOOSE
2.	EQUIPMENT INTERCONNECTION	4" IPS AL TUBE/TWIN MOOSE ACSR	3" IPS AL TUBE / TWIN MOOSE ACSR	3" IPS AL TUBE / TWIN MOOSE ACSR
3.	JACK BUS/DROPPERS	TWIN MOOSE ACSR	TWIN MOOSE ACSR	TWIN MOOSE ACSR
- ALL THE DIMENSIONS ARE IN MM.
- LIGHTNING PROTECTION OF SWITCHYARD SHALL BE DONE BY LIGHTNING MAST AND LOCATION OF LM SHALL BE AS PER D/SPL CALCULATION.
- DIMENSIONS AND HENCE CLEARANCES ARE AS PER TANTRANSCO INPUT DRAWINGS.
- SEPARATE DRAWING SHALL BE REFERRED FOR ERECTION KEY DIAGRAM, TRENCH LAYOUT, EARTH MAT LAYOUT, CONTROL ROOM, TOWER/ BEAM, FIRE FIGHTING SYSTEM, ILLUMINATION SYSTEM, AIR CONDITIONING & VENTILATION SYSTEM, FENCE, GATE, GRAVEL ETC.
- F.G.L. AS DECIDED AT SITE WITH TANTRANSCO = 95.85M, 96.85M AND 97.85M AS SHOWN.
- THE HEIGHT OF FENCE AND GATE WOULD BE SHOWN IN THE CORRESPONDING CIVIL DRAWING.
- STATIC TENSION ON THE BUSES AND SHIELD WIRE SHALL BE SHOWN IN THE STRUCTURE LOADING DIAGRAM SEPARATELY.
- TANTRANSCO TO GIVE THE COORDINATES OF FENCE / BOUNDARY WALL AND DIMENSIONS BETWEEN CONDUCTORS.
- WHEREVER SPACE IS NOT AVAILABLE ROAD REQUIREMENT SHALL BE FINALISED AT SITE.
- UNDERHUNG INSULATORS SHALL BE SUSPENDED FROM TOP PCD.
- LOCATION OF DO SET AND DISTRIBUTION TRANSFORMER MAY CHANGE TO SUIT SITE CONDITION.

