BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NOIDA

DOCUMENT NO.	TB-415-316-001	REV 00	PREPARED	CHECKED	APPROVED
TYPE OF DOC.	TECHNICAL SPECFICATION	NAME	GV	VK	AG
TITLE: 220kV GAS INSULATED SWITCHGEAR (GIS)		SIGN			3&4 V11 4/12/21
		DATE			
		GROUP	TBEM		
CUSTOMER	LTHP LTD. (A wholly owned subsidiary of NHPC Ltd.)				
CONSULTANT	NHPC Ltd.				
PROJECT	Teesta-VI H.E. Project (4x125 MW)				
LOA. NO.	LTHPL/CEO/Teesta-VI/2020/340 dtd. 04.09.2020				

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Remarks: It is to be noted that data and details of Guaranteed Technical Particulars (GTP) shall not be reviewed during Technical Evaluation/ Review, hence compliance of Guaranteed Technical Particulars (GTP) in line with Technical Specification shall be deemed to under complete compliance of bidder.

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Contents

SECTION 1:
SCOPE, PROJECT SPECIFIC TECHNICAL REQUIREMENTS & BILL OF QUANTITIES

1. Scope

This technical specification covers the requirements of design, engineering, fabrication, manufacturing, shop assembly, inspection and testing at manufacturer's works before supply, proper packing and delivery to project site, supervision of unloading & storage at site, and supervision of installation/ erection, site testing & commissioning, putting into successful operation complete with all materials, support structures, anchoring bolts, accessories, commissioning spares & maintenance spares, special spanners, tools & tackles, any specific required ancillary services, SF6 gas for first filling & spare etc. including training of Customer/ BHEL personnel for 220kV GIS with LCC & its Accessories complete in all respects for efficient & trouble-free operation mentioned under this specification.

Hence, the electrical scope of work under this requisition shall include but not be limited to basic and detailed engineering, as required, manufacturing, supply, transportation to site, inspection at manufacturer's work, supervision of installation, commissioning including site testing along with necessary equipment, training to Customer/ BHEL personnel, Insulation coordination studies, supply of all mandatory spares, commissioning spares, special tools and tackles as defined in the equipment datasheet, drawings, standard specifications, standards etc. attached or referred with technical specification.

This section covers the specific technical requirements of 220kV GIS with LCC & its Accessories. This constitutes minimum technical parameters for the above item as specified by the BHEL/ Customer. The offered 220kV GIS with LCC & its Accessories shall also comply with the Section-3 (Project Details and General technical requirements for all equipment under the Project) of this specification.

The specification comprises of following sections:

Section-1	:	Scope, Project Specific Technical Requirements & Bill of Quantities
Section-2	:	Equipment Specification under scope of Supplies
Section-3	:	Project Details & General Technical Requirements (For All Equipment under the Project)
Section-4	:	Annexures Annexure A- Compliance Certificate Annexure B- Schedule of Technical Deviations Annexure C- Guaranteed Technical Particulars Annexure D- Technical Checklist

The following order of priority shall be followed. In case of conflict between requirements specified in various documents, the more stringent one shall be followed. BHEL/Customer concurrence shall, however, be obtained before taking a final decision in such matters.

1. Statutory Regulations

In particular, the latest version of the following statutory regulations, as applicable, shall be followed for system,

- o Indian Electricity Act
- o CEA regulations
- o The Factory Act

2. Section-1
3. Section-2
4. Section-3
5. Codes & Standards

Bidder shall furnish list of conflicts/ ambiguities/ deviations, if any, along with their technical offer and also furnish the basis that is considered for submitting technical offer. BHEL/Customer will resolve listed conflicts prior to award. In case of ambiguity, bidder shall inform BHEL/Customer of their interpretation. In case bidder fails to convey the same prior to award, BHEL/ Customer decision on interpretation shall be considered final if need arises during the execution. No additional cost or extra time on account of conflicts/ ambiguities/ deviations shall be admissible.

The 220kV GIS being supplied shall be with double bus bar arrangement and with Seven (7) bay configuration and LCC (Local control center). Due integration of outdoor 220 KV facilities and transformer system shall be in the bidder's scope. The scope includes supply of a minimum of following items also,

(a) The incoming line bays will have Gas insulated bus duct connectivity with 220kV XLPE Cable.
(b) The termination of incoming XLPE cable with Gas Insulated Bus-duct shall be through interconnected gas insulated bus duct termination module complete with all accessories.
(c) The connectivity of transformer bays with 220 KV/34.5 KV outdoor transformer shall also be through Gas insulated Bus-duct. The connectivity with GIB and Transformer HV bushing shall also be through interconnected gas insulated bus duct complete with all accessories. Any intermediate conductors or connectors required for GIB to Transformer connectivity shall also be in bidder's scope

In general, no deviation from the requirements specified in various clauses of this specification shall be allowed and hence, a certificate to this effect shall have to be furnished along with the offer (Annexure-B), however bidder shall furnish list of conflicts/ ambiguities/ deviations (Annexure-A), if any. Any conflicts/ ambiguities/ deviations mentioned elsewhere in technical offer shall not be reviewed.

The equipment is required for the following project:

Name of the Customer	:	**LTHP LTD. (A wholly owned subsidiary of NHPC Ltd.)**
Name of Consultant	:	**NHPC Ltd.**
Name of Main Contractor	:	**Bharat Heavy Electricals Limited**
Name of the Project	:	**Teesta-VI H.E. Project (4x125 MW)**

The scope of supplies shall be as per commercial terms and conditions enclosed separately with the notice inviting tender/ enquiry.

2. Codes & Standards

The performance, testing and rating of the switchgear shall conform to the latest edition of the following IEC / IS publications,

IEC 60694	Common clauses for High Voltage Switchgear & Control Gear
IEC 62271-203	Gas Insulated metal-enclosed Switchgear for rated voltages above 52kV
IEC 62271-207	Seismic Qualification for Gas-insulated Switchgear Assemblies for rated voltages above 52kV
IEC 60376	New Sulphur Hexafluoride
IEC 62271-100	High Voltage Alternating Current Circuit Breakers
IEC 62271-1	Common Clauses for High Voltage Switchgear and Control-Gear Standards
IEC 62271-102	Alternating Current Disconnections (Isolators) and Earthing Switches
IEC 60044-1	Current Transformers
IEC 60044-2	Voltage Transformers
IEC 60137	Bushings for Alternating Voltages above 1000V
IEC 62271-209	Cable Connections for Gas-insulated Switchgear
IEC 60480	Guide to Checking of Sulphur Hexafluoride taken from Electrical Equipment
IEC 60099-1/4	Non-linear Resistor type Arresters for AC Systems
IEC 60439	Factory-built Assemblies of Low-voltage Switchgear and Control Gear.
IEEE 80 (2000)	IEEE Guide for Safety in AC Substation Grounding.
CIGRE-44	Earthing of GIS- An Application Guide. (Electra no. 151, Dec'93).
IEC 61639	Direct connection between Power Transformers and Gas-insulated metal-enclosed Switchgear for Rated Voltage 72.5kV and above

These are only indicative list and hence any other codes & standards, if applicable shall be complied by bidder.

3. Specific Technical Requirements

Specific technical requirements 220kV GIS with LCC & its Accessories shall be as follows,

Sl. No.	Technical Parameters	Unit	Particulars
	Type of GIS		Indoor Type, phase segregated
	Installation		Indoor
	Meteorological data		
1.1	Maximum ambient temperature	^{0}C	37
1.2	Minimum ambient temperature	^{0}C	8

2	Maximum Relative humidity	%	96.4
3	Minimum Relative humidity	%	5.8
4	Average Annual Rain Fall	mm	2544
5	Maximum Altitude above Mean Sea Level	m	1000
6	Seismic Level	Zone	4
	Switchgear Design Data		
10	Service Voltage	kV	220
11	Maximum Service Voltage	kVp	245
12	Rated Insulation Level		
	-at power frequency 1 min	kV	460
	-at lightning impulse (1.2/50 µs wave)	kV	1050
13	Frequency	Hz	50
14	Rated service current (minimum)		
	- Bus bar	A	2000
	- Input Feeder bay	A	2000
	- Transformer bay	A	2000
	- Bus coupling bay	A	2000
15	Rated short time withstand current (Symmetrical)	kA	40
	- Duration	Seconds	1
16	Internal fault withstand time without burn Through	ms	As per IEC-62271-203
17	Temperature rise at rated service current (indicative)		
	- Conductor	°C	As per IEC-60694
	- Enclosure	°C	
18	Rated SF6 gauge pressure at 20°C		
	- Circuit breaker	bar rel.	As per standard
	- Switchgear	bar rel.	
19	Enclosure design pressure		
	- Circuit breaker	bar rel.	As per standard
	- Switchgear	bar rel.	
20	Leakage rate of SF6 per annum for the whole substation	%	< 0.5
21	Maximum partial discharge level	pC	≤ 5
22	Factory Dielectric routine test 50Hz	kV	460
23	Site dielectric test	kV	380
24	Painting of switchgear		
	- GIS Bay / GIB		RAL 7038
	- LCC for GIS		RAL 1013

25	Surface protection of steel frames		Hot-dip Galvanizing with Zinc with 610gm/ square meter
26	Degree of Protection	IP	42

All current carrying components of the equipment specified shall be capable of continuous operation at the specified rated current without exceeding the maximum temperature rise specified in the relevant IEC standards. Thermal calculations shall be based on the climatic conditions mentioned elsewhere in specification.

4. Other General Requirements

Other general requirements 220kV GIS with LCC & its Accessories shall be as follows:

1. Storage shall be provided by BHEL/ its contractor. However, bidder shall provide their tentative space requirement for covered and/ or open store area during tender stage only. In addition to this, bidder shall submit their standard storage instruction manual specifically specifying the items with details of type of storage.
2. Bidder shall submit list of consumables with shelf life of less than six months and same shall be dispatched just before the erection and only after specific clearance from BHEL/Customer.
3. Packing of GIS & its accessories shall be suitable for long term storage without any deterioration in quality and performance (minimum 18 month, if required).
4. Bidder shall offer their latest type tested compact model to accommodate the specified & allocated space as per attached layout drawing of GIS. Bidder to note that if bidder fails to meet above requirement, its technical offer is liable for non-evaluation.
5. Bidder shall conduct insulation co-ordination studies in line with IEC:60071 for establishing surge arrester rating, quantity and any other requirement for successful operation of GIS.
6. Bidder shall be required to submit 3D OGA Drawing (light weight surface 3D model, exportable in 3D Autocad), compatible with Primtech for complete GIS & its accessories.
7. Bidder shall check and ensure adequacy of system protection for successful operation of GIS. After checking of system by bidder, GIS shall be installed and if any failure, malfunction of any part occurs after/ during commissioning, same shall be replaced immediately without any extra cost.
8. The 220kV GIS building shall comprise an EOT (Electric overhead travel) crane of minimum capacity 5 (Five) Ton or as per GIS OEM/ bidder recommendation, whichever is higher for lifting of any components of GIS switchgear EOT crane shall be provided for GIS. However, EOT crane for GIS is not envisaged in bidder's scope but bidder shall provide all the calculations basis for sizing of EOT crane during tender stage only.
9. CT/ VT parameters mentioned in CT VT parameter document is indicative only. Bidder has to ensure correctness of CT/VT sizing for GIS during contact stage / detailed Engineering stage.
10. Any change in bay pitch (distance between bays) as per civil requirement for during detailed engineering stage shall be incorporated by the bidder without any cost and delivery implication to BHEL.
11. Bidder shall include painting and marking of all buses, individual incomers, all outgoing feeders etc. with details such as tag no., feeder rating, sending end source reference etc. for all switchboards.
12. The GIS shall be designed in such a way that suitable walkways are provided all around the switchgears so that the operators will be able to have free access to all the operating

mechanism.

13. The GIS Equipment shall be complete with all necessary supports, ladders, galleries, staircases, catwalks, movable platforms or walkways (for accessing the equipment above two meters for maintenance and operation), mechanism cabinets, internal cable raceways etc for each bay and it shall be of modular construction and extendable design. All structures, galleries, staircases and walkways shall conform to the relevant Occupational Safety and Health Administration (OSHA).
14. Special tools & tackles for installation and testing kits for testing & commissioning shall be in bidder's scope, however, it shall be brought at site on returnable basis only.
15. Bidder shall provide list of general tools, tackles, slings, spanners, gauges and other lifting devices, drills, instruments, testing kits and appliances necessary for the complete assembly, installation, gas filling, maintenance, site testing of the GIS, however, the same shall be arranged by BHEL.

5. Earthing of GIS

Bidder to submit detailed calculations and layout drawings for earthing system during detailed engineering stage based on technical specification Section-2 of technical specification, bidder's design philosophy, IS/IEC requirement as applicable. Bidder to provide the bill of quantity of entire items required for the earthing of the GIS. However, supply of 40mm MS ROD, 75X12/50x6mm GI Flat shall be done by BHEL. Any other earthing material, as per design/BOQ, shall be in bidder's scope of supply only. Erection of earthing will be done by BHEL team under the supervision of bidder/manufacturer, as per manufacturer's design.

6. Modular Design & Future extensions

1. The GIS switch gear shall be of modular design offering high degree of flexibility. Each module shall be complete with SF6 gas circuit breaker, disconnectors, Maintenance Grounding switches, fast Earthing switches, voltage transformers, Current transformers, bus & elbow sections, Gas Insulated Bus-duct, local control cubicle and all necessary components required for safe & reliable operation and maintenance.
2. The GIS shall be single-phase enclosure type.
3. In those design where bus bar is continuous, provision is to be made available for isolation of individual bay without disturbing adjacent bay.
4. The switchgear shall be of the freestanding, self-supporting dead-front design, with all high-voltage equipment installed inside gas-insulated, metallic grounded enclosures, and suitably sub-divided into individual arc and gas proof compartments, preferably for:
   (1) Bus bars
   (2) Intermediate compartment
   (3) Circuit breakers
   (4) Line dis-connectors
   (5) Voltage transformers
   (6) Gas Insulated bus duct section between GIS and,
   (7) Gas insulated bus section between GIS and oil filled transformer.
   (8) Current Transformers.
5. The bus enclosure shall be sectionalized in a manner that maintenance work on any bus disconnector (when bus and bus disconnector are enclosed in a single enclosure) can be

carried out by isolating and evacuating the small effected section and not the entire bus.

6. Arc faults caused by external reasons shall be positively confined to the originating compartment and shall not spread to other parts of the switchgear. In case of any internal arc fault in a busbar, busbar disconnector or circuit breaker, of double bus system, repair works must be possible without shutting down complete substation and at least one busbar and the undisturbed bays must remain in operation.
7. The busbar system shall be sectionalized for each bay and contained in individual SF6 gas tight bus compartments to prevent contamination of the gas of the whole bus bar due to fault in one bay zone and refill lesser quantity of SF6 gas.
8. Where bus Coupler is specified and in case of any internal arc fault in a busbar, busbar disconnector or sectionaliser, repair work must be possible without shutting down the complete substation and at least one half of the substation must remain in operation.
9. Documents indicating sequence of repair work steps and description of necessary restrictions during work shall be submitted with the technical manual during as built drawing submission.
10. Each bay module should be equipped with suitable arrangement for easy dismantling and refitting during maintenance without disturbing other units.
11. Bus duct lengths shall be taken from the end of bay equipment (VT, LA etc.) to end equipment (XLPE Cable to SF6 Bus duct termination module, SF6 to oil bushing/ connection etc.)
12. Material clearance certificate shall be issued after demonstration of the functionality of maintenance equipment.
13. Structure Materials for support of GIS, Bus Ducts, SF6 to oil bushing/ connection and SF6 Bus duct termination module/connection including Foundation Bolts, Embedded Items, Rails and/ or other structural items required. All steel structure members shall be hot-dip galvanized after fabrication. Unless otherwise specified, minimum mass of zinc coating for Galvanizing shall be 610 gm/square meter. All field assembly joints shall be bolted. Field welding shall not be acceptable. Noncorrosive metal or plated steel shall be used for bolts and nuts throughout the work. Manufacturer shall provide suitable foundation channels and anchor bolts to support the switchgear assemblies. All mounting bolts, nuts and washers shall be provided to fasten the switchgear base frames to the foundation channels.
14. Necessary arrangement to be made in earthing switch for testing purpose i.e. Primary current injection/CB testing/CRM etc.

7. Maintenance and Repair of Circuit Breaker

1. The positioning of the circuit breaker in the GIS shall be such that it shall be possible to access the circuit breaker of any feeder from the front side for routine inspection, maintenance and repair without interfering with the operation of the adjacent feeders.
2. The GIS shall be so designed that any component of the GIS can be removed easily. With minimum flexibility in the layout arrangement it shall be possible to remove the circuit breaker with both busbars remaining in service and it shall be possible to remove the disconnector of the busbars, with one bus bar remaining in service. For achieving this requirement, adequate number of intermediate compartments, if required, shall be provided to ensure equipment & operating personnel's safety.
3. The bidder shall be required to demonstrate clearly in his submitted documents the suitability of the switchgear design in this respect. The arrangement shall be such that expansion of the original installation can be accomplished with minimum GIS down time.
4. In case of extension, the interface shall incorporate facilities for installation and testing of

extension to limit the part of the existing GIS to be re-tested and to allow for connection to the existing GIS without further dielectric testing.

5. All the elements shall be accessible without removing support structures for routine inspections and possible repairs.

8. Interchangeability & Future Extension

1. As much as possible, all the parts shall be of standard manufacturer with similar parts and assemblies being interchangeable.
2. The GIS system shall be suitable for future extension on either end by the addition of extra feeders, bus couplers, bus-bars, circuit breakers, dis-connectors, and other switch gear components. The arrangement of gas sections or compartments shall be such as to facilitate future extension without any drilling, cutting or welding on the existing equipment. To add equipment, it shall not be necessary to move or dislocate the existing switchgear bays
3. The layout shall ensure that GIS bus link section is provided for future extension of the GIS buses to avoid de-gassing and modification of the existing bus.
4. The physical layout shall ensure free movement of the SF6 Gas Cart and easy access to all components of the GIS for maintenance purposes.

9. Bill of Quantities

Quantities for supply and services for 220kV GIS with LCC & its Accessories shall be as per Annexure-220kV GIS BOQ. However, the scope broadly covers the following requirements,

The 220kV GIS and accessories with double bus bar arrangement and with Seven (7) bay configuration and LCC (Local control center) including due integration of outdoor 220kV facilities and transformer system.

10. Drawings / Documents required for Engineering Manufacturing Clearance

The drawings/ documents, as follows shall be used for providing technical clearance for manufacturing of GIS and furthermore, it shall be used for delay analysis, if any, from bidder. The schedule for submission and resubmission shall be in line with details provided in section-3. The first drawing submission will be counted from the date of submitting reasonably correct drawings.

Sl. No.	Overall Drawings approval required in Cat I /Cat II
1	220KV GIS- Gas Schematics with Single Line Diagram (Including CT VT Parameters)
2	220KV GIS- Guaranteed Technical Particulars (Including all GIS equipment
3	220KV GIS- Layout Plan & Section
4	220KV GIS- Interfacing Drawings for Cable Connection Module, SF6 to Oil Module with Guaranteed Technical Particulars
5	220KV GIS- Equipment Layout with Earthing philosophy
6	220KV GIS- Type Test Reports (Including all GIS equipment)
7	220KV GIS- Secondary Engineering Base Design
8	220KV GIS- Control Schematics for GIS and Local Control Cabinet
9	220KV GIS- Maintenance Equipment Catalogue with Guaranteed Technical

	Particulars
10	220KV GIS- Quality Assurance Plan & Inspection Test Schedule
11	220KV GIS- Civil Design Specification with Foundation Loading Diagram (Including interfacing details)
12	220KV GIS- Quantification for main Items, Spares, Consumables

The Manufacturing clearance shall be provided Lot wise, however lot item can be clubbed together subject to approval of drawing/ documents. MFC date will be counted from the date of approval of drawings in Cat I/ cat II , for each lot , as per the following table. Please refer to Sl. No. of items in the BOQ also,

Lot description covering BOQ items	**Sl. No. of approved Drawing required in Cat I/ Cat II for MFC**
Lot-1 (BOQ item A1 to A9)	Sl. No. 1, 2, 3, 6, 10,11 and 12
Lot-2 (BOQ item A10 to A13)	Sl. No. 1, 2, 3, 4, 6, 8 and 10
Lot-3 (BOQ item A15 and A16)	Sl. No. 3, 5, 10, 11 and 12
Lot-4 (BOQ item A14 and A17)	Sl. No. 2, 3, 10 and 12
Lot 5 (BOQ item B, C and D)	Sl. No. 9, 10 and 12

11. Type Testing

Bidder shall ensure that 220kV GIS with LCC & its Accessories, being procured should have valid type test certificates as per specified in IEC standard 62271 – 203 & 62271-100 (amended up to date) at any ISO/IEC accredited laboratories.

Type test certificates to be submitted by bidder shall not be older than 23.03.2010. In those cases, where type test certificates are older than 23.03.2010, OEM/ bidder shall carry out the type tests at at any ISO/IEC accredited laboratories prior to dispatch of equipment with no commercial implication to BHEL/Customer.

In case any of Type tests have not been conducted on the offered design or there has been a change in the design after the type tests. The requisite tests shall be conducted by bidder on the offered design without any extra cost and delivery impact to BHEL/ Customer.

Type test should have been carried out as per relevant IEC standards at the type test must have been carried out at any ISO/IEC accredited laboratories. The type test certificates, as specified in IEC standard 62271 – 203 & 62271-100 (amended up to date) shall be required for verification as evidence of successful completion of type tests.

12. Quality Plan

The successful bidder shall submit Quality Assurance Plan for major components such as breakers, disconnecting switches, lightning arrestors, earth switches, etc. with in-process inspection methods, tests, records, etc. for BHEL/ Customer approval. Customer hold points will also be included in the plan, which shall be mutually agreed by the BHEL/ Customer and Bidder and

approved. In case bidder has reference Quality Assurance Plan agreed with BHEL/Customer, same shall be submitted for specific project to BHEL/ Customer approval. There shall be no commercial implication to BHEL/ Customer on account of Quality Plan approval.

Superior quality control system shall be adopted to assure high product quality. Raw materials of the best commercial grade quality and high reliability shall be used in the manufacture of GIS. High reliability of materials shall be ensured so as to keep maintenance work to a minimum. All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved quality plan. The supplier shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and comply with the requirements of the specification. Charges for all these tests for all the equipment & components shall be deemed to be included in bidder's scope.

13. Inspection & Testing

1. GIS and its associated materials shall be subject to inspection by BHEL/ Customer or authorized representative at bidder/manufacturers' works. Hence, Bidder shall furnish all necessary information concerning the supply to BHEL/ Customer.
2. During fabrication, the equipment shall be subject to inspection by BHEL/ Customer or by an agency authorized by BHEL/ Customer to assess the progress of work as well as to ascertain that only quality raw material is used.
3. Bidder shall ensure that the hazardous area equipment provided shall have the necessary test certificates and valid CCOE approval certificates.
4. Bidder shall also furnish factory acceptance test (FAT) from manufacturers for BHEL/ customer approval in line with specific requirements mentioned in Section-2.
5. Shop Tests to be conducted at manufacturer works (Refer Clause 5.2 of Annexure-I)

14. Field Testing & Commissioning

1. Bidder shall carry out the supervision of installation, field testing and commissioning of 220kV GIS with LCC & its Accessories. Further appropriate test and commissioning reports and as-built documentation as necessary be submitted.
2. Field testing and commissioning of 220kV GIS with LCC & its Accessories shall be done by Bidder/OEM only.
3. Bidder shall also submit site acceptance testing (SAT) procedures and get them approved from BHEL/ Customer before carrying out the site testing at site.
4. All switchboard protection shall be subject to primary injection test before commissioning.
5. Bidder/ OEM shall coordinate with manufacturers of other equipment wherever required and shall freely and readily supply all technical information for this purpose as and when called for.
6. All electrical equipment shall be said to be installed and mechanically complete after circuit testing, primary and secondary injection testing and loop simulation is complete. Due care and consideration shall be given to the installation of 220kV GIS with LCC & its Accessories.
7. Field Tests to be conducted under manufacturer supervision (Refer Clause 5.3 of Annexure-I)

15. Makes of Equipment/ Components

Bidder/ vendor while ordering shall ensure the availability of spare parts and maintenance support services for the offered equipment for full life of equipment covered under the contract. Bidder/ OEM shall give a notice of at least Two (2) years to BHEL/ Customer before phasing out the products/spares to enable the owner for placement of order for spares and services.

16. Packing and Dispatch

1. The equipment shall be carefully packed for transport by sea, rail and road in such a manner that it is protected against the climatic conditions and for any damage during transportation, transit and storage. Packing of the equipment shall be suitable for long storage (minimum 18 months).
2. The SF6 equipment shall be shipped in the largest factory assembled units within transport and loading limitations and considering handling facilities on site to reduce the erection and installation work on site to a minimum. Where possible all items of equipment or factory assembled units shall be boxed in substantial crates or containers to facilitate handling in a safe and secure manner.
3. Each individual piece to be shipped, whether crate, container or large unit, shall be marked special notations such as 'Fragile', 'This side up', 'Centre of gravity', 'Weight', 'Owner's particulars', 'PO no.' etc., and other details as per purchase order.
4. The equipment may be stored outdoors for long periods before installation. The packing shall be completely suitable for outdoor storage in areas with heavy rains and high ambient temperature.
5. Special precautions shall be taken to protect any parts containing electrical insulation against the ingress of moisture. This applies particularly to the equipment of which each gas section shall be sealed and pressurized prior to shipping. Either dry nitrogen/air or dry SF6 gas shall be used and the pressure shall be such as to ensure that, allowing for reasonable leakage, it will always be greater than the atmospheric pressure for all variations in ambient temperature and the atmospheric pressure encountered during shipment to site and calculating the pressure to which the sections shall be filled to ensure positive pressure at all times during shipment.
6. All blanking plates, caps, seals, etc., necessary for sealing the gas sections during shipment to site shall be provided. Any seals, gaskets, `0' rings, etc. that will be used as part of the arrangement for sealing off gas sections for shipment of site, shall not be used in the final installation of the equipment at site. Vendor to provide quantity of components accordingly considering permanent installation and commissioning.

17. Abbreviations Used

The following terminology/ acronym hereunder and elsewhere in the technical specification used and their grammatical variations shall unless repugnant to the subject or context thereof, have the following full form hereunder respectively assigned to them, namely,

GIS:	Gas Insulated Switchgear
LCC:	Local Control Centre
CT:	Current Transformer
DC:	Direct Current
HV:	High Voltage

EHV:	Extra High Voltage
kV:	Kilovolt
Hz:	Hertz
IP:	Ingress Protection
SAT:	Site Acceptance Testing
CCOE:	Chief Controller of Explosives
OEM:	Original Equipment Manufacturer
IP:	Ingress Protection
PE:	Poly Ethylene
ANSI:	American National Standards Institute
ASTM:	American Society for Testing and Materials
BIS:	Bureau of Indian Standards
BS:	British Standard
IEC:	International Electro Technical Commission
IEEE:	Institute of Electrical & Electronics Engineers
IS:	Indian Standards
NEMA:	National Electrical Manufactures Association
CEA:	Central Electricity Authority
DIN:	Deutsches Institiut fur Normung
CCE:	Continuous and Comprehensive Evaluation
LPCB:	Loss Prevention Certification Board
BHEL:	Bharat Heavy Electricals Limited
ISBL:	Inside Battery Limit
OSBL:	Outside Battery Limit
LSTK:	Lump sum Turnkey
GIS:	Gas Insulated Sub-station
URT:	Unit Ratio Transformer
QAP:	Quality Assurance Plan
BOQ:	Bill of Quantities

18. Definitions Used

The following expressions hereunder and elsewhere in the technical specification used and their grammatical variations shall unless repugnant to the subject or context thereof, have the following meanings hereunder respectively assigned to them, namely:

1. Battery Limit: The demarcated area within which the Unit is to be located.
2. Bid/Bidding Documents: The totality of the documents comprising the Bidding Document for the notice inviting tender.
3. Contract: The totality of agreement between Customer/ Purchaser/ Owner/ LTHPL and the Contractor/ LSTK Contractor/ BHEL as derived from the contract documents.
4. Contractor/ LSTK contractor: The bidder selected by the Customer/ Purchaser/ Owner/LTHPL for the performance of the work and supply of materials. In this case, it is BHEL.
5. Customer/ Purchaser/ Owner: LTHP Ltd. (A wholly owned subsidiary of NHPC Ltd.)

6. Consultant: Any person(s)/ Firm nominated/ assigned by the Contractor/ LSTK Contractor/ BHEL for providing the engineering consultant services. In this case, it is NHPC.
7. Bidder/ vendor / Sub-Contractor: The bidder selected for this intended work shall be known as vendor.

19. List of Documents/ Drawings

Following drawing/ documents are attached for information purpose,

1. TB-3-415-510-001, R1: 220kV GIS & Potheadyard- Single Line Diagram
2. TB-2-415-316-002, R1: 220kV Potheadyard- Layout Plan & Section
3. Tender Drawings of GIS Hall and Transformer Cavern
4. NH-DEM-TS-VI-GA-06 – Tender Drawing of GIS Hall layout
5. TSVI-PRT04WD005-A - Single Line Diagram for 220kV GIS

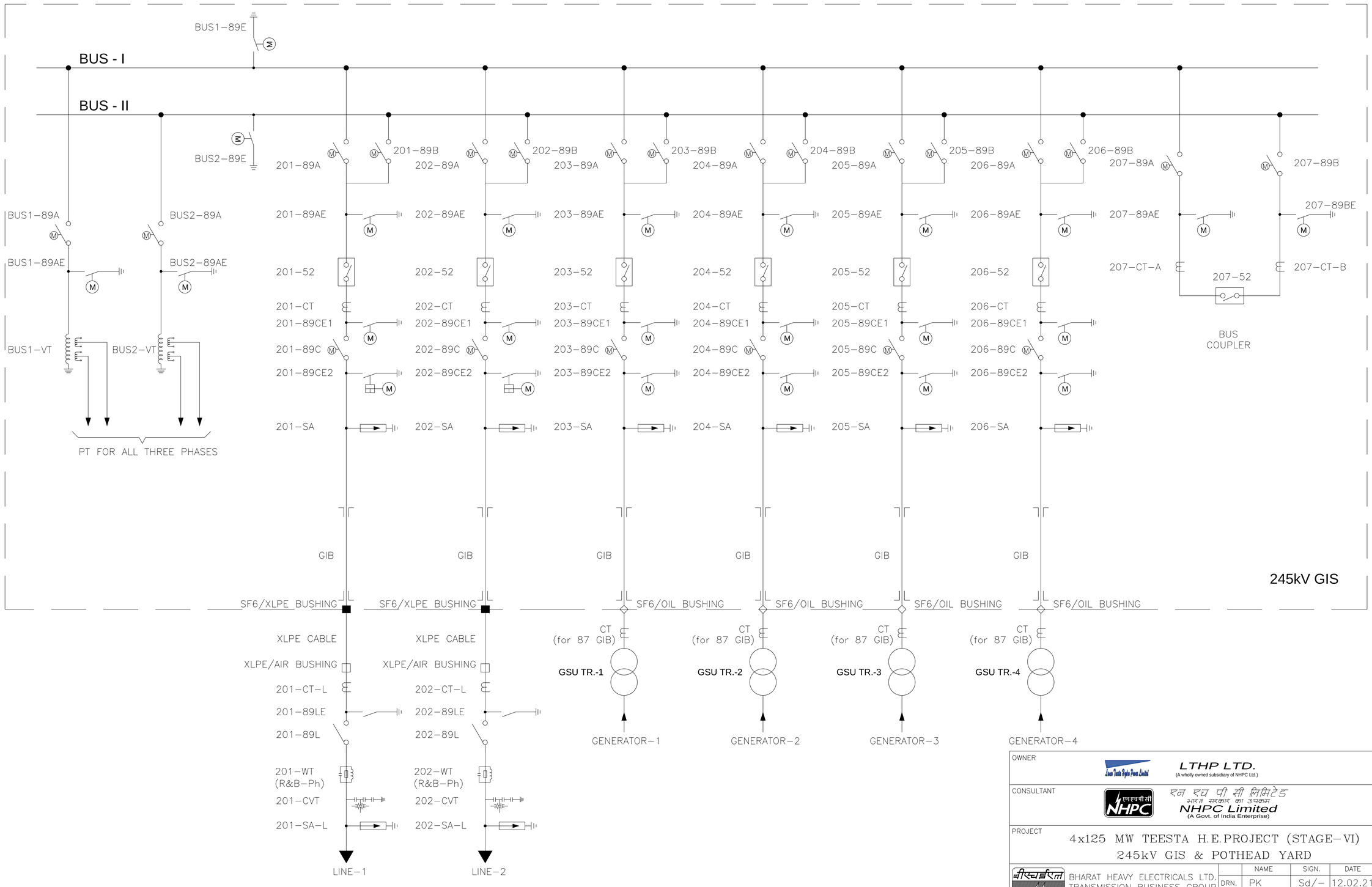
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm)

COMPUTER FILE NAME

REF. DRG. NO.

