Annexure-TQR

TECHNICAL PRE-QUALIFICATION REQUIREMENT

Name of Project: Vishnugad Pipalkoti Hydro Electric Project (4X111MW)

Name of Customer: THDC India Limited, Rishikesh, Uttarakhand

Name of Item: 400kV Post Insulators

TECHNICAL PRE-QUALIFICATION REQUIREMENT
The Bidder should have manufactured, type tested (as per IEC/IS) & supplied 400kV or above class Post Insulators as on the original scheduled date of technical bid opening of this tender.

SUPPORTING DOCUMENTS TO BE ATTACHED		
Sl. No.	**Required Criteria**	**Supporting Documents to be submitted by bidder along with technical bid**
1	Manufacturing	Approved Drawings / GTP / Approved Quality Plan / Factory Inspection Test Report etc. of offered item
2	Supply	PO / Dispatch clearance / LR / Material Receipt certificate at site / installation or commissioning certificate etc. of offered item
3	Type test	TTR approval from customer/Type test report etc establishing successful type tested design

Notes (General points):

1. Consideration of offer shall be subject to customer's approval of bidder's, if applicable.

2. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self- attested English translated document should also be submitted.

3. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.

4. After satisfactory fulfilment of all the above criteria / requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.

9/12/25

09/12/25

9.12.25

PREPARED BY

REVIEWED BY

APPROVED BY

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

NOIDA

DOCUMENT NO.	TB-382-316-003	REV 00	Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECFICATION	NAME	BY	SS	VK
Title: 400kV Post Insulator & its accessories *(Suitable for an altitude of approx. 1101 from Mean Sea Level (MSL))*		SIGN			
		DATE	08.12.25	08.12.25	08.12.25
		GROUP	TBEM		
		WO No.	84008A		

CUSTOMER	THDC India Limited, Rishikesh, Uttarakhand
PROJECT	Vishnugad Pipalkoti Hydro Electric Project (4X111MW)

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Remarks: Bidder to note that data and details of Annexure-D (Guaranteed Technical Particulars) shall not be reviewed during technical evaluation/ scrutiny, hence compliance of guaranteed technical particulars in line with technical specification shall be bidder's responsibility.

Rev. No.	Date	Altered	Checked	Approved	
Distribution				To	
				Copies	

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

1. Scope

This technical specification covers the requirements of design, manufacture, inspection including third party inspection and testing at manufacturer's work before supply, proper packing and delivery to project of equipment (400kV Post Insulator & its accessories) complete with all fittings, accessories, mandatory spares, as applicable of the equipment complete in all respects for efficient & trouble-free working mentioned under this specification.

This section covers the specific technical requirements of equipment. This constitutes minimum technical parameters for the above item as specified by the BHEL/ THDCIL. The offered equipment Insulated Switchgear 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/ Service
Section-3	:	Project Details & General Technical Requirements (For all equipment under the Project)
Section-4	:	Annexures Annexure-A: Compliance Certificate to Technical Specification Annexure-B: Deviation/ Change Request to Technical Specification 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/ THDCIL 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
   - o Requirements of other statutory bodies as applicable, e.g. CEA etc.
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/ THDCIL will resolve listed conflicts prior to award. In case of ambiguity, bidder shall inform BHEL/ THDCIL of their interpretation. In case bidder fails to convey the same prior to award, BHEL/ THDCIL 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.

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-A), however bidder shall furnish list of conflicts/ ambiguities/ deviations (Annexure-B), 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	:	THDC India Limited, Rishikesh, Uttarakhand
Name of Main Contractor	:	Bharat Heavy Electricals Limited
Name of the Project	:	Vishnugad Pipalkoti Hydro Electric project (4X111MW)

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

2. Codes & Standards

1. The rating as well as performance and testing of the equipment shall comply with the latest editions and amendments of the following standards as applicable, unless otherwise specified elsewhere in this specification,

IS 2544	Porcelain post insulators for system with nominal voltage greater than 1000V
IS 2147 (P-II)	Dimensions of Indoor and Outdoor Porcelain Post Insulators and Post Insulator Units for Systems with Nominal Voltages Greater Than 1000 V, Part II: Outdoor Cylindrical Post Insulators
IS 2147 (P-III)	Dimensions of Indoor and Outdoor Porcelain Post Insulators and Post Insulator Units for Systems with Nominal Voltages Greater Than 1000 V, Part III: Outdoor Pedestal Post Insulators
IEC 60273	Characteristic of indoor and outdoor post insulators for systems with nominal voltages greater than 1000 V
IEC 60168	Tests on Indoor & Outdoor Post Insulators of Ceramic Material
IEC 60815	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions

2. For the purpose of this specification all technical terms used hereinafter shall have the meaning as per IEC/ IS specification.
3. The equipment shall also conform to the provisions of Indian Electricity Rules, 1956 and other statutory regulations currently in force in the country.
4. In case Indian standards are not available for any equipment, standards issued by IEC/ BS/ VDE/ IEEE/ NEMA or equivalent agency shall be applicable.

3. Specific Technical Requirements

1. The equipment (400kV Post Insulator with its Accessories) shall perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation.
2. Equipment shall be able to withstand all external and internal mechanical, thermal and

electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (wherever applicable) short circuit etc. for the equipment.

3. The equipment shall also comply to facilitate erection of equipment, all items to be assembled at site shall be "match marked".
4. The equipment shall be installed at the altitude of +1101 M approx. and hence, bidder shall submit detailed calculation of altitude correction factor for equipment and changes being done in design as per applicable IS/ IEC. It may please be noted that altitude correction factor may result in increased technical requirement of system parameters (basic impulse level, power frequency withstand voltage and switching impulse withstand voltage etc.) and minimum clearances (phase to phase, phase to earth, min. distance of the lowest earth part of insulators supporting live conductor from top of plinth level and section clearance etc.), applicable.
5. In addition to this, the other specific technical requirements for the equipment shall be as follows,

