TECHNICAL PRE QUALIFICATION REQUIREMENT

Name of Project : - 400kV Switchyard for 1x660MW Panki TPS

Name of Customer : -UPRVUNL

Name of Item : - ABT Meter

TECHNICAL PRE QUALIFICATION REQUIREMENT
a) The manufacturer whose energy meters are offered should have manufactured, tested and supplied the energy meters for a Power Utility/ transmission utility within the last ten (10) years as on date of schedule date of bid opening of this tender. b) The bidder should be manufacturer/ authorized distributor of the energy meter quoted.

SUPPORTING DOCUMENTS TO BE ATTACHED		
Sr	**Required Criteria**	**Supporting Documents to be submitted by bidder along with technical bid**
1	Manufacturer/ Authorized Distributor	Proof of Manufacturing facilities/ Valid authorization letter from OEM etc.
2	Supply	PO / Dispatch clearance / LR / Material Receipt certificate at site / installation or commissioning certificate etc.

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.

PREPARED BY

24/06/22

REVIEWED BY

24/06/22

APPROVED BY

24.6.22

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NOIDA

DOCUMENT NO.	TB-401-510-E40	Rev 00	Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECFICATION	NAME	PC	RD	VK
TITLE		SIGN			
		DATE	23.6.22		23.6.22
ABT METER		GROUP	TBEM		
		WO No.			

CUSTOMER	UPRVUNL
PROJECT	400kV Switchyard at 1x660MW Panki TPS

Contents

Remarks: Bidder to note that data and details of Guaranteed Technical Particulars & Design documents shall not be reviewed during Technical Evaluation/ Review, hence compliance of Guaranteed Technical Particulars in line with Technical Specification shall be bidder's responsibility.

Rev	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 requirement of design, manufacture, testing at works, proper packing & dispatch of ABT Meter as per contract. The electrical scope of work under this requisition shall include but not be limited to manufacturing, supply, transportation, inspection at manufacturer's work, commissioning including site testing, acceptance testing of the meter. No deviation from the requirements specified in various clauses of this specification shall be allowed. A certificate to this effect shall have to be furnished along with the offer.
The meters offered shall be of UPRVUNL/UPPTCL approved make or its subsequent approval from UPRVUNL/UPPTCL shall be bidder's responsibility, with no commercial implications to BHEL. If any of the make offered by the bidder is not acceptable to M/s UPRVUNL/UPPTCL, the bidder has to supply alternate UPRVUNL/UPPTCL approved make, meeting the specification, with no commercial implications to BHEL.
Wherever bidder offers any item/spare in lieu of the same being "Built-in feature" of any fitment or the same being "Not applicable" is subject to approval by UPRVUNL/UPPTCL. No price implication will be entertained by BHEL at contract stage if any separate item is insisted by UPRVUNL/UPPTCL to meet the contract requirement.

This section covers the specific technical requirements of the ABT Meter. This constitutes minimum technical parameters for the above item as specified by the BHEL/ UPRVUNL/ UPPTCL. The offered ABT Meter shall also comply with the Section-2 (Equipment Specification Under Scope of Supplies) of this specification and Section-3 (Project Details and General technical requirements for all equipment under the Project)
Note: The terms used in this specification namely, "Employer/Purchaser" refers to UPRVUNL/UPPTCL, "Contractor "refers to BHEL & "Sub-contractor" refers to successful bidder.

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)
Annexures		Annexure A- Schedule of Technical Deviations Annexure B- Compliance Certificate to Technical Specification

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/ UPRVUNL/ UPPTCL concurrence shall, however, be obtained before taking a final decision in such matters.