SIGN. AND DATE

INVENTORY NO



REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD		27.12.16	CHD/APPD	01	30.06.21	CHD/APPD MVK SKS
ZONE			ZONE			ZONE			ZONE			ZONE					REVISED AS PER NHPC COMMENTS.

OWNER: LTHP LTD. (A wholly owned subsidiary of NHPC Ltd.)

CONSULTANT: NHPC Limited (A Govt. of India Enterprise)

PROJECT: 4x125 MW TEESTA H.E.PROJECT (STAGE-VI)
245kV GIS & POTHEAD YARD

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	PK	Sd/-	12.02.21	N.A.
CHD.	MVK	Sd/-	12.02.21	
APPD.	SKS	Sd/-	12.02.21	

DEPT.	UNTOL. DIMS.		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
PE&SD	GR.		N.T.S	N.A.	N.A.	N.A.	N.A.
CODE 450	g/M/f						

TITLE: SINGLE LINE DIAGRAM OF 245kV GIS & 245kV POTHEAD YARD

CARD CODE: NA

DRG.NO. TSVI-PYD06TD001-B / TB-3-415-510-001

REV. 01

SHT. No 01 NO. OF SHT. 02

COMPUTER FILE NAME

REF. DRG. NO.

SIGN. AND DATE

INVENTORY NO

LEGEND:- BOQ FOR 220kV GIS

S.N.	EQUIPMENT	SYMBOL	QTY.	EQUIPMENT DESIGNATION
1.	245kV, 2000A, 3x1–Ph, METAL ENCLOSED CIRCUIT BREAKER		07	201–52, 202–52, 203–52, 204–52, 205–52, 206–52, 207–52
2.	245kV, 2000A, 3–Ph , GROUP OPERATED MOTORISED DISCONNECTOR		22	201–89A, 201–89B, 201–89C, 202–89A, 202–89B, 202–89C, 203–89A, 203–89B, 203–89C, 204–89A, 204–89B 204–89C, 205–89A, 205–89B, 205–89C, 206–89A, 206–89B, 206–89C, 207–89A, 207–89B, BUS1–89A, BUS2–89A
3.	245kV, 3–Ph, GROUP OPERATED MAINTENANCE EARTHING SWITCH MOTORISED		22	201–89AE, 201–89CE1, 202–89AE, 202–89CE1, 203–89AE, 203–89CE1, 203–89CE2, 204–89AE, 204–89CE1, 204–89CE2, 205–89AE, 205–89CE1, 205–89CE2, 206–89AE, 206–89CE1, 206–89CE2, 207–89AE, 207–89BE, BUS1–89AE, BUS2–89AE, BUS1–89E, BUS2–89E
4.	245kV, 3–PH, GROUP OPERATED HIGH SPEED EARTHING SWITCH MOTORISED		02	201–89CE2, 202–89CE2
5.	245kV CURRENT TRANSFORMER (1–Ph)		24	201–CT, 202–CT, 203–CT, 204–CT, 205–CT, 206–CT, 207–CT–A, 207–CT–B,
6.	220kV VOLTAGE TRANSFORMER (3–Ph)		02	BUS1–VT, BUS2–VT
7.	216kV SURGE ARRESTER (1–Ph)		18	201–SA, 202–SA, 203–SA, 204–SA, 205–SA, 206–SA
8.	245kV SF6 to OIL BUSHING (1–Ph)	◇	12	----------
9.	245kV SF6 to XLPE BUSHING (1–Ph)	■	06	----------

LEGEND:– BOQ FOR POTHEADYARD

S.N.	EQUIPMENT	SYMBOL	QTY.	EQUIPMENT DESIGNATION
1.	245kV, 2000A, 40kA/1s, HDB ISOLATOR WITH 1 EARTH SWITCH (BOTH MOTORISED) (MECHANICALLY GANGED) (3–Ph)		02	201–89L, 202–89L 201–89LE, 202–89LE
2.	245kV, 2000A, 40kA/1s, CURRENT TRANSFORMER (1–Ph)		06	201–CT–L, 202–CT–L
3.	245kV, 4400pF, $\frac{245kV}{\sqrt{3}}/\frac{110V}{\sqrt{3}}/\frac{110V}{\sqrt{3}}/\frac{110V}{\sqrt{3}}$ CVT (1–Ph)		06	201–CVT, 202–CVT
4.	216kV SURGE ARRESTER (1–Ph)		06	201–SA–L, 202–SA–L
5.	245kV, 1mH, 2000A, 40kA/1s WAVE TRAP (GANTRY MOUNTED) (1–Ph)		04	201–WT, 202–WT
6.	245kV XLPE CABLE SEALING END (1–Ph)	□	06	----------

MAIN SYSTEM PARAMETERS;–	
RATED VOLTAGE	220 kV
HIGHEST SYSTEM VOLTAGE	245 kV
NO. OF PHASES	3
LIGHTENING IMPULSE PHASE TO EARTH/ ACROSS OPEN SWITCHING DISTANCE AND BETWEEN PHASES	1050 kV_P / 1200 kV_P
POWER FREQUENCY PHASE TO EARTH/ ACROSS OPEN SWITCHING DISTANCE AND BETWEEN PHASES	460 kVrms / 530 kVrms
CREEPAGE DISTANCE	25mm/kV
SHORT CIRCUIT RATING (GIS)	40 kA for 1s
SHORT CIRCUIT RATING (POTHEAD YARD)	40 kA for 1s
RATED PEAK WITHSTAND CURRENT	100 kA
FREQUENCY	50 Hz
SYSTEM EARTHING	SOLIDLY EARTHED

NOTES:-

1. THE CT/CVT DETAILED PARAMETERS SHALL BE MENTIONED SEPARATELY IN KEY PROTECTION DIAGRAM.
2. WAVE TRAP IN LINE BAYS WOULD BE IN TWO PHASES ONLY. HOWEVER, FOUNDATION FOR BPI WILL BE IN ALL PHASES.

REV.	DATE	ALTERED	CHD/APPD
ZONE			
01	30.06.21	REVISED AS PER NHPC COMMENTS.	MVK SKS
	27.12.16		

OWNER: Lara Tesla Hydro Power Limited — LTHP LTD. (A wholly owned subsidiary of NHPC Ltd.)

CONSULTANT: NHPC — एन एच पी सी लिमिटेड, भारत सरकार का उपक्रम, NHPC Limited (A Govt. of India Enterprise)

PROJECT: 4x125 MW TEESTA H.E.PROJECT (STAGE–VI)
245kV GIS & POTHEAD YARD

BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP NOIDA

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	PK	Sd/–	12.02.21	N.A.
CHD.	MVK	Sd/–	12.02.21	
APPD.	SKS	Sd/–	12.02.21	

DEPT.	UNTOL. DIMS.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
PE&SD	GR.	N.T.S	N.A.	N.A.	N.A.	N.A.
CODE 450	g/M/f					

TITLE: SINGLE LINE DIAGRAM OF 245kV GIS & 245kV POTHEAD YARD

CARD CODE: NA

DRG.NO.: TSVI–PYD06TD001–B / TB–3–415–510–001

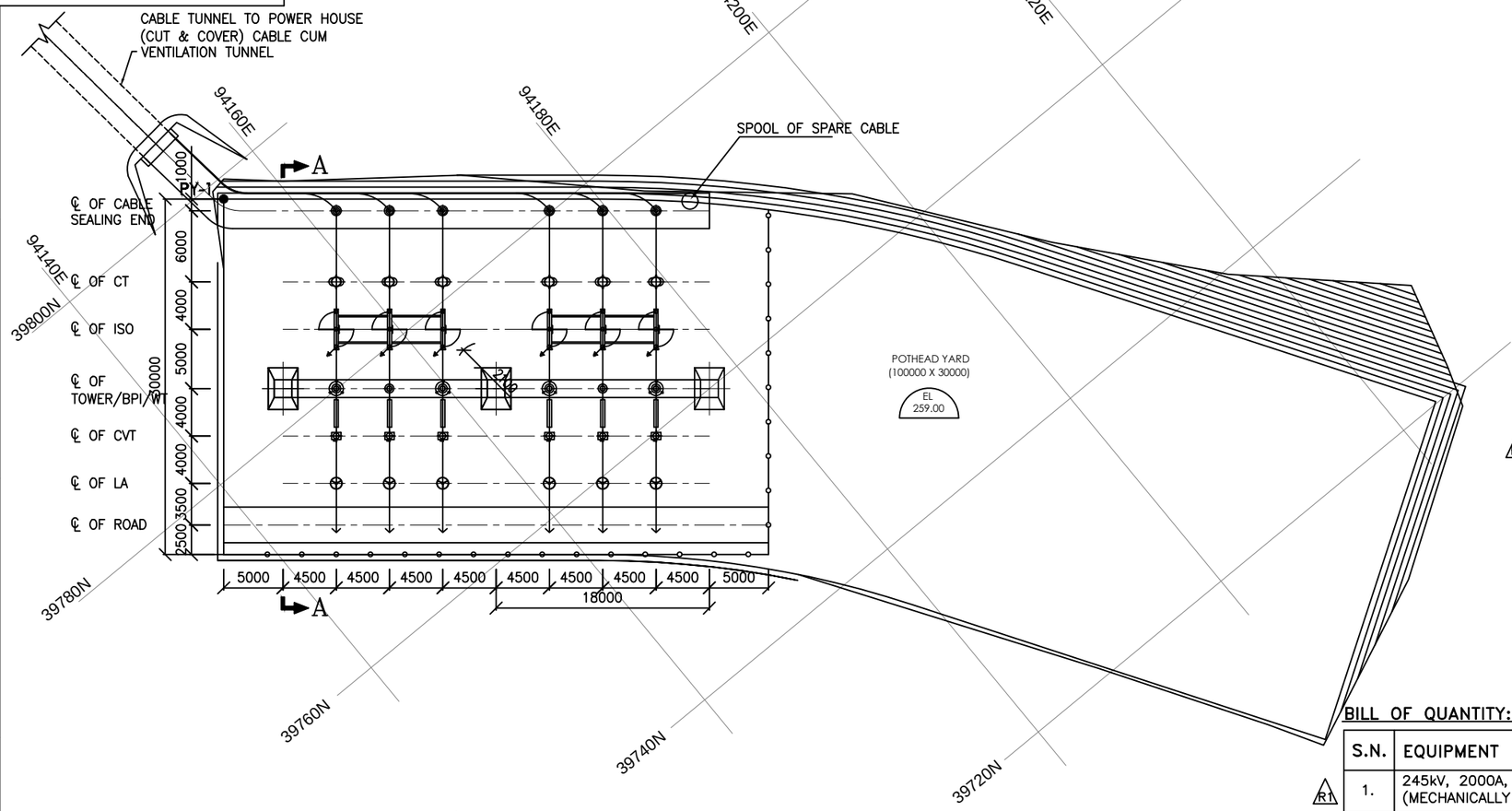
REV.: 01

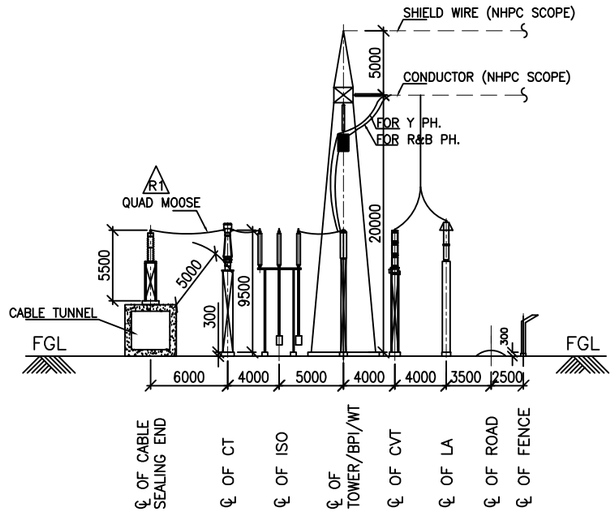
SHT. No 02 | NO. OF SHT. –

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN mm

DRG. NO. TB-2-415-316-002





SECTION A–A

S.NO.	DESCRIPTION	UNIT	245kV
1.	PHASE TO PHASE	mm	2100
2.	PHASE TO EARTH	mm	2100
3.	MIN. DISTANCE OF THE LOWEST EARTH PART OF INSULATOR SUPPORTING LIVE CONDUCTORS FROM GROUND	mm	2550
4.	SECTION CLEARANCE	mm	5000
5.	HEIGHT OF CONDUCTOR CENTER LINE OF FIRST LEVEL FROM PLINTH LEVEL	mm	5500
6.	PLINTH HEIGHT	mm	300
7.	SUB CONDUCTOR SPACING	mm	250

R1

SYSTEM PARAMETERS	245kV
LIGHTNING IMPULSE WITHSTAND VOLTAGE PHASE TO EARTH/ ACROSS OPEN SWITCHING DISTANCE AND BETWEEN PHASES (kVp)	1050/1200
1 MIN POWER FREQUENCY WITHSTAND VOLTAGE PHASE TO EARTH/ ACROSS OPEN SWITCHING DISTANCE AND BETWEEN PHASES (kVrms)	460/530
HIGHER SYSTEM VOLTAGE (kV)	245
CREEPAGE DISTANCE (mm/kV)	25
SHORT CIRCUIT CAPABILITY (kA FOR 1SEC)	40

R1

BILL OF QUANTITY:–

S.N.	EQUIPMENT	QTY.	SYMBOL
1.	245kV, 2000A, 40kA/1s, HDB ISOLATOR WITH 1 EARTH SWITCH (MECHANICALLY GANGED) (MOTOR AS WELL AS MANUAL) (3–Ph)	02	
2.	245kV, 2000A, 40kA/1s, CURRENT TRANSFORMER (1–Ph)	06	
3.	245kV, 4400pF, $\frac{245kV}{\sqrt{3}}/\frac{110V}{\sqrt{3}}/\frac{110V}{\sqrt{3}}/\frac{110V}{\sqrt{3}}$ CVT (1–Ph)	06	
4.	216kV SURGE ARRESTER (1–Ph)	06	
5.	245kV, 1mH, 2000A, 40kA/1s WAVE TRAP (GANTRY MOUNTED) (1–Ph)	04	
6.	245kV XLPE CABLE SEALING END (1–Ph)	06	
7.	220kV BUS POST INSULATORS (1–Ph)	06	
8.	220kV XLPE POWER CABLE (–Ph)	1 LOT*	

R1

NOTE:–

1. ALL DIMENSIONS ARE IN MM, UNLESS OTHERWISE SPECIFIED.
2. 220KV POTHEAD YARD SHALL BE LOCATED AT EL 259.00M.
3. NHPC TO CHECK THE LOCATION OF DEAD END TRANSMISSION LINE TOWER.
4. NHPC TO ENSURE TO PROVIDE ACCESS TO 220KV POTHEAD YARD AT EL 259M.
5. GIS AND XLPE CABLE ROUTING SHALL BE SHOWN IN SEPARATE DRAWINGS.
6. WAVE TRAP (GANTRY MOUNTED) IS CONSIDERED IN R&B PHASES OF LINES.
7. PROTECTION AGAINST DIRECT LIGHTNING STROKE FOR POTHEAD YARD AREA SHALL BE BY SPIKE.
8. CIVIL WORKS IN NHPC SCOPE.
9. DETAILS OF CABLE TUNNEL TO BE PROVIDED BY NHPC.

LEGENDS:–

——————— BHEL SCOPE

– – – – – NOT IN BHEL SCOPE

———o———o——— FENCE OF POTHEAD YARD

R1

NHPC DOC. NO.

T S VI – P Y D 0 6 T D 0 0 2 – B

ADDITIONAL INFORMATION

W.O. No. –

STATUS OF DRAWING

CONTRACT

DISTRIBUTION OF PRINTS

OWNER: LTHP LTD. (A wholly owned subsidiary of NHPC Ltd.)

Loon Taste Hydro Power Limited (A wholly owned Subsidiary of NHPC LTD.)

CONSULTANT: एन एच पी सी लिमिटेड, भारत सरकार का उपक्रम, NHPC Limited (A Govt. of India Enterprise)

PROJECT: 4x125 MW TEESTA H.E.PROJECT (STAGE–VI)
220kV GIS, XLPE CABLES & POTHEAD YARD

भारत हेवी इलेक्ट्रिकल्स लिमिटेड, ट्रांसमिशन परियोजना विभाग, भोपाल
BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP, NOIDA

	NAME	SIGN	DATE
DRN	PK	Sd/–	16.02.20
CKD	MVK	Sd/–	16.02.20
APPD	SKS	Sd/–	16.02.20

REV.	DATE	ALTERED	CHECKED	APPROVED
01	12.04.21	MVK	MVK	SKS

REVISED AS PER NHPC COMMENTS.

DEPT TBEM | CODE 422 | UNTOL.DIMS. GR. | SCALE 1:400 | WEIGHT (K.G.) | REF. TO ASSY. DRG. | ITEM NO. | NO. OF ITEM

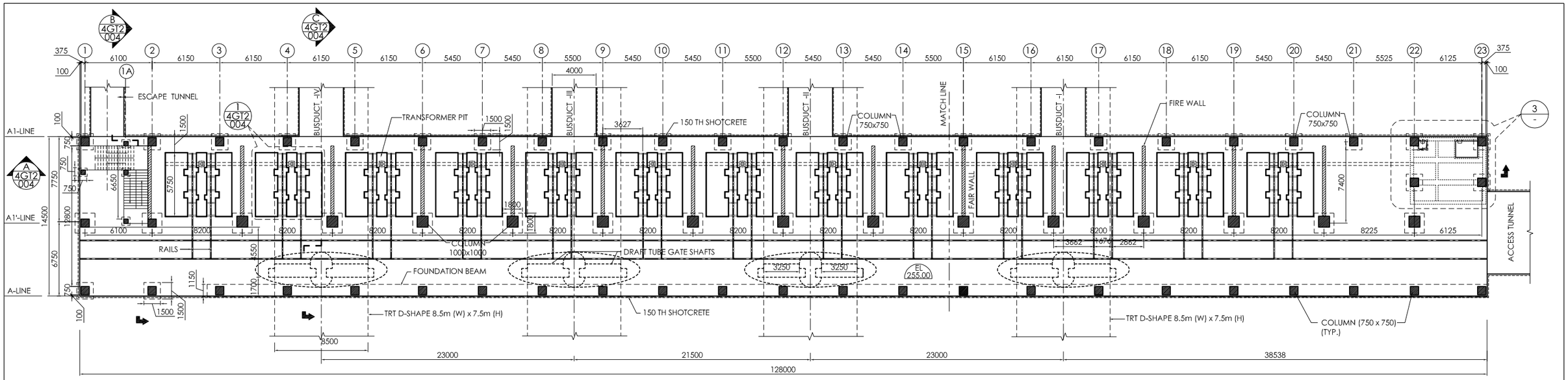
TITLE: LAYOUT PLAN & SECTION ELEVATION OF POT HEAD YARD (245kV)

DRAWING NO.: TB–2–415–316–002 | REV. 01

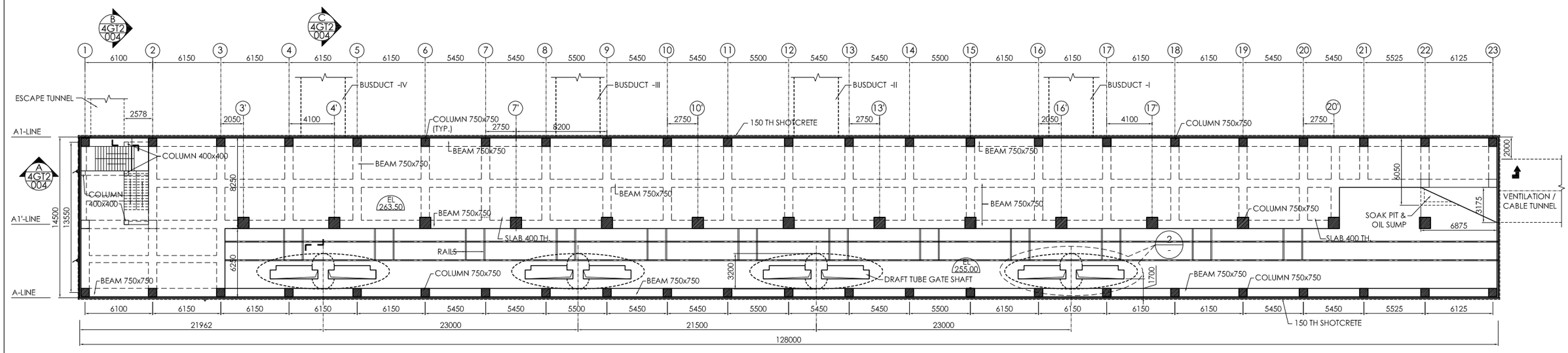
SHT. No. 1 | NO. OF SHT. 1

REF. DRG. NO. | SIGN AND DATE | INVENTORY NO.

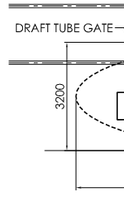
A2



PLAN AT EL 255.00

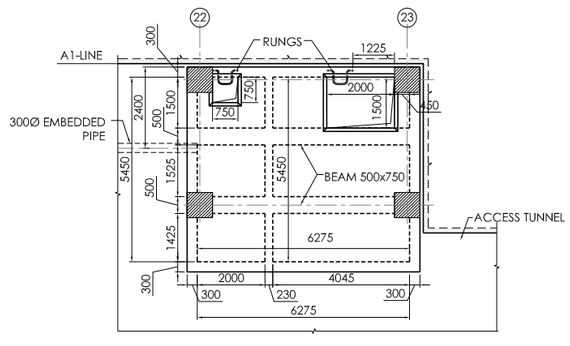


PLAN AT EL 263.50
(GIS FLOOR)



DRAFT TUBE GATE SHAFT

DETAIL 2 / -



OIL & WATER SUMP-PLAN AT EL. 255.00

DETAIL 3 / -

SCALE:-
0 1.25 2.5 3.75 5.0 6.25 M

TENDER DRAWING
NOT FOR CONSTRUCTION

SCALE:-
0 2.5 5.0 7.5 10.0 12.5 M.

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS.
2. EXISTING STATUS OF WORK SHALL BE VERIFIED ON THE SITE PRIOR TO COMMENCEMENT OF WORK.
3. THERE MAY BE SOME EXTRA HATCHES, CUTOUT, HOOKS & EMBEDMENT AS PER E&M REQUIREMENT.
4. THE DETAILS SHOWN ON TENDER DRAWING MAY UNDERGO CHANGES DURING CONSTRUCTION STAGE AS PER SITE CONDITION.

DATE	NO.	REVISION OR ISSUES	BY	CH.	APP.
26.04.19	00	ISSUED FOR TENDER			

DESIGN MEMO NO. / डिजाइन मेमो संख्या: 3105-41-MOC-01-0

LANCO TEESTA HYDRO POWER LIMITED (LTHPL)

एन एच पी सी लिमिटेड
(भारत सरकार का उद्यम)
NHPC Limited
(A GOVT. OF INDIA ENTERPRISE)

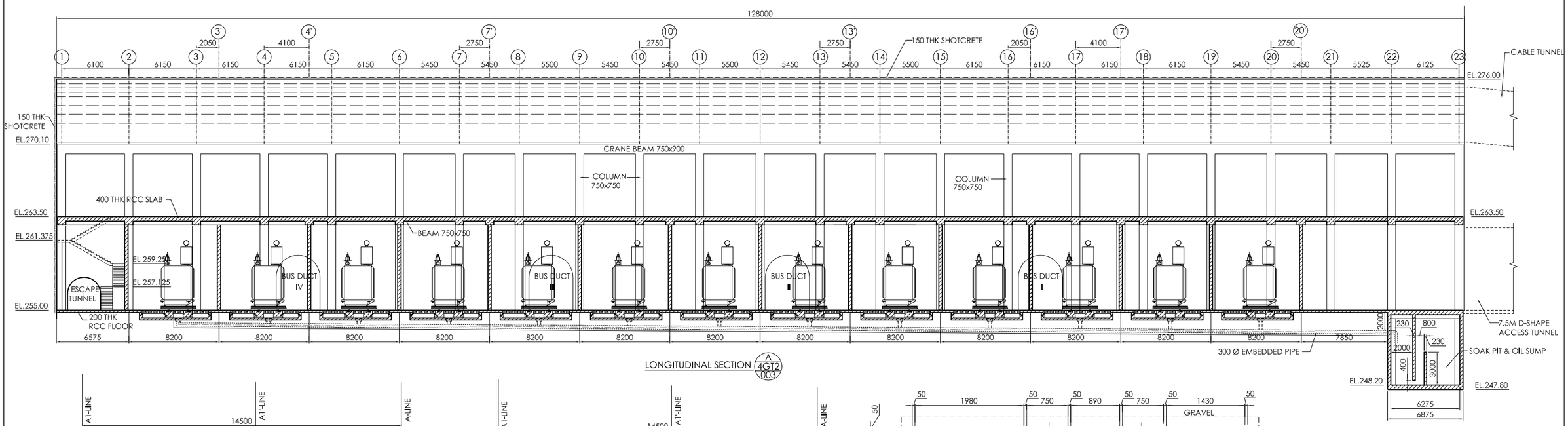
तीस्ता (चरण– VI) जलविद्युत परियोजना
TEESTA (STAGE-VI) H.E. PROJECT

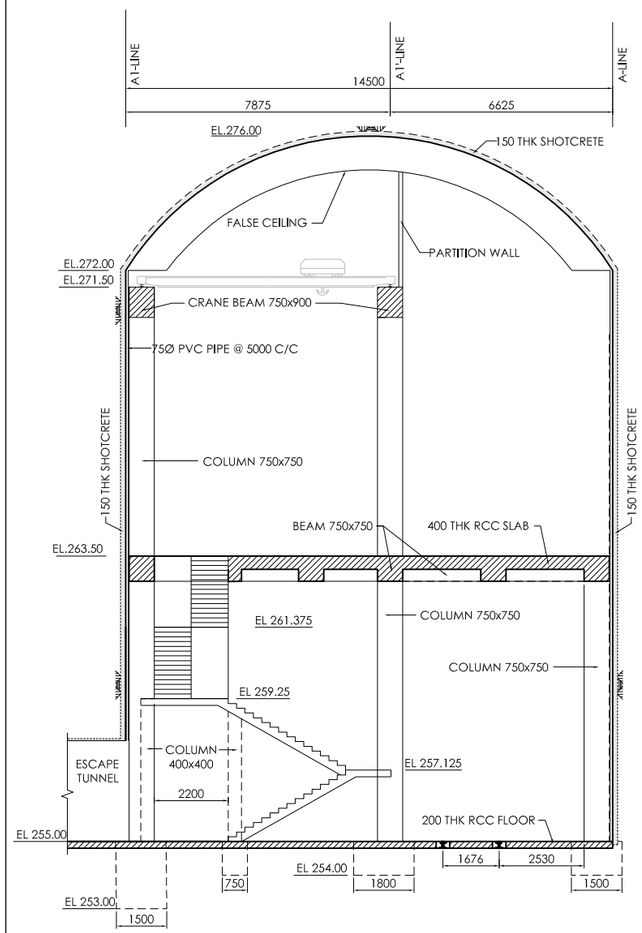
TRANSFORMER CAVERN
GENERAL ARRANGEMENT
PLAN

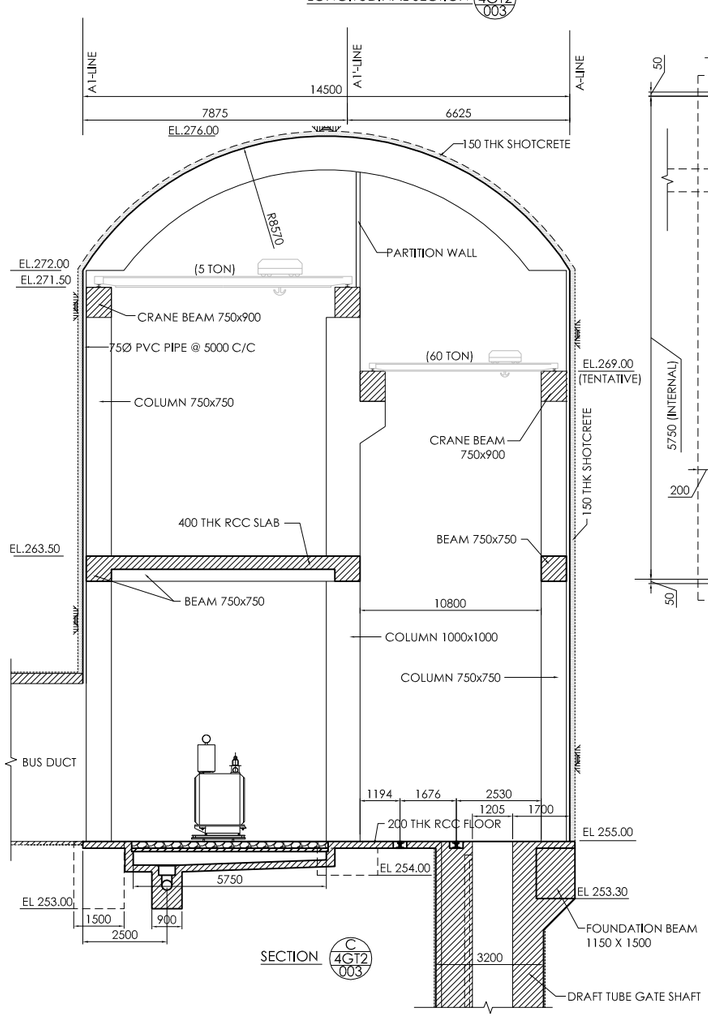
DRAWN	SUBMITTED	RECOMMENDED	VETTED BY E&M	APPROVED
तयार किया	प्रस्तुत	अनुशंसित	पुनरीक्षण	अनुमोदन

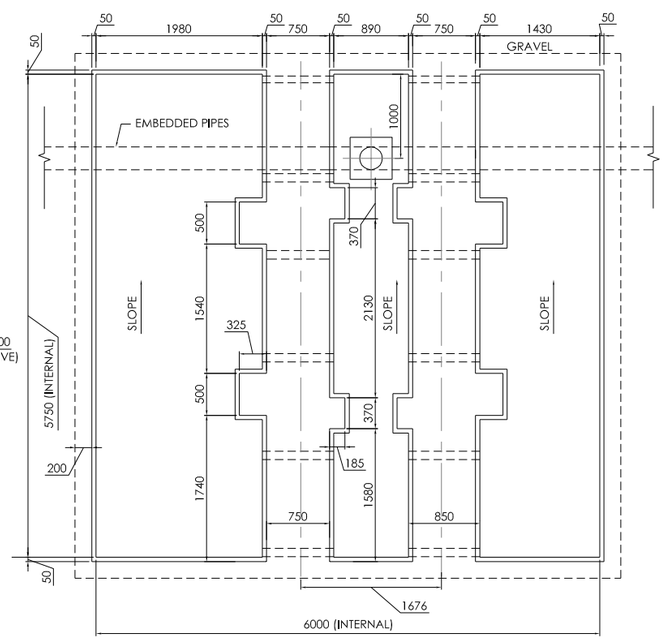
DATE / दिनांक	DRG. NO. / ड्रॉइंग संख्या					
APRIL, 2019 अप्रैल २०१९	NHTS-VI	4GT2	41	GA	003	00

DRG NO. 4GT2 - 003









TRANSFORMER PIT

DETAIL 1 4GT2 003

SCALE:-

0 0.5 1.0 1.5 2.0 2.5 M.