400kV Post Insulator		
Sl. No.	Description	Technical Requirements
1	Type	Solid core, porcelain
2	Voltage class	420kV
3	One-minute power frequency withstand voltage (Dry & wet)	680kVrms
4	Lightning impulse withstand voltage (1.2/50micro sec) (Dry)	± 1425kVp
5	Switching surge withstand voltage (250/2500micro sec) (Wet)	± 1050kVp
6	Maximum radio interference voltage	500micro volts at 305kV
7	Corona extinction voltage (kVrms)	320kVrms(min)
8	Total cantilever strength (Kg) (min)	8kN/(800kg)
9	Torsional moment	As per IEC: 60273
10	Total height of insulator (mm)	~~3650mm~~ 4000
11	Pollution level as per IEC: 815	Heavy (III)
12	Total creepage distance for heavy pollution (mm)	13200mm
13	Pitch Circle Diameter (PCD)-Top	127mm
	No. of holes	4xM16
	Pitch Circle Diameter (PCD)-Bottom	300mm
	No. of holes	8x18dia
14	Altitude and Installation	+1101 M approx. and outdoor

4. General Technical Requirements

The general technical requirements for the equipment shall be as follows,

1. Aluminium used for corona ring shall be grade 63401/ 19501 confirming to IS: 5082.

2. Insulators shall also meet requirement of IEC-60815 for 420 kV systems, as applicable having alternate long & short sheds. Insulator shall be type and routine tested as per IEC: 60168.
3. Hot Dip Galvanised Fixing Hardware for inter-unit joining and fixing to structure (both top & bottom) shall be supplied with post insulators.
4. Other standard fittings and accessories, which are not specifically mentioned but are usually provided with post insulator of type and rating being offered for efficient and trouble free operation.
5. The bidder must fill up all the details required for offered item/s. Instead of indicating "refer drawing, or as per IS/IEC", the exact value/s must be filled in.

5. Bill of Quantities

1. Quantities for the equipment shall be as follows.

Sl. No.	Item Description	Unit	Qty.
	Supply Item- Main Items		
1	Supply- Post Insulator: 400kV, 8kN, 31mm/kV, 1 phase Solid Core Post Insulators complete in all respect (without corona ring)	No	30
2	Supply- Post Insulator: 400kV, 8kN, 31mm/kV, 1 phase Solid Core Post Insulators complete in all respect (with corona ring)	No	2
	Supply Item- Mandatory Spares		
1	Supply- Post Insulator: 400kV, 8kN, 31mm/kV, 1 phase Solid Core Post Insulators complete in all respect (without corona ring)	No	1

2. However, any item not appearing herein but required for completeness of the work and mentioned elsewhere is deemed to be included in bidder's scope.
3. The quantities in BOQ may vary up to ±20% in line with quantity variation clause. However, individual quantities may be deleted or vary up to any extent.

6. Drawings / Documents required for Technical Clearance for Manufacturing

The engineering drawings/ documents, shall be used for providing technical clearance for manufacturing of the equipment, which shall be used for delay analysis, if applicable, by TBMM.

1	400kV Post Insulator - Drawings & Guaranteed Technical Particulars
2	400kV Post Insulator - Type Test Reports
3	400kV Post Insulator - Quality Assurance Plan

Date of Submission of drawings/ documents shall be counted only from the date of submission of reasonably correct drawings/ documents. In case drawing/ document are not duly stamped in

category-1/ category-2 by customer, BHEL stamp/ confirmation shall be treated final to proceed further.

The technical clearance for manufacturing shall be provided to TBMM department after completion of engineering approval.

The successful bidder shall have to extend all possible supports like timely submission/ re-submission of drawings, visit to end customer to facilitate documents approval without any commercial implications to BHEL. Acceptance of bidder's documents shall be subject to end customer/ THDCIL approval.

6. Type Testing

Bidder shall ensure that the equipment being procured shall be of proven design and should have valid type test certificates as per specified in IS/ IEC standards (amended up to date) at any NABL accredited laboratories.

The validity of type test reports shall be as per the latest CEA guidelines for the validity period of type test(s) conducted on major electrical equipment in Power Transmission system as on original scheduled date of technical bid opening of this tender.

In case any of Type tests have not been conducted on the offered design or there has been a change in the design due to high altitude requirement/ any other technical issue 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.

Bidder shall provide following type tests, but not limited to,

1. Power frequency withstand test (dry & wet)
2. Lightning impulse test (dry)
3. Switching impulse test (wet) (applicable for or 420 kV and above class Insulator only)
4. Measurement of RIV (Dry)
5. Corona extinction voltage test (Dry)
6. Test for deflection under load
7. Test for mechanical strength.

7. Quality Plan

The successful bidder shall submit Quality Assurance Plan 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/ THDCIL. In case bidder has reference Quality Assurance Plan agreed with BHEL/ THDCIL same shall be submitted for specific project to BHEL/ THDCIL 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 the

equipment. 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 tests for the equipment shall be deemed to be included in bidder's scope.

8. Inspection & Testing

1. Equipment shall be subject to inspection by BHEL/THDCIL or authorized representative at bidder/ manufacturers' works. Hence, Bidder shall furnish all necessary information concerning the supply to BHEL/ THDCIL.
2. Routine and acceptance tests as listed in relevant standard and section-2, technical specifications shall be complied.
3. Bidder shall also furnish factory acceptance test (FAT) from manufacturers for BHEL/ THDCIL approval in line with specific requirements mentioned in section-2, technical specification.

9. Makes of Equipment/ Components

1. The offered equipment shall be brand new with state of art technology and proven field track record. No prototype equipment shall be offered.
2. Bidder while ordering shall ensure the availability of spare parts and maintenance support services for the equipment at least for 10 years from the date of supply.
3. Bidder shall give a notice of at least one year to the BHEL/ THDCIL before phasing out the products/ spares to enable the owner for placement of order for spares and services.
4. The equipment offered by the bidder shall be complete in all respects. Any material and component not specifically stated in this specification but which are necessary for trouble free operation of the equipment and accessories specified in this specification shall be deemed to be included unless specifically excluded. All such equipment/ accessories shall be supplied without any extra cost. In addition to this, all similar components shall be interchangeable and shall be of same type and rating for easy maintenance and low spare inventory.
5. Specific reference in this specification and documents to any material by trade name, make or catalogue number shall be construed as establishing quality and performance requirements.

10. Packing and Dispatch

1. The equipment shall be properly packed for selected mode of transportation i.e. 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. The panels shall be wrapped in polyethylene sheets before being placed in wooden crates/ cases to prevent damage to the finish. Crates/ cases shall have skid bottoms for handling. Special notations such as 'Fragile', 'This side up', 'Weight', 'Owner's particulars\ 'PO nos.' etc., shall be clearly marked on the package together with other details as per purchase order.
2. The equipment may be stored outdoors for long periods before installation. The packing should also be suitable for outdoor storage areas with heavy rains/ high ambient temperature unless otherwise agreed and hence, Packing shall be suitable for long storage (minimum 1 year).