1. Statutory Regulations
2. Section-1
3. Section-2

4. Section-3

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/UPRVUNL/ UPPTCL will resolve listed conflicts prior to award. In case of ambiguity, bidder shall inform BHEL of their interpretation. In case bidder fails to convey the same prior to award, BHEL/ UPRVUNL/ UPPTCL 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-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 ABT Meters are required for the following project:

Name of the Customer:	Uttar Pradesh Rajya Vidyut Utpadan Nigam Limited
Consultant:	NTPC Ltd.
Name of Main Contractor:	Bharat Heavy Electricals Limited
Name of the Project:	1x660MW Panki TPS

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

2. CODES & STANDARDS

The various equipment covered under this specification shall comply with the requirements of the latest edition of the relevant IEC/IS/IEEE/ISO standards only. Preference for latest IEC standards for particular equipment / system shall be governed over IEEE/ IS/ ISO standards. Further rules, guidelines and standard laid down by international/ national agency shall be applicable in this specification.

3. SPECIFIC TECHNICAL REQUIREMENTS

Technical requirements for the meters shall be as per Section-2. Specific requirement is follows:

Sl. No.	Technical Parameters	Particulars
	Equipment	ABT Meter
(i)	Accuracy	0.2s
(ii)	Communication ports	RS232/ RS485/ Ethernet ports
(iii)	Standards to which meter complies	Microprocessor-based conforming to IEC 62052-11, IEC 62053-22, IS 14697
(iv)	Demand integration period	5 min and 15 min block
(v)	Memory Capacity	40 days

4. BILL OF QUANTITIES

SN	Detailed Description	Unit	Total Qty
1.	ABT Compliant Main Meters	Nos.	2
2.	ABT Compliant Check Meters	Nos.	2
3.	MRI along with necessary base computing software	Nos.	1
4.	Energy Metering panel	Nos.	1

Notes:

1. The ABT meters shall be microprocessor-based MWH meters having an accuracy class of 0.2S or better. MVARH meters shall have accuracy class of 0.5 or better.
2. These meters shall have provision for downloading of data through an optical port and /or through RS 232/485/ Ethernet port.
3. The Date/time shall be displayed on demand. The clock shall be synchronized by GPS time synchronization equipment being supplied by the contractor on SNTP over Ethernet.
4. Meters must also comply with any other additional/latest requirements as notified by CEA/CERC even if not specified in relevant clauses.
5. Site support at the time of commissioning shall be deemed to be included in the offer by the bidder. No price implication shall be entertained at later stage.

5. TECHNICAL PRE-QUALIFYING REQUIREMENT:

Please refer document: Annexure_TQR

6. DRAWINGS & DOCUMENTATION

6.1. Drawings / documents required for engineering manufacturing clearance

The drawings/ documents, as follows shall be used for providing engineering manufacturing clearance of the equipment and furthermore, it shall be used for delay analysis, if any from bidder. The schedule for submission and resubmission shall be in line with activity schedule of Purchase Order. The successful bidder is required to submit drawings and documents that shall cover but not limited to the following:

Sl.	Description of Drawing
1	ABT Meter - Guaranteed Technical Particulars/ catalogues
2	ABT Meter - Test Reports/ Test Certificate

NOTE:

1. Date of Submission of first lot of drawings/ documents shall be counted only from the date of submission of reasonably correct drawings/ documents.
2. The successful bidder shall ensure vendor approvals, if required as well as approvals of all requisite drawings/ datasheets/ type test reports/ QAP etc, wherever required, for the offered equipment as per this specification from UPRVUNL/UPPTCL.

3. The successful bidder shall have to extend all possible supports like timely submission/ resubmission 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 approval

7. TYPE TEST

The manufacturer shall submit the type test reports as per relevant IEC/ International standards for the offered make/model to the employer. It is completely on the discretion of the end customer to accept/ repeat the type test report. No price implication shall be entertained during contract stage/later stage for respective type test repetition.

8. PACKING AND DISPATCH

1. All equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site. While packing all the materials, the limitations from the point of view of availability of transportation facilities in India should be taken into account. The Bidder shall be responsible for any loss or damage during transportation, handling and storage.

2. The Bidder shall include and provide for security, protection and packing the equipment so as to avoid loss or damage during transport by any mode.

3. The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbols i.e. FRAGILE, HANDLE WITH CARE, THIS SIDE UP etc. along with WEIGHT, OWNER PARTICULARS/ PO Nos.