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS.
2. EXISTING STATUS OF WORK SHALL BE VERIFIED ON THE SITE PRIOR TO COMMENCEMENT OF WORK.
3. THERE MAY BE SOME EXTRA HATCHES, CUTOUT, HOOKS & EMBEDMENT AS PER E&M REQUIREMENT.
4. CRANE BEAM LEVELS MAY CHANGE AS PER SITE CONDITION DURING CONSTRUCTION STAGE.
5. THE DETAILS SHOWN ON TENDER DRAWING MAY UNDERGO CHANGES DURING CONSTRUCTION STAGE AS PER SITE CONDITION.

TENDER DRAWING
NOT FOR CONSTRUCTION

SCALE:-

0 2.5 5.0 7.5 10.0 12.5 M.

DATE	NO.	REVISION OR ISSUES	BY	CH.APP
26.04.19	00	ISSUED FOR TENDER		

DESIGN MEMO NO. डिजाइन मेमो संख्या: 3105-41-MOC-01-0

LANCO TEESTA HYDRO POWER LIMITED (LTHPL)

एन एच पी सी लिमिटेड (भारत सरकार का उद्यम)
NHPC Limited
(A GOVT. OF INDIA ENTERPRISE)

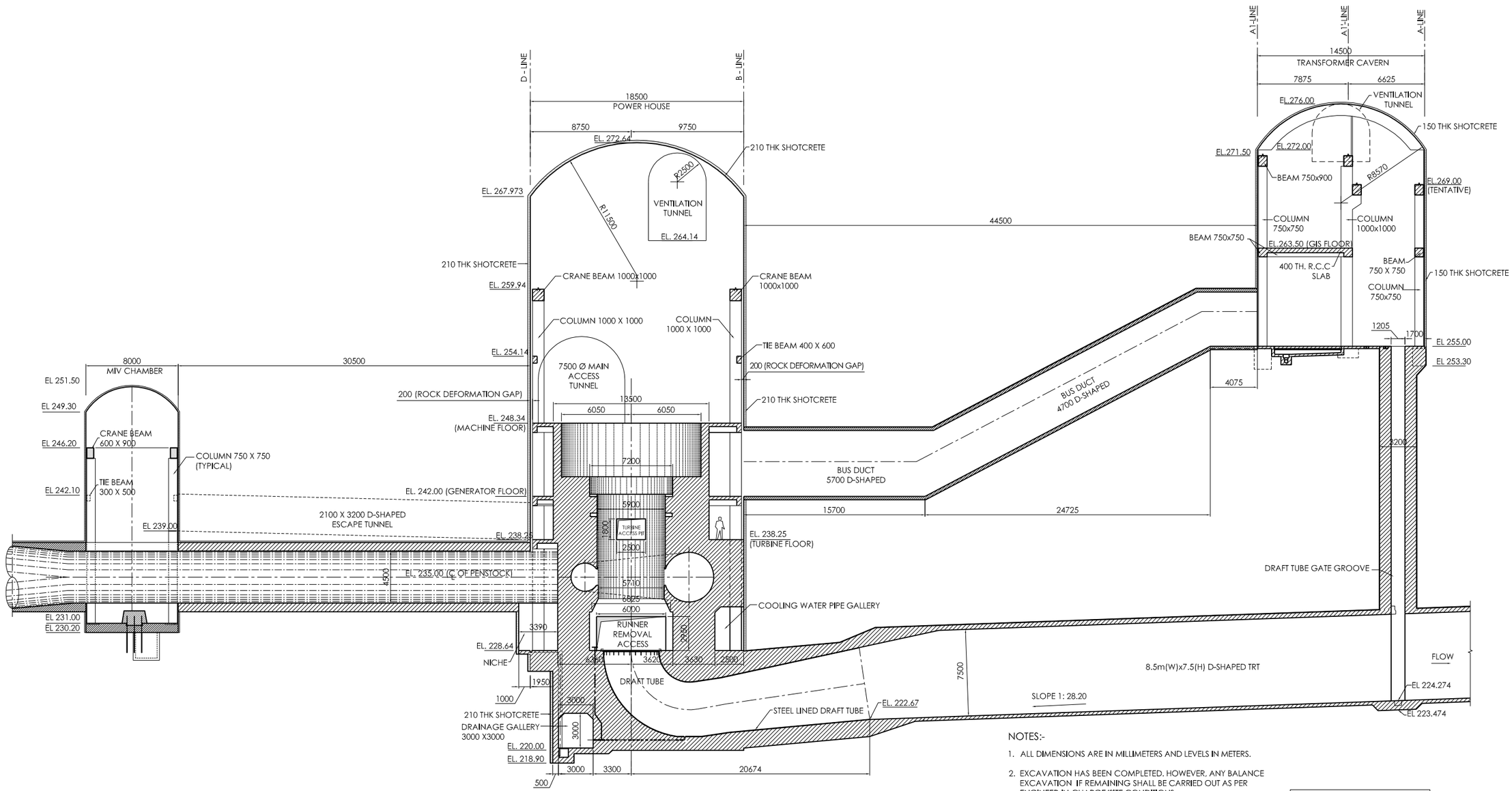
तीस्ता (चरण– VI) जलविद्युत परियोजना
TEESTA (STAGE-VI) H.E. PROJECT

TRANSFORMER CAVERN
GENERAL ARRANGEMENT
LONGITUDINAL & CROSS SECTIONS

DRAWN	SUBMITTED	RECOMMENDED	VETTED BY E&M	APPROVED
तयारित	प्रस्तुत	अनुशंसित	पुनरीक्षन	अनुमोदन

DATE	DRG. NO.					
दिनांक: APRIL, 2019 अप्रैल २०१९	NHTS-VI	4GT2	41	GA	004	00

DRG NO. 4GT2 - 004



TYPICAL CROSS SECTION

(THROUGH MIV,POWER HOUSE & TRANSFORMER CAVERN)

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS IN METERS.
2. EXCAVATION HAS BEEN COMPLETED. HOWEVER, ANY BALANCE EXCAVATION IF REMAINING SHALL BE CARRIED OUT AS PER ENGINEER-IN-CHARGE/SITE CONDITIONS.
3. DRAWING IS BASED ON LTHPL DRAWINGS AND 200MM FLOOR THICKNESS SHOWN IS SAFE FOR UDL LOAD OF 1.5 TON/ SQUARE METER (1.5 T/m²). MAXIMUM LOAD ON MACHINE FLOOR, GENERATOR FLOOR AND TURBINE FLOOR SHALL NOT EXCEED UDL OF 1.5 TON/ SQUARE METER (1.5 T/m²).
4. FLOOR ELEVATIONS SHOWN ARE WITHOUT FLOOR FINISH. FLOOR FINISH SHALL CONFORM TO SECTION B.15 OF TECHNICAL SPECIFICATION.
5. EXISTING STATUS OF WORK SHALL BE VERIFIED ON THE SITE PRIOR TO COMMENCEMENT OF WORK.
6. THERE MAY BE SOME EXTRA HATCHES, CUTOUT, HOOKS & EMBEDMENT AS PER E&M REQUIREMENT.
7. TURBINE PIT ACCESS ORIENTATION MAY BE MODIFIED AS PER CONSTRUCTION DRAWING.
8. THE DETAILS SHOWN ON TENDER DRAWING MAY UNDERGO CHANGES DURING CONSTRUCTION STAGE AS PER SITE CONDITION.

TENDER DRAWING
NOT FOR CONSTRUCTION

SCALE:-

0 2.5 5.0 7.5 10.0 12.50 M.

DATE	NO.	REVISION OR ISSUES	BY	CH.	APP.
26.04.19	00	ISSUED FOR TENDER			

DESIGN MEMO NO. डिजाइन मेमो संख्या: 3105-41-MOC-01-0

LANCO TEESTA HYDRO POWER LIMITED (LTHPL)

एन एच पी सी लिमिटेड
(भारत सरकार का उद्यम)
NHPC Limited
(A GOVT. OF INDIA ENTERPRISE)

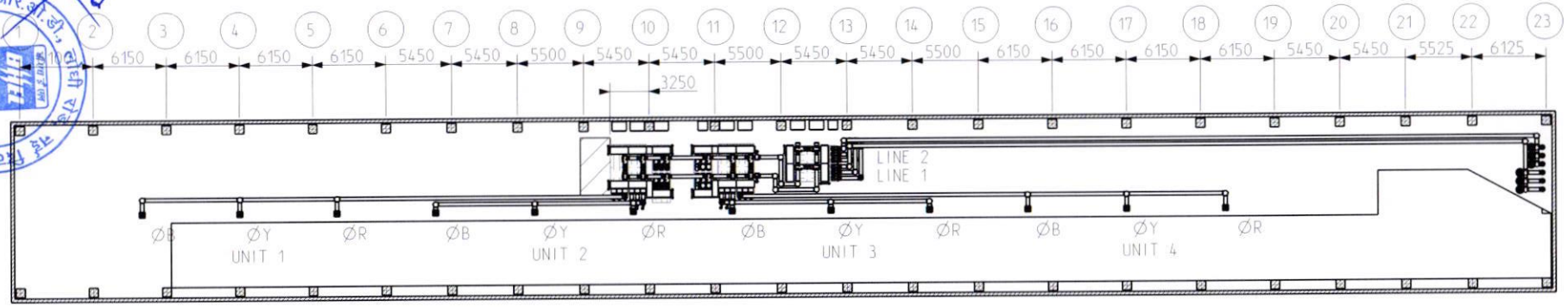
तीस्ता (चरण– VI) जलविद्युत परियोजना
TEESTA (STAGE-VI) H.E. PROJECT

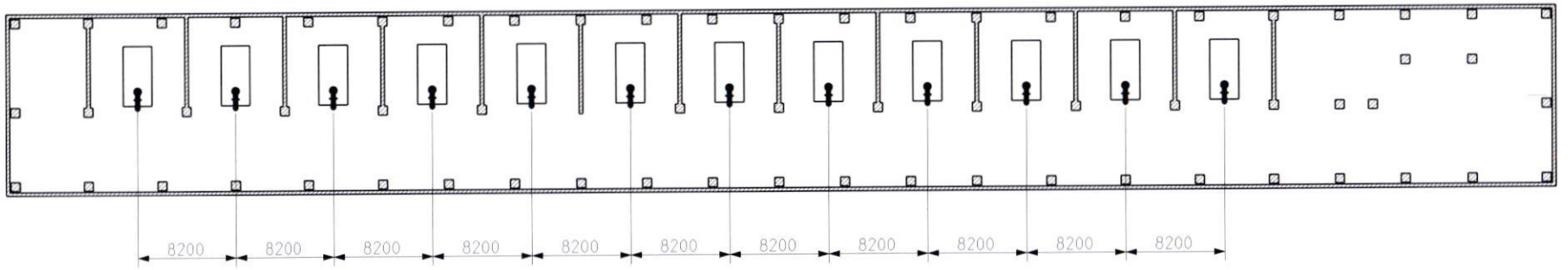
POWER HOUSE COMPLEX
GENERAL ARRANGEMENT
CROSS SECTION

DRAWN तयारीकर्ता	SUBMITTED प्रस्तुत	RECOMMENDED अनुशंसित	VETTED BY E&M पुनरीक्षण	APPROVED अनुमोदन

DATE दिनांक	DRG. NO. ड्रॉइंग संख्या					
April ,2019 अप्रैल २०१९	NHTS-VI	4CT2	41	GA	003	00

DRG NO. 4CT2-003

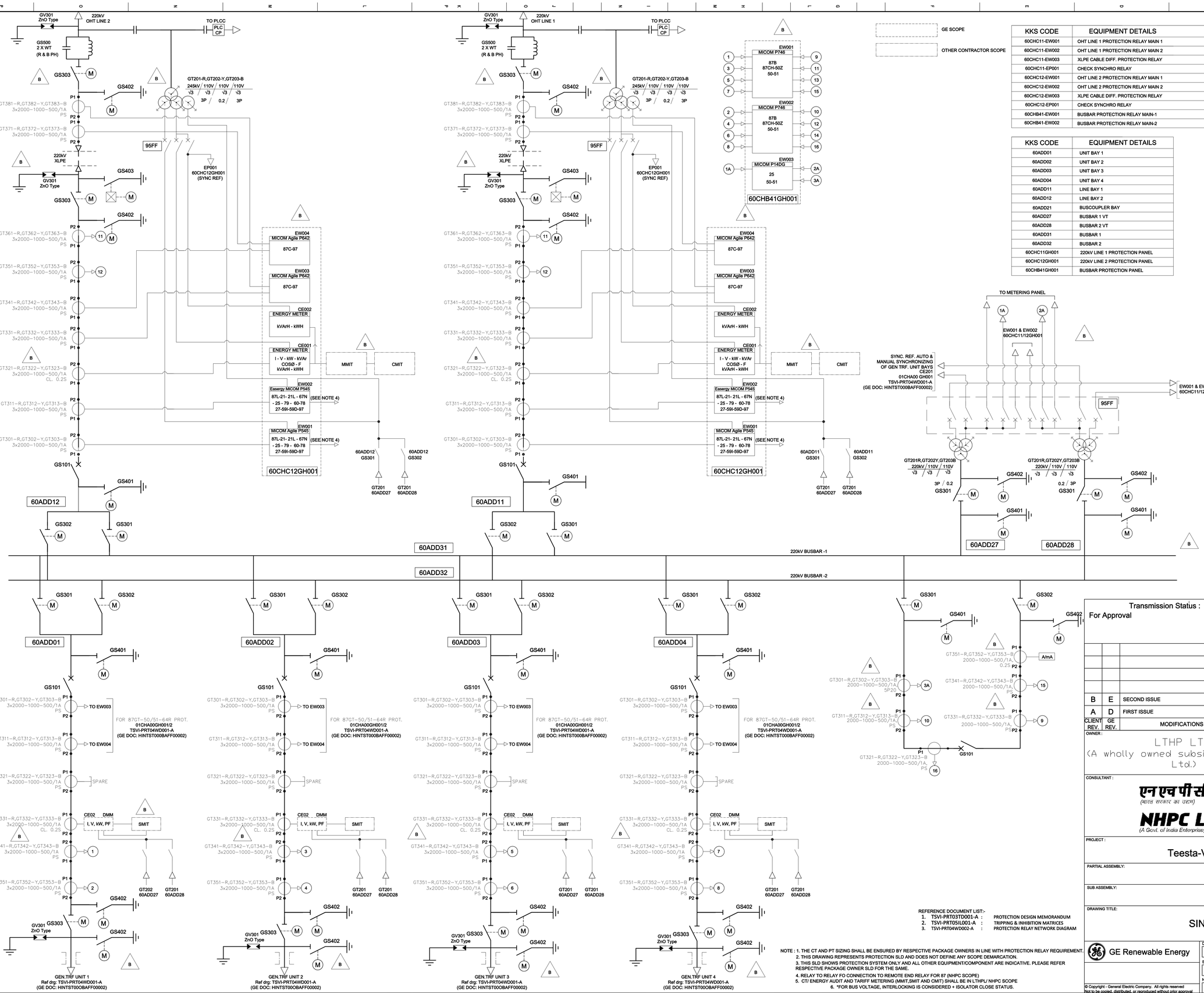




TENDER DRAWING

NOT FOR CONSTRUCTION

DRG NO. NH-DEM-TS-VI-GA-06



KKS CODE	EQUIPMENT DETAILS
60CHC11-EW001	OHT LINE 1 PROTECTION RELAY MAIN 1
60CHC11-EW002	OHT LINE 1 PROTECTION RELAY MAIN 2
60CHC11-EW003	XLPE CABLE DIFF. PROTECTION RELAY
60CHC11-EP001	CHECK SYNCHRO RELAY
60CHC12-EW001	OHT LINE 2 PROTECTION RELAY MAIN 1
60CHC12-EW002	OHT LINE 2 PROTECTION RELAY MAIN 2
60CHC12-EW003	XLPE CABLE DIFF. PROTECTION RELAY
60CHC12-EP001	CHECK SYNCHRO RELAY
60CHB41-EW001	BUSBAR PROTECTION RELAY MAIN-1
60CHB41-EW002	BUSBAR PROTECTION RELAY MAIN-2

KKS CODE	EQUIPMENT DETAILS
60ADD01	UNIT BAY 1
60ADD02	UNIT BAY 2
60ADD03	UNIT BAY 3
60ADD04	UNIT BAY 4
60ADD11	LINE BAY 1
60ADD12	LINE BAY 2
60ADD21	BUSCOUPLER BAY
60ADD27	BUSBAR 1 VT
60ADD28	BUSBAR 2 VT
60ADD31	BUSBAR 1
60ADD32	BUSBAR 2
60CHC11GH001	220kV LINE 1 PROTECTION PANEL
60CHC12GH001	220kV LINE 2 PROTECTION PANEL
60CHB41GH001	BUSBAR PROTECTION PANEL

ANSI	DESIGNATION	CEI
21	DISTANCE OR UNDERIMPEDANCE RELAY	Z <
21L	FAULT DISTANCE LOCATOR RELAY	Z >
25	SYNCHRONIZING / SYNCHRONISM-CHECK DEVICE	Uf
27	UNDERVOLTAGE RELAY	U <
50	OVERCURRENT RELAY	I >>
50N	OVERCURRENT RELAY, NEUTRAL	IN >>
50Z	CIRCUIT BREAKER FAILURE RELAY	I >>
51	INVERSE TIME OVERCURRENT RELAY	I >
51N	TIME-LAG OVERCURRENT RELAY, NEUTRAL	IN >
59I	OVERVOLTAGE RELAY	U >
59D	OVERVOLTAGE RELAY	U >>
60	VT FUSE FAILURE	I =
67	DIRECTIONAL OVERCURRENT RELAY	I >
67N	DIRECTIONAL HOMOPOLAR OVERCURRENT RELAY	IN >
78	MEASURING RELAY AND PHASE-ANGLE PROTECTION	U
79	RECLOSING RELAY	O->I
81 O/U	UNDER/ OVER FREQUENCY	
87B	BUSBAR DIFFERENTIAL RELAY	ΔI
87CH	CHECK ZONE DIFFERENTIAL RELAY	ΔI
87C	XLPE CABLE DIFF.PROTECTION	ΔI
87L	LINE DIFF.PROTECTION	ΔI
95FF	CVT FUSE FAILURE SUPERVISION	
97	FUSE FAILURE PROTECTION	

	DISCONNECTOR		CAPACITOR
	CIRCUIT BREAKER		INDUCTOR WINDING
	CONTACTOR		BATTERY
	THERMAL EFFECT MAGNETIC EFFECT		EARTH MASS
	CONNECTING LINK		MECHANICAL INTERLOCK
	TRANSFORMER WITH 2 WINDINGS		ELECTRICAL INTERLOCK
	TRANSFORMER WITH 3 WINDINGS	M	ELECTRICAL MOTOR OPERATED
	CURRENT TRAFO.		ISOLATED PHASE BUS DUCT
V	INDICATING INSTRUMENT		CABLE
	IMPULSE COUNTER		OVERHEAD LINE
	LIGHTNING ARRESTER		CARRIER LINE TRAP
	RESISTOR	PLC CP	POWER LINE CARRIER COUPLING DEVICE
	ADJUSTABLE RESISTOR	G	SYNC. GENERATOR
	HIGH SPEED MECHANISM		PT
	GAS INSULATED BUS DUCT	MMIT	MAIN METER FOR INTERFACE TRANSMISSION
SMIT	STANDBY METER FOR INTERFACE TRANSMISSION	CMIT	CHECK METER FOR INTERFACE TRANSMISSION
DMM	DIGITAL MULTIFUNCTION METER	A/mA	AMMETER

REFERENCE DOCUMENT LIST:-
1. TSVI-PRT03TD001-A : PROTECTION DESIGN MEMORANDUM
2. TSVI-PRT05IL001-A : TRIPPING & INHIBITION MATRICES
3. TSVI-PRT04WD002-A : PROTECTION RELAY NETWORK DIAGRAM

NOTE : 1. THE CT AND PT SIZING SHALL BE ENSURED BY RESPECTIVE PACKAGE OWNERS IN LINE WITH PROTECTION RELAY REQUIREMENT.
2. THIS DRAWING REPRESENTS PROTECTION SLD AND DOES NOT DEFINE ANY SCOPE DEMARCATION.
3. THIS SLD SHOWS PROTECTION SYSTEM ONLY AND ALL OTHER EQUIPMENT/COMPONENT ARE INDICATIVE. PLEASE REFER RESPECTIVE PACKAGE OWNER SLD FOR THE SAME.
4. RELAY TO RELAY FO CONNECTION TO REMOTE END RELAY FOR 87 (NHPC SCOPE)
5. CT/ ENERGY AUDIT AND TARIFF METERING (MMIT,SMIT AND CMIT) SHALL BE IN LTHPL/ NHPC SCOPE
6. *FOR BUS VOLTAGE, INTERLOCKING IS CONSIDERED + ISOLATOR CLOSE STATUS.

Transmission Status : For Approval	Space for Approval Stamp by Owner

CLIENT REV.	GE REV.	MODIFICATIONS	DATE	PREPARED	CHECKED	APPROVED	STATUS
B	E	SECOND ISSUE	25/11/2021	SHAUNAK	AKHIL	HIMANI	GFR
A	D	FIRST ISSUE	11/06/2021	SHAUNAK	AKHIL	HIMANI	GFR

OWNER : LTHP LTD. (A wholly owned subsidiary of NHPC Ltd.)

Lower Teesta Hydro Power Limited (A wholly owned Subsidiary of NHPC LTD.)

CONSULTANT : एन एच पी सी लिमिटेड (भारत सरकार का उद्यम) NHPC Limited (A Govt. of India Enterprise)

PROJECT : Teesta-VI H.E. Project (4x125MW)

PARTIAL ASSEMBLY: 220 KV GIS

SUB ASSEMBLY:

DRAWING TITLE: SINGLE LINE DIAGRAM

GE Renewable Energy

DRAWING / DOCUMENT NUMBER: HINTST000BAFF00001
SUPPLIER NUMBER (IF REQUIRED):
NHPC DOCUMENT NUMBER: TSVI-PRT04WD005-A
GE LATEST REV.: E
SH.NO. / NO. OF SH.: 1 / 1
DIMENSIONS: mm (UNLESS OTHERWISE NOTED)
LANGUAGE: ENGLISH
SCALE: NONE
GE Confidential

028

5. 245 kV GAS INSULATED SWITCHGEAR

5.1 Type Test

The contractor is required to carry out all type tests as per relevant IEC/ International Standards on one apparatus of each type of similar rating and shall submit the reports to the Employer. The type test may not be mandatory if similar equipment has been type tested and test certificate(s) for relevant tests are accepted by the Employer.

5.2 Shop Test

The GIS shall be routine tested as per relevant IEC with latest amendments. Following shop tests shall be carried out by the manufacturers at their works:-

Test on Enclosures as per IEC: 62271

- Pressure Test
- Gas leakage test

Test on Circuit Breaker as per IEC: 60056

- Test on Auxiliary & Control circuit:
  - Wiring Check
  - HV Test
  - IR Measurement

- Mechanical Operation Test:
  - 5 Open & 5 Close Operations at Minimum supply voltage & Minimum Pressure.
  - 5 Open & 5 Close Operations at Maximum supply voltage & Maximum Pressure.
  - 5 Open & 5 Close Operations at rated supply voltage Pressure.
  - Measurement of operation time.

- Electrical test:
  - Power Frequency Voltage Dry Test on Main Circuit
  - Measurement of Contact Resistance of Main Circuit.
  - Measurement of Resistance of Circuit Breaker Closing and Trip Coils.
  - Partial Discharge Measurement.
  - Measurement of Power Consumption of Motor Operated Mechanism at Rated Supply Voltage.
  - Operational & Interlocks Check
  - Operational Check of Pressure Density Monitoring Switches.

Tests on Disconnect Switches and Earthing Switches as per IEC: 60129

- IR, HV and wiring check on Auxiliary & Control Circuit.
- Mechanical Operation Test.
- Power Operation Frequency Voltage Tests of the Main Circuit and Partial Discharge Measurement.

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Sahadev Khatua
Chief Executive Officer
LTHPL, Sikkim

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- Measurement of the Resistance of Main Circuit.
- Operation & Interlock Check.
- IR Measurement.
- Measurement of Power Consumption of Motor.

Test on Current Transformer as per IEC: 61869

- Verification of Terminal Marking.
- Inter-Turn Over voltage Test.
- Test for Accuracy
- Composite Error Test
- Power Frequency Withstand Tests on Primary Winding and Partial Discharge Measurement
- Power Frequency Withstand Between Sections of Primary and Secondary Winding and on Secondary Winding

Test on Voltage Transformer as per IEC: 61869

- Pressure & Gas Leakage Test
- Verification of Terminals Markings.
- Power Frequency Withstand Tests on Primary Winding and Partial Discharge Measurement (150% of rated max. phase voltage).
- Power Frequency Withstand Tests Between Sections and on Secondary Windings.
- Induced Over-voltage Withstand Test.
- Test for Accuracy.

Test on Surge Arrestor as per IEC: 60099-4

- Pressure Test on Enclosure.
- Lightning Impulse Residual Voltage Test.
- Measurement of Power Frequency Voltage.
- Partial Discharge Measurement

Test on Local Control Cubicles

- Visual & Dimensional Check.
- Checking of BOM and Layout.
- Verification of Correct Wiring.
- Dielectric Tests.
- IR Measurement.
- Functional Tests by Simulation.

The details of tests are given in Model Quality Assurance Plan of Gas Insulated Switchgear.

5.3 Field Test

All field tests including tests during installation, pre-commissioning, commissioning, field acceptance tests shall be conducted by the Contractor, in presence of representative of the Employer.

Procedure to be adopted for conducting the operational, pre-commissioning, commissioning, performance and field acceptance test shall be submitted well in advance, at least six (6) month before start of relevant testing, for approval by the Employer.

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All field tests shall be carried out under the supervision of Manufacturer. Following field tests shall be performed:

- Visual inspection, checks and verifications,
- Mechanical operation tests of circuit breakers, disconnectors and earthing switches and high-speed earthing switches,
- Gas leakage test,
- Insulation resistance measurement,
- DC resistance measurement of the main circuit,
- Gas density monitor check,
- Inter lock test,
- Measurement of moisture content in gas before filling
- Manual operating check of circuit breakers, disconnectors and earthing switches,
- Test of auxiliary electrical, pneumatic and hydraulic devices.
- CT and PT testing
- High voltage tests on the main circuit on complete assembly.
- Power frequency test of auxiliary and control circuit (2 kV r.m.s for 1 minute),
- Partial discharge measurement test,
- Testing of on line monitoring systems and verification and calibration of various sensors,
- Recording and analysing of base line data of gas density, gas pressure, moisture, CF4 and air in gas (offline),
- Other tests not mentioned specifically but required by IEC.