11. Exceptions

Followings are not in bidder's scope of supply (BHEL supplied items)

a. Equipment support structure

12. 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. Bid/ Bidding Documents: The totality of the documents comprising the Bidding Document for the notice inviting tender.
2. Contract: The totality of agreement between Customer/ Purchaser/ Owner and the Contractor/ BHEL as derived from the contract documents.
3. Contractor: The bidder selected by the Customer/ Purchaser/ Owner for the performance of the work and supply of materials. In this case, it is BHEL.
4. Customer/ Purchaser/ Owner: THDC India Limited
5. Consultant: Any person(s)/ Firm nominated/ assigned by the Customer/ Purchaser/ Owner for providing the engineering consultant services.
6. Bidder/ vendor/ OEM: The bidder selected for this intended work shall be known as vendor/ OEM.

13. 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,

AC:	Alternating Current
DC:	Direct Current
kV:	Kilovolt
Hz:	Hertz
IP:	Ingress Protection
BOQ:	Bill of Quantities
QAP:	Quality Assurance Plan
NIT:	Notice Inviting Tender
PI:	Post Insulator
OEM:	Original Equipment Manufacturer
BHEL:	Bharat Heavy Electricals Limited
BIS:	Bureau of Indian Standards
BS:	British Standard
ANSI:	American National Standards Institute
ASTM:	American Society for Testing and Materials
IS:	Indian Standards
IEC:	International Electro Technical Commission
IEEE:	Institute of Electrical & Electronics Engineers
CEA:	Central Electricity Authority
NEMA:	National Electrical Manufacturers Association

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SECTION2:

The precedence of order for documents shall be as per follows,

1. Standard Technical Specification
2. Design basis report

SECTION-2
STANDARD EQUIPMENT SPECIFICATION FOR 400kV POST INSULATOR

1. General

This section covers the standard technical specification for Post Insulator.

2. General Technical Requirements

The post insulators shall conform in general to latest IS: 2544, IEC: 60168, IEC: 60273 and IEC: 60815.

3. Constructional Features

1. Post type insulators shall consist of a porcelain part permanently secured in a metal base to be mounted on the supporting structures. They shall be capable of being mounted upright. They shall be designed to withstand any shocks to which they may be subjected to by the operation of the associated equipment. Only solid core insulators will be acceptable.
2. Porcelain used shall be homogeneous, free from lamination, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.
3. Glazing of the porcelain shall be of uniform brown in color, free from blisters, burrs and other similar defects.
4. The insulator shall have alternate long and short sheds with aerodynamic profile. The shed profile shall also meet the requirements of IEC: 60815 for the specified pollution level.
5. When operating at normal rated voltage there shall be no electric discharge between conductor and insulators which would cause corrosion or damage to conductors or insulators by the formation of substance produced by chemical action.
6. The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.
7. All ferrous/iron parts shall be hot dip galvanised in accordance with the latest edition of IS: 2633, & IS: 2629. The zinc used for galvanising shall be grade Zn 99.95 as per IS: 209. The zinc coating shall be uniform, adherent, smooth, reasonably bright, continuous and free from imperfections such as flux ash, rust stains, bulky white deposits and blisters. The metal parts shall not produce any noise generating corona under the operating conditions.
8. a) Every bolt shall be provided with a hop dip galvanised steel washer under the nut so that part of the threaded portion of the bolts is within the thickness of the parts bolted together.

   b) Flat washer shall be circular of a diameter 2.5 times that of bolt and of suitable thickness. Where bolt heads/nuts bear upon the bevelled surfaces they shall be provided with square tapered washers of suitable thickness to afford a seating square with the axis of the bolt.

   c) All bolts and nuts shall be of steel with well-formed hexagonal heads forged from the

solid and shall be hot dip galvanised. The nuts shall be good fit on the bolts and two clear threads shall show through the nut when it has been finally tightened up.

9. Aluminium used for corona ring shall be of grade 63401 or 19501 conforming to IS-5082.
10. Bidder shall furnish drawings for the essential design features of assembly of shells and metal parts, and number of shells per insulator.

4. Tests

The post insulators shall be subjected to type, acceptance, sample and routine tests as per IS: 2544 and IEC: 60168.

1. The following type tests reports of the post insulators shall be furnished for approval and waiver.
   (i) Power frequency withstand test (dry & wet)
   (ii) Lighting impulse test (dry)
   (iii) Switching Impulse test (wet) (for 420 kV insulator only)
   (iv) Test for deflection under load
   (v) Test for mechanical strength
   (vi) Measurement of RIV (dry) and Corona extinction voltage test (dry). The test procedure shall be as detailed in Annexure-A.

If bidder already has THDCIL approved valid standard type test approval same may also be get extended for this Project also.

2. In addition to acceptance/sample/routine tests as per IS: 2544 and IEC: 60168, the following tests shall also be carried out.
   (i) Soundness test, metallurgical tests and magnetic particle inspection (MPI) on MCI/SGI caps as acceptance test.
   (ii) All hot dip galvanized components shall be subject to check for uniformity of thickness and weight of zinc coating on sample basis as an acceptance test.
   (iii) The bending test shall be carried out at 50% minimum failing loads in four directions as a routine test and at 100% minimum failing load in four directions as an acceptance test.
   (iv) Acceptance norms for visual defects allowed at site and also at works shall be agreed in the quality plan

ANNEXURE-A
CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

1. General

Unless otherwise stipulated, all equipment together with its associated connectors, where applicable, shall be tested for external corona (for 400kV & above) both by observing the voltage level for the extinction of visible corona under falling power frequency, voltage and by measurement of radio interference voltage (RIV) for 132kV and above.

2. Test Levels

The test voltage levels for measurement of external RIV and for corona extinction voltage are listed under the relevant clauses of the specification.