LEGENDS :-

- BHEL SCOPE
- - - NOT IN BHEL SCOPE
- BOUNDARY WALL

BOQ FOR STRING INSULATOR & HARDWARE

Sl. No.	ITEM DESCRIPTION	Quantity (SETS)
1.	400 kV Double Tension String Insulator with double anchoring point(anchor spacing 450mm), 2x25 discs with tension clamp, Corona Ring and Turn Buckle set suitable for Quad ACSR Moose Conductor (sub conductor spacing 450mm)	36
2.	400 kV Double Tension String Insulator with double anchoring point(anchor spacing 450mm), 2x25 discs with tension clamp, Corona Ring and without Turn Buckle set suitable for Quad ACSR Moose Conductor (sub conductor spacing 450mm)	36
3.	400 kV Double Tension String Insulator with double anchoring point(anchor spacing 450mm), 2x25 discs with tension clamp, Corona Ring and Turn Buckle set suitable for Twin ACSR Moose Conductor (sub conductor spacing 450mm)	57
4.	400 kV Double Tension String Insulator with double anchoring point(anchor spacing 450mm), 2x25 discs with tension clamp, Corona Ring and without Turn Buckle set suitable for Twin ACSR Moose Conductor (sub conductor spacing 450mm)	57
5.	400 kV Single Suspension String Insulator, with 25 discs, Corona Ring, drop type clamp suitable for Twin ACSR Moose Conductor (sub conductor spacing 450mm)	69
6.	230 kV Double Tension String Insulator with double anchoring point (anchor spacing 450mm), 2x15 discs with tension clamp and Turn Buckle set suitable for Quad ACSR Moose Conductor (sub conductor spacing 225mm)	33
7.	230 kV Double Tension String Insulator with double anchoring point (anchor spacing 450mm), 2x15 discs with tension clamp and without Turn Buckle set suitable for Quad ACSR Moose Conductor (sub conductor spacing 225mm)	33
8.	230 kV Double Tension String Insulator with Double anchoring point (anchor spacing 450mm), 2x15discs with tension clamp and Turn Buckle set suitable for Twin ACSR Moose Conductor (sub conductor spacing 225mm)	36
9.	230 kV Double Tension String Insulator with Double anchoring point (anchor spacing 450mm), 2x15 discs with tension clamp and without Turn Buckle set suitable for Twin ACSR Moose Conductor (sub conductor spacing 225mm)	36
10.	Both side Bolted type Tension Clamp for mid span isolation with 3Discs suitable for Twin Moose Conductor (sub conductor spacing 225mm) (For 230kV CT and Line Bars)	27
11.	Single Suspension String Insulator with 3 discs, drop type clamp suitable for Twin ACSR Moose Conductor (sub conductor spacing 225mm) (For 230kV Lines) (To be suspended from Twin Moose String Conductor)	12
12.	Both side Bolted type Tension Clamp for mid span isolation with 3Discs suitable for Twin Moose Conductor (sub conductor spacing 225mm) (For 110kV CT and Line Bars)	18
13.	Single Suspension String Insulator, with 3 discs, drop type clamp suitable for Twin ACSR Moose Conductor (sub conductor spacing 225mm) (For 110kV Lines) (To be suspended from Twin Moose String Conductor of out going lines)	4
14.	110 kV Double Tension String Insulator with double anchoring point(anchor spacing 450mm), 2x8discs with tension clamp and Turn Buckle set suitable for Quad ACSR Moose Conductor (sub conductor spacing 225mm)	27
15.	110 kV Double Tension String Insulator with double anchoring point(anchor spacing 450mm), 2x8 discs with tension clamp and without Turn Buckle set suitable for Twin ACSR Moose Conductor (sub conductor spacing 225mm)	27
16.	110 kV Double Tension String Insulator with Double anchoring point, 2x8 discs with tension clamp and Turn Buckle set suitable for Twin ACSR Moose Conductor (sub conductor spacing 225mm)	24
17.	110 kV Double Tension String Insulator with Double anchoring point, 2x8 discs with tension clamp and without Turn Buckle set suitable for Twin ACSR Moose Conductor (sub conductor spacing 225mm)	24



SINGLE LINE DIAGRAM

COMPUTER Dwg PATH NAME :
 REF. Dwg. No.
 SIGN. & DATE
 INVENTORY No.

ADDITIONAL INFORMATION W.O.No. 83006	PROJECT NAME TAMILNADU TRANSMISSION CORP. LTD. 400/230-110kV SUBSTATION ANIKADAVU
STATUS OF DRAWING DISTRIBUTION OF PRINTS	NAME OF CONSULTANT BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION
DATE 08.08.14	SCALE 1:635
DATE 08.08.14	DATE 13.09.13
DATE 08.08.14	DATE 13.09.13
DATE 08.08.14	DATE 13.09.13

REV.	DATE	ALtered	CHKD	BY	DATE	ALtered	CHKD	BY	DATE	ALtered	CHKD	BY	DATE
01	08.08.14	ISSUED	SKS	SKS	08.08.14	ISSUED	SKS	SKS	08.08.14	ISSUED	SKS	SKS	08.08.14
02	08.08.14	ISSUED	SKS	SKS	08.08.14	ISSUED	SKS	SKS	08.08.14	ISSUED	SKS	SKS	08.08.14
03	08.08.14	ISSUED	SKS	SKS	08.08.14	ISSUED	SKS	SKS	08.08.14	ISSUED	SKS	SKS	08.08.14

DRAWING TITLE: LAYOUT PLAN
 400/230-110kV SUBSTATION ANIKADAVU
 DRAWING NO. TB-0-364-316-002
 SHEET No. 01 OF 01