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Sl. No.	BOQ Description	Detailed Description	Unit	Qty
A	**Supply- GIS: 220kV, 40kA for 1 second, 2000A, phase isolated type SF6 gas insulated GIS double main bus scheme**	GIS shall be 220kV, 2000A, 40kA for 1 second, etal enclosed phase isolated t pe S 6 gas insulated switchgear s ste ha ing Double Bus GIS configuration co plete with local control centre (L). T pical Ba includes Busbar, ircuit Breaker, Disconnector Maintenance Grounding Switch, ast Acting Make Proof Grounding Switches, Voltage Transfor er, urrent Transfor er, Surge Arrestor, S 6 to able onnection Module, S 6 to il onnection Module, GIS bus duct, Pressure Switches etc. (efer attached Single Line Diagra and Section-2 of TS). GIS shall co prise following ba s but not li ited to, a. 2 Set- ull E uipped Line GIS Ba , co plete with local control cabinet (L), cable etc. b. 4 Set- ull E uipped Transfor er GIS Ba , co plete with local control cabinet (L), cable etc. c. 1 Set- ull E uipped Buscoupler GIS ba , co plete with local control cabinet (L), cable etc. GIS shall be co plete with all necessar ter inal bo es, inspection windows, S 6 gas filling, interconnecting cabling wirings, grounding connections, gas onitoring s ste s and pipings, tra s, support structures. Hence, the scope shall include suppl , erection and ounting of hardware and interconnecting cables between GIS to L and between L to L including able Tra s, Tags, Glands, ferrules, Lugs etc, howe er cables be ond L panel shall be supplied and laid b BHEL under the super ision and input of the bidder.	Lot	1
A.1	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - Trans ission Line Ba odule	220kV, 40kA for 1 second, 2000A GIS double ain bus sche e grid inco er GIS ba , each set co prising of following but not li ited to, (a) 1 set- 1 phase circuit breaker, co plete with dedicated operating echanis for each pole. (b) set- 1 phase single-pole, group-operated disconnector, co plete with anual and otor dri en operating echanis . (c) 2 set- 1 phase single-pole, group-operated safet earthing switches, co plete with anual and otor dri en operating echanis . (d) 1 set- 1 phase single-pole, group-operated high-speed earthing switch, co plete with anual and otor dri en operating echanis . (e) no- 1 phase ulti ratio current transfor ers as per T VT para eters (f) Pressure relief de ice, busbar, insulator, e pansion joint fle ible, insulators etc. as re uired. (g) An other ite re uired to co plete the s ste in all respects but not li ited to abo e. (h) GIS bus duct, S 6 to air bushing connection odule are not included in this ba and these ite s are co ered separatel else where in the B .	Set	2
A.2	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - Generator Ba odule	220kV, 40kA for 1 second, 2000A GIS double ain bus sche e Generator ba odule, each set co prising of following but not li ited to, (a) 1 set- 1 1 phase circuit breaker, co plete with dedicated operating echanis for each pole. (b) set- 1 phase single-pole, group-operated disconnector, co plete with anual and otor dri en operating echanis . (c) set- 1 phase single-pole, group-operated safet earthing switches, co plete with anual and otor dri en operating echanis . (d) no- 1 phase ulti ratio current transfor ers as per T VT para eters (e) Pressure relief de ice, busbar, insulator, e pansion joint fle ible, insulators etc. as re uired. (f) An other ite re uired to co plete the s ste in all respects but not li ited to abo e. (g) GIS bus duct, S 6 to air bushing connection odule are not included in this ba and these ite s are co ered separatel else where in the B .	Set	4
A.	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - Buscoupler Ba odule	220kV, 40kA for 1 second, 2000A GIS double ain bus sche e buscoupler ba odule, each set co prising of following but not li ited to, (a) 1 set- 1 phase circuit breaker, co plete with dedicated operating echanis for each pole. (b) 2 set- 1 phase single-pole, group-operated disconnector, co plete with anual and otor dri en operating echanis . (c) 2 set- 1 phase single-pole, group-operated safet earthing switches, co plete with anual and otor dri en operating echanis . (c) 6 no- 1 phase ulti ratio current transfor ers as per T VT para eters (d) Pressure relief de ice, busbar, insulator, e pansion joint fle ible, insulators etc. as re uired. (e) An other ite re uired to co plete the s ste in all respects but not li ited to abo e.	Set	1
A.4	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - Bus Measure ent Ba	220kV, 40kA for 1 second, 2000A GIS double ain bus sche e bus easure ent GIS ba , each set co prising of following but not li ited to, (a) 1 set- 1 phase disconnector with single aintenance grounding switch, co plete with operating echanis . (b) no- 1 phase ulti winding oltage transfor ers as per T VT para eters (c) Pressure relief de ice, busbar, insulator, e pansion joint fle ible, insulators etc. as re uired. (d) An other ite re uired to co plete the s ste in all respects but not li ited to abo e.	Set	2
A.5	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - Bus Earth Switch Ba	220kV, 40kA for 1 second, 2000A GIS double ain bus sche e bus earth switch ba GIS ba , each set co prising of following but not li ited to, (a) 2 set- 1 phase high speed ake proof grounding switch, co plete with operating echanis . (b) Pressure relief de ice, busbar, insulator, e pansion joint fle ible, insulators etc. as re uired. (c) An other ite re uired to co plete the s ste in all respects but not li ited to abo e.	Set	1
A.6	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - GIS E tension Module	220kV, 40kA for 1 second, 2000A GIS double ain bus sche e GIS e tension odule phase, shall be as follows, but not li ited to, (a) Between sections of bus bars, bus duct connections, and shall be used to create electrical connecti it considering the ther al e pansion, acco odating of GIS Modules due to shifting of GIS ba s, arising due to ci il and architectural re uire ents or e pansion joint in the building that houses GIS. (b) Bidder shall consider the bus bar odules including the bellows co pensators like lateral ounting units, A ial co pensators, Parallel co pensators, tolerance co pensators and ibration co pensators etc.	Set	1
A.7	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - GIS Bus E tension Module for future ba e tension	220kV, 40kA for 1 second, 2000A GIS double ain bus sche e GIS bus e tension odule phase, shall be as follows, but not li ited to, (a) Arrange ent of gas co part ents shall be such as to facilitate future e tension on either end. Shall be co patible with GIS supplied b an other anufacturer. (b) Bidder shall consider the bus bar odules including the bellows co pensators like lateral ounting units, A ial co pensators, Parallel co pensators, tolerance co pensators and ibration co pensators etc.	Set	2

Sl. No.	BOQ Description	Detailed Description	Unit	Qty
A.8	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - GIS Surge Arrester Module with Surge ounter	220kV, 40kA for 1 second, 2000A GIS double ain bus sche e, Surge arrester odule with Surge ounter, each set co ptrising of following but not li ited to, (a) 1 set- nos. GIS surge arrester odules with surge counter in each phase (1 no. in each phase) (b) Pressure relief de ice, busbar, insulator, e pansion joint fle ible, insulators etc. as re uired. (c) An other ite re uired to co plete the s ste in all respects but not li ited to abo e.	Set	6
A.9	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - Gas Insulated Bus Duct	220kV, 2000A S 6 gas insulated GIS Bus duct shall shall include the following but not li ited to, (a) 1 phase S 6 gas insulated bus duct to connect line GIS ba with S 6 to EHV able ter ination odule at upper portion of ca ern as per la out drawing. (b) 1 phase S 6 gas insulated bus duct to connect transfor er GIS ba with S 6 to oil bushing connection of tranfor er. (c) Pressure relief de ice, busbar, insulator, e pansion joint fle ible, insulators etc. as re uired. The total tentati e length indicated is the su of all 1 phase S 6 bus duct fro respecti e ba to S 6 to EHV cable connection S 6 to oil bushing connection. Howe er, e act length shall be decided based on the details finali ed during detailed engineering.	Mtr	750
A.10	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - S 6 to EHV able ter ination Module.	Single phase 220kV, 2000A S 6 to EHV able ter ination odule shall be supplied as per IE . (a) Single phase ,220kV , 2000A , ter ination odule for ter inating GIS S 6 bus duct. (b) Scope of suppl shall be as per latest ersion of IE . (c) Pressure relief de ice, busbar, insulator, e pansion joint fle ible connection etc. as re uired. (d) Barrier cones, echanis bo and other ite s as re uired. (e) An other ite re uired to co plete the s ste in all respects but not li ited to abo e.	o	6
A.11	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - S 6 to oil bushing connection	Single phase 220kV , 2000A S 6 to il ter ination odule shall be supplied for the ter ination of GIS duct. (a) Single phase ,220kV , 2000A , ter ination odule for ter inating GIS S 6 bus duct. (b) Scope of suppl shall be as per latest ersion of IE . (c) Pressure relief de ice, busbar, insulator, e pansion joint fle ible connection etc. as re uired. (d) Barrier cones, echanis bo and other ite s as re uired. (e) An other ite re uired to co plete the s ste in all respects but not li ited to abo e.	o	12
A.12	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - Local ontrol entre (L)	Local ontrol entre (L) for each ba shall include the following but not li ited to, (a) Line GIS ba - 2 set (b) Transfor er GIS ba - 4 set (c) Buscoupler GIS ba - 1 set Bidder shall eet the re uire ent of L for the co plete GIS S ste in ini u 7 nos of L , howe er e act no L shall be decided during detailed engineering. and hence an additional re uire ent during detailed engineering shall not be pa able.	Lot	1
A.1	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - S 6 gas re uired for placing GIS into successful operation	irst filling of S 6 gas for the e uip ent supplied plus an additional uantit sufficient for conducting all the tests on e uip ent at site before placing it into successful operation. To be supplied in returnable c linders.	Lot	1
A.14	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - Structure Materials for support of GIS, Bus Ducts, S 6 to oil bushing connection and S 6 to able connection including oundation Bolts, E bedded Ite s, ails and or other ite s structural ite s re uired	Structure Materials for support of GIS, Bus Ducts, S 6 to oil bushing connection and S 6 to able connection including oundation Bolts, E bedded Ite s, ails and or other ite s structural ite s re uired. All steel structure e bers shall be hot-dip gal ani ed after fabrication. nless otherwise specified, ini u ass of inc coating for Gal ani ing shall be 610 g s uare eter. All field asse bl joints shall be bolted. ield welding shall not be acceptable. oncorrosi e etal or plated steel shall be used for bolts and nuts throughout the work. Manufacturer shall pro ide suitable foundation channels and anchor bolts to support the switchgear asse blies. All ounting bolts, nuts and washers shall be pro ided to fasten the switchgear base fra es to the foundation channels. In addition to abo e, supports, platfor s, foundation bolts, e bedded parts in floors etc., are also included in the scope as per the specification, but not li ited to the following, (a) Base Plate, hannel, Metallic Structural Me ber, e bedded ite s, rails for seating of GIS s ste (b) Lattice Pipe structure re uired for GIS ba , GIB,S 6 to oil bushing connection and S 6 to air bushing connection. (c) oundation bolt Anchor astening bolts for GIS s ste , if re uired. (d) E uip ent fi ing hardware. (e) able tra arrange ent (ounted on structures of) GIS ba , GIB,S 6 to oil bushing connection and S 6 to air bushing connection. (f) An other structural ite re uired to co plete the s ste in all respects but not li ited to abo e.	Lot	1
A.15	ontinuous nline Gas onitoring s ste	ontinuous online onitoring and diagonastic s ste s to onitor gas densit , gas pressure, leakage, operating para eters i.e. te perature etc. co plete with Sensors, input output odule, control processor unit, rela s, junction bo es, panels, wiring cabling and associated accessories in all respect for easuring, onitoring and data a uisition of intended para eters to be onitored, alongwith integration of the s ste with plant S ADA s ste . o unication protocol with plant S ADA shall be as per IE -61850 Modbus	Lot	1
A.16	H Partial Discharge ouplers	H partial discharge couplers for co plete GIS and GIB area.	Lot	1

Sl. No.	BOQ Description	Detailed Description	Unit	Qty
A.17	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - o plete Earthing Materials including High re uenc Earthing	Earthing Materials, e cept 40 MS rod,75 12 50 6 GI lat, which shall be pro ided b BHEL as free issue ite (IM), howe er, e act re uiren ent shall be inti ated b bidder based on the earthing philosph appro ed, and Super ision of erection of all earthing connection for GIS to Earth Mesh on loor shall be in scope of bidder including an special re uire ents including high fre uenc earthing. In case, high fre uenc earthing is not re uired, necessar design and calculations shall be sub itted b bidder. It shall be in line with clause 5.5.15, Section-2 of technical specification and entioned elsewhere in Technical Specification.	Lot	1
A.18	Suppl - GIS 220kV, 40kA for 1 second, 2000A GIS double ain bus sche e - onsu ables for GIS s ste	All consu ables including grouting aterial and che icals for the che ical anchors bolts etc., if applicable for GIS s ste shall be pro ided b bidder, howe er, in case of consu ables with shelf life less than si onths shall be supplied with special per ission and inti ation fro BHEL.	Lot	1
B	**Supply: Special Tools**	Special tools shall be shipped in separate containers, clearl arked with the na e of the e uip ent for which the are intended.		
B.1	Suppl Special Tools - Handling de ices and Tools for ba s	Handling de ices and Tools for asse bling and dis antling of ba s co plete GIS odules including ircuit Breaker	Set	1
B.2	Suppl Special Tools - Handling de ices and Tools for e uip ents	Handling de ices and Tools for asse bling and dis antling each t pe of operating echanis of ircuit Breakers, disconnectors and earthing switches	Set	1
B.	Suppl Special Tools - Gas leakage detector		os	1
B.4	Suppl Special Tools - Endoscope	Endoscope for checking the position of contact through iewing window	os	1
B.5	Suppl Special Tools - ontrol kit for densit switch threshold		os	1
B.6	Suppl Special Tools - S 6 pressure control and easuring set (Digital)		os	2
B.7	Suppl Special Tools - Tools for Gas handling		Set	1
B.8	Suppl Special Tools - Gas processing and filling unit		Set	1
B.9	Suppl Special Tools- An other special tools and tackles re uired for proper aintenance of GIS units has to be supplied b the bidder	Bidder to sub it the list of such tools including their ake and detailed specification, for acceptance.	Set	1
C	**Supply: Testing Instruments**	Testing instru ents shall be shipped in separate containers, clearl arked with the na e of the e uip ent for which the are intended. Howe er, Breaker Ti ing Measure ent it shall be brought b bidder during co issioning on returnable basis.		
.1	Suppl Testing Instru ents- S 6 gas ulti anal ser kit	S 6 gas ulti anal ser with gas return s ste for S 6, S 2, H2 , H oncentration, H2S concentration, concentration in PPM etc. It shall be of reputed ake, howe er ake and odel shall be subject to detailed engineering.	os	1
.2	Suppl Testing Instru ents- Portable Vaccu eter with probes		os	1
.	Suppl Testing Instru ents- ontact Ther o eter	ontact Ther o eter in the operating range of 10-100 deg.	os	1
.4	Suppl Testing Instru ents- B peration anal ser kit (alongwith D M kit)	ircuit Breaker operation anal ser kit to be supplied alongwith D M kit. It shall be in line with clause 5.9.1.2, Section-2 of technical specification and entioned elsewhere in Technical Specification.	os	1
D	**Supply: Mandatory Spares**			
D.1	Suppl Mandator Spares- Spare S 6 gas re uired for the co plete GIS	1 Lot 10 of the total uantit . This spare uanitit shall be supplied in non-returnable c linders of 40kg in read to use condition.	Lot	1
D.2	Suppl Mandator Spares- o plete circuit breaker with operating echanis for 1 pole in a sealed packing with pro ision onitoring gas pressure Vacuu		o	1
D.	Suppl Mandator Spares- o plete disconnector switch with operating echanis , cone and enclosure for 1 pole in a sealed packing with pro ision of onitoring gas pressure Vacuu	1 Set 1 no for each t pe	Set	1
D.4	Suppl Mandator Spares- o plete earthing switch with operating echanis , cone and enclosure for 1 pole in a sealed packing with pro ision of onitoring gas pressure Vacuu		o	1
D.5	Suppl Mandator Spares- o plete high speed earthing switch with operating echanis , cone and enclosure for 1 pole in a sealed packing with pro ision of onitoring gas pressure Vacuu		o	1
D.6	Suppl Mandator Spares- Tripping coil for ircuit Breaker		o	6
D.7	Suppl Mandator Spares- losing coil for ircuit Breaker		o	6
D.8	Suppl Mandator Spares- upture disc co plete asse bl including replace ent kit.	1 Set 2 nos. for each co part ent	Set	1
D.9	Suppl Mandator Spares- Sealing ring Gaskets	1 Set e uired for one Ba	Set	1

Sl. No.	BOQ Description	Detailed Description	Unit	Qty
D.10	Suppl Mandator Spares- Local ontrol abinet - M B, fuses, ti e rela , au iliar rela , indicating la p, resistors, li it switches, contactor and ter inals	1 Set e uired for one Ba	Set	1
D.11	Suppl Mandator Spares- S 6 filling al e for circuit breaker one		o	2
D.12	Suppl Mandator Spares- S 6 filling al e for other ones (e cluding circuit breaker one)		o	2
D.1	Suppl Mandator Spares- Gas densit pressure easure ent and onitoring -input output and processing cards	1 Set e uired for one Ba	Set	1
D.14	Suppl Mandator Spares- Gas densit Pressure trans itter		o	2
D.15	Suppl Mandator Spares- HMI for gas onitoring and PD s ste		o	1
D.16	Suppl Mandator Spares- Insulating cone	1 Set 2 nos. of each t pe used	Set	1
D.17	Suppl Mandator Spares- bser ation window		o	2
D.18	Suppl Mandator Spares- H coupler for PD easure ent		o	6
D.19	Suppl Mandator Spares- Multi core urrent Transfor ers odule	1 Set 2 nos. of each t pe used	Set	1
D.20	Suppl Mandator Spares- Voltage Potential Transfor er odule		o	2
D.21	Suppl Mandator Spares- orona Shield		o	1
D.22	Suppl Mandator Spares- Surge Arrestor		o	2
E	**Supply: Operation & Maintenance Spares**	Bidder to uote B for reco ended spares for two ears of nor al operation aintenance fro the date of co issioning. Bidder shall uote reco ended spares for two ears of nor al operation aintenance fro the date of co issioning. In case of no such re uire ent, bidder shall sub it the certification stating that e do not hereb reco end an operation aintenance spares for the period of two ears fro the date of co issioning, howe er in case of such re uire ent in future, sa e shall be supplied free of cost.	Lot	1
F	**Service: GIS- Supervision of Erection, Testing & Commissioning and handing over to Customer**	These acti ities shall be carried out at site in stages as per re uire ent or front a ailabilit at site, and hence ultiple isits for co pletion of work are en isaged.		
.1	Ser ice GIS- 220 V, Site isit for super ision of unloading erification of GIS aterials for proper storage and up-keeping at site	Site isit for super ision of unloading erification of aterials for proper storage and up-keeping at site includes following acti ities but not li ited to, (a) Super ision of safe unloading of GIS its accessories at site. (b) econcililation, storage upkeeping of aterials, with due instructions training to site persons for long storage.	Lot	1
.2	Ser ice GIS- 220 V, Super ision of erection of GIS ba s including L	Super ision of co plete GIS ba s along with all ba e uip ent such as GIS e tension odule, GIS bus e tension odule, surge arrester, oltage transfor er, L including structure, cabling, earthing other associated acti ities shall be included in the scope.	Lot	1
.	Ser ice GIS- 220 V, Super ision of erection of GIS- or gas insulated bus duct	Super ision of co plete GIS ba s along with all ba e uip ent including support structure, earthing other associated acti ities shall be included in the scope.	Mtr	750
.4	Ser ice GIS- 20 V, Super ision of erection of GIS- S 6 to oil bushing connection	Super ision of erection of GIS- S 6 to oil bushing connection including support structure, earthing other associated acti ities shall be included in the scope.	o	12
.5	Ser ice GIS- 220 V, Super ision of erection of GIS- S 6 to EHV cable GIS connection odule	Super ision of erection of GIS- S 6 to EHV cable GIS connection odule including support structure, earthing other associated acti ities shall be included in the scope.	o	6
.6	Ser ice GIS- 220 V, Testing co issioning of GIS ba s including L	Testing co issioning of co plete GIS ba s including other associated acti ities in line with site acceptance testing as per custo er appro ed SAT procedure shall be in bidder s scope.	Lot	1
.7	Ser ice GIS- 220 V, Testing co issioning of GIS- S 6 to oil bushing connection	Testing co issioning of GIS- S 6 to oil bushing connection including other associated acti ities in line with site acceptance testing as per custo er appro ed SAT procedure shall be in bidder s scope.	o	12
.8	Ser ice GIS- 220 V, Testing co issioning of GIS- S 6 to EHV cable GIS connection odule	Testing co issioning of GIS- S 6 to EHV cable GIS connection odule including other associated acti ities in line with site acceptance testing as per custo er appro ed SAT procedure shall be in bidder s scope.	o	6
.9	Ser ice GIS- 220 V, Testing co issioning of GIS- inal Successful High Voltage Power re uenc Testing of co plate GIS	arr ing out successful HV Power re uenc Testing of GIS as per IE including Arrange ent of HV Test kit (on returnable basis) shall be in scope of bidder, which includes charges HV test kit with operator, accessories tools re uired for co pletion of HV testing. Ba s a be co issioned separatel . o dela shall be per itted on account of the non a ailabilit of the HV test kit.	Lot	1
.10	Ser ice GIS- 220 V- Insulation o-ordination Studies for GIS S ste	Insulation co-ordination acti ities shall in bidder s scope. In case of non a ailabilit of e act input details, sa e shall be done be done on basis of standard inputs a ailable and shall be re ised after a ailabilit of e act input details.	Lot	1
.11	Ser ice GIS- 220 V- inal Docu entation	inal Docu entation including As Bulit Drawing Docu ent, Site Testing eports Protocols, Handing o er protocols along with anuals shall be sub itted etc. b bidder.	Lot	1
G	**Service: Training**			
G.1	Ser ice Training- Training for GIS for a period of at least 5 working da s at Manufacturer s works	It shall be in line with clause 1.10.2, Section-2 of technical specification and entioned elsewhere in Technical Specification.	Man da s	20
G.2	Ser ice Training- Training for GIS for a period of at least 5 working da s at project site	It shall be in line with clause 1.10.2, Section-2 of technical specification and entioned elsewhere in Technical Specification.	Man da s	20

Sl. No.	BOQ Description	Detailed Description	Unit	Qty
H	**Supply: Unit reference price of GIS part item/ equipment**	GIS part ite e uip ent shall be re uired for suppl as a andator spares or an addition deletion of e uip ent, due to da age, theft, additional re uire ent b custo er during detailed engineering or later stage. It is to be ensured b bidder that unit prices ha e a logical relationship with prices of asse blies in ain ite s (Ba , Busbar etc). The reference prices shall be used for breakup rates, if re uired at an stage. The reference prices shall be considered for e aluation.		
H.1	Suppl nit reference price of GIS part ite e uip ent- 220kV , 2000A ircuit Breaker	1 Set 1 o of each rating and t pe with one poles with enclosure without operating echanis	Set	1
H.2	Suppl nit reference price of GIS part ite e uip ent- 220kV , 2000A Disconnector	1 Set 1 o of each rating and t pe with all three poles with enclosure without operating echanis	Set	1
H.	Suppl nit reference price of GIS part ite e uip ent- 220kV , 2000A Safet earthing switch	1 Set 1 o of each rating and t pe with all three poles with enclosure without operating echanis	Set	1
H.4	Suppl nit reference price of GIS part ite e uip ent- 220kV , 2000A ast acting ake proof grounding switch High speed ake proof grounding switch	1 Set 1 o of each rating and t pe with all three poles with enclosure without operating echanis	Set	1
H.5	Suppl nit reference price of GIS part ite e uip ent- Surge Arrestor including Surge ounter	1 Set 1 o of each rating and t pe with enclosure. ated oltage a be changed after insulation coordination stud .	Set	1
H.6	Suppl nit reference price of GIS part ite e uip ent- 220kV urrent Transfor er	1 Set 1 o of each rating and t pe with enclosure	Set	1
H.7	Suppl nit reference price of GIS part ite e uip ent- 220kV Voltage Transfor er	1 Set 1 o of each rating and t pe with enclosure	Set	1
H.8	Suppl nit reference price of GIS part ite e uip ent- perating Mechanis for ircuit Breaker	1 Set 1 o of each rating and t pe	Set	1
H.9	Suppl nit reference price of GIS part ite e uip ent- perating Mechanis bo for Disconnector	1 Set 1 o of each rating and t pe	Set	1
H.10	Suppl nit reference price of GIS part ite e uip ent- perating Mechanis bo for Safet earthing switch	1 Set 1 o of each rating and t pe	Set	1
H.11	Suppl nit reference price of GIS part ite e uip ent- perating Mechanis for ast acting ake proof grounding switch High speed ake proof grounding switch	1 Set 1 o of each rating and t pe	Set	1
H.12	Suppl nit reference price of GIS part ite e uip ent- 220kV, 1 Phase bus bar conductor		Mtr	1
H.1	Suppl nit reference price of GIS part ite e uip ent- 220kV, 1 phase GIS etalic enclosure for bus bar an e uip ent		Mtr	1
H.14	Suppl nit reference price of GIS part ite e uip ent- 220kV, 1 Phase conductor for bus duct		Mtr	1
H.15	Suppl nit reference price of GIS part ite e uip ent- 220kV, 1 phase GIS etalic enclosure for bus duct		Mtr	1
H.16	Suppl nit reference price of GIS part ite e uip ent- Gas per eable co unication barrier t pe Insulator	1 Set 1 o of each rating and t pe	Set	1
H.17	Suppl nit reference price of GIS part ite e uip ent- Gas non-per eable non - co unication non-barrier t pe Insulator	1 Set 1 o of each rating and t pe	Set	1
H.18	Suppl nit reference price of GIS part ite e uip ent- H Partial Discharge oupler	1 Set 1 o of each rating and t pe	Set	1
H.19	Suppl nit reference price of GIS part ite e uip ent- Pressure densit onitor, onitor de ice Switch	1 Set 1 o of each rating and t pe	Set	1
H.20	Suppl nit reference price of GIS part ite e uip ent- Pressure relief de ice	1 Set 1 o of t pe	Set	1
H.21	Suppl nit reference price of GIS part ite e uip ent- upture disc	1 Set 1 o of t pe	Set	1
H.22	Suppl nit reference price of GIS part ite e uip ent- Elbow bend cross and T section	1 Set 1 o of t pe	Set	1
H.2	Suppl nit reference price of GIS part ite e uip ent- E pansion joint	1 Set 1 o of t pe	Set	1
H.24	Suppl nit reference price of GIS part ite e uip ent- le ible connections	1 Set 1 o of t pe	Set	1
H.25	Suppl nit reference price of GIS part ite e uip ent- Gas seals	1 Set 1 o of t pe	Set	1
I	**Service: Unit reference price of GIS part item/ equipment**			
I.1	Ser ice nit reference price of GIS part ite e uip ent- Ser ices of super ision for Erection of GIS	Ser ices of super ision for Erection of GIS	Manda	1

Sl. No.	BOQ Description	Detailed Description	Unit	Qty
I.2	Ser ice nit reference price of GIS part ite e uip ent- Ser ices of Testing o issioning of GIS	Ser ices of Testing o issioning of GIS	Manda	1
I.3	Service: To and Fro Charges including local conveyance for Service Engineer	To and Fro Charges including local conveyance for Service Engineer	Trip	6
I.4	Ser ice nit reference price of GIS part ite e uip ent- Hiring charges of HV test kit with operator	Additional HV test kit charges including charges of operator, HV test kit, accessories tools re uired for co pletion of HV test (Dielectric Test after installation of GIS). HV test kit charges include one or ore ba at site.	Lot	1

TECHNICAL PRE-QUALIFYING REQUIREMENT

Bidder should be manufacturer of 220kV class GIS. Bidder needs to meet the following technical requirements as stipulated here under:

Route-1:

a) The bidder should have successful experience in designing, manufacturing, supply, supervision of installation, testing and commissioning of Gas Insulated Switchgear (GIS) having rated voltage of 220kV class or higher with current rating of 2000A or above and short circuit current rating of 40kA or above, in last 10 years as on **scheduled date#**.

b) The GIS so manufactured should have been in **successful operation*** at least at three (3) power stations/ substations.

OR

Route-2:

Alternatively, the bidder, who have established manufacturing and testing facilities in India based on technological support of collaborator/parent/principal/JV company and not meeting the requirement stipulated in (Route-1) above, can also be considered provided that:

a) Min. 220kV class or higher with current rating of 2000A or above and short circuit current rating of 40kA or above, in last 10 years as on **scheduled date#** from the works where the offered GIS is to be manufactured.

AND

b) The collaborator/parent/principal/JV company meets the requirements stipulated in (Route-1) above. A technical collaboration agreement for 220kV class GIS shall be submitted.

NOTE: -

Originally Scheduled date of technical bid opening of this Tender.
* Successful operation means Performance Certificate issued by customer without any adverse remarks.

PREPARED BY 22/11/21 | REVIEWED BY 22/11/21 | APPROVED BY 22/11/21

5 GAS INSULATED SWITCHGEAR

5.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance testing, acceptance testing, training of Employer's personnel, handing over to employer and guarantee for two years of 245 kV GIS System as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

5.1.1 245 kV GIS

Indoor metal-enclosed phase isolated type SF_6 gas insulated switchgear system rated for 245 kV, 3 phases, 50 Hz consisting of following major items:

1) Two (2) 3-phases, 2000A SF_6 gas insulated metal enclosed bus bars complete in all respects, comprising of:
   a) Six (6), individual bus bars enclosures running the length of the switchgear,
   b) Six (6) single-phase, 2-core voltage transformers, three in each bus
   c) Six (6) single-phase disconnector complete with manual and motor driven operating mechanisms, one in each single phase bus for isolation of voltage transformer,
   d) Twelve (12) single-phase group-operated safety earthing switches complete with manual and motor driven operating mechanisms,
2) One (1) bus-coupler bay modules, each comprising of:
   a) One (1), 3-pole SF_6 gas insulated circuit breaker, complete with dedicated operating mechanism for each pole.
   b) Six (6), Single Phase, 3-Core multi ratio Current Transformer
   c) Two (2), 3-phase, single-pole group-operated disconnector complete with manual and motor driven operating mechanisms,
   d) Two (2), 3-phase, single-pole group-operated safety earthing switches complete with manual and motor driven operating mechanisms,
   e) One (1), local control cubicle for control of coupler bay, bus bar VT, disconnector. & earth switch.
3) Four (4) generator bay modules, each comprising of:

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Sahadev Khatua
Chief Executive Officer
LTHPL, Sikkim

a) One (1), 3-pole SF_6 gas insulated circuit breaker, complete with dedicated operating mechanism for each pole,

b) Three (3), Single Phase, 6-Core, multi ratio, Current Transformer

c) Three (3) single-phase surge arrestors,

d) Three (3), 3-phase, single-pole group-operated disconnector, complete with manual and motor driven operating mechanisms,

e) Three (3), 3-phase, single-pole group-operated safety earthing switches, complete with manual and motor driven operating mechanisms,

f) Three (3) terminal connection module for direct connection of Generator Transformers (Scope as per IEC 62271-211).

g) One (1), local control cubicle .

4) Two (2) transmission line bay modules, each comprising of:

a) One (1), 3-pole SF_6 gas insulated circuit breaker, complete with dedicated operating mechanism for each pole.

b) Three (3), Single Phase, 6-Core, multi ratio, Current Transformer

c) Three (3), 3-phase, single-pole group-operated disconnector, complete with manual and motor driven operating mechanisms,

d) Two (2), 3-phase, single-pole group-operated safety earthing switches, complete with manual and motor driven operating mechanisms,

e) One (1), 3-phase, single-pole group-operated high-speed earthing switch, complete with manual and motor driven operating mechanism,

f) Three (3) single-phase surge arrestors,

g) Three (3), XLPE cable termination module (Scope as per IEC 62271-209),

h) One (1), local control cubicle.

5) Gas insulated bus duct (GIB) –Gas insulated bus duct interconnecting main GSU Transformers to respective unit bays and Line bays to respective XLPE cable termination module at upper portion of cavern, inside cable tunnel as per layout drawing. There should be margin of adjusting level difference of at least 50 mm on either side. Length of GIB shall be as per Layout drawings.

6) All necessary terminal boxes, SF_6 gas filling, interconnecting power and control wiring, earthing connections, gas monitoring equipment and piping support structures etc,

7) Grounding of GIS and GIB with existing Earthmat.

8) Cable tray, Cable pit / trench for connecting cable between LCC to main equipment and from LCC to LCB (in the premises of GIS hall) except the main cable trench shall have state-of-art covering/chequered plates as finalized during detail engineering and shall be in GIS manufacturer's scope.

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9) The first filling of SF_6 gas for the equipment supplied plus an additional quantity sufficient for conducting all tests on equipment at the site before placing it into successful operation. SF_6 gas shall be supplied in returnable cylinders. In addition about 10 % spare gas (of total used for GIS) by weight shall be supplied in 40 kg non returnable cylinders,

10) Continuous on-line monitoring and diagnostic systems to monitor gas density, gas pressure, leakage, operating parameters i.e. temperature etc. complete with sensors, control/processor units, wiring/cabling in all respect and integration of the systems with plant SCADA system. Communication protocol with plant SCADA shall be as per IEC-61850/ Modbus,

11) UHF Partial Discharge Couplers

12) Coordination and provision of necessary contacts and/or ports for integration with plant SCADA system.

13) Necessary arrangement for facilitating GIS erection even in case of dust, minor water drops in the cavern.

14) Spare parts in accordance to clause 5.8 "Spare Parts" of this section.

15) Tools and instruments in accordance to clause 5.9 "Tools and Instruments" of this section

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

5.2 Specific Parameters and Layout Conditions

5.2.1 Layout and General Arrangement

The Contractor shall follow the layout arrangement drawings as enclosed to develop the actual layout.

GIS and its associated equipments shall be installed and handled by a EOT crane of 5T capacity and handling height of 6 m from crane hook.