3. Test Methods for RIV

1. RIV tests shall be made according to measuring circuit as per International Special-Committee on Radio Interference (CISPR) Publication 16-1(1993) Part -1. The measuring circuit shall preferably be tuned to frequency with 10% of 0.5 Mhz but other frequencies in the range of 0.5 MHz to 2 MHz may be used, the measuring frequency being recorded. The results shall be in microvolts.
2. Alternatively, RIV tests shall be in accordance with NEMA standard Publication No. 107-1964, except otherwise noted herein.
3. In measurement of, RIV, temporary additional external corona shielding may be provided. In measurements of RIV only standard fittings of identical type supplied with the equipment and a simulation of the connections as used in the actual installation will be permitted in the vicinity within 3.5 meters of terminals.
4. Ambient noise shall be measured before and after each series of tests to ensure that there is no variation in ambient noise level. If variation is present, the lowest ambient noise level will form basis for the measurements. RIV levels shall be measured at increasing and decreasing voltages of 85%, 100%, and 110% of the specified RIV test voltage for all equipment unless otherwise specified. The specified RIV test voltage for 765kV, 400 kV, 220 KV is listed in the detailed specification together with maximum permissible RIV level in microvolts.
5. The metering instruments shall be as per CISPR recommendation or equivalent device so long as it has been used by other testing authorities.
6. The RIV measurement may be made with a noise meter. A calibration procedure of the frequency to which noise meter shall be tuned shall establish the ratio of voltage at the high voltage terminal to voltage read by noise meter.

4. Test Methods for Visible Corona

1. The purpose of this test is to determine the corona extinction voltage of

apparatus, connectors etc. The test shall be carried out in the same manner as RIV test described above with the exception that RIV measurements are not required during test and a search technique shall be used near the onset and extinction voltage, when the test voltage is raised and lowered to determine their precise values. The test voltage shall be raised to 110% of specified corona extinction voltage and maintained there for five minutes. In case corona inception does not take place at 110%, test shall be stopped, otherwise test shall be continued and the voltage will then be decreased slowly until all visible corona disappears. The procedure shall be repeated at least 4 times with corona inception and extinction voltage recorded each time. The corona extinction voltage for purposes of determining compliance with the specification shall be the lowest of the four values at which visible corona (negative or positive polarity) disappears. Photographs with laboratory in complete darkness shall be taken under test conditions, at all voltage steps i.e. 85%, 100%, and 110%. Additional photographs shall be taken at corona inception and extinction voltages. At least two views shall be photographed in each case using Panchromatic film with an ASA daylight rating of 400 with an exposure of two minutes at a lens aperture of f/5.6 or equivalent. The photographic process shall be such that prints are available for inspection and comparison with conditions as determined from direct observation. Photographs shall be taken from above and below the level of connector so as to show corona on bushing, insulators and all parts of energised connectors. The photographs shall be framed such that test object essentially, fills the frame with no cut-off.

For recording purpose, modern devices utilizing UV recording methods such as image intensifier may also be used.

2. The test shall be recorded on each photograph. Additional photograph shall be taken from each camera position with lights on to show the relative position of test object to facilitate precise corona location from the photographic evidence.
3. In addition to photographs of the test object preferably four photographs shall be taken of the complete test assembly showing relative positions of all the test equipment and test objects. These four photographs shall be taken from four points equally spaced around the test arrangement to show its features from all sides. Drawings of the laboratory and test set up locations shall be provided to indicate camera positions and angles. The precise location of camera shall be approved by Purchaser's inspector, after determining the best camera locations by trial energisation of test object at a voltage which results in corona.
4. The test to determine the visible corona extinction voltage need not be carried out simultaneously with test to determine RIV levels.
5. However, both test shall be carried out with the same test set up and as little time duration between tests as possible. No modification on treatment of the sample between tests will be allowed. Simultaneous RIV and visible corona extinction voltage testing may be permitted at the discretion of Purchaser's inspector if, in his opinion, it

will not prejudice other test.

5. Test Records:

In addition to the information previously mentioned and the requirements specified as per CISPR or NEMA 107-1964 the following data shall be included in test report:

(i) Background noise before and after test.
(ii) Detailed procedure of application of test voltage.
(iii) Measurements of RIV levels expressed in micro volts at each level.
(iv) Results and observations with regard to location and type of interference sources detected at each step.
(v) Test voltage shall be recorded when measured RIV passes through 100microvolts in each direction.
(vi) Onset and extinction of visual corona for each of the four tests required shall be recorded.

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SECTION 3:
PROJECT DETAILS & GENERAL TECHNICAL REQUIREMENTS
(FOR ALL EQUIPMENT UNDER PROJECT)

1. GENERAL

1. This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.
2. The provisions under this section are intended to supplement general requirements for the materials, equipment's and services covered under other respective sections 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 hold good.

2. PROJECT INFORMATION AND SYSTEM PARAMETERS

Project information and System parameters shall be as follows,

A.	Project Information	
a)	Customer/ Purchaser/ Owner	THDC India Ltd., Rishikesh, Uttarakhand
b)	Consultant/ THDCIL	SMEC
c)	Project Title	Vishnugad Pipalkoti Hydro Electric Project (4X111MW)
d)	Location	The Vishnugad Pipalkoti Hydro Electric Project (4 x 111 MW) is located on Alaknanda River, a major tributary of river Ganga, in district Chamoli in the state of Uttarakhand.
e)	Transport Facilities	The nearest railhead is Rishikesh (225 Km) and the nearest Airport is Jolly Grant, Dehradun (240 Km). The project is approachable by an all-weather road (National Highway No. 58).
f)	Postal Address	It shall be provided separately
B. Site Conditions		
a)	Maximum ambient Temperature	40^0C
b)	Minimum ambient Temperature	-7^0C

c)	Design ambient temperature for electrical equipment design	40^0C
d)	Relative humidity	100%
e)	Pollution Severity	Heavily Polluted
f)	Seismic zone	IV
g)	Seismic Coefficient	0.38g (In horizontal direction), 0.19g (In vertical direction) for design purpose
h)	Basic Wind speed	39m/sec
i)	Maximum rainfall	293.3mm in 24 hours
C. System Parameters and Clearances (At EL 1000)		
i)	Nominal system Voltage	400kV
ii)	Highest system voltage	440kV
iii)	Rated short time current	40kA for 1 sec
iv)	Frequency	50Hz±3 %
v)	Normal Current	2000A
vi)	Lightning impulse withstand voltage	1425kVp
vii)	Switching Impulse voltage	1050kVp
viii)	Power frequency withstand Voltage	630kVrms
ix)	Minimum creepage Distance	25mm/kV
x)	System earthing	Solidly earthed
xi)	Phase to phase Clearance	4200mm
xii)	Phase to Earth Clearance	3500mm
xiii)	Sectional Clearance	6500mm
D. Auxiliary Power Supply		

i)	3 phase A.C power supply	415V ± 10%, 50 Hz ± 3%, 3-phase 4 wire, solidly earthed , Frequency variation under extreme condition ± 5%
ii)	1 phase A.C power supply	240V ± 10%, 50 Hz ± 3%, 1-phase , 2 wire , AC supply , Frequency variation under extreme condition ± 5%
iii)	D.C. power supply	220V + 20% to -25%, 2-wire ungrounded 48V + 20% to -25% , 2 wire system positively earthed
iv)	Combined variation of voltage ± 10%, and frequency ± 5%,	

3. GENERAL TECHNICAL REQUIREMENTS

i. Type Tests

All equipment/systems to be supplied shall conform to type tests as per relevant standards and proven type. The Bidder / vendor shall furnish the reports of all the type tests carried out within last ten years from the date of signing of contract (i.e. 18.11.2014) as listed in relevant clauses in respective electrical specification and relevant standards for all components / equipment / systems. These reports should be for the tests conducted on identical/ similar components /equipment/systems to those offered / proposed to be supplied under this contract.

Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off.

In case Vendor is not able to submit report of type test(s) conducted in last ten years, or in case type test report(s) are not found to be meeting the specification/relevant standard requirements, then all such tests shall be conducted under this contract by the Bidder free of cost to Employer/Purchaser, and reports shall be submitted for approval. No charges shall be paid under this contract. All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bid price.

ii. Codes and Standards

All materials and equipment shall generally comply in all respect with the latest edition of relevant international electro-technical commission (IEC) or any other internationally accepted standard which ensure equal or better quality or relevant Indian standard(IS) mentioned against each equipment and this specification. Other International/National standard such as DIN, VDI, BS etc. shall be accepted for only material codes and manufacturing standards, subject to the employer's approval.

ASTM (American Society for Testing Materials), AISI (American Iron and Steel Institute), DIN (German Industrial Standards) and BSI (British Standards) are approved standards for the supply of Materials.

Material tests according to DIN 50049-3.1 C shall be provided for all important parts of the equipment such as: steel plates for parts under hydraulic pressure, all major castings (runner, shutoff valve, etc.), large forgings (turbine and generator shaft etc.), high stressed large bolts etc.

For less important parts, certificates according to DIN 50049-2.3 are acceptable.

Materials shall be new and of first-class quality, suitable for the purpose, free from defects and imperfections, and the classifications and grades in conformance with the latest issue of the respective ASTM, AISI, DIN or BS standard. Material to other standards may be used if approval by the Owner has been obtained. Material specifications, including grade or class data, shall be shown on the appropriate detail drawings submitted for review.

The vendor shall indicate in the Technical Data Schedules, the materials and applicable standards for all major parts of the supply.

The materials shall be carefully selected for the intended purpose and due consideration of the site conditions and the tropical environment. Higher grade material shall be used where ordinary material is insufficient.

"Not withstanding reference made to various standards all equipment and works as per provisions and requirements of relevant and latest Indian Standards shall be acceptable".

In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.

The international SI-system of units shall be used for documents, calculations, correspondence, drawings etc.

4. MATERIAL/ WORKMANSHIP

i. General Requirement

Where the specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered Equipment it is understood that the same must be new, of highest grade of the best quality of their kind conforming to best engineering practice and suitable for the purpose for which they are intended.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be devised, constructed and documented so that the component parts

shall be accurately positioned and restrained to fulfil their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from purchaser.

Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall be interchangeable with, and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, levelling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances and instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture's limits suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

The vendor/ contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The vendor/ contractor shall apply all operational lubricants to the equipment installed by him.

All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the vendor/ contractor has any special requirement for the specific application of a type of oil or grease not available in India. If such is the case, he shall declare in the proposal, where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian vendor/ contractor. The same shall be applicable to other consumables too.

The vendor/ contractor shall furnish the following:

- All oil for initial filling of all equipment supplied, plus 10% additional.
- Grease if required for initial filling of all of the equipment, plus 10% additional.

- Flushing fluids to flush and clean all systems.

ii. Provisions for Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favourable to the growth of fungi and mildew. The indoor equipment's located in non-air conditioned areas shall also be of same type.

5. COLOUR SCHEME AND CODES FOR PIPE SERVICE/ PANELS

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 Owner. Identification of the respective conductors shall be in accordance with the requirements of IEC publication 204. In cable having 5 conductors or more the individual conductors shall be numbered throughout the entire length. In cables having less than 5 conductors colour coding in accordance with IEC Recommendations 204 shall be used.

The vendor/ contractor shall propose a colour scheme for those equipment/Items for which the colour scheme has not been specified in the specification for the approval of purchaser. The decision of purchaser shall be final. The scheme shall include,

Live parts of electrical connections shall be colour coded as follows,

Conductor Designation	Coding Alphanumeric	Symbol	Colour
AC network 3 phase	Phase 1	R	Red
	Phase 2	Y	Yellow
	Phase 3	B	Blue
	Neutral	N	Black
AC single phase	Phase	P	Red
	Neutral	N	Black
	Earth	E	Green yellow
DC network	Positive	a	Red
	Negative	b	Black

Colour Coding for Mimic Diagrams

Mimic diagrams to be arranged on switchgear cubicles, control panels/desks, etc., shall be colour coded as follows,

420kV	Gold
13.8kV	Signal red
415V	Black
220V DC	Violet
48V DC	White

All the steel works shall be thoroughly cleaned of rust, scale, oil, grease, dirt and scarf by pickling, emulsion cleaning, etc. The sheet steel shall be phosphated /oven dried and then painted with two coats of zinc rich primer paints. After application of the primer, two coats of finished synthetic enamel paint shall be applied. The colour of the finished coats inside shall be glossy white and exterior of the treated sheet steel shall be shade 631 of IS 5 /RAL 7032 for all switchboard /MCC/distribution board, control panels etc.

Sufficient quantities of touch paint shall be furnished for application at site. All the indoor cubicles shall be the same as exterior surface and for other miscellaneous items, colour scheme will be approved by the purchaser.

6. PROTECTION

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

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

7. FUNGI-STATIC VARNISH

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

8. SURFACE FINISH

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

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

9. GALVANIZING

The minimum weight of the zinc coating shall be 610 gm/sq.m and minimum average thickness of coating shall be 86 microns for all items having thickness 6mm and above. For items lower than 6mm thickness requirement of coating thickness shall be as per relevant ASTM. For surface which shall be embedded in concrete, the zinc coating shall be 610 gm/sqm minimum.

10. TRANSPORT AND PACKING

i. Packing

The bidder is advised to have a total study of all aspects of transportation of equipment's to site and should make schedule of transportation in accordance with the prevailing conditions at site. The bidder shall specifically understand that the Purchaser will do the general co-ordination of storage and erection works as well as civil engineering works of power house. An appropriate Period for transportation shall be considered accordingly.

The delivery dates, transportation and erection periods and for all other associated activities indicated in the Contract Documents shall be strictly adhered to. Changes, which are unavoidable or necessary, will be regulated in accordance with the stipulations laid down in the General Conditions of Contract.

From the time of manufacturing until commissioning all parts of the plant shall be protected and insured at the vendor/ contractor's expense against loss & damage of any kind. Parts, which are damaged during transport, storage, erection or trial operation, shall be replaced at the vendor/ contractor's expense.

ii. Packing and Marking

The vendor/ contractor shall prepare all plant, devices and materials for shipment to protect them from damage in transit, and shall be responsible for and make good all damages due to improper preparations, loading or shipment.

After the workshop assembly and prior to dismantling for shipment to the Site, all items of machinery and plant shall be carefully marked to facilitate site erection. Wherever applicable, these markings shall be punched or painted so that are clearly visible.

Dismantling shall be done into convenient sections, so that the weights and sizes are suitable for transport to Site and for handling on the Site under the special conditions of the Project.

All individual pieces shall be marked with the correct designation shown on the vendor/ contractor's detailed drawings and other documents (packing, lists, spare part lists, in Operating and Maintenance Instructions, etc.).

Each piece, separately shipped, or smaller parts packed within the same case or box, shall be legibly, marked to show the unit to which it is a part and match-marked to show its relative Position in the unit.

Unit marks and match-marks shall be done preferably by punching the marks into the metal before painting, galvanizing, etc., and shall be clearly legible after painting, galvanizing etc. In labelling, the vendor/ contractor shall endeavour to use as few designations as possible, and each part of identical size and detail shall have the same designation, regardless of its final position in the plant.

All parts of the plant shall be packed at the place of manufacture; the packing shall be suitable for shipment by sea and for all special requirements of the transportation to Site. Where necessary, double packing shall be used in order to prevent damage and corrosion during intermediate storage.

All identical members shall be packed together, if reasonably possible, in a form convenient for shipment and handling.

Small items shall be packed in boxes and large items shall be protected where necessary, by timber, straw and sacking. Drums shall be used for electric cables, steel ropes, steel wire and similar materials. All bolts, nuts, washers. etc., shall be packed in containers. Each container shall include only bolts, nuts or washers of identical size.

All parts shall be suitable protected against corrosion, water, sand, heat, atmospheric conditions, shocks, impact, vibrations, etc.

All electrical parts shall be carefully protected from damage by sand, moisture, heat or humid atmospheric conditions by packing them in high pressure polyethylene foil. Where parts may be affected by vibration, they shall be carefully protected and packed to ensure that no damage will occur while they are being transported and handled.

Spare parts shall be packed separately and designated as specified and shall be delivered properly and adequately packed for several years' storage. All packing costs shall be included in the scope of Work.

iii. Shipping marks

The vendor/ contractor shall mark all containers with the implementing document number pertinent to the shipment. Each shipping container shall also be clearly marked on at least two sides as follows,

Consignee:

Contract No.:

Port of destination:

Item number (if applicable):

Package number, in sequence:

Quantity per package:

Description of Work:

Net and gross weight, volume, Dimensions:

iv. Packing lists

The vendor/ contractor shall provide the Purchaser with one (1) original and two (2) copies of all shipping documents and relevant packing lists of each shipment of equipment items after the same has been shipped. One copy (1) of the packing list shall sent to the Purchaser's Representative. All packing lists shall contain the name of the vendor/ contractor or supplier and shall show the complete markings on each packed box or crate that has been shipped. Separate packing lists shall be prepared for each and all shipments made. One copy of the packing list shall be placed inside each box or crate, and one copy inserted in a weatherproof envelope affixed to the outside of each box or crate.

11. HANDLING, STORING AND INSTALLATION

Vendor/ contractor may engage manufacturer's Engineers to supervise if required for unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser. Vendor/ contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, vendor/ contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Vendor/ contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning.

Vendor/ contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the vendor/ contractor. The vendor/ contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances, the vendor/ contractor shall immediately proceed to correct the discrepancy at his risks and costs.

12. DEGREE OF PROTECTION

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

a) Installed out door: IP-55

b) Installed indoor in air conditioned area: IP-42

c) Installed in covered area IP:52

d) For LT switchgear (AC & DC distribution Boards): IP-54

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

13. RATING PLATES, NAME PLATES AND LABELS

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. Nameplates of distributing agents only will not be acceptable. Nameplates shall also be provided for identification of all panels, cubicles and other enclosures as well as for panel-mounted devices, dials, gauges instruments and control devices. Nameplates shall be marked with the nomenclature and units of measurement used in the metric system (SI- units), and a schedule of such markings shall be submitted for review. Type of nameplates and wording on identification nameplates shall be submitted in English for approval. The Owner will translate the text if needed and the vendor/ contractor shall furnish and attach the nameplates.

Cautionary signs: English shall be used as prime language on nameplates required for caution or warning signs, identification plates for control devices, and instruction plates.

Other nameplates: Nameplates which are not required for the operation of the equipment and are not of a cautionary or warning nature required for the safety of personnel, i.e. showing motor speeds, horsepower, electrical characteristics, name and address of manufacturer and other information necessary for maintenance and repair work are to be in English.

14. EARTHING

Circuit breakers, LA, Isolator, CVT, CT, BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat. Control panels, Relay panel, outdoor marshalling boxes, Junction boxes, lighting panels and distribution board shall be provided with two grounding pads, for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earth wire.

All equipment such as cubicles, motors, etc. shall be connected directly to the grounding system using copper wire of area not less than 50 mm2 at two different points. In general all iron parts such as supports, covers, railing, etc. shall be connected to the grounding system. Each conductor shall have its own separate connection point. Pressed on closed shoes shall be used for connections to bars.

15. TERMINAL BLOCKS AND WIRING

i. Wiring

Wiring within cubicles and equipment enclosures shall conform to requirements of this section unless otherwise specified. Control wiring shall be stranded copper and shall be not smaller than 2.5 mm2, except as otherwise agreed by the Owner. Larger size wiring shall be used where needed for the current carrying capacity requirements.

Cables shall have at least 1100 V PVC insulation except for 220V DC and telemetering or communication system equipment for which 650V and 300V rating respectively are acceptable.