5.2.2 245 kV GIS

i) The switchgear shall have double bus bar arrangement. The rated capacity of switchgear including bus bar and all feeders shall be 2000A.

ii) 245 kV SF_6 gas insulated switchgear shall be installed at EL 263.50 M.

iii) The interconnection between main GSU transformers and respective unit bays shall be through interconnecting gas insulated bus ducts..

iv) The connection from GIS line bays to pothead yard is through 220 kV XLPE cables. However the interconnection between GIS Line bays and respective XLPE cable shall be through interconnecting gas insulated bus ducts termination module which shall be located in cable tunnel at EL 271.0 m. The pot yard for taking off the power

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is located at EL 260.0 M Each bus shall be capable of evacuating full station capacity including overload.

v) The single line diagram for 245 kV GIS is given in drawing no. NH/DEM/TS-VI/CP/01, NH/DEM/TS-VI/CP/02 and NH/DEM/TS-VI/CP/03.

vi) GIS is meant for Hydro Station, which will run as a peaking station and each breaker is envisaged to undergo multiple close open operations per day. The contractor shall supply Circuit Breakers to meet such operational requirements.

vii) As per protection scheme, CB trip coil supervision relay is provided in protection panel. As such CB trip coil supervision provided in LCC shall take this in to consideration

viii) GIS shall be subdivided into separately monitored zones for each circuit breaker, each termination, each main bus or bus sections, voltage transformers, disconnectors with or without earth switches, current transformers and surge arrestors etc. Typical arrangement of gas isolation is shown in clause 5.5.5. The contractor can propose any other arrangement equivalent/ better than this same and the same shall be finalized during detail engineering.

5.3 Rating and Functional Characteristics

S.No.		
	A) System Description	
i	Location	Indoor
ii	Scheme	Double Bus bar arrangement
iii	No. of Bays	7
	B) System Requirement	
i	Rated voltage kV	245 kV
ii	Rated frequency, Hz	50
iv	Rated withstand Voltage	
	- Power Frequency phase to Earth/ across open switching distance and between phases (rms value)	460 kV/ 530kV
	- Lightening Impulse phase to Earth/ across open switching distance and between phases (peak value)	1050 kV/ 1200kV
v	Rated short time withstand current (r.m.s) for 1 Sec	40 kA
vi	Rated Peak withstand current	100 kA
vii	Rated normal current, A, r.m.s	2000A

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viii	Control voltage DC (for closing, tripping of breaker, spring charging motor and motors for disconnector and earth switch)	220 V + 10% / -10% (-20% for trip coils)
ix	Auxiliary AC supply, 3 phase	415 ± 10% V
x	Partial discharge of switchgear assembly at highest voltage for equipment, pc	<10
xi	Maximum Gas leakage rate (%) of the respective volume, per year	0.5%
	C) Circuit Breaker	
i	Type	SF6
ii	Description	Three separate pole equipped with single pole operating mechanism
iii	First-pole-to clear factor	1.3
iv	Rated short circuit breaking capacity, kA (r.m.s)	40 kA
v	Rated short circuit making capacity, kA (peak)	100 kA
vi	Rated line charging breaking current capacity, A	125 A
vii	Rated cable charging breaking current capacity, A	250 A
viii	Duty Cycle	
a)	- Line Breakers	O-0.3s-CO-3 min– CO
b)	- Generator feeder and bus coupler breaker	O-0.3s -CO-3 min–CO
c)	Closing Time	<100 ms
d)	Breaking Time	<60ms
ix	Small inductive current breaking capability (without producing excessive over voltages)	10A
x	Mechanical endurance class	M2
xi	Capacitive switching class	C2
	D) Disconnector	
i	Type	Three separate pole mechanically coupled and group-operated

ii	Operation	Motor as well as manual
iii	Rated capacitive current make and break capacity	0.5 A
iv	Rated Bus Transfer Current	80% of rated normal current
v	Rated Bus Transfer Voltage	20 V r.m.s
E)	**Earthing Switch**	
i	Making Capacity kA (peak)	100 kA
ii	Rated short-time current	40 kA
iii	Rated Induced Current/Voltage for Electromagnetic coupling(rms)	80A/2 kV
iv	Rated Induced Current/Voltage for Electrostatic coupling(rms)	3A/12 kV
F)	**Current Transformers**	
i	Current ratio	
a)	Generator	2000-1000- 500A/1A
b)	Line bay/Bus coupler	2000- 1000 - 500A/1A
ii	Accuracy class	
a)	- For protection	PS
b)	- For metering	0.2S
G)	**Surge Arrestor**	
i	Type	Gapless metal Oxide station type
ii	Rated arrestor voltage	216kV rms
iii	Nominal discharge Current (8/20μs wave)	10 kA
iv	Continuous operating voltage at 50° C	168 kVrms
v	Long duration Discharge class	Class 3
vi	Energy dissipation capability	5 kJ/KV
vii	Partial Discharge at highest level	<50pC
H)	**Bus Voltage Transformer**	
i	Type	Inductive type, single phase, two core
ii	Location	R,Y,B phase

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iii	Purpose	Protection, Synchronising and Metering
iv	Voltage ratio	(220/√3)kV/(110/√3)V/ (110/√3) V
v	Accuracy class - Metering - Protection & Synchronising	 0.2 3P
vi	Voltage factor	1.5 for 30 s, 1.2 for continuous

5.4 Performance Guarantee

The GIS system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

Contractor shall state and guarantee the following:

a) Number of mechanical and fault current operation of circuit breaker interrupter unit before it is opened for inspection and maintenance,

b) Number of operation of operating mechanism before it is opened for inspection and maintenance.

5.5 Design and Construction

5.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

S.No.	Standards	Description
1	IEC 62271(All Parts)	"High voltage switchgear and control gear",
2	IEEE C37.122-1993	IEEE Standard for Gas-Insulated Sub-stations (GIS)
3	IEEE C37.123-1996	IEEE Guide to specifications for Gas-Insulated, Electric Power Substation Equipment
4	IEC 60376 – 2005 Edition	Specification of technical grade sulphur hexafluoride (SF6) for use in electrical equipment

5	IEC 60859	Cable connection for Gas Insulated Switchgear
6	IEC 60099-4	Metal-oxide surge arresters without gaps for AC systems

5.5.2 General

It is understood that each manufacturer has its own particular design concept and it is not the purpose of this specification to impose unreasonable restrictions. However, in the interest of safety, reliability and maintainability, the switchgear offered shall meet the following minimum modular concept and design requirements:

a) Fail safe inter and intra bay Inter locking scheme

b) Maintenance of one bus bar with the other bus bar in service,

c) Maintenance of one feeder with adjacent feeders in service,

d) All the partition/ compartment shall be designed for one side at rated pressure and other side at vacuum so as to perform maintenance safely. The contractor shall demonstrate through gas compartment segregation or otherwise how compliance of service continuity as per S. No. b, c, f and g are achieved. GIS gas partition diagram as per tender drawing is indicative only and any other better method to achieve service continuity as referred in clause 5.5.2 will also be accepted.

e) Interchangeability of similar parts,

f) Future extension of bays, with maximum one bus outage at a time. Future extension of bays shall be compatible with GIS supplied by any other manufacturer. Accordingly, all the interfacing details and technical requirements/parameters for future extension of bays, independent of the manufacturer, shall be submitted including any additional need of installations including buffer gas compartments / appropriate disconnect facilities or any other alternative.

The arrangement of gas sections or compartments shall be such as to facilitate future extension on either end without any drilling, cutting or welding on the existing equipment from any manufacturer and without the necessity of moving & dislocating the existing switchgear bay.

g) Possible to remove and replace the fully assembled parts of circuit breaker, any additional need of installations including buffer gas compartments / appropriate disconnect facilities or any other alternative

h) Pressure relief device for each pressurised section,

i) Gas density monitoring device for each isolated section/module,

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All mechanical parts, which are outside of gas filled compartment, must be externally accessible and serviceable without disconnecting the main bus bar or feeder circuits.

All current carrying components of the equipment specified shall be capable of continuous operation at the specified rated current without exceeding the maximum temperature rises specified in the relevant IEC standards.

5.5.3 Arrangement and assembly

The arrangement shall be single-phase enclosed. The assembly shall consist of completely separate pressurized sections designed to minimize the risk of damage to personnel or adjacent sections in the event of a failure occurring within the equipment. Rupture diaphragms shall be provided to prevent the enclosures from uncontrolled bursting and suitable deflectors provide protection for the operating personnel. In order to achieve maximum operating reliability, no internal relief devices shall be installed because adjacent compartments would be affected. Modular design, complete segregation, arc-proof bushings and "plug-in" connection pieces shall allow ready removal of any section and replacement with minimum disturbance of the remaining pressurized switchgear.

5.5.4 Metal enclosed Bus bar

The bus bars shall be single-phase isolated metal-enclosed type. The enclosure material shall be of aluminium or aluminium alloy and enclosure design shall essentially be based on following considerations

a) Temperature and solar radiations

b) Thermal cycling, vibration, shock and seismic

c) Design Pressure on normal and abnormal conditions

Conductors and live part shall be mounted on moulded epoxy resin insulators specially made for the EHV application. The conductors shall be made of tubular aluminium. Silver plated finger contacts at the ends of conductor or mounted on support insulators shall be provided to form sliding contact permitting the conductor to expand axially on a temperature rise, without imposing any mechanically stresses on the supporting insulators. Metal bellows compensators shall be provided on enclosure for permitting longitudinal expansion. The enclosure shall be dimensioned for the full return current. Compensators shall be bypassed by copper straps.

5.5.5 Arrangement of gas isolation

Typical arrangement of gas isolation is shown below. The contractor can propose any other arrangement equivalent/ better than this same and the

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same shall be finalized during detail engineering.

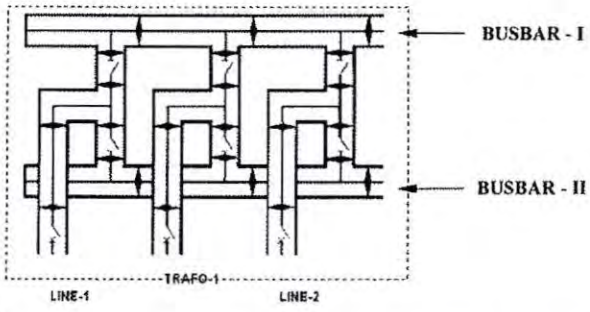

Figure I: Considering reduced pressure at adjacent compartment for outage of maximum one feeder during maintenance/repair.

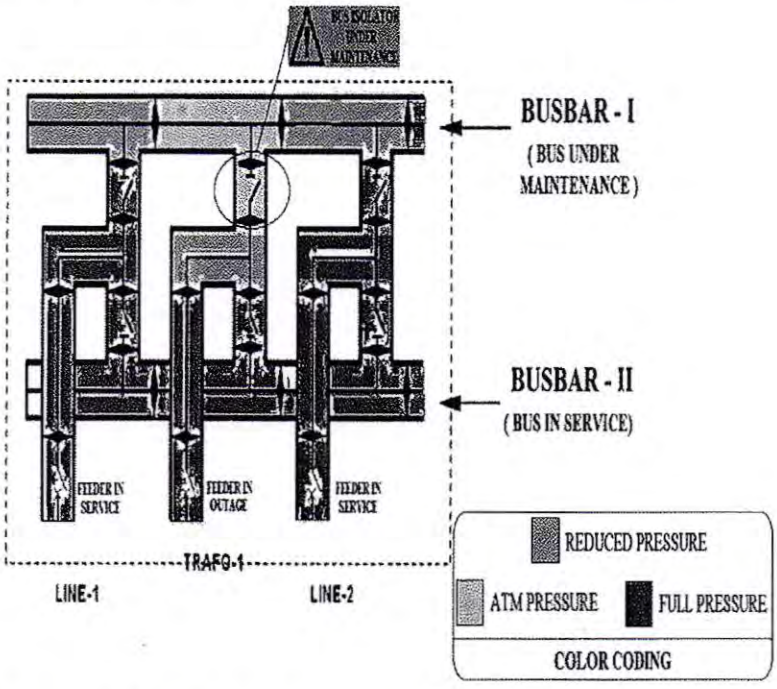

Figure II: Considering bus isolator under maintenance in proposed partitioning arrangement.

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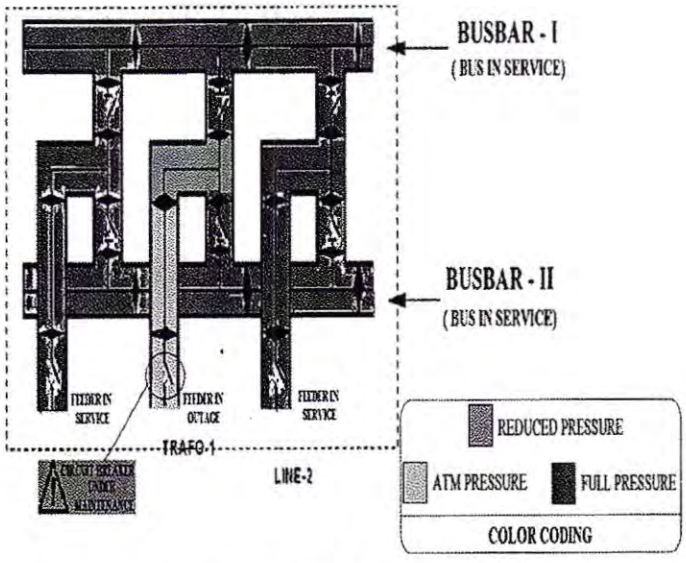

Figure III: Considering Circuit Breaker under maintenance in proposed partitioning arrangement.

5.5.6 Circuit breakers

The circuit breaker shall be designed to minimize switching over voltages and also to be suitable for out-of-phase switching. The specified arc interruption performance must be consistent over the entire operating range, from line-charging currents to full short-circuit currents. The complete contact system (fingers, clusters, jets, SF_6 gas) shall be designed to withstand at least twenty (20) operations at full short-circuit rating without the necessity to open the circuit breaker for service or maintenance.

The interrupter and operating drive should be simple and sturdy conforming to C2 & M2 class complying with T_{100} & L_{75} without maintenance respectively as per IEC 62271-100.

The operating mechanism shall be spring/spring or hydraulic / spring type or any other which have the proven operational performance subject to the employers approval.

The circuit breakers shall comprise three single-phase metal clad breakers poles. Each pole shall consist of the operating mechanism, interrupter unit and the enclosure with basic supporting structure. The mechanism shall be trip free mechanically or electrically with anti pumping device. Grading capacitors shall be provided to ensure uniform voltage distribution between interrupting elements. SF_6 circuit breakers shall conform to IEC-62271-100. Auxiliary contacts of the breakers shall be provided for the local and remote indications, the performance of various control and protection schemes and the interlocking scheme. Alarm and

cut-off contacts for mechanism faults and gas pressure loss shall also be provided. The circuit breaker shall be capable of being operated locally or from remote.

5.5.7 Current transformers

The current transformers shall be of single phase inductive type and shall have multi core with multi ratio, which shall be changeable by means of taps on secondary side. Independent cores shall be used for different purposes as per drawing No.NH/DEM/TS-VI/CP/01 of protective relaying and metering diagram.

Scope shall cover any additional CTs and/or no. of cores for CTs for additional protection and metering if felt necessary during detailed engineering.

5.5.8 Voltage transformers

The voltage transformers shall be of single phase inductive type with secondary windings as shown in drawing NH/DEM/TS-VI/CP/01, 2 & 03. Independent cores shall be used for different purposes as per drawing No. NH/DEM/TS-VI/CP/01 & 02 of protective relaying and metering diagram.

The voltage transformer shall be located in a separate module and shall be connected phase to ground to the phase buses.

Scope shall cover any additional VTs and/or no. of cores for VTs for additional protection and metering if felt necessary during detailed engineering.

5.5.9 Disconnector

The three-phase disconnector shall comprise of three separate pole and all the three poles shall be mechanically coupled via robust mechanical link. All three poles shall be group-operated manually as well as through motor driven mechanisms.

The disconnector shall have provision for visual indication of switching position. Disconnector shall conform to IEC 62271-102. Sufficient auxiliary contacts shall be provided for indications (local and remote), interlocking schemes and the performance of various control and protection schemes.

5.5.10 Earthing switch

The 3-phase earthing switch shall comprise of three separate pole and all the three poles shall be mechanically coupled via robust mechanical link. All three poles shall be group-operated manually as well as through motor driven mechanisms.

Each earthing switch shall be electrically interlocked with its associated disconnector and circuit breaker and mechanically position padlocked. Sufficient auxiliary contacts for indications and interlocking shall be provided. Inspection window shall be provided in the enclosure. Necessary arrangement shall be made in Earthing Switch for testing purposes i.e. primary current injection/ CB testing.

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5.5.11 High speed earthing switch

The three-phase high-speed make-proof type-earthing switch shall comprise of three separate pole and all the three poles shall be mechanically coupled via robust mechanical link. All three poles shall be group-operated manually as well as through motor driven mechanisms. It shall be used to discharge the respective charging current in addition to their safety earthing functions.

Each earthing switch shall be electrically interlocked with its associated disconnector and circuit breaker. Sufficient auxiliary contacts for indications and interlocking shall be provided. Inspection window shall be provided in the enclosure.

5.5.12 Surge arrestor

The surge arrestor shall be of gap-less heavy-duty station type and the live part shall comprise of non-linear metal oxide resistors without spark gap. Provision shall be made for measurement of leakage current and connection of discharge counter.

The arrestors shall be either the plug in construction or the disconnect link type and be attached to the GIS in such a manner that they can be readily disconnected during the dielectric tests. The metal housing of the arrestor should be connected to the metal enclosure of the GIS through the flanged or bolted joints. Number/position of surge arrestor as shown in Tender drawing is indicative and will be finalized during detail engineering based on insulation coordination studies.

5.5.13 Termination arrangements

The Contractor shall co-ordinate the interface arrangement and scope of supply of respective manufacturers for 245kV GIS termination on 220kV side of transformers through GIB and Pothead yard through XLPE cables. The scope of all the termination shall be as per IEC 62271.

5.5.14 Name Plate

Each auxiliary control cubicle must be identified with the feeder designation to which it is assigned.

Each switchgear bay module shall have a rating plate with the information required by IEC 60517.

Each instrument transformer must have its own rating plate with the information as required in IEC 61869 and IEC 60186.

5.5.15 Earthing

The enclosures of all the GIS and GIB shall be grounded at several points so that there shall be a grounded gauge around all live parts. All conduits and cables sheaths shall be connected to the ground bus, to be provided, in the control cubicles and the marshalling boxes. All steel structures shall be grounded. The manufacturer shall recommend earthing requirements during engineering in the first submission of drawings

a) All wirings to GIS and GIB shall be shielded and grounded at both ends.

b) Subassembly to subassembly ground conductors shall be provided to assure safe voltage gradients.

5.5.16 SF_6 GAS

The gas shall generally conform to IEC 60376 – 2005 edition but for following

a)	Water	≤	5 ppm by weight
b)	Carbon Tetra Fluoride	≤	250 ppm by weight
c)	Air	≤	250 ppm by weight

5.5.17 On-line monitoring

Continuous on line monitoring system shall be provided to monitor conditions such as gas density, gas pressure, gas leakage, moisture (offline) etc. and operating parameters such as current, voltage, temperature etc. of GIS and GIB for smooth operation and detection of any changes in insulation at an early stage during normal operation to take appropriate remedial action .

Each system shall be complete with sensors, input/output module, control/processor unit, relays, junction boxes, cabling and associated accessories for measuring, monitoring and data acquisition of intended parameters to be monitored.

5.5.17.1 Gas monitoring system

Each gas-filled compartment shall have its own SF_6 gas density / pressure monitoring system, each comprising of a temperature compensated SF_6 gas density monitoring unit and having alarm/trip contacts.

Gas pressure and density shall be continuously monitored and displayed by a suitable temperature compensated instrument, which will provide an alarm signal in case of pressure drop before the allowable minimum pressure is reached.

5.5.17.2 Couplers for Partial discharge measurement

For detection of PD signals, sufficient number of UHF couplers to cover the entire switchgear, shall be provided along the chambers. Location of couplers shall be decided during detail engineering.

The UHF PD couplers shall be of external, passive, maintenance free antenna type and compliant to CIGRE TF, 15/33.03.05 1998 (<=5pC).

5.5.18 Local control cubicle

The Local control cubicle shall contain all the equipment required for controlling and monitoring the bay. Each bay's local control cubicle shall have at least the following main function:

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a) The mimic diagram with control switches for electrically operated circuit breakers, disconnector and earthing switches as well as the position indication of all components provided with auxiliary switches,

b) Alarm facia with indicating lamps for monitoring of gas density,

c) Trip circuit healthiness,

d) Electric interlocking between devices,

e) Interface between central control and the switchgear,

f) Interior lighting, safety shrouding, heating to prevent condensation etc.

All the switchgear bay modules shall be supplied with a local control cubicle of the floor standing type. The cubicle shall have full height, hinged, gasket lockable double doors. One door shall have safety glass window through which various controls can be viewed without opening the door. The cubicle shall be utilized as both the switchgear bay local control module and as the terminating centre for all power supply, control, annunciation and supervisory wiring interfacing with the system. Adequate no. of potential free contact shall be made available for providing necessary input/output interface.

Implemented technology for control shall be digital and local control cubicle shall incorporate bay control unit for integration to plant SCADA system through local control Board for GIS. Colour of the cubicles shall be as per GTR clause no. 1.5.2- Colour schedule

5.6 Drawings, Documents and Design Calculations

5.6.1 Design memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause 1.6 "Record and Documentation" of "Section 1- General Technical Requirements."

5.6.2 Drawings and documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in "Section 2 - Technical Documents" of "General Technical Specification (GTS)".

5.6.3 Design calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of "General Technical Specification (GTS)" covering at least the following, for review / acceptance:

Insulation Co-ordination studies for surge arrestor location and sufficiency of numbers.

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5.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 "Delivery, Installation and commissioning" of "Section 1 - General Technical Requirements."

5.8 Spare Parts

Specified spare parts to be supplied under this section are as follows:

S.No.	Description	Quantity
1	SF6 gas for use during operation and maintenance in non-returnable cylinders.	10% of total quantity in 40 kg cylinders
2	Complete circuit breaker with operating mechanism for 1 pole in a sealed packing with provision of monitoring gas pressure/Vacuum	1 no.
3	Complete disconnector switch with operating mechanism,cone and enclosure for 1 pole in a sealed packing with provision of monitoring gas pressure/Vacuum	1 no.
4	Complete earthing switch with operating mechanism, cone and enclosure for 1 pole in a sealed packing with provision of monitoring gas pressure/Vacuum	1 no.
5	Complete high speed earthing switch with operating mechanism, cone and enclosure for 1 pole in a sealed packing with provision of monitoring gas pressure/Vacuum	1 no.
6	Trip coils for circuit breakers	6 nos.
7	Closing coils for circuit breakers	6 nos.
8	Rupture disc complete assembly including replacement kit.	2 nos. for each compartment
9	Sealing / "O" ring / Gaskets for one bay	1 set
10	Spares for local control cabinet - MCB, fuses, time relay, auxiliary relay, indicating lamp, resistors, limit switches, contactor and terminals	1 set
11	SF6 filling valve for circuit breaker zone	2 nos.

12	SF6 filling valve for other zones(excluding circuit breaker zone)	2 nos.
13	Gas density/ pressure measurement and monitoring -input output and processing cards for one bay	1 set
14	Gas density/ pressure transmitter	2 no.
15	HMI for gas monitoring and PD system.	1 no each.
16	Insulating cone	2 nos. of each used type
17	Observation window	2 nos.
18	UHF coupler for PD measurement	6 nos.
19	Multi core Current Transformers module of each type used	2 nos.
20	Voltage/ Potential Transformer module	2 nos.
21	Corona shield	1 no.
22	Surge Arrestor	2 nos.

One set is defined as total number required for one bay of GIS.

5.9 Tools and Instruments

The Contractor shall supply all necessary tools and instruments etc. for installation, repair and maintenance in accordance to clause 1.9 "Tools and Instruments" of "Section 1 - General Technical Requirements".

5.9.1 Special tools

The Contractor shall list and supply all special tools. List of such tools including their make and detailed specification, shall be submitted for acceptance by the Employer.

The list of special tools must include the following in addition to the tools recommended by manufacturer(s)

a) One (1), set of handling devices and tools for assembling and dismantling of bays / complete GIS modules including circuit breaker,

b) One (1) set of handling devices and tools for assembling and dismantling each type of operating mechanism of circuit breakers, disconnectors and earthing switches,

c) Two (2) gas leakage detector

d) One (1) no Endoscope for checking the position of contact through viewing window

e) One (1) control kit for density switch threshold.

f) Two (2) SF6 pressure control and measuring set (digital)

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g) One (1) set of tools for gas handling.

h) One (1) Gas processing and filling unit.

5.9.1.2 Testing instruments

The Contractor shall propose the list of testing instruments including their make and detailed specification to be accepted by the Employer.

Proposed list shall include following mandatory items:

a) One (1) no. SF6 multi analyser with gas return system for SF6, SO_2, H_2O, HF concentration, H_2S concentration, CO concentration in PPM, etc,

b) One(1) no. Portable vacuum meter with probes

c) One (1) no. Contact thermometer 10-100^{0}C

d) One (1) no. Circuit Breaker Operation Analyzer (Along with DCRM Kit) :

This instrument shall be used for testing of EHV circuit breakers in live/charged GIS (up to 245 kV AC). It shall be suitable to perform close, open, close-open, open-close-open operations on CB under test (with a facility to introduce time delay between composite operations) and to measure and record breaker closing & opening timings during aforesaid operations (of main contact and pre-insertion time for PIR contacts).

The operation analyser shall be suitable to measure and record contact speed, travel of contact and contact wipe at various stages of operations. It shall have the facility to measure Dynamic contact resistance of arcing contact and main contact while closing/opening of C.B. It shall be suitable to measure auxiliary contact (wet and dry) timings.

The operation analyser shall be suitable to measure and record current rise & all of tripping and closing coils. It shall have availability of minimum no. of following channels:

Twelve (12) time measuring channels, expandable to further eight (08) similar channels.

Six (06) analog channels for trip/close coil currents and for contact travel measurement.

Auxiliary contact timing channels (02 dry & 02 wet)

The instrument shall have facility to get hard copy of test results (by connecting suitable printer or from in-built printer). The instrument shall contain all standard accessories including testing lead of 20 meter length with suitable clamp/connectors and carrying case. Required software for analysis of data measured shall be supplied with the test kit. The testing equipments shall be robust in design so that it can be transported from one place to other and performance shall not be affected even in worst conditions. Test kit shall be suitable for simultaneous measurement of DCR for both breaks of one pole of C.B, if existing.

The instrument shall have menu driven software to enable the user its easy operation. It shall be possible to enter various test parameters and relevant data such as date, breaker no. etc. in the analyzer (which will

appear as header for each print). The analyzer shall have facility to download test results to a PC. A portable memory bank shall be provided to store the results, taken by kit at site.

The test kit shall be suitable for 230 volts ± 10% and 50 Hz ± 5%, single phase AC input supply

5.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements specified separately in "Quality assurance and Testing Specifications (QTS)".

SECTION- 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other sections of tender documents and are not exclusive. However, in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall prevail.

3.1 PROJECT DETAILS

Name of the Project:	**Teesta-VI H.E. Project (4x125 MW)**
Name of the Customer:	**LTHP LTD. (A wholly owned subsidiary of NHPC Ltd.)**
Name of Consultant :	**NHPC**

Teesta (stage-VI) H.E Project is the last of the six projects in cascade development hydro power potential of Teesta River in the state of Sikkim. Teesta-VI Project is located in south (District) of Sikkim. It is a run of river scheme, with a barrage proposed across River Teesta at Sirwani about 100km downstream of L D Kazi Bridge, near Singtam village on singtam-Dikchu Road. Barrage site is located about 4 km from Singtam. The river has been diverted through the completed barrage bays on the left side to facilitate construction of the remaining barrage and Desilting Basin and all other components (Head Regulator Intake, De- silting Basin, Tunnel intake, head Race Tunnel, Surge shaft, pressure shaft, MIV cavern, power House, Transformer cavern, Tail Race Tunnel and pot Head yard) which are on the right bank of river Teesta. Power House site will be near Subin khore 27.5 km from Singtam and about 31.5 km from Barrage site by road. A gross head of 116 m between the HRT intake site and the power house site is to be utilized for power generation.
It is a run of the river scheme for power generation. The power house will have an installed capacity of 500 MW (4x125MW) and the annual energy production is estimated to be 2400 MU with 95% machine availability.

3.2 Location of Project:

The approximate distance of Project Barrage site from different important towns is as below:

From Singtam to Barrage Site	4.0 kms (approx.)
From Rangpo to Power House Site	12.5 kms (approx.)
From Singtam to Silliguri	95 kms (approx.)
Fronr Barrage site to Silliguri	99 kms (approx.)
From Power House site to Silliguri	67 kms (approx.)
From Silliguri to Kolkata	577 kms

3.3 Salient Features:

Location:

- Country — India
- State — Sikkim
- District — South
- River — Teesta
- Nearest Village — Singtam
- Dam site Near — Sirwani
- Latitude — 27 deg 14'42" N
- Longitude — 88 deg 29'15" E
- Nearest Rail Head — Silliguri, West Bengal, lndia
- Nearest Airport — Bagdogra, West Bengal, India

Hydrology:

- Catchment Area at diversion site — 4558 Sq. Km
- Rain fed catchment — 2295 Sq. Km
- Snow catchment — 2263 Sq. Km.
- Average Annual Rainfall — 2544 mm
- Maximum Temperature — 37 deg
- Minimum Temperature — 8 deg
- Maximum Relative Humidity — 96.4%
- Minimum Relative Humidity — 5.8%
- Standard Project Flood — 11600 Cumec (SPF)
- Average annual yield — 11861 Mcum

POWER HOUSE COMPLEX:

- Location — Right Bank
- Type — Underground
- Installed capacity — 500 MW
- Number and capacity of units — 4 Nos. of 125 MW each
- Size of Power House Cavern — 142.75m x t8.5m x 52.44 m high
- Size of Transformer cum GIS Cavern — 128mx14.5mx21 m high
- Service bay level — EL 248.34 m
- Type of turbine — Francis, vertical axis
- C/L of turbine — EL 235 m
- Rated head (Weighted Average Head) — 105 .4 m
- Type of switchgear — GIS (Indoor)
- Size of pothead yard — 100 m (L) x 30 m (w)

3.4 Seismic Zone

The project is situated in a hilly seismic area and falls within Zone-IV of the seismic zoning Map of lndia. The forces being caused by earthquake including hydraulic loads which may occur additionally shall be taken in to account for computations. More over vertical and

horizontal acceleration shall be combined in the most unfavourable way. For horizontal and vertical accelerations, a factor of 0.15 g and 0.075 g respectively shall be assumed. Stresses resulting after including these loads shall not exceed permissible stresses.
The Contractor shall design all equipment supplied under this contract to satisfy the seismic criteria. The Contractor shall submit to the Employer the method of calculation and relevant codes he intends to use for this purpose.
ln addition to the above, the IS-1893 shall be adopted for seismic design. Hydrodynamic forces due to seismic conditions shall be considered on HM or EM equipment in addition to hydro static loads.

3.5 Transportation and Storage

The Contractor shall inform himself fully as to all relevant transport facilities and requirements, loading gauges and other limitations and shall ensure that the equipment as prepared for transport shall conform to such limitations. The Contractor shall also be responsible for obtaining from the Indian railway or highway authorities any permit that may be required for the transport of loads exceeding the normal gauges.
The Contractor shall provide means for all unloading and reloading for all consignments of plant; both during transport to Site and on the Site. Consignments shall be unloaded immediately on arrival at Site. The Contractor is required to take the necessary steps in order to provide the carriage, special supporting structures for heavy loads, etc. All parts of the plant shall be brought, as far as possible, to their final place of erection. The Contractor shall construct their own storage facilities at site.
The warehouses shall be weatherproof, with good ventilation and solid floors. The floors of the warehouses and storage areas shall be designed to carry the loads imposed on them by the stored parts. The following parts shall be stored inside enclosed warehouses:

Bolts, pins, packing, tools, insulation materials, electrical parts with electrical devices attached, electric motors, instruments, welding material and equipment, all small parts and all parts of the plant which already have been finally painted.

lf large parts are stored in the open air, they shall be provided with weather resistant and fire-resistant covers. Electrical parts, which are not packed suitably and those so packed, but whose packing has been damaged shall be kept in suitable places from the moment of storage to the moment of installation. All insulation materials which will be taken from the warehouse for installation and which are stored temporarily in the station shall be protected from weather or humidity. All the equipment shall be stored as per standard storage and preservation instructions etc. of the suppliers. Dehumidifiers shall be installed in store/enclosed area as per direction of Engineer-in-charge.

3.6 Transport Limitation

For shipments, the Manufacturer shall pack the items to meet size and weight restrictions of the Indian railways and road systems. Shipments from Manufacturer's work (in case offshore consignments) shall travel to Port of entry - lndia, from where these will be transported, after necessary port clearances etc., by the Contractor to nearest rail head for the Project, and further transported to site. However, in certain cases the Contractor may be required to

transport the materials from Port of entry to Project site directly by road transport. For onshore consignments, the Contractor shall be responsible in all respects for transportation of all material and equipment up to the project site.
The Contractor shall consult with the concerned authorities in railways and highways to ensure that his packaging will be such as to permit him to transport the plant and equipment within such imposed limits. The Contractor shall arrange to deliver the maximum sized sub-assemblies consistent with safe and convenient transport.
All materials and equipment etc. arrived at nearest railhead for the Project will be unloaded from rail wagons and reloaded on to road transport for shipment to project site by the Contractor. All components shall be so designed and constructed as would enable easy assembly of components at works and at the same time permit easy transportation. The weighs and sizes of the components/packages shall be within the permissible transport limits for the project site.

3.7 Main features of Project

The project shall comprise of following major components:
i) Four units of 125 MW each at generator terminal at rated condition,
ii) An underground Power house housing four (4) main inlet valves of butterfly biplane lattice type in MIV cavern, (4) vertical-shaft generating units, each composed of a Francis turbine directly coupled to a synchronous generator and other related auxiliaries in power house cavern,
iii) A Transformer cavern having 13 nos. 11/220/√3kV single phase generator transformers,
iv) A 245kV GIS hall in Transformer cavern for installing 245kV GIS,
v) A 245 kV outdoor pothead yard for evacuation of generated power through 220kV transmission lines.
vi) installed Capacity - 500 MW
vii) No. and size of Units - 4 units of 125 MW each
viii) Generation voltage – 11kV
ix) Transmission voltage – 220kV
x) Type of Power House – Underground
xi) Type of Switchyard - Indoor type GIS
xii) GSU Transformer - 13 nos. 51 MVA, Single Phase, 50 Hz, 11/220/√3kV OFWF/ ODWF type
xiii) Method of connection between Transformer and GIS - GIB

3.8 Operating Requirement, Specification

The equipment/system to be supplied under this contract shall be suitable for continuous operation under varying grid parameters as allowed in latest "Indian Electricity Grid Code" and "Indian Electricity Rule". The equipment supplied shall also be compliant with latest Central Electricity Authority-Technical Standards for Construction of Electrical Plants and Electric Line Regulations and latest CERC norms at the time of supply of equipment.

The equipment/system shall be designed to operate continuously without any problem under +/-10 % voltage variation and +/-5% frequency variation, Temperature rise/ variation limit for equipment shall be determined considering the above variation. Frequent start/stop requirement of all equipment for daily operation shall be taken into consideration while designing.

3.9 Auxiliary voltages

The electrical equipment like switchboards, MCCB, Surge Protection Devices, motors, contactors, relays, luminaries, heaters, switches, sockets, Terminal Blocks, Power outlets etc. should be rated for any of the following voltages:

A) AC power

Three-phase system with grounded neutral for feeding 3-phase and 1-phase equipment (connected between phase and neutral), type TN-C 415/240V +/-10% and 50Hz +/-5%. All motors and other electrical apparatus should be designed to work continuously under +/-5% frequency variation and +/-10% voltage variation.

B) DC power

i) 220V +/- (Plus/minus) 10% DC Systems, ungrounded, with earth fault detection for the supply to main control circuits for high and medium voltage switchgear, protection circuits and to other larger essentials loads,

ii) Other voltage systems eventually needed, shall be generated from the above systems by means of dc/dc converters, inverters etc.

3.10 Performance Guarantee

The Contractor shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment systems covered in these specifications.

The Contractor shall demonstrate all the guarantees covered herein during functional guarantee/ acceptance tests.

3.10.1 SYSTEM PARAMETERS

S. No.	Description of parameters	220 kV System
1.	System operating voltage	220 kV
2.	Maximum operating voltage of the system(rms)	245 kV
3.	Rated frequency	50 Hz
4.	No. of phase	3
5.	Rated Insulation levels	
i)	Full wave impulse withstand voltage (1.2/50 microsec.)	1050 kVp
ii)	Switching impulse withstand voltage (250/2500 micro sec.) dry and wet	-
iii)	One minute power frequency dry withstand voltage (rms)	-
iv)	One minute power frequency dry and wet withstand voltage (rms)	460 kV
6.	Corona extinction voltage	156 kV
7.	Max. radio interference voltage for frequency between 0.5MHz and 2MHz	1000 micro-Volt at 156kV rms
8.	Minimum creepage distance (25mm/kV)	6125 mm
9.	Min. clearances	
i)	Phase to phase	2100 mm
ii)	Phase to earth	2100 mm
iii)	Sectional clearances	5000 mm
10.	Rated short circuit current for 1 sec. duration	40 kA
11.	System neutral earthing	Effectively earthed

3.10.2 Control and Monitoring

The system shall be controlled and monitored by the SCADA system. The details of "Control and Monitoring System" and "Protection System" are covered under separate package EM-I.

It shall be the responsibility of the Contractor to make all necessary provisions required to achieve seamless and compatible interfacing of control and monitoring systems of all equipment with plant SCADA system.
Provisions of all transducers/ sensors, instruments, gauges for mechanical parameters (temperature, pressure, flow, vibration, etc.) and electrical parameters (current, voltage, frequency, power, MVAR, KWH, etc.) and spare contacts of relays, breakers, isolators push buttons, control/selector switches etc. from various equipment for monitoring, alarm, annunciation, control function etc. through plant SCADA system are in the scope of this contract.

For connecting marshalling box/junction box with various equipment in field, multi-pin plug connecter system shall be used, if feasible. The contact carriers shall have two capacitive PE connects each to give the proper earthing to the system and it shall be suitable for electrical data equivalent to 250V/10A. The contact type shall fulfil the requirement of IEC 60 352/ DIN EN 60 352. The contact carriers shall be covered by housing made up of polyamide 6.6 of V0 in flammability class in accordance with UL 94 and fulfil the requirement of lP65 at least. The housing shall be directly sealable on the mounting wall without the need of any kind of wall mounting base. The complete arrangement shall be highly reliable even under harsh conditions, due to high degree of protection."
It shall also be possible to control locally the main elements of the system from local control cubicles. Local control shall be performed in a standalone manner independent of SCADA system, and all information (faults, alarms, measurements, status) necessary for such control shall be displayed locally. Provision of control selector switch for selection of control through Local Control Cubicle, Unit Control Board / Local Control Board and plant SCADA system shall be made in Local Control Cubicles and Unit Control Boards / Local Control Boards.
lf the system consists of redundant subsystems, the priority of operation of such subsystems shall be selectable, either from SCADA system or locally.

3.10.3 Power supply for control and monitoring

A reliable surge protected power supply shall be provided for powering the electronic circuits of the equipment component. The power supply shall be from two independent DC station battery source, one as primary and other as secondary. Switchover from primary to secondary will follow automatically on failure of primary and return to the primary source automatically following restoration of primary supply. The primary source of supply and the charger of the battery should be protected with surge protection device. The surge arrester should be pluggable type and should have indication to show its life.
The power supply shall include redundant converter (dc-dc) connected to station battery source uch that failure of any regulated output voltage shall cause instantaneous transfer to a redundant converter without affecting normal operation of the equipment component in any way. Contacts shall be provided to alarm on power supply failure and local indication shall be

provided to identify the failed functional block, The Contractor shall provide full details of the proposed power supply system for approval by the Employer.
ln case AC supply is required for any control function, same shall be sourced from two on line UPS, with one main and other standby and with automatic change over facility.

3.10.4 Colour Schedule

Colour standard references to major equipment/ system shall be as mentioned in Annexure. The interior of all cubicle and panels shall preferably have a matt white finish unless specified otherwise.

3.11 Electrical equipment enclosures

3.11.1 General

Unless otherwise specifically called for or described in these Contract documents all electrical appliances shall conform to the applicable IEC Publications.
The cubicles and enclosures shall be of protection class lP 40 or higher according to their location. For outside installation and area which are humid, corrosive, and prone to dripping and/ or spray of water, the protection class of cubicles shall be lP 65. Cubicles housing electronic cards/modules such as of unit control boards/local control boards, digital governors, static excitation equipment shall be of Protection class of lP 5X.

Cables shall have at least 1100 V PVC insulation except for 220V DC and tele-metering or communication system equipment for which 650V and 300 V ratings respectively are acceptable.
Wring shall terminate at terminal blocks al one side only. Where tap connections are required, they shall be made on terminal blocks. Wiring shall be neatly arranged and laid in wire ways accessible from the front door. The wire ways shall not be filled more than 70 %. Each cubicle shall be provided with an earthing bar (PE) of sufficient cross section carrying any possible fault current without undue heating. All metallic parts of the cubicle not forming part of the live circuits, all instrument transformer terminals to be earthed and other earthing terminals as well as all cable screens and PE-wires shall be connected to the earthing bar.
All internal equipment and wiring shall be neatly and clearly marked as indicated on the schematic and wiring diagrams- internal wiring and cables shall be marked with sleeve type engraved marking. Marking system and marking material shall be subject to approval by Employer' identification of the respective conductors shall be in accordance with the requirements of IEC publication 60204. ln cable, having five conductors or more the individual conductors shall be numbered throughout the entire length. ln cables having less than five conductors colour coding in accordance with IEC Recommendations 60204 shall be used.

3.11.2 Terminal blocks

Control circuits and power circuits shall be completely separated by use of divided or separate terminal blocks.
The screw type modular Terminal Block should be manufactured as per IEC-60947-7-1. The insulating material of Terminal Block should be of polyamide 6.6 meeting VO/V2 in

flammability Class as per UL94. All metal parts including screws should be of copper alloy. The Terminal Block should be suitable for mounting on both 'DIN' as well as 'G' Type rail. All the metal parts should be captive and touch proof. The Terminal Block should have screw locking design so that it can withstand vibration level up to 59 and also prevent accidental loosening of conductors. The terminal blocks shall also have necessary accessories like end clamp, separation plates elc. Terminal block for CT shall be provided with shorting and disconnecting arrangement. Test terminal block for CT and PT with plug shall also be provided in all protection and measuring circuit
also provided in panel.
Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

All circuits except CT/ PT circuits	Minimum of two of 2.5 sq. mm copper flexible
All CT/ PT Circuits	Minimum of 2 nos. of 6 sq. mm copper flexible

Al least 20 % spare terminals shall be provided on each panel/ cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

3.11.2.1 Protection requirement

For short circuit and overload protection of power and control circuits, air circuit breakers, moulded case circuit breakers or MCBs shall be used. Outlets from AC (and DC) distribution panels are protected in their respective panels.

3.11.2.2 Switches, Lamps & Instruments

General
Control switches, indicating lamps and instruments shall be arranged so that all parts are readily accessible for servicing without the necessity to remove other devices, terminal blocks or excessive amount of wiring.
All control switches and indicating devices mounted in cabinets and enclosures shall be visible with the doors closed.
Identification nameplates shall be provided for all control switches, indicating instruments and lamps, in accordance with clause "Nameplates".
Instruments and controls shall be located so that their dials, indicators and nameplates are clearly readable. Data for all instruments to be provided, including type, size, scale range, electrical ratings, nameplate and name of manufacturer, shall be furnished. Steel panels shall be provided for group mounting of the instruments.
All instruments shall be of an approved type and shall match, insofar as practicable, the other instruments with which they are associated; their dial type, scaled markings and units, type of connection and mounting, shall be co-coordinated. All piping and tubing required for instruments shall be furnished and installed. All instruments and control switches shall be furnished with necessary auxiliaries, i.e. resistors, shunts etc.

3.11.2.3 Control and Selector switches

The switches and push buttons shall be provided with ample contact ratings, suitable cam or block arrangements necessary for the control functions on 230 V AC or 220V DC circuits. The control switches used in mimic diagrams shall be of discrepancy type with built in lamp indication.
Control and Selector switches shall be rotary type with escutcheon plates clearly marked to show the function and positions. The switches shall be of sturdy construction suitable for mounting on panel front. Switches with shrouding of live parts and sealing of contacts against dust ingress shall be provided.
Circuit breaker control switches shall have three positions and shall be spring return to "NEUTRAL" from "CLOSE" and "TRIP" positions and shall have pistol grip handles. They shall have at least two (2) contacts closing in close position, and two (2) contacts closing in trip position unless specified otherwise.
Ammeter and voltmeter selector switches shall have four stay out position with adequate number of contacts for three phase 4 wire system. These shall have oval handles. Ammeter selector switches shall have make before break type contacts to prevent open circuiting of CT secondaries. Contacts of the switches shall be spring assisted and shall be of suitable material to give a long trouble free service.

3.11.2.4 Push buttons

Push-buttons shall be of spring return, push to actuate type. Their contacts shall be rated to make, continuously carry and break 10A at 230V AC and 0.5A at 220V DC.
All push buttons shall have one normally open and one normally closed contact, unless specified otherwise. The contact faces shall be of silver or silver alloy.

All push buttons shall be provided with integral escutcheon plates marked with its function. The colour of the button shall be as follows:

Green : Breaker Close
Red : Breaker Open
Black : For overload reset

3.11.2.5 Indicating and signalling lamps

Each indicating and signaling lamp shall have a removable cap, which can be inscribed with wording and shall not be affected with the heat of the lamp.
Indicating lamps are preferably of LED type & low watt consumption and shall be replaceable from the front of the panel. The indicating and signaling lamps shall be of the same size and type.
Lamps shall be provided with series resistors, preferably built-in the lamps assembly.
The lamps shall have escutcheon plates marked with its function, wherever necessary.

Lamps shall have translucent lamp-covers of the following colours, as warranted by the application.

Red : ACB's/MCCB's close
Green : ACB's/MCCB's open
White : Auto trip
Amber : For all healthy conditions e.g. control supply
Voilet : Circuit breaker spring charged
Blue : For all alarm conditions (e.g. overload) Also for "SERVICE" & "TEST" positions indicators

Indication lamps should be located just above the associated push buttons/control switches. All indicating lamps shall be suitable for continuous operation at 90% to 110% of their rated voltage.

3.11.2.6 HRC Fuses

HRC-Fuses shall have visible operation indicators.

HRC-Fuses shall be mounted on fuses carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of bases. In such cases one set of insulated fuse pulling handles shall be supplied with each switchgear.

HRC-Fuse rating shall be chosen by the tenderer depending upon the circuit requirements.

3.11.2.7 Indicating instruments and Meters

Instruments mounted on panels, shall be of the semi flush type back connected, matching pattern, shape, and of approved finish to present neat and fitting appearance consistent with functional requirements Mechanical quantity measuring instruments which are directly mounted on equipment shall have circular dials and shall be properly supported and guarded against accidental injury/breakage. These shall be placed in convenient locations.
The instruments shall accurately measure and indicate the quantity under all conditions of operation with minimum instrument errors. Changes in ambient temperature within the range prevailing at site shall not affect the accuracy Contact making instruments shall have contacts suitable for 240 V AC or 220 V DC circuits.
The reading scales on the dials shall be in metric units only and range shall be such that the normal operating values of the quantities are indicated in the middle 3rd of the scale. The dials pointer etc. shall be designed to facilitate accurate reading by minimizing parallax and glare from instrument window and by providing clear bold dial markings. The size of dial and length of the scales of the indicating instruments shall be large enough to suit the requirements. The scale plates of panel mounted indicating instruments shall have a permanent white mat finish with black graduations and the pointer shall also be of the black colour. Instruments mounted on panels shall be of flush type and shall be back connected. All instruments on a switchgear panel shall be of matching pattern, shape and finish so as to present a pleasing appearance consistent with the functional requirements.
All instruments shall conform to relevant International or national applicable standards. These shall be subjected to tests prior to dispatch. The instruments shall be shock, vibration and

moisture proof. The electrical instruments shall withstand dielectric test of 2000 V RMS to ground for one (1) minute as per standards.
The coils of electrical instruments shall be designed for continuous operation at 110% of the full load current at instrument potential. The coil rating of the measuring instruments shall be coordinated with those of the associated instrument transformers (i.e. CTs, PTs, etc.) by the supplier. The VA burden of the instruments shall be as low as possible. The meters shall be of the first grade in respect of accuracy classification.
Energy meter shall be suitable for 3-phase, 4-wire unbalanced system and shall comply generally with the relevant standard. All instruments shall be tested in accordance with the requirements of relevant standards.

3.11.2.8 Integrating instruments

The Wh and VArh meters shall be of the semi-flush-mounted type. Each meter shall be connected to terminal blocks suitable for opening and short-circuiting for testing purposes. The meter cases shall be dust-tight and with removable covers. The meters shall be three-phase, three elements, equipped with an impulse contact mechanism, potential free for remote metering purposes, and shall be suitable for continuous operation from secondary of potential transformers and from secondary of current transformers, with transformer ratios and connections indicated on the contract drawings.
The meters shall be provided with primary-rated, direct reading registers, with five or more digits and a suitable multiplier. The meters for the outgoing lines shall be of the two-way type and all meters shall have mechanism to prevent negative registration.
The meters shall have built in over-voltage protection and isolation according to IEC Publication 60521. The tolerance ambient temperature range of the meters shall be 0 to 45 degrees C.
The protection class of the Wh meters shall be 0.2 and the VArh meters 0.2 according to IEC Publication 60687.

3.11.2.9 Measuring converters

The converters shall be suitable for direct connection to the secondary circuits of the potential and current transformers used, or other sensors, each as they apply. The converters shall be static type, having all accessories to provide an output signal of 4-20 mA, filtered DC.
For the measuring converters the following minimum requirements shall be fulfilled:

- Current transducers shall be single-phase, of accuracy class 0.2 or better.
- Voltage transducers shall be single-phase of accuracy class 0.2 or better.
- W and VAR transducers shall be two elements, three-phase. Accuracy class of the transducers shall be 0.2 or better.

3.11.2.10 Measuring transformers

All current and voltage transformers shall be completely encapsulated cast resin insulated type suitable for continuous operation at the temperature prevailing inside the switchgear enclosure, when the distribution board is operating at its rated condition and the outside ambient temperature is 40 deg.C.

All instrument transformers shall be able to withstand the thermal and mechanical stresses resulting from the maximum short circuit and momentary current ratings of the associated switchgear.
All instrument transformer shall have clear indelible polarity markings. All secondary terminals shall be wired to a separate terminal on an accessible terminal block where star-point formation and earthing shall be done.

All VTs shall have readily accessible HRC current limiting fuses on both primary and secondary sides. The class of insulation should be E or better.

The parameter & rating of CTs & PTs are minimum requirement & tentative only. Contactor shall submit the calculations for selection of CT/PT for approval to purchaser. Potential transformer secondary windings shall be rated 110 / V3 V Current transformer secondary windings shall have a rated current of 1A / 2.5A / 5A.

3.11.2.11 Nameplates Labels and Cautionary signs

Each major and auxiliary item of equipment shall have a nameplate permanently affixed thereto, or as directed, showing in a legible and durable manner the serial number, name and address of the manufacture, rated capacity, speed, electrical characteristics, and other significant information, as applicable.
The module identification plate shall clearly give the feeder number and feeder designation wherever applicable. For single front switchboards, similar panel and board identification labels shall be provided at the rear also.
All name plates shall be of non-rusting metal or 3-ply lamicoid with white engraved lettering on black back-ground, inscriptions and lettering sizes shall be as per their standard practice. Suitable plastic sticker labels shall be provided for easy identification of all equipment, located inside the panel/module. These labels shall be positioned so as to be clearly visible and shall give the device number, as mentioned in the module wiring drawings.
Caution and warning signs must be displayed in English, Hindi and local language. Identification plates and instruction plates shall preferably be bilingual i.e. English and Hindi/ local language.

3.11.2.12 Motors

All electric motors for driving various equipment shall conform to relevant standards viz. IEC, BS or IS as applicable. The motor rating, torque characteristics, speed etc. shall be selected to suit the duty requirements.
Type of starter for motors shall be duly approved by the purchaser during detailed engineering. The detailed design calculation for selection of type of starters is to be submitted for approval. The priority for type of starters shall be in the following order:
1. Variable frequency drive
2. Soft starter
3. Star delta/ auto –transformer
4. Direct on-line starter

The enclosure of each motor shall be of the type best suited for the service conditions of the motor. The motor insulation shall be resistant to moisture, oil or oil vapour and the motors in

general shall be so designed as to suit the tropical climate. Varnished cambric or glass insulation class F shall be used for connection from the windings to the terminals.
The terminal box shall be closed conduit box type conveniently located, and shall have means for terminating the external wiring for outdoor use. The motor terminals shall be of the stud type totally enclosed. Eye bolts or lugs shall be provided for lifting.
Space heaters to avoid condensation shall also be provided. Special type of motors, not adequately covered by these specifications, shall be offered for any special application, but these shall be subject to the approval of purchaser.

3.11.2.13 Space heaters

Space heater shall be provided in the Distribution Boards, Control & Protection panels, Motor Control panels etc. The space heaters shall be suitable for continuous operation on 240V AC, 50 HZ single phase supply, and shall be automatically controlled by thermostats. Necessary isolating switches and fuses shall also be provided.

3.11.2.14 Auxiliary relay, contacts and devices

All relays and timers in protective circuits shall be flush mounted on panel front with connections from the inside. They shall have transparent dust tight covers removable from the front. All protective relays shall have a draw out construction for easy replacement from the front. They shall either have built-in test facilities, or shall be provided with necessary test blocks and test switches located immediately below each relay. The auxiliary relays and timers may be furnished in non-draw out cases.
All AC auxiliary relays shall be suitable for operation with VTs and CTs secondaries.
DC auxiliary relays shall be designed for 220V DC unless otherwise specified and shall operate satisfactorily between 80% and 110% of the rated voltage. Relays shall have adequate thermal capacity for continuous operation in circuits in which they are used.
All protective relays and timers shall have at least two potentially free output contacts. Relays shall have contacts as required for protection schemes. Contacts of relays and timers shall be silver faced and shall have a spring action. Adequate number of terminals shall be available on the relay cases for applicable relaying schemes.
Suitable number of auxiliary contacts or auxiliary relays shall be provided with each VCB's / ACB’s for indication, remote indication, annunciation and automatic changeover and interlocking scheme.
All protective relays, auxiliary relays and timers shall be provided with hand reset operation indicators (flag) for analysing the cause of operation.

3.11.2.15 Welding & NDT

Preparation of base material

Members to be joined by welding may be cut to shape and size by mechanical means such as shearing, machining, grinding, or by gas or arc cutting, to suit the conditions. Edges shall be shaped according to ASME requirements. Design of welded joints and selection of weld filler metal shall be in accordance with approved standards and shall allow thorough penetration and good fusion of the weld with the base metal. The edges of surfaces to be welded shall be

sound metal free of visible defects such as laminations or defects caused by cutting operation at least 30 mm back from the edge of the weld, and free from rust, oil, grease, and other foreign matter.
The establishment of welding procedures, welder's qualifications shall conform to the requirements of the ASME Boiler and Pressure Vessel Code Section VIII and IX. The approved copy of the WPS & WPQR in accordance with the ASME requirements shall be submitted to the purchaser for review and record.

3.11.2.16 Field welding

Filler material required for field-welded joints shall be furnished by the Contractor. The Contractor shall perform all welding work at site in accordance with the applicable WPS. Only qualified welders shall be used for undertaking welding as per the applicable WPS.NDT shall be performed as per the approved drawings.

Preparation for field welding

All cutting, chamfering, and other shaping of metals necessary for the field connection shall be done as far as possible in the shop. Adequate temporary bolted field connections shall be provided to hold the assemblies rigidly and in proper alignment during shop and field assembly.
To ensure proper alignment during field erection, a minimum of two dowels shall be provided for each field connection between subassemblies. The holes shall be drilled and the dowels fitted at shop assembly after the subassemblies have been satisfactorily aligned. All stipulations for welding, structural work and other, shall be applied to fieldwork as well as to shop work, except where otherwise stated.

3.11.2.17 Painting

All the equipment furnished and installed by the Contractor shall be completely painted for final use, with the exception of those parts or surfaces that are expressly designated as unpainted. Surfaces to be painted shall receive the preparatory treatment and required number of coats. The Contractor shall perform all painting work in the shop, before shipment, followed by a final coat of paint at site after installation as per the standard procedure.
All materials, supplies, and articles furnished shall be the standard products of recognized reputable manufacturers. Colour schedule of equipment supplied shall be finalized during detailed design stage.

3.11.2.18 Galvanization

Unless otherwise specified, all structural steel including ladders, platforms, hand rails and the like and all exterior and interior steel surfaces of outdoor Works, as well as bolts and nuts associated with galvanised parts shall be hot-dip galvanised, electrolytically galvanised or sherardized, as may be appropriate to the particular case.

A) Material:

For galvanising, only original blast furnace raw zinc shall be applied, which shall have a purity of 98.5%. The thickness of the zinc coat shall be:

i) For bolts and nuts, approx. 60 micrometre.

ii) For all other parts, except for hydraulic steel structures or parts intermittently or permanently submerged in water, approx. 70 micrometre.

B) Galvanising of hardware:

Bolts, nuts, washers, locknuts and similar hardware shall be galvanised in accordance with the relevant standards. Excess smelter shall be removed by centrifugal spinning.

C) Straightening after galvanising:

All plates and shapes, which have been warped by the galvanising process, shall be straightened by being re-rolled or pressed. The material shall not be hammered or otherwise straightened in a manner that will injure the protective coating. Materials that have been harmfully bent or warped in the process of fabrication or galvanising shall be rejected.

D) Repair of galvanising:

Material on which galvanising has been damaged shall be re-dipped unless the damage is local and can be repaired by soldering or by applying a galvanising repair compound; in this case, the compound shall be applied in accordance with the manufacturer's instructions. Soldering shall be done with a soldering iron using 50/500/o solder (tin and lead). Surplus flux or acid shall be washed off promptly and the work shall be performed so as not to damage the adjacent coating or the metal itself, Any member on which the galvanised coating becomes damaged after having been dipped twice shall be rejected.

3.11.2.19 Pumps

All pumps forming part of the generating units and other plant and equipment shall be of high performance requisite type (viz. centrifugal, rotary etc.) and rating, of reputed make, and shall be directly coupled to their driving motors. The pumps shall be of self-priming type and with proper sealing systems and protection.

The materials of construction of pumps in general shall suit the service conditions. The materials of construction of the pumps handling water, such as drainage & dewatering pumps, turbine top cover drainage pumps etc. shall be resistant to abrasive effects of silt in such water. The pumps shall operate quietly without undue noise and vibration in their full operating range of head and flow. They shall be easy to maintain.

3.11.2.20 Embedded parts, Anchor Bolts and Fasteners

All embedded anchor bolts, rods, pipes, welding plates and support plates shall be provided by contractor. Anchor bolts shall consist of a threaded steel rod installed inside a pipe sleeve to provide lateral adjustment after the sleeve is embedded. The threaded end of the rod shall be provided with two steel nuts and two steel washers to permit leveling and anchoring the equipment prior to grouting.

Approved types of expansion or chemical anchors shall be used where practicable for small equipment.

3.11.2.21 Rust Prevention and Protection during Transit: -

Bright steel parts including all machined surfaces shall be given a thick coat of tar or tallow or any other approved rust resisting paint in plain colour to prevent rusting during shipment and transport.

3.11.2.22 Civil Works

Civil foundations for equipment of the generating units and other plant and equipment will be prepared by the Purchaser in accordance with the basic design data to be supplied by the Contractor.
The Contractor shall provide design for foundations and install the concrete inserts/embedment; support steels and/or components for foundation /supports purpose, shall do any chipping / levelling works, denting / painting etc.

3.11.3 Erection, Testing, Commissioning and performance of Guarantee Tests

3.11.3.1 Testing and inspection

Materials used for construction of major & important sub-assemblies shall be thoroughly shop tested and inspected by the Contractor at his own expense prior to dispatch. Shop test shall comprise of routine test & type tests.
The shop tests and inspections shall be as spelt out in individual equipment specifications as dealt in succeeding sections but shall not be limited to the same. Any other tests and inspection not specifically listed but are otherwise considered essential and advisable shall also be conducted.
The Bidders shall furnish schedule of the shop tests and inspections on materials and equipment. Important tests/inspections shall be subject to witness by the purchaser for which the Contractor shall give sufficient advance notice. In case purchaser is unable to witness shop tests/inspections, the Contractor shall be so intimated and the tests/inspections may then be carried out in the absence of the Purchaser.

Equipment on which tests and inspections have been duly witnessed and approved by the Purchaser may be dispatched by the Contractor. Equipment on which tests and inspections have not been witnessed by the purchaser shall be dispatched only after the shop tests and inspection Certificates have been approved by the Purchaser.

3.11.3.2 Dimensional Checks and Visual Inspection

Dimensional checks shall be performed on all major parts, components and partial assemblies, especially when close tolerances and fits are involved (tolerance of shafts, between stationary and moving parts, connecting dimensions for the assembly with other supplies, etc.). If the dimensional checks show discrepancies in measurement, which may affect the fit, assembly or dismantling of the respective part or component, the same have to be corrected correspondingly. Such correction or modification shall, however, in no way lead to sacrifices with respect to reliability of operation or inter-changeability, and shall be

performed only after the agreement of the Owner has been obtained. If the correction or modification cannot be carried out in accordance with the terms mentioned above, the part or component concerned may be subject to rejection. Faulty machine parts or equipment shall by no means be delivered.

3.11.3.3 Functional Tests

Functional tests on partial assemblies and/or complete assemblies shall be carried out as much as possible already in the manufacturer's workshops. Such tests shall be performed as far as possible under operation-like conditions.
When requested by the Owner, the functional tests shall be repeated until full proof has been obtained that the functioning of the assemblies will comply with the requirements of the Contract Documents.

3.11.3.4 Erection, commissioning & field tests

The Contractor has to do all the work related to assembly, erection, testing and commissioning complete in all respects. All necessary tools, plants, labour, materials including consumables for performing installation, testing and pre-commissioning shall be provided by the Contractor.
The Contractor shall submit the necessary data/information, layout and foundation/support drawings well in advance. The Contractor shall provide and install the concrete inserts/embedment, support steels and/or components for foundation/supports purpose as per approved erection drawings and coordinate the activities with civil contractors to keep his activities in synchronism with civil work. All installation for foundation shall be verified and accepted by the Engineer.
The Contractor shall use anchor fasteners for installation of piping, fixtures, mountings, conduits, cabling, panels etc. Minor Chipping of concrete is permitted. However, taking support from reinforcement bars shall not be allowed.