For current and potential transformer secondary circuits the cross section of the conductors shall not be less than 6 mm2 and 4 mm2 respectively.

Wiring shall terminate at terminal blocks at one side only. Where tap connections are required they shall be made on terminal blocks. Wiring shall be neatly arranged and laid in conduits accessible from the front door. The conduits 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.

ii. Terminal blocks

The terminal blocks shall be located to allow a neat and easy connection work and shall be safely accessible while the equipment is in service. Control circuits and power circuits shall be completely separated by use of divided or separate terminal blocks. Power terminal blocks shall be rated in accordance with applicable standards, and shall be provided with covers. Control wiring terminal shall be equipped with facilities for opening the circuit. It shall be possible to interchange a single terminal block for a new one without dismantling a whole row. Current transformer terminal blocks shall have provisions for short circuiting. Not more than two wires shall be connected to any one terminal. Terminal blocks using screws acting directly on the wire will not be accepted. At least 20% spare terminals shall be provided. Terminals shall be marked with printed labels.

But preferably the terminal blocks shall be non-disconnecting stud type equivalent to Elmex type CATM4, Phoenix cage clamp type of Wedge or equivalent. The Insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

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

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

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

16. ELECTRICAL EQUIPMENT ENCLOSURE

i. General

All electrical equipment, apparatus and devices shall be of suitable design for satisfactory operation under the conditions prevailing at the Site. The equipment shall operate satisfactorily under normal load and voltage variations in accordance with IEC Publications.

The design shall also include all necessary provisions ensuring the safety of the operating and maintenance personnel.

All electrical connections and contacts shall be of ample cross section and capacity for carrying continuously the specified currents without undue heating and shall be secured by bolts or set-screws of ample size, fitted with locknuts or lock washers of approved types.

Unless otherwise expressly stated, conductors and all other current carrying parts shall be electrolytic copper in accordance with approved, applicable standards.

Cubicles and other enclosures containing electrical equipment shall be especially treated to prevent corrosion. All cubicles shall be provided with a door switched lighting fixture and a single phase socket for power outlet.

All interior surfaces of electrical apparatus, enclosures etc. including contactors, relays, coils, etc., shall be treated in an approved manner to prevent mould growth. Such treatment shall in no way interfere with the proper operation of the equipment either electrically or mechanically.

Bigger assemblies such as switchboards, etc., shall be designed to present suitable transportation divisions adapted to the local conditions within the plant.

Unless otherwise specifically called for or described in these Contract Documents all electrical appliances shall conform to the applicable IEC Publications.

ii. Construction requirements

All cubicles and enclosures shall be of good quality standard production subject to approval by the Owner. Cubicles shall be free floor standing type, of rigid frame covered with removable steel sheets. The frame shall be bolted to the floor. There shall be provision and enough space for entrance of cables from above or below as necessary. The cubicles shall be ventilated if needed; in this case removable filter inserts shall be fitted to the air entrance openings. Provision for cable fastening shall be inside the cubicles and enclosures, and sufficient space from cable fastenings to nearest terminal. All control and indicating instruments such as contactors, circuit breakers, auxiliary relays, indicating instruments, switches etc., shall be functionally displayed in appropriate location. All indicating devices shall be visible with the door closed. The layout is subject to the approval of the Owner.

If required, flush mounted hinged steel doors with latches shall be available: doors shall be with approved locks. The locks shall be of the same type throughout the plant. All panels and cubicles shall have a uniform appearance.

The cubicles and enclosures shall be of protection class IP 54 or higher according to their location, unless otherwise, there are constraints which may prevent to maintain above protection class and same shall be justified by the vendor/ contractor and approval shall be taken from the owner for the deviation. All cubicles shall be equipped with automatically controlled heating elements for protection against internal condensation and moisture.

All panels/cubicles shall have approximately 20% space for mounting of future devices.

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

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

17. SPACE HEATERS

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

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

18. QUALITY

All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the vendor/ contractor for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the vendor/ contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award.

Manufacturing Quality Plan will detail out for all the components and equipment, various tests/ inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by vendor/ contractor's/ sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/

performance testing. The Quality Plan shall be submitted on electronic media e.g. E-mail in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD-ROM.

Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the vendor/ contractor's "Site Quality Control Organisation", during various stages of site activities starting from receipt of materials/equipment at site.

The Bidder shall also furnish copies of the reference documents/plant standards/ acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/ standards etc. will be subject to Employer's approval without which manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval.

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

All material used for equipment manufacture including casting and forging 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.

The vendor/ contractor shall submit to the Employer Field/ Site Welding Schedule for field welding activities. The field/site welding schedule shall be submitted to the Employer along with all supporting documents, like welding procedures, heat treatment procedures, procedures etc. at least ninety days before schedule start of erection work at site.

All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/ BS-4870 or other International equivalent standard acceptable to the Employer.

All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing.

All brazers, welders and welding operators employed on any part of the contract either in vendor/ contractor's/ sub-contractor's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS- 4871 or other equivalent International Standards acceptable to the Employer.

Welding procedure qualification & Welder qualification test results shall be furnished to the Employer for approval. However, where required by the Employer, tests shall be conducted in presence of Employer/authorised representative.

Any other statutory requirements for the equipment/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding.

Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.

No welding shall be carried out on cast iron components for repair.

All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.

The vendor/ contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the sub-contractor proposed by the vendor/ contractor for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment etc., list of which shall be drawn up by the vendor/ contractor and finalised with the Employer, shall be subject to Employer's approval. The vendor/ contractor's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-contractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion.

For components/equipment procured by the vendor/ contractors for the purpose of the contract, after obtaining the written approval of the Employer, the vendor/ contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-contractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc. Such quality plans of the successful vendors shall be finalised with the Employer and such approved Quality Plans shall form a part of the purchase order/ contract between the vendor/ contractor and sub-contractor. 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, quality plans and delivery

conditions shall be furnished to the Employer on the monthly basis by the vendor/ contractor.

Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the vendor/ contractor's or their sub-contractor's quality management and control activities. The vendor/ contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.

The vendor/ contractor shall carry out an inspection and testing programme during manufacture in his work and that of his subcontractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Vendor/ contractor shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.

Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer 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 vendor/ contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.

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

Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.

19. DOCUMENTATION

i. List of Documents

The bidder shall submit a detailed list of drawings / documents along with the bid proposal which he intends to submit to the Employer after award of the contract.

The supplier shall necessarily submit all the drawings / documents unless anything is waived.