3.11.3.5 Installation procedure

The Contractor shall submit six copies of all detailed programs and the procedures to be adopted for erection / installation, testing and commissioning well in advance, before start of erection activities/ installation.
The installation procedure shall also have a section “site quality assurance plan” containing erection data sheets / site protocols for various components. These sheets should specify site measurements/ inspections required to be made for ensuring proper installation.

3.11.3.6 Cable laying

Wiring between equipment enclosures shall be made with cables, laid in trenches and/or cable trays and in cable conduits. The Contractor shall submit for review to the Engineer a cable route layout-showing location of trenches, conduits and trays. All material for cable laying such as cable trays supports and fastening material shall be furnished and placed by the Contractor. Cables shall be properly fastened and marked where they enter enclosures by either cable clamps or nipples.

Cables in horizontal cable trays shall be fastened properly with clamps or plastic strips. Power and control cables shall be placed in separate trays or conduits. Cables shall be clearly marked at each terminal point and appropriate intermediate locations as per Standard.

Conduits shall be of heavy gauge rigid steel, hot-dip galvanized, cut square reamed, threaded and screwed tight at all joints.
Conduit entrances to pull boxes and switches shall have double lock nuts & insulating bushings. No running thread shall be used.
Flexible metallic conduit shall be used for connection to equipment, which are subject to vibration, and also for connection to level/limit/pressure switches.

3.11.3.7 Field inspection

The Contractor shall permit Engineer to perform inspections of the assembly which will include a complete verification of the assembly of all parts as to their levels, clearances, pertinent fits, alignments and quality of workmanship. The field supervisor of the Contractor shall provide Engineer with three (3) copies of all the clearances, tolerances and data of all pertinent fits, alignments and levels, so that the latter may repeat the Contractor's measurement, if desired.
Unless otherwise specified, any rejection based on the inspection will be reported to Contractor within fifteen (15) days.

3.11.3.8 Field tests

All field tests including tests during installation, pre-commissioning, commissioning, performance and field acceptance tests shall be conducted by the Contractor, in the presence of representative of the Employer. Procedure to be adopted for conducting these tests shall be submitted well in advance, before start of relevant testing, for approval of the Employer.
The equipment / system shall be deemed to be commissioned and ready for trial run only after successful operation for a test service period specified in sub clause "Performance Testing". In the event of any failure this period shall be repeated for any number of times till the successful operation as described above is achieved.
All test equipment and instruments shall be furnished by the Contractor and will remain the Contractor's property after the fulfilment of all field tests.
Any defects or leaks disclosed in the tests shall be duly mended/ repaired to meet the desired function and retested. All necessary materials and labour for performing all the above tests shall be provided by the Contractor.
The Contractor shall prepare written test certificates in a form agreed upon by the Contractor and Employer of all tests results and hand them over to the Employer in due time.
The design, location and approval tests of anchoring rings for the fixing of lifting apparatus necessary for assembly and dismantling of equipment and plant accessories shall be the responsibility of the Contractor.

3.11.3.9 Taking over of facilities

Taking over" means that the Facilities (or a specific part thereof where specified) have been completed operationally and structurally and put in a tight and clean condition, and that all

work in respect of pre-commissioning of the Facilities or such specific part thereof has been completed and commissioning has been attained as per Technical Specifications. The contractor shall make formal request for taking over the facility to the EIC.

3.11.3.10 Operation acceptance

The operational acceptance by the Employer of the Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts), which certifies the Contractor's fulfilment of the Contract in respect of Functional Guarantees of the Facilities (or the relevant part thereof) in accordance with the provisions of Specification.

3.11.3.11 Consumables, oils and Lubricant

The Contractor shall deliver to the Owner all equipment complete with initial fill of fluids, grease or lubricants, transformer oil, Nitrogen, SF6 gas and other used gases in non-returnable drums / containers and replace any quantity used up or lost during installation and testing.
The oil used for the lubrication and oil pressure systems for the turbine, governor, shutoff valve and generator shall be preferably of the same type.

Supply

The Contractor shall furnish the following:
(i) All oil for initial filling of all equipment supplied, plus additional oil equivalent to the first filling requirement of one unit.
(ii) Grease if required for initial filling of all of the equipment, plus 10% additional.
(iii) Gases for initial filling of all equipment supplied, plus 10 % additional quantity.
(iv) Flushing fluids to flush and clean all systems.

3.11.3.12 Submission of Drawings, Documents, Manual, software, Calculations, Safety Margin Details etc.

All drawings and documents shall be submitted to purchaser in hard form as well as in editable soft form. Bidder shall submit Six (6) number hard copies along with copy in electronic form media of the documents & drawings to purchaser for reference / review / approval. A comprehensive list of all such drawings/documents planned to be submitted for reference/approval shall be provided beforehand to the purchaser.

At the time of completion of contract, the Contractor shall submit ten (10) copies along with five (5) copies in electronic form in DVD media, of approved and as built drawings together with operation and maintenance manual.

Loading drawings

For all larger pieces of Works which, due to their dimensions and/or weight and transport limitations, will require special means for their transportation, the Contractor shall submit binding loading drawings indicating dimensions, weights, etc., of the respective pieces of Works and the necessary trailer for its transportation to the site.

Foundation drawings

If a piece of works requires its own foundation or needs a special area for installation, the contractor shall submit drawings indicating all pertinent dimensions, static and dynamic loads, etc. They shall include all essential details required for proper design and construction of the foundations and/or buildings.

In addition, they shall include openings, sleeves, slopes and the arrangement of any supporting structure, i.e. base-frames or other steel constructions for permanent fixing or erection purposes.

If conduits are to be installed in the foundations, the relevant information such as diameter, length, and purpose shall be indicated on the drawings.

Arrangement drawings

All arrangement drawings shall be drawn to scale. The General Arrangement Drawings shall show the physical arrangement of Works (constructions, machines, complete switchgears, control panels, instrument cubicles, etc.), civil constructions (buildings, rooms, foundations, ducts, etc.) and reserved areas (for pipes, cables, lines, etc.) in relation to each other and to agreed co-ordinates and boundaries. Such drawings shall be prepared for the whole plot, for separate plots and for each building (building, hall, room, ducts and trenches, etc.).

Outline drawings

The Outline Drawing shall show all elements and the main dimensions of individual components where necessary in plan view, cross-section, side and top views. If reasonably possible such dimensions can be shown on Arrangement Drawings.

Design drawings

The Design Drawings shall include the shop drawings, assembly drawings, erection drawings, piping diagrams and piping arrangement drawings, etc., showing the dimensions, design and data of all constructions, apparatus and Works to be furnished under this Contract. The drawings shall - where applicable - substantially conform to the Contract Drawings and shall show:

- 3-D Assembly drawings for major components in hard and soft form.
- Details of manufacturing and treatment of major single work pieces specially manufactured for this Contract
- Assembly of the Works in plan and elevation with main dimensions Sub-assembly of the principal components of the Works with overall dimensions, adjustment and clearance tolerances, numbers of corresponding detail drawings
- Sub-assemblies in which the Contractor proposes to ship the Works
- All necessary details of the parts connecting to the Works supplied by others
- Location and sizes of auxiliary connections for oil, grease, water, air, electrical power etc.
- Location and size of the instruments and accessories provided
- Methods of lubrication and sealing
- Instructions for heat treatment, pressure tests, surface preparation and anticorrosive protection
- Full details of parts for which adjustment is provided or which are subject to wear
- Method and sequence of installation, field joints, erection and lifting devices, jacks, grout plugs, anchoring details, etc., if not shown on foundation drawings.

Installation drawings

The construction, mechanical, electrical and I & C Installation Drawings shall provide detailed information on the disposition of the various items of a system (e.g. lighting fixtures, socket outlets, connection boxes, transmitters, actuators, loudspeakers, telephones, pipes, valves, pumps, compressors, etc.) and of the piping and wiring respectively included in the installation or assembly. They shall be based on dimension drawings of cubicles, rooms, buildings or areas containing the Works.

Diagrams

Single-line diagrams

This is a simplified diagram of the essential electrical Works and their interconnections. Each circuit shall be represented by a single line only. It shall contain all required technical information of the Works represented, e.g. voltage, current, capacity, short-circuit level, ratios, voltage variations, positive and zero sequence impedances, measuring transformer and protection relay indices, interlocking, kind of switch drive, code designation, etc. as applicable.

Circuit diagrams

The Circuit Diagrams shall show the power circuits in all the phases with the main apparatus as well as the pilot circuits (measuring and control circuits). It shall show in full the functioning of part or all installations, Works or circuits with all required technical details.

Block diagrams

The Block Diagrams shall be used to show in a simplified manner the main inter - relationships between the elements of a system by means of symbols, block symbols and pictures without necessarily showing all the connections. The symbols used for the individual kinds of components, e.g. servomotors, computing modules, etc., shall clearly be explained on the diagram or on an attached legend.

Logic diagrams

The Logic or Functional Diagrams shall be used for representation of logic and sequence controls and interlocking by showing only binary logic elements and their effect on the various process equipment disregarding their electrical realisation. Logic function elements (AND, OR, NOR, NAND, STORAGE, etc.) shall be used for processing and combining binary signals.

Terminal diagrams

Such diagrams shall be prepared for any type of terminal box, marshalling rack, control cubicle, switchboard, etc., and shall show the terminals (properly numbered) and the internal and/or external conductors (wires or cables) connected to them.
The terminal diagram of each individual switchboard, terminal box, panel, etc., shall contain, but not be limited to the following information:

Protection co-ordination diagrams

These diagrams shall show in a graphical manner separately for each power supply circuit:

- A simplified single-line diagram of the circuit with technical data of all instrument transformers and relays

- Co-ordinated tripping curves of related protection devices
- Setting of the protection devices.

Emergency shutdown diagram
This diagram shall show the sequential steps and interdependencies during emergency closure.

Flow Charts
Flow charts shall be used for representing sequence of events for start / stop / shut down of the machine including associated equipment and auxiliaries.

Manuals
The following manuals covering all equipment of EM works shall be supplied as per the time schedule in both editable soft and hard form: -

Sr.No.	Manual Description
1.	Storage and preservation manual
2.	Safety manual
3.	Erection Manual
4.	Testing and commissioning manual
5.	Operation manual
6.	Maintenance manual
7.	Long term storage manual for Generator Transformer
8.	Long term storage manual for boxed up component / equipment.
9.	Repair process / procedure manual for equipment / system

As built drawing to be provided incorporating changes made during erection, testing and commissioning.

Drawing & Document Submission Schedule
Drawings & documents submission schedule of the EM package with the categorization (i.e. Approval / reference) & tentative submission date shall be submitted to purchaser.

Preliminary list of drawings under various categories have been prepared and appended at Section 1 of the Technical Specification.

3.12 DRAWINGS & DOCUMENTS TO BE SUBMITTED BY THE SUCCESSFUL BIDDER AFTER AWARD OF CONTRACT

One set of soft copies of all the approved drawings, documents including as built drawings shall be furnished by the Bidder to the Owner / Consultant in compact discs.

White prints or other non-reproducible drawings can be mailed folded. Blue prints shall generally not be used.

All drawings, prepared by the Bidder shall be as per IS: 696. Supplier's standard drawings are exempted from the above size limitation, unless his "standard" includes drawings of very large size or length. There shall be sufficient reference notes on the drawings to permit identification of all the drawings which are required for a proper understanding.

Bills of material and drawings shall be cross-referenced for easy identification.
All drawings shall be dimensioned in the metric system. Where drawings are usually made in the British (or other) system, they shall also have metric system dimensions in parentheses or below dimension line. Titles and written notations shall be in English. If the original is in another language it shall carry English translation. The translations will appear immediately on the drawings. Attached lists of translated words shall not be accepted.

Drawings and bills of material shall be identified by a numbering system to be mutually agreed later on. Any additional identification numbers or symbols that the Bidder selects to use for his own purposes are permissible so long as Owner's number is the prime means of identification.

The scale of the drawing shall be shown clearly in the title block of the drawing. Wherever possible, scales of drawings shall be:-

1:1	1 : 2.5	1 : 5	1 : 10	1 : 20	1 : 25
1:50	1 : 100	1 : 200	1 : 300	1 : 500	
1: 1000	1 : 2000	1 : 5000			

All reproducible must be made from original drawings.
All revised drawing shall clearly indicate the number, date and subject to each revision. All the revisions carried out in the drawings shall be clearly identified and marked.
Drawing list shall be kept up-to-date, incorporating all new additions, cancellations and changes, and will be reissued periodically with Progress Report.
General arrangement drawings shall be submitted for approval to the Owner/ Consultant prior to the commencement of detail engineering by the Bidder. These drawings shall show to scale all major equipment including electrical equipment and building outlines and overall dimensions as well as tie-in dimensions and clearances shall be clearly indicated. Approved arrangement drawings shall be used as basis for design and preparation of detail drawing to be prepared by the Bidder. The Bidder shall furnish all the necessary drawings, data etc., of the plant/equipment with appropriate "Status" stamp in adequate no. of copies as indicated below:

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	Prints	CDs
1	Drawings and Data Sheets	1	6	10	05
2	Drawings “As Built “	-	-	10	05
3	Type Test Reports	1	6	10	05

4	Erection Manuals	-	6	10	05
5	Operation and Maintenance Manuals	-	6	05	08
6	Manufacturing Quality Plan	1	6	10	-
7	Field Quality Plan	1	6	10	-
8	Inspection Test Reports	-	-	10	-

3.12.1.1 QUALITY ASSURANCE PROGRAMME

The Bidder shall follow Quality Assurance Programme to ensure that the equipment and services under the scope of contract whether manufactured or performed at the Bidder's works or at his sub-vendor's premises or at the project site or at any other place of work are in accordance with the technical specifications. Such programme shall be outlined by the Bidder and be submitted along with the bid. The QA programme shall be generally in line with IS/ISO- 9001 and generally cover the following:

- ORGANISATION STRUCTURE FOR THE MANAGEMENT AND IMPLEMENTATION OF THE PROPOSED QUALITY ASSURANCE PROGRAMME
- QUALITY SYSTEM MANUAL
- DESIGN CONTROL SYSTEMS
- DOCUMENTATION AND DATA CONTROL SYSTEMS
- QUALIFICATION/EXPERIENCE OF BIDDER'S KEY PERSONNEL.
- PROCEDURE FOR PURCHASE OF MATERIAL, PARTS, COMPONENTS AND SELECTION OF SUB-VENDOR'S SERVICES INCLUDING VENDOR ANALYSIS, SOURCE INSPECTION, INCOMING RAW-MATERIAL INSPECTION, VERIFICATION OF MATERIALS PURCHASED, ETC.
- SYSTEM FOR SHOP MANUFACTURING AND SITE ERECTION CONTROLS INCLUDING PROCESS, FABRICATION AND ASSEMBLY.
- CONTROL OF NON-CONFORMING ITEMS AND SYSTEM FOR CORRECTIVE ACTIONS AND RESOLUTION OF DEVIATIONS.
- CONTROL OF CALIBRATION AND TESTING OF MEASURING / TESTING EQUIPMENT.
- SYSTEM FOR QUALITY AUDITS.
- SYSTEM FOR IDENTIFICATION AND APPRAISAL OF INSPECTION STATUS.
- SYSTEM FOR AUTHORISING RELEASE OF MANUFACTURED PRODUCT TO THE PURCHASER.
- SYSTEM FOR TRANSPORTATION /DELIVERY, HANDLING, STORAGE AND PRESERVATION.
- SYSTEM FOR MAINTENANCE OF RECORDS.

GENERAL REQUIREMENTS - QUALITY ASSURANCE

All materials, components and equipment covered under scope and its technical specifications shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme agreed mutually.

Minimum Quality Assurance Test Requirement (QATR) to be followed during Manufacturing and Field erection indicating requirement of various tests / inspections, on major equipment /

items, to be carried out as stipulated in technical specification and standards mentioned therein, are attached hereto and are part of bidding documents.

Clarification, if any, on these quality assurance test requirement, raised by bidder shall be discussed and resolved during pre-bid meeting.

After the award of contract, the contractor shall submit the detailed Manufacturing & Field Quality Assurance Plans for complete equipment / material during detailed engineering for approval and acceptance by LTHP Ltd./Consultant in line with technical specification, Quality Assurance – General & Test Requirements and detailed engineering.

Manufacturing Quality Assurance Plans shall detail out for all the components and equipment & various tests/inspection, to be carried out in conformity with relevant latest IEC/IS/ISO etc., quality practices and procedures to be followed by Contractor's / Sub vendor's Quality Control Organization, the relevant reference documents, standards and acceptance norms etc. during all stages of material procurement, manufacture, assembly and final testing / factory acceptance tests.

The Field Quality Assurance Plans shall detail out the various tests/inspection to be carried out in conformity with relevant latest IEC/IS/ISO, quality practices and procedures etc. to be followed by the contractor's / sub-contractor's site Quality Control Organisation during various stages of site activities from receipt of material/equipment at site till final commissioning/ acceptance/handover.

All major items/ equipment/ components to be manufactured in house as well as procured from sub-vendors (Bought out Items, BOI) to be listed in the bid. Bidder shall submit Quality Assurance Plan submission schedule in the bid for above listed items in attached Format (duly filled in the format F-060-05 Issue 2.0 Rev. 00, Total 1 Page) in line with L2 Schedule.

For components / equipment / Bought out Items procured by the contractor for the purpose of the contract, the Contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the sub-vendors.
The quality plans called for from the sub-vendors shall detail out, during the various stages of manufacture and installation, the quality practices and procedures followed by the sub-vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc.

Such quality plans of the successful sub-vendors shall be finalized with the LTHP Ltd./Consultant in line with requirement mentioned above and such approved Quality Plans shall form a part of the purchase order/contract between the contractor and his sub-vendor.

Within three weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications and other related documents such as data sheet, drawings, quality plans and delivery conditions shall be furnished to the LTHP Ltd./Consultant by contractor

along with a report of the Purchase Orders placed, on the monthly basis, so far for the contract.

The Quality Plans shall be submitted on electronic media e.g. CD or E-mail in addition to hard copy, for review and approval of LTHP Ltd./Consultant. After approval, the same shall be submitted in compiled form on CD-ROM by contractor.

For all spares, replacement items and additional similar items, the quality requirements/Quality Plans as agreed for the main equipment supply shall be applicable.

All material of construction shall be as per technical specification / approved drawings / GTP.

Contractor's Plant internal standards must be traceable to acceptable International / National standards & salient points of difference (if any) shall be clearly stated with submission of plant standards. The contractor shall furnish copies of reference documents, plant standards, acceptance norms, test and inspection procedure etc. as referred in Quality Plans along with Quality Plan to LTHP Ltd./Consultant. These Quality Plans and reference documents/standards etc. will be subject to approval of LTHP Ltd. without which manufacturer shall not proceed. These documents shall form a part of the contract.

Tests on components and sub-assemblies shall be carried out at various stages of manufacturing, till the product undergoes the final tests in conformity with the relevant standards.

The Customer Hold Points (CHPs), identified in approved quality plan, i.e. testing checks which shall be carried out in the presence of the LTHP Ltd./NHPC, beyond which the work will not proceed without written consent of LTHP Ltd.'s authorized representative.
The contractor / sub-vendor shall carry out routine test on 100% items at his works. The quantum of check / test for routine and acceptance test by LTHP Ltd./Consultant shall be generally as per criteria / sampling plan defined in referred standards. Wherever standards have not been mentioned, quantum of check / test for routine / acceptance test shall be as agreed during detailed engineering.
The quantum of check when specified in percentage (%) / sampling basis shall be treated as per lot per sub-vendor. When the quantum of check is indicated to in whole no., then same quantum of check shall be applicable to each sub-vendor supplying the same equipment.

For sub-vendors identified during pre-award stage for submission of vendor details/ credentials (category "DR"), contractor shall submit documents in format F-060-01 after placement of award in the manner as specified as under prior to any procurement and within a month after placement of award or a period as agreed at the time of pre-award discussions.

The proposed sub-vendors should be registered vendors of the bidder and must have proven experience for successful operation for similar equipment / items / processes as mentioned elsewhere in technical specification.

Before assigning any portion of work to the sub-vendor, other than one specified and duly accepted in the contract, the contractor will take prior approval of BHEL/ LTHP Ltd./NHPC.

Normally no request for change of sub-vendors or inclusion shall be entertained by LTHP Ltd./NHPC. But in exceptional circumstances, if the request for change of sub-vendors or inclusion is found reasonable and justified, then the same shall be entertained and the decision of LTHP Ltd./NHPC in this respect shall be final and binding. The time consumed for the change / inclusion of sub-vendors shall not be excluded from the stipulated time of the completion of the contract. This change shall not relieve the contractor from the responsibility to complete the work within stipulated time in any manner.

The contractor's proposal shall include sub-vendor's facilities established at the respective works, the process capability, process stabilization, Q.C. system followed, experience list etc. along with his own technical evaluation of sub-vendor. (Format F- 060-01 issue 2.0 rev. 01, Supplier / Sub-vendor Assessment Sheet, Total 14 pages).

However, whenever felt necessary, sub-vendor assessment will also be carried out by LTHP Ltd./Consultant in accordance with the above procedure and by factory visits; for existing/proposed vendors/sub-vendors. This approval shall not relieve the contractor from any obligation, duty or responsibility under the contract & LTHP Ltd./NHPC shall not be responsible for any complications arising between the contractor and his subcontractor(s) / sub-vendor (s) and / or any other liabilities.

LTHP Ltd./Consultant reserves the right to carry out quality audit and quality surveillance of the system and procedures of the contractor / or their sub-vendor. The contractor shall provide all necessary assistance to enable LTHP Ltd./Consultant to carry out such details & surveillance including Quality Manuals, if required by LTHP Ltd./Consultant.

All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirement of ASME section-VIII/IX or other International equivalent standard acceptable to LTHP Ltd./Consultant. All welding/brazing procedures shall be submitted to LTHP Ltd./Consultant/BHEL for review / verification prior to carrying out the welding/brazing. However, wherever required by the LTHP Ltd./Consultant, tests shall be conducted in presence of LTHP Ltd.'s authorized representative.

All Brazers, Welders and welding operators employed on any part of the contract either in Contractor/his sub-vendor's works or at site or elsewhere shall be qualified as per ASME section-VIII/IX or other equivalent Standards acceptable to LTHP Ltd./Consultant.

Unless otherwise proven and specifically agreed with LTHP Ltd./Consultant, welding of dissimilar material and high alloy materials shall be carried out at shop only.

All non-destructive examination shall be performed in accordance with written procedures as per International Standards. The NDT operator shall be qualified as per SNT-TC-IA (of the American or Indian Society of non-destructive examination). NDT shall be recorded in a

report, which include detail of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of correlation of the test report with the job.

All material used for equipment manufacture including castings and forgings, etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties; chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.

Contractor shall submit Field Welding Schedule for field welding activities like field welding location, numbers, welding procedure to be used, requirements, codes and NDT requirement along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures, etc. to LTHP Ltd./Consultant for review at least ninety days before schedule start of erection work at site.
Any other statutory requirements as applicable for the equipment / systems shall also be complied with.

The inspection calls shall be placed at least 06 weeks in advance for overseas inspections excluding India and 15 days in advance for inspections within India.
Before submitting the inspection call to LTHP Ltd./NHPC for witnessing the Customer Hold Points (CHP's) and/or requesting LTHP Ltd./NHPC for issuance of Material Dispatch Clearance Certificate (MDCC) based on Test Certificate (TC) review / Certificate of Conformance (COC), the contractor shall ensure that all Drawings / documents / GTP / technical data sheet, relevant to respective CHP / MDCC requirement, has been duly approved /accepted / noted by LTHP Ltd./NHPC.

Contractor shall ensure readiness of offered equipment by all means, before raising such call to LTHP Ltd./NHPC to attend CHP inspections. In case, LTHP Ltd./NHPC engineer (s) on reaching at a place of inspection found that material is not ready for inspection due to whatsoever reason, the complete inspection expenditure of LTHP Ltd./NHPC engineer(s) as per actual shall be chargeable to the contractor.

Only calibrated testing & measuring instruments shall be used while performing tests during manufacturing and erection, testing & commissioning at site by the contractor. Copy of the calibration certificates will be submitted to LTHP Ltd./Consultant by the contractor during inspection as an evidence.

Non-conformities observed during manufacturing, shop testing, handling, packaging, transportation, storage, preservation, erection, testing & commissioning are required to be intimated by the contractor. The acceptance/rejection of the non-conformities will be at the discretion of LTHP Ltd./NHPC.

Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the acceptance of LTHP Ltd./NHPC. Action taken in accordance with decision of disposal of non-conformity for repair / rework / modification of the item / equipment and to prevent re-

occurrence. The corrective and preventive action may involve modification of item / equipment, change in procedure and system etc. to achieve quality improvement at all stages and levels.

Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the LTHP Ltd./NHPC to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings etc.

No material shall be dispatched from the manufacturer's works before the same is duly accepted, subsequent to pre dispatch/final inspection including verification of records of all previous tests/inspection by LTHP Ltd./NHPC and duly authorised for Dispatch by issuance of Material Dispatch Clearance Certificate (MDCC).

The test reports of type tests conducted as per contract, in line with requirement stipulated in the technical specification / quality plan should be got accepted from LTHP Ltd./Consultant before final inspection / issuance of MDCC.

All materials used or supplied shall be accompanied by valid and approved material certificates and tests and inspection reports. These certificates and reports shall indicate the heat numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it to ensure physical correlation and traceability of material vis-a-vis test certificate. Such identification no. shall remain same and verifiable for all stages of manufacturing and installation.

3.12.1.2 QA DOCUMENTATION

The contractor shall be required to submit the QA Documentation in two hard copies and two CD ROMs, as identified in respective quality plan.

Each QA Documentation shall have a project specific Cover Sheet bearing name and identification number of equipment including index of its contents with page control on each document. The QA Documentation file shall be progressively completed by the Contractor/sub-vendor to allow regular reviews by all parties during the manufacturing.

The final quality document will be compiled and issued at the final assembly place of equipment before despatch. However, CD-ROM may be issued not later than three weeks.

Before dispatch / commissioning of any equipment, the Contractor shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The Contractor will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

The contractor shall be required to submit copies of the following quality assurance documents in original duly reviewed and accepted by contractor along with the request letter for issuance of MDCC (Material Dispatch Clearance Certificate):

- QUALITY PLAN CHECK LIST.
- MATERIAL MILL TEST REPORTS ON COMPONENTS AS SPECIFIED IN QUALITY PLAN.
- SKETCHES AND DRAWINGS USED FOR INDICATING THE METHOD OF TRACEABILITY OF THE
- RADIOGRAPHS TO THE LOCATION ON THE EQUIPMENT.
- NON-DESTRUCTIVE EXAMINATION RESULTS REPORTS INCLUDING INTERPRETATION REPORTS.
- CALIBRATION CERTIFICATE OF ALL METERS & MEASURING INSTRUMENTS PROPOSED TO
- BE SUPPLIED AS PART OF RELEVANT BILLING BREAKUP ITEM.
- ROUTINE TEST REPORTS FOR TESTING REQUIRED AS PER APPLICABLE CODES AND
- STANDARDS REFERRED IN THE SPECIFICATIONS.
- INSPECTION REPORTS DULY SIGNED BY AUTHORIZED REPRESENTATIVE OF LTHP Ltd./NHPC AND CONTRACTOR FOR THE AGREED CUSTOMER HOLD POINTS.
- ALL THE ACCEPTED DEVIATIONS SHALL BE INCLUDED WITH COMPLETE TECHNICAL DETAILS.
- LIST OF BALANCE POINTS IF ANY.
- CERTIFICATES IN RESPECT OF CALIBRATION, WELDERS & BRAZERS QUALIFICATION ETC.
- COPY OF ALL REFERENCE DRAWINGS AND REFERENCE TECHNICAL DOCUMENTS
- ACCEPTANCE OF TYPE TEST REPORTS BY LTHP Ltd./CONSULTANT.

Similarly, the Contractor shall be required to submit two sets (two hard copies and two CD ROMs), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/procedures, within 2 weeks after commissioning of individual system.

On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Consultant and other set to LTHP Ltd. For the particular case of phased deliveries, the complete quality document to the LTHP Ltd./Consultant shall be issued not later than 3 weeks after the date of the last delivery of equipment.

3.12.1.3 Safety

Safety of personnel

All equipment and services provided under this contract shall abide by international standards commonly accepted in the hydroelectric utility industry for safety of personnel whether involved with operation or maintenance.

Safety of operation

All equipment and services provided under this contract shall abide by commonly accepted standards for safety of operation.

The various system and sub-systems supplied under this contract shall be designed to follow and operate under a clear hierarchical structure:

- Plant control level,
- Unit control level,

- Functional control level, functional drive group level,
- Local drive level.

Each hierarchical control level shall perform its specific tasks and always depend on the subordinate lower control levels. In general, should a higher control level failure occur, the lower control level shall not be affected and shall be able to control the power plant with full safety.

The Contractor shall accordingly build into the "Electrical & Mechanical System" adequate levels of autonomy, independence, redundancy and functional distribution to insure that safety is maintained at all times.

3.12.1.4 Earthing

Earthing terminals for equipment of these specifications shall form part of equipment supplies. The contractor shall connect the earthing conductors to these terminals as required.

Risers from earthing bus shall be in the scope of purchaser. However, extension from these risers to the equipment shall be in the scope of supplier in the Power House, Transformer Hall, Switchyard.

However, overall earthing arrangement required for HT panel, LT panel, DG set, motor & motor control panels etc. at isolated location such as Dam Site, TRT Outfall area and Surge Shaft either by pit earthing or counter poise etc. shall be in the scope of supplier including civil works, design, material supply (for main earthing risers, interconnection, charcoal, salt, Bentonite etc.), erection, testing & commissioning etc.

A copper ground bus, sized to carry maximum short circuit current, shall run along the entire length of panel structure and shall have terminal connector at each end for connection to station ground grid (50 X 6 mm G.I. flat).

Tests

Each panel shall be completely assembled, wired, adjusted and tested at the factory prior to shipment. The test shall include wiring continuity tests, insulation tests and functional tests to ensure satisfactory operation and control of individual equipment.

Special Cables

Special cables for specific purpose, as required, shall be supplied and installed by the Bidder.

3.12.1.5 Completeness of the specification

Any fittings, accessories, equipment or any other things required for successful commissioning of Project, though may not have been specifically mentioned in the specification but are usually necessary for the completeness of the equipment shall be deemed to be included in the specification and shall be supplied by the contractor without any extra cost to the Employer.

3.12.1.6 Packaging and Shipment

The Contractor shall provide such packing of the Goods as it 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 and exposure to extreme temperatures, salt and precipitation during transit and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the final destination of Goods and the absence of heavy handling facilities at all points in transit.

The packing, marking and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the Contract and, subject to any subsequent instruction ordered by the Employer consistent with the requirements of the Contract.
After unpacking of Goods the packing material shall become the property of Employer

The contractor shall wrap, pack and crate all plant included in the work or part thereof, suitable for shipment to a tropical location, facilitating proper handling and protection from damage in rail, truck, ocean or air shipment as applicable. An approved drying agent, such as Silica Gel, shall be packed in containers or packages holding plant which may be adversely affected by moisture or excessive humidity.

All packing crates shall be clearly marked before shipping to indicate the contract number, shipping address, volume, weight, name, number and unit number of the contents, slinging and weight bearing points.

All plant parts shall be marked to facilitate erection. Each packing crate shall contain a packing list in a waterproof envelope. Parts shall be described and also identified by their numbered marking in the packing list.

Three copies of the packing list shall be forwarded to the purchaser prior to dispatch. The ownership of packaging materials shall be of Employer. All wooden packaging crates and steel support structures shall be dumped to the designated area within 5kms of the power house as per the direction of Engineer in charge.

The supplier shall be entirely responsible for the insurance, shipment, handling and transportation.

The equipment shall not be dispatched by the Bidder from the place of manufacture to the site until the dispatch instructions are issued by the Owner.

3.12.1.7 PACKAGING, HANDLING AND SITE STORAGE

The Contractor shall follow the general requirement of packaging, Handling and Storage elaborated in "section 8 - Transport and installation" of "General Technical Specification (GTS). The Contractor shall pack all the consignment in sea worthy packaging, wherever required, strong enough to withstand rough handling during transit. Machine surface shall be suitably

protected against scratches, corrosion, shocks, impact etc. Packages shall be suitably and distinctly identified for type of handling and kind of storage.
The packaging and storage of electronic equipment shall be strictly in accordance with internationally accepted standards. Electronic equipment shall be packaged, shipped and stored in anti-static packing. All packages shall be stored indoor. Packages containing electronic equipment shall be stored in humidity controlled environment.
lf required, dehumidifiers shall be deployed by Contractor to control the condition of storage space. Storage of the equipment till commissioning is responsibility of the Contractor.

3.13 SPECIAL INSTRUCTIONS TO BIDDERS

General

The Bidder shall base the equipment design on the information given in this specification. The equipment shall be complete in all respects. Any item which is not specifically mentioned herein but found essential for safe and efficient operation and maintenance and satisfactory performance of the system shall be deemed to have been included in the scope of the Bidder. It shall be presumed that the Bidder has studied the site, all the drawings, tender documents and is fully aware of the scope of work involved and the site conditions prevailing.

3.14 Codes and Standards

a) All equipment, systems and works covered under this specification shall comply, in all respect, with requirements of applicable latest statutes and that of latest editions of codes and standards. Latest regulations and safety & environmental requirements as applicable in India / state of installation shall also be complied with.
b) All codes and standards mentioned shall mean as relevant and applicable to a particular equipment / system.
c) All other codes/standards not covered in Section 1 / Section 2 but required for the plant and system offered shall also be referred / followed by the Bidder. The Bidder, along with the bid, shall submit a comprehensive list of codes and standards to be followed for various equipment / system.
d) In all cases where IBR does not govern, German, American, British, ISO or other international standards established to be equivalent or superior to the codes specified are also acceptable. In the event of any conflict between the requirements of equivalent codes and standards and the requirements of Indian standards / regulations, the latter will govern unless specified otherwise in the specifications.
e) The Bidder shall be responsible to be in possession of all the specified Codes / Standards and ensure reference to the same before submitting the offer/ bid.
f) Mandatory codes / local regulations to be followed for safety, design, fabrication and operation of the switchyard shall be, followed:
g) If the equipment supplied does not conform to the codes and standards mentioned in this specification, but is manufactured to the Bidder's own standard, developed as a result of his experience, is also acceptable provided the same is found to be superior to the above mentioned codes and standards. The Bidder shall identify such equipment and shall also present sufficient data to the Owner / Consultant to support his design and to

establish the superiority. The design may be accepted by Owner/ his Consultants only if the Purchase / his consultant is satisfied that sufficient experience exists with the design proposed.

h) Design not meeting the stipulations of the codes and standards will not be acceptable.

i) Apart from various codes and standards mentioned in Section 1/2, the Manufacturer shall comply with other requirements of codes and standards mentioned in this Specification for detailed design, manufacture, testing, erection, construction etc.

Control System	IEEE – 122 , 1992
Metering / Dosing pumps	API 675 – 1987 (Positive displacement pumps – controlled volume) API 676 – 1987 (Positive displacement pumps – Rotary).
Centrifugal pumps	API 610 – 1990, ASME PTC 8.2 – 1965
Gear Box	API 613 – 1993 & AGMA 420 & 421
Coupling	API 671 – 1993
Structural	IS 1893 – 1991, IS 875-1992 & IS 800 – 1991
Pressure Vessel	ASME Sec. VIII, Div. 1 – 1995
Piping	ANSI B 31.1-1995 / 31.3 – 1993, IBR
Valve	API
Instrument	ISA, API
Electrical	As per specification attached & relevant
	IS/IEC
Tanks	API 650- 1993
Electrodes	AWS, IS
Painting	IS Standards
Performances Tests	
Overload test of crane and hoists	IS 3177

3.15 Deviations and Assumptions

Bidders requested to carefully examine and understand the specifications and seek clarifications, if required, to ensure that they have understood the specifications. The Bidder's offer should not carry any sections like clarifications, interpretations and/or assumptions. In the event of conflict between the Technical Specifications and the condition of contract, the requirements as indicated in the technical specification shall govern, unless confirmed otherwise by the Owner in writing before the award of contract, based on written request from the bidder for such a clarification.

In the event of conflict between requirements of any two clauses of the specification documents, the more stringent requirements shall apply, unless otherwise confirmed by the Owner in writing before the award of this contract, based on a written request from the Bidder for such clarification.

The Bidders are advised that while making their Bid Proposals and quoting prices, all terms and conditions of bidding documents may appropriately be taken into consideration. Bidders are required to furnish a certificate indicating their full compliance to the terms and conditions of the bidding documents.

3.16 Limit of Contract

Equipment furnished shall be complete in all respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/ or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions. All similar standard components/ parts of similar standard equipment provided shall be interchangeable with one another.

This review by the Owner's Engineer / Consultant may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicative of the accuracy of the information submitted. This review and/ or approval by the Engineer shall not be construed by the Bidder, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements specified under these specifications and documents.

3.17 Latent Defects

Notwithstanding the issue of the Take Over Certificate, the Contractor shall be responsible for making good with all possible speed any Latent Defect in any Works /equipment of the plant which appears at any time before the expiry of defect liability period. And shall remedy such defect at its own cost and expense. The latent defect liability period shall be a minimum of 5 years from the end of defect liability period. The defects to which this applies are defects in design, materials or workmanship or defects arising from any act or omission of the Contractor done or omitted prior to Take-over of the portion of the Plant affected by the defects or during the Warranty Period which a reasonable examination at the end of the Warranty Period would not have disclosed.

3.18 Defect Liability

The Contractor warrants that all the facilities or any part thereof are new, unused, and of the most recent or current models, and that they incorporate all recent improvements in design and materials, unless provided otherwise in the Contract.
The Contractor further warrants that the Plant and equipment shall be free from defects arising from any act or omission of the Contractor or arising from design, materials, and workmanship, under normal use in the conditions prevailing in the, If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant and equipment supplied or part thereof, the Contractor shall promptly, in consultation and agreement with the Employer regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good (as the Contractor shall, at its discretion, determine) such defect as well as any damage to the Facilities caused by such defect. The Contractor shall not be responsible for the repair, replacement or making good of

any defect or of any damage to the Facilities arising out of or resulting from any of the following causes:
(a) Improper operation or maintenance of the Plant and equipment by the Employer
(b) Operation of the Facilities outside specifications provided in the Contract
(c) Normal wear and tear.

3.19 Completion Schedule

The Bidder shall submit Time Bar chart indicating completion date of major activities such as submission of design data / calculations and drawings for approval, manufacturing of components / units, supply, inspection etc. without which the Tender shall not be considered. Time Bar Chart furnished shall afterwards form part of the contract and cannot be altered arbitrarily except Force Majeure conditions as may be agreed with the Owner.

3.20 Drawings & Documents for Owner's use and Archives

The Bidder shall submit all final drawings, documents, manuals for Owner's use and for reference / record required during course of operation and maintenance of the plant. Numbers of copies and their form (hard copy, electronic form, reproducible) to be submitted and the details of the documents, drawings, manual etc. to be furnished by the Bidder are described elsewhere in the specification.

Drawings, documents, calculation, data & Information to be submitted by the Bidder along with the offer:

Technical Data to be submitted with the Tender

1) List of performance tests proposed by the Bidder to demonstrate the guaranteed parameters for generator and other electrical equipment.
2) Specific energy consumption.
3) Type test certificates for major categories of equipment, issued by independent testing authority.
4) Guaranteed Technical Parameters.
5) Technical catalogues.
6) Manufacturing Quality Plan

Operation & Maintenance Manuals

Instruction manuals, presenting the basic categories of information for the operating and/or maintenance personnel, as detailed herein below shall be furnished by Bidder.
The instruction manuals shall present the following basic categories of information in particular complete and comprehensive manner and prepared for the use by operating and/or maintenance personnel.

i. Instructions for initial commissioning, short duration and long duration shut down.
ii. Instruction for operation, routine inspection and maintenance including preventive maintenance.

iii. Recommendation for inspection points, method of inspection and period of inspection.
iv. Information on detection, cause and rectification of troubles and faults.
v. Instructions on normal repairs and overhaul.
vi. Complete parts list with proper and complete identification (Tag nos./Serial nos. as shown in the respective approved drawings) and ordering information for all replaceable parts. The identification details of equivalent and alternative makes for these spare parts which are not manufacturer's own product shall also be listed.
vii. List of all special tools and tackle & spares and instructions for use of such tools and tackle & spares.
viii. One complete set of as built drawings of the entire systems.
ix. The information shall be organized in a logical and orderly sequence. A general description of equipment including significant technical characteristics shall be included to familiarize operating and maintenance personnel with the equipment. Such description and technical characteristics shall not differ from the approved data.
x. Necessary drawings, curves and other illustrations shall be included or copies of appropriate approved drawings shall be bound in the manuals. Tests, adjustment and calibration information, as appropriate, shall be included. Safety and other warning notices and installation, maintenance and operating cautions shall be emphasized.
xi. Write-up, figures, part list etc., shall be clearly legible. The manuals shall be prepared on good quality paper securely bound in durable folders.
xii. The instruction manuals shall be subject to Consultant's approval in the same fashion as that for drawings.
xiii. Instruction manual shall give step by step procedure for Erection, testing and commissioning
xiv. Operation, Maintenance and Repair Instruction manual shall also contain:
xv. List of spare parts with ordering specifications and manufacturer's catalogues
xvi. List of consumables, lubricants, chemicals with specifications, brand names and annual consumption figures.
xvii. Drawings relevant for erection, operation, maintenance and repair of the equipment.
xviii. Procedure for ordering spares.
xix. Maintenance Manual shall also include:
xx. Diagnostic trouble shooting / fault location charts
xxi. Tests for checking of proper functioning.

Drawings / documents for approval

- Quality Control & Quality Assurance plan.
- G.A. and Cross Sectional drawings of all equipment indicating weights, material of construction, bill of material, dimension, specification etc.
- Final design calculations and assumptions.
- Actual performance data and characteristic curves based on the testing at site.
- Technical specification of all equipment, motors, for all system and all other accessories.
- Final list of drawings.
- As built drawings.

Miscellaneous

i. General arrangement and cross sectional drawings of all major components with bill of material.

ii. Foundation drawings, load data & design calculation for all equipment.

iii. Erection drawings for all equipment and structures showing complete erection details.

iv. Engineering and design calculations of installations and units.

v. QAPs

vi. Detailed procedures of shop testing of all the items applicable shall be submitted to the Owner/ Consultant for approval before conducting tests.

vii. Following shop test certificates/test curves/data, shall be furnished.

- Materials and components test certificates.
- Performance test results and characteristic curves of all fans, pumps, and electric drive motors etc.
- Non-destructive test results as applicable.
- Reports and test certificates of shop tests.
- Type test & routine test certificates.

viii. Detailed quality assurance program along with quality plan shall be submitted.

Following data shall be furnished: -

a) Technical data of all the plant, equipment, drive motors, instruments, panels, etc. shall be furnished.
b) Following lists/tables / write ups shall be furnished, complete with tag nos. and brief specification. Proper numbering system as approved by Consultant/Owner shall be adopted.

i) Instrument schedule (with service, range, make of instrument).
ii) Flow element schedule.
iii) Valve schedule.
iv) Pipe schedule.
v) Cable schedule (Power & Control).
vi) Schedule of actuators (electric/pneumatic)

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Employer would be discussed and finalized at the time of award. 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.

Note: The contractor 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.

3.21 Workmanship and Quality Control

All moving parts of equipment, which can conceivably cause injury to the operator and otherwise authorized personnel within the vicinity of working area shall be suitably guarded and warning displays shall be put at prominent places.

The Bidder shall clearly indicate and identify the plans and procedures, which shall be followed in the design, manufacture and installation of plant and equipment to control and assure to the Owner of the desired quality.

FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistance varnish shall be applied on 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 interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

3.22 Title Block:

<table>
<tr><td>Project</td><td colspan="4">Teesta-VI H.E. Project (4x125 MW)</td></tr>
<tr><td>Customer</td><td colspan="4">Lanco Teesta Hydro Power Limited
(A wholly owned Subsidiary of NHPC LTD.)
LTHP LTD. (A wholly owned subsidiary of NHPC Ltd.)</td></tr>
<tr><td>Consultant</td><td colspan="4">NHPC Ltd.</td></tr>
<tr><td rowspan="4">BHEL</td><td rowspan="4">BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA</td><td></td><td>Name</td><td>Sign</td></tr>
<tr><td>Drawn</td><td></td><td></td></tr>
<tr><td>Checked</td><td></td><td></td></tr>
<tr><td>Approved</td><td></td><td></td></tr>
<tr><td colspan="2">Title</td><td colspan="2">Drawing Number :</td><td>Rev</td></tr>
</table>

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SECTION -4

Contents

ANNEXURE-A: COMPLIANCE CERTIFICATE OF TECHNICAL SPECIFICATION

The bidder shall confirm compliance to the following by signing and stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.

2. There are no deviation(s) with respect to specification other than those furnished in the schedule of deviations.

3. Only those technical submittals which are specifically asked for in Notice Inviting Tender (NIT) to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of technical offer.

4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.

5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

Date: Bidder's Stamp & Signature

ANNEXURE-B: DEVIATION/ CHANGE REQUEST OF TECHNICAL SPECIFICATION

Bidder shall list out all technical potential deviation/ change request (s) along with clause with respect to technical specifications.

Sl. No.	Page No.	Clause No.	Deviation	Reason/ Justification(s)

Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date: Bidder's Stamp & Signature

Annexure - C

GUARANTEED TECHNICAL PARTICULARS

5 GAS INSULATED SWITCHGEAR

5.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Employer's Requirement	Bidder's confirmation/seal/ signature
1.1	Standard		IEC-62271(all sections)	Confirmed
1.2	Rated Voltage Un	kV	245	Confirmed
1.3	Rated Frequency in			
	-Normal condition	Hz	50	Confirmed
	-Exceptional Condition	Hz	As per IEC 62271-203	Confirmed
1.4	Power frequency withstand voltage, (One) 1 minute			
	- Phase to ground	kV rms	460	Confirmed
	-across the isolating distance and between phases	kV rms	530	Confirmed
1.5	Lightning impulse withstand voltage			
	- against ground	kV	1050	Confirmed
	-across the isolating distance	kV	1200	Confirmed
1.6	Switching impulse withstand voltage			
	- against ground	kV	NA	Confirmed
	- between phases	kV	NA	Confirmed
	-across the isolating distance	kV	NA	Confirmed
1.7	Maximum partial discharge of switch gear assembly	-	In line with IEC 62271-203	Confirmed
1.8	Maximum leakage rate in percent of the respective volume, per year	%	0.50%	Confirmed
1.9	Temperature rise	-	As per IEC 60694	Confirmed
1.10	Minimum symmetrical short-time withstand current, (One) 1 second	kA	40	Confirmed
1.11	Minimum peak short-circuit withstand current	kA	100	Confirmed
1.12	**Circuit Breaker**			
1.12.1	Standard		IEC 62271-100	Confirmed
1.12.2	Rated continuous current	A	2000	Confirmed
1.12.3	Rated symmetrical short-circuit breaking current	kA	40	Confirmed
1.12.4	Rated short-circuit making current	kA	100	Confirmed
1.12.5	Line charging current breaking capability	A	125	Confirmed
1.12.6	Small inductive current breaking capability (without producing excessive over voltages)	A	10	Confirmed
1.12.7	Operating sequence			
	- Line breakers	-	O-0.3s-CO-3 min–CO	Confirmed
	- Generator feeder & bus coupler breakers	-	O-3min-CO-3 min–CO	Confirmed

BHEL R.O.D. Lodhi Road New Delhi-3

Bidder's Seal and Signature of Authorized Representative

5 GAS INSULATED SWITCHGEAR

5.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Employer's Requirement	Bidder's confirmation/seal/ signature
1.12.8	Total breaking time	ms	<60 ms	Confirmed
1.12.9	Total closing time	ms	<100 ms	Confirmed
1.12.10	First pole to clear factor	-	1.3	Confirmed
1.12.11	Operating Mechanism	-	Spring/hydraulic/ other	Confirmed
1.12.12	Compliance to Class C2 and M2	-	Yes	Confirmed
1.12.13	Minimum number of operations at full short circuit rating	-	20	Confirmed
1.13	**Disconnector**			
1.13.1	Standard	-	IEC 62271-102	Confirmed
1.13.2	Rated continuous current	A	2000	Confirmed
1.13.3	Minimum make and break capability for capacitive current	A	0.5	Confirmed
1.13.4	Total operating time (closing or opening cycle)	-	As per accepted international practice	Confirmed
1.14	**Fast Acting Grounding Switch**			
1.14.1	Standard	-	IEC 62271-102	Confirmed
1.14.2	Rated short-circuit making current (peak)	kA	100	Confirmed
1.14.3	Rated switching capacity			
	- inductive currents/voltage	-	80A/2 kV	Confirmed
	- capacitive currents/voltage	-	3A/12 kV	Confirmed
1.14.4	Total operating time (closing or opening cycle)	-	As per accepted international practices	Confirmed
	- fast acting time	-	As per accepted international practices	Confirmed
1.15	**Safety Grounding Switch**			
1.15.1	Standard	-	IEC 62271-102	Confirmed
1.15.2	Rated short time withstand current, (One) 1 s	kA	40	Confirmed
1.15.3	Total operating time(closing or opening cycle)	-	As per accepted international practices	Confirmed

BHEL R.O.D. Lodhi Road New Delhi-3

Bidder's Seal and Signature
of Authorized Representative

5 GAS INSULATED SWITCHGEAR

5.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Employer's Requirement	Bidder's confirmation/seal/ signature
1.16	**Bus Voltage Transformers**			
1.16.1	Standard	-	IEC 61869	Confirmed
1.16.2	Rated transformation ratio			
	- for protection	-	(220/√3)kV/(110/√3) V	Confirmed
	- for metering	-	(220/√3)kV/(110/√3) V	Confirmed
1.16.3	Accuracy class / rated burden			
	- for protection	-	3P	Confirmed
	- for metering	-	0.2	Confirmed
1.17	**Surge Arrestor**			
1.17.1	Standard	-	IEC 60099-4	Confirmed
1.17.2	System voltage	kV	220	Confirmed
1.17.3	rated arrestor voltage	kV	216	Confirmed
1.17.4	rated nominal discharge current	kA	10	Confirmed
1.17.5	Minimum continuous operating voltage (COV)	kV	168	Confirmed
1.17.6	One minute (dry) power frequency withstand voltage of arrestor housing	kV	460	Confirmed
1.17.7	Lightening Impulse withstand voltage of arrestor housing with 1.2/50 ms wave	kV	1050	Confirmed
1.18	**Current Transformer**			
1.18.1	Standard	-	IEC 61869	Confirmed
1.18.2	Current ratio	-		
	Generator	-	2000-1000-500/1A	Confirmed
	Line bay/Bus coupler	-	2000-1000-500/1A	Confirmed
1.18.3	Accuracy class	-		
	For protection	-	PS	Confirmed
	For metering	-	0.2S	Confirmed
1.19	**SF6 properties**			
	Standard	-	IEC 60376	Confirmed
	Water	-	<5	Confirmed
	Carbon Tetra Fluoride	-	<250	Confirmed
	Air	-	<250	Confirmed

BHEL R.O.D. Lodhi Road New Delhi-3

Bidder's Seal and Signature
of Authorized Representative

5 GAS INSULATED SWITCHGEAR

5.1 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Employer's Requirement	Bidder's confirmation/seal/ signature
1.20	**Partitioning Provision**			
1.20.1	Compliance with IEC 62271-203 and PTS clause no. 5.5.2	-	Yes	Confirmed
1.20.2	Provision of partioning so that maintenance of one bus with other bus in operation and PTS clause no. 5.5.2 & 5.5.5	-	Yes	Confirmed
1.20.3	Provision of partioning so that maintenance of one feeder with other feeders in operation and PTS clause no. 5.5.2 & 5.5.5	-	Yes	Confirmed
1.21	Gas monitoring system with provision of alarm and tripping and integration with plant scada system and PTS clause no. 5.5.2 & 5.5.5	-	Yes	Confirmed
1.21.1	Parameters monitored:			
	Gas Density	-	Yes	Confirmed
	Gas Pressure	-	Yes	Confirmed
	Leakage	-	Yes	Confirmed
	SF_6 gas pressure alarm system	-	Yes	Confirmed
1.22	UHF couplers	-	Yes	Confirmed
1.23	Gas processing system	-	Yes	Confirmed
1.24	Interlocking of operation of CB, Isolator and earthing switch	-	Yes	Confirmed
1.25	Conformance to IEC 60859 for cable connection for GIS	-	Yes	Confirmed
1.26	Complete Compliance of specification	-	Yes	Confirmed
1.27	Design of GIS including Provision of universal interfacing for extension of GIS with GIS of any other make/model. Refer PTS clause no. 5.5.2	-	Yes	Confirmed

BHEL R.O.D. Lodhi Road New Delhi-3

Bidder's Seal and Signature
of Authorized Representative

ANNEXURE-D: TECHNICAL CHECKLIST

Sl. No.	Particulars	Confirmation by Bidder	
1	**Technical Qualifying Requirement**		
1.1	The bidder to furnish relevant documents for meeting the qualifying requirement. Performance certificates shall be submitted in English. Translated pages should be attested by the ultimate customer, if attested only by the bidder it shall be notarized.	Confirmed	Yes/ No
1.2	The technical bid shall be submitted by the Manufacturer of GIS & its accessories in case of Indian Manufacturer; however, agent may submit the technical offer in case of foreign manufacturer. The bidder's scope includes supply and services such as -Supervision of installation, -Testing and commissioning.	Confirmed	Yes/ No
1.3	All the documents shall be submitted in English. Translated pages should be attested by the ultimate customer, if attested only by the bidder it shall be notarized.	Confirmed	Yes/ No
2	**Un-priced BOQ**		
2.1	Confirm that all items have been quoted separately. (If any item has not been quoted, the same shall be specifically brought out with technical reasons thereof, else offer shall be liable for rejection).	Confirmed	Yes/ No
2.2	Any other supply/ service required for the execution for the complete work of GIS & its accessories is deemed to be included in the offer, whether specifically mentioned in the specification or not. Bidder to submit list of items along with their respective quantities required for completeness of GIS & its accessories.	List of items required to be attached.	Yes/ No
2.3	Building for GIS shall be constructed by Civil contractor based on the input (configuration, structure loads and other interfacing details etc.) provided by bidder. The supply of all structural material to be embedded including foundation bolts, plates etc. as well as consumables like grouting material etc. shall be in bidder's scope. The erection of structure shall be done by BHEL under supervision of bidder.	Confirmed	Yes/ No
2.4	Bidder shall provide the details for Cable Connection module,	Confirmed.	Yes/ No

	and SF6 to Oil connection etc. and hence, interfacing details for connection with other parts shall be provided by the bidder.	(Details is submitted)	
2.5	Bidder shall submit list of consumables with shelf life of less than six months and same shall be dispatched just before the erection and only after specific clearance from BHEL/Customer.	Confirmed (List is attached)	Yes/ No
2.6	Commissioning spares for testing & commissioning of GIS till handing over shall be under bidder's scope.	Confirmed	Yes/ No
2.7	Detailed list of Tools & tackle & Testing Equipment to be supplied at site on returnable/ non-returnable basis.	List attached	Yes/ No
2.7	Detailed list of Tools & tackle & Testing Equipment to be supplied at site on returnable/ non-returnable basis.	List attached	Yes/ No
2.8	GIS shall be complete with all necessary terminal boxes, SF6 gas filling, interconnecting cabling & wiring, grounding connections, gas monitoring equipment and piping, support structures etc.	Confirmed	Yes/ No
2.9	The scope of supply shall also include all erection and mounting hardware and interconnecting cables within GIS.	Confirmed	Yes/ No
2.10	Design philosophy of earthing submitted with the bid	Confirmed	Yes/ No
2.11	Design of Earthing of GIS shall be in bidder scope. The items and accessories required for completeness of earthing shall be in bidder's scope. Mesh on floor shall be provided by BHEL as per bidder's design.	Confirmed	Yes/ No
3	**Technical**		
3.1	The 220kV GIS building shall comprise an EOT (Electric overhead travel) crane of minimum capacity 5 (Five) Ton or as per GIS OEM/ bidder recommendation, whichever is higher for lifting of any components of GIS switchgear EOT crane shall be provided for GIS. However, EOT crane for GIS is not envisaged in bidder's scope but bidder shall provide all the calculations basis for sizing of EOT crane during tender stage only.	Confirmed	Yes/ No
3.2	Thermal rating for all current carrying parts shall be minimum 40kA for 1sec as mentioned in technical specification.	Confirmed	Yes/ No
3.3	Internal components maintenance free for at least 10 years/ as mentioned in technical specification.	Confirmed	Yes/ No
3.4	Material of enclosure – non-magnetic material	Confirmed	Yes/ No
3.5	Bidder shall provide AC and DC auxiliary loads for GIS.	Confirmed (Enclosed with bid)	Yes/ No

3.6	Catalogues of GIS	Confirmed (Enclosed with bid)	Yes/ No
3.7	Catalogues of all Maintenance equipment. Bidder to confirm that offered equipment meets the requirements of specification.	Confirmed (Enclosed with bid)	Yes/ No
4	**Calculations**		
4.1	The design of the equipment shall be such that the agreed permitted movement of foundations and mechanical or thermal effects do not impair the assigned performance of the equipment.	Confirmed	Yes/ No
4.2	Insulation co-ordination study shall be conducted and based on the same the number & location of surge arresters shall be decided. The number and location of surge arresters shall be indicated with the bid.	Confirmed	Yes/ No
4.3	Measures to limit external over voltages (e.g. surge arresters) should be considered and detailed out based on the site conditions etc.	Enclosed with bid	Yes/No
5	**Technical Deviations**		
5.1	Confirm that the Complete systems have been offered as per the requirements of Technical Specification and Technical Deviation sheet has been submitted. Deviations mentioned elsewhere in the bid will not be considered.	Confirmed	Yes/ No
6	**Bar-chart**		
6.1	Bidder will submit detailed bar chart indicating all the milestones from Engineering till manufacturing/ testing, dispatch to site and commissioning based on the drawing & document schedule attached in section1.	Confirmed	Yes/ No
7	**Conditions**		
7.1	Storage shall be provided by BHEL/ its contractor. However, bidder shall provide their tentative space requirement for covered and/ or open store area during tender stage only. In addition to this, bidder shall submit their standard storage instruction manual specifically specifying the item detailed with details of type of storage.	Details given with the bid.	Yes/ No
8	**Site Test**		
8.1	Special tools & tackles for installation and testing kits for testing & commissioning shall be in bidder's scope, however, it shall be brought at site on returnable basis only.	Confirmed	Yes/ No
8.2	Bidder shall provide list of general tools, tackle, slings,	Confirmed	Yes/ No

	spanners, gauges, slings and other lifting devices, drills, instruments, testing kits and appliances necessary for the complete assembly, installation, gas filling, maintenance, site testing of the GIS, however, it shall be arranged by BHEL.		
8.3	All field tests including tests during installation, pre-commissioning, commissioning, field acceptance tests shall be conducted by the bidder, in presence of representative of the BHEL/ Customer. No separate site test will be conducted by BHEL/ Customer	Confirmed	Yes/ No
9	**Type Test Requirements**		
9.1	Bidder shall ensure that 220kV GIS with LCC & its Accessories, being procured should have valid type test certificates as per specified in IEC standard 62271 – 203 & 62271-100 (amended up to date) at any ISO/IEC accredited laboratories.	Confirmed	Yes/ No
9.2	Type test certificates to be submitted by bidder shall not be older than 23.03.2010. In those cases, where type test certificates are older than above date, OEM/ bidder shall carry out the type tests at at any ISO/IEC accredited laboratories prior to dispatch of equipment with no commercial implication to BHEL/Customer.	Confirmed	Yes/ No
9.3	Type test report for GIS shall be submitted along with the bid. Differences, if any, in the items offered and those which have been type tested shall be clearly brought out along with explanation for suitability.	Confirmed and enclosed with bid	Yes/ No
9.4	In case any of Type tests have not been conducted on the offered design or there has been a change in the design after the type tests. The requisite tests shall be conducted by bidder on the offered design without any extra cost and delivery impact to BHEL/ Customer. Technical valid- Any error or incompleteness (any/all additional type tests not carried out) or discrepancy in the test reports vis-à-vis offered equipment due to any design / manufacturing changes (including substitution of components) or non-compliance with the requirement stipulated in the Technical Specification.	Confirmed	Yes/ No
9.5	The type tests conducted earlier should have either been conducted in an accredited independent laboratory (accredited base on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located).	Confirmed. Details provided with bid.	Yes/ No

	The short circuit test should have been conducted in a laboratory which should be a member of STL (Short-Circuit Testing Liaison - www.stl-liaison.org). If the laboratory is not a national laboratory and member of STL, relevant papers of accreditation shall be submitted in English. If the laboratory is in-house, the tests should have been witnessed by a client.		
9.6	The type test report shall be complete including the list of test objects, photographs, oscillographs, test arrangement, drawing of tested objects (GIS, equipment etc.) and test connections. The type test report shall be in English. If it is in any other language, it should include an English version (Translation shall be attested by the Bidder). The English version should be complete with measured values and conclusion.	Confirmed	Yes/No

Date: Bidder's Stamp & Signature

TECHNICAL PRE-QUALIFYING REQUIREMENT

Bidder should be manufacturer of 220kV class GIS. Bidder needs to meet the following technical requirements as stipulated here under:

Route-1:

a) The bidder should have successful experience in designing, manufacturing, supply, supervision of installation, testing and commissioning of Gas Insulated Switchgear (GIS) having rated voltage of 220kV class or higher with current rating of 2000A or above and short circuit current rating of 40kA or above, in last 10 years as on **scheduled date#**.

b) The GIS so manufactured should have been in **successful operation*** at least at three (3) power stations/ substations.

OR

Route-2:

Alternatively, the bidder, who have established manufacturing and testing facilities in India based on technological support of collaborator/parent/principal/JV company and not meeting the requirement stipulated in (Route-1) above, can also be considered provided that:

a) Min. 220kV class or higher with current rating of 2000A or above and short circuit current rating of 40kA or above, in last 10 years as on **scheduled date#** from the works where the offered GIS is to be manufactured.

AND

b) The collaborator/parent/principal/JV company meets the requirements stipulated in (Route-1) above. A technical collaboration agreement for 220kV class GIS shall be submitted.

NOTE: -

Originally Scheduled date of technical bid opening of this Tender.
* Successful operation means Performance Certificate issued by customer without any adverse remarks.

PREPARED BY 22/11/21 | REVIEWED BY 22/11/21 | APPROVED BY 22/11/21