All engineering data submitted by the vendor/ contractor after final process including review and approval by the Employer shall form part of the Contract Document and the entire works performed under this specification shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

ii. Drawings

All drawings submitted by the vendor/ contractor including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required, the dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and interconnection between various portions of equipment and any other information specifically requested in the specifications.

Each drawing submitted by the vendor/ contractor shall be clearly marked with the name of the Employer, the unit designation, THDCIL contract no. and the name of the Project. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the vendor/ contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Employer if so required.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the vendor/ contractor's risk. The vendor/ contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Employer. Approval of vendor/ contractor's drawing or work by the Employer shall not relieve the vendor/ contractor of any of his responsibilities and liabilities under the Contract.

iii. Approval Procedure

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 finalised 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. The following schedule shall be followed generally for approval.

i.	Approval/comments/by employer on Initial submission	Within 3 weeks of receipt
ii.	Resubmission	Within 2 (two) weeks (whenever from date of comments required) Including both ways postal time.
iii.	Approval or comments	Within 2 weeks of receipt of resubmission
iv.	Furnishing of distribution copies	2 weeks from the date of last approval.

Note: The vendor/ 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.

The title block of drawings shall contain the following information incorporated in all contract drawings. Please refer below mention Title block for Submission of Documents.

Title Block

Customer	M/s THDC India Ltd., Rishikesh, Uttarakhand
Project:	Vishnugad Pipalkoti Hydro Electric Project (4X111MW)
Vendor/ contractor:	Bharat Heavy Electricals Ltd.

iv. Documents to be Submitted along with Offer

1. Drawings
2. Guaranteed Technical Particulars
3. Type Test Reports
4. Manufacturing Quality Plan

v. Documentation Schedule

Sl. No.	Description	Tender Stage	Contract stage for approval	Final Documentation	
			Prints	Prints	CDs
1	Drawings and Data Sheets	1	5	10	-
2	Drawings "As Built "	-	-	10	04
3	Type Test Reports	1	2	3	-
4	Erection Manuals	-	2	4	-
5	Operation and Maintenance Manuals	-	2	4	-
6	Manufacturing Quality Plan	1	2	4	-
7	Field Quality Plan	1	2	4	-
8	Inspection Test Reports	-	-	4	-

Soft copies of drawings at contract stage shall also be submitted in PDF format. Drawings will also be submitted in CD in AUTOCAD package for all major items. Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top.

20. ELECTRICAL MEASUREMENTS

All Electrical instruments shall be of flush mounted design, dust and moisture-proof. AC Ammeter and Voltmeters shall have moving iron system of not less than 1.5 accuracy class for connection to the secondary side of instruments transformer.

The indicating elements of each digital indicator shall be seven segment LED illumination type. The number of digits of each digital indicator shall be selectable to be sent the required indication. The watt and the var indicators for the circuits where direction of power flow may be changed, shall be provided with "+" and "- "signs.

All transducers shall be solid –state type with an output signal range of 4-20mA DC OR 1 to 5V DC, unless otherwise specified.

All wells for capillary type thermometers, resistance temperature sensors and thermocouples shall be of the weld-in type. Wells for thermometers and temperature sensors of the screw-in type shall be restricted to measuring points for lubrication oil, and to such measuring points where welding is not suitable, e.g., at cast-iron parts. Shop-welded thermometer wells be covered by screw caps for protection during transportation and erection.

Resistance thermometers and thermocouples shall be equipped with waterproof connection heads. Thermometer arrangements shall be such that the connection heads do not become warmer than 80OC, and the measuring inserts are easily exchangeable.

The temperature sensors shall be selected in such a way to minimize the number of different spare inserts.

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(s) 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: Technical Checklist

A) Technical Parameters-400kV Post Insulator

The offer may not be considered, in case, following information & checklist are not enclosed. Put a tick mark (√) on 'YES' if the specified requirement is met, or put a tick mark on 'NO', if the specified requirement is not met and give comments in the "Remarks" column.

	TECHNICAL CHECK LIST		
1	**Un-priced BOQ**		
1.1	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) Record the same in schedule of technical deviations.	Confirmed	Yes/No
2	**TYPE TESTS REQUIREMENTS**		
2.1	All equipment being supplied shall conform to type tests as per technical specification (and relevant IS/IEC standards) and shall be subject to routine tests in accordance with requirements stipulated under respective sections.	Confirmed	Yes/No
2.2	Type test report for item has been 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
2.3	In case the test reports are not found technically valid during contract stage by BHEL/Customer, the bidder shall repeat these test(s) at no extra cost to the purchaser and no delivery implication.	Confirmed	Yes/No
2.4	The validity of type test reports shall be as per the latest CEA guidelines (amended time to time) as on the original scheduled date bid submission for BHEL tender. In case, where type test certificates are older than period as per latest CEA guidelines (amended time to time), bidder/ manufacturer shall carry out the type tests prior to dispatch of equipment without any commercial implication on BHEL/ THDCIL.	Confirmed.	Yes/No
3	**GENERAL**		
3.1	Post insulator shall be supplied complete with Hot Dip Galvanized hardware for inter unit joining and fixing to structure (both top & bottom).	Confirmed	Yes/No

B) TYPE TESTS

i) Whether type test reports of the tests as per relevant IS/ IEC conducted earlier on identical or similar material are available (test reports are of the test conducted within 10 years as on date of bid opening.

(YES)

ii) If type test reports are not acceptable to Customer/ BHEL, then above tests shall be conducted by the bidder free of cost.

(YES)

Date: Bidder's Stamp & Signature

ANNEXURE-D: Guaranteed Technical Particulars
(400kV Post Insulator & its accessories)

Sl. No.	Description	Particulars
1	General	
i)	Manufacturer's Name	
ii)	Applicable standards	
2	No. of Units/Stacks	
3	Provision of corona ring	
4	Provision of corona ring	
5	Diameter of Insulator	
6	PCD for bolts	
7	Guaranteed electro-thermal-mechanical strength (Tension, Bending & Torsion)	
8	Dry flashover voltage	
9	Wet flashover voltage	
10	Impulse test 1.2/50 micro second full wave withstand	
11	Switching impulse withstand voltage	
12	Overall Height	
13	Weight of one complete insulator	
14	Creepage distance	
i)	Total	
ii)	Protected	
m)	RIV for complete stack	
n)	Cantilever strength	
i)	Upright	
ii)	Under hung	

Date: Bidder's Stamp & Signature