4. Any material found short inside the packing cases shall be supplied by the Bidder without any extra cost.

5. 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 as per relevant Clause of Section 2 & Section-3.

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SECTION 2

EQUIPMENT SPECIFICATION UNDER SCOPE OF SUPPLIES

1. ABT Based Tariff Energy Meters:

The Energy meter is of class 0.2s accuracy suitable for ABT requirement as specified below in Clause 1.1 shall be provided. All ABT type meters shall be fed from accuracy class 0.2s CT and accuracy class 0.2 CVT/VT/PT.

The metering system shall have following features:

i. Meters shall be microprocessor-based MWH meters having an accuracy class of 0.2S or better. MVARH meters shall have accuracy class of 0.5 or better.

ii. These meters shall have provision for downloading of data through an optical port and /or through RS 232/485/ Ethernet port.

iii. Even under absence of VT input, energy meter display shall be available, and it shall be possible to download data from the energy meters.

1.1. Technical Requirements of Energy Meters for ABT Requirement

Contractor shall supply energy meters as per the technical specification given below:

i. Shall be microprocessor-based conforming to IEC 62052-11, IEC 62053-22, IS 14697

ii. Shall carry out measurement of active energy (both import and export) and reactive energy (both import and export) by 3-phase, 4 wire principle suitable for balanced/ unbalanced 3 phase loads.

iii. Shall have an accuracy of energy measurement of at least Class 0.2S for active energy and at least Class 0.5 for reactive energy.

iv. The active and reactive energy shall be directly computed in CT & VT primary ratings.

v. The reactive energy shall be recorded for each metering interval in four different registers as MVARh (lag) when active export, MVARh (Lag) when active import, MVARh (lead) when active export, MVARh (Lead) when active import.

vi. Two separate registers shall be provided to record MVARH when system voltage is >103% and when system voltage is < 97%.

vii. Shall compute the net MWh and MVARh during each successive 5 minute and 15-minute block metering interval along with a plus/minus sign, instantaneous MWh, instantaneous MVARh, average frequency of each 5 minute and 15 minutes, net active energy at midnight, net reactive energy for voltage low and high conditions at each midnight.

viii. Each energy meter shall have a display unit. It shall display the net MWh and MVARh with a plus/minus sign and average frequency during the previous metering interval; peak MW~~h~~ demand since the last demand reset; accumulated total (instantaneous) MWh and MVARh with a plus/minus sign, date and time; and instantaneous current and voltage on each phase.

ix. All the registers shall be stored in a non-volatile memory. Meter registers for each metering interval, as well as accumulated totals, shall be downloadable. All the net active/reactive energy values displayed or stored shall be with a plus /minus sign for export/import.

x. At least the following data shall be stored before being over-written for the following parameters: -

	Parameters	**Details**	**Min No. of days**
1	Net MWH	5 min and 15 min block	40 days in meter
2	Aver Freq	5 min and 15 min block	40 days in meter
3	Net MVARH for V>103%	5 min and 15 min block	40 days in meter
4	Net MVARH for V<97%	5 min and 15 min block	40 days in meter
5	Cumulative Net MWH at every midnight	5 min and 15 min block	10 days in meter/ 40days in PC
6	Cumulative Net MVARH for V>103% at every midnight		10 days in meter/ 40days in PC
7	Cumulative Net MVARH for V<97% at every midnight		10 days in meter/ 40days in PC
8	Date and time blocks of VT failure on any phase		

xi. Shall have a built-in clock and calendar with an accuracy of less than 15 seconds per month drift without assistance of external time synchronizing pulse.

xii. Date/time shall be displayed on demand. The clock shall be synchronized by GPS time synchronization equipment being supplied by the contractor.

xiii. The voltage monitoring of shall be inbuilt feature provided to signal failures to the Substation Automation System, the meter shall be suitable to operate with power drawn from the VT supplies.

xiv. The power supply to the meter shall be healthy even with a single-phase VT supply. An automatic backup, in the event of non-availability of voltage in all the phases, shall be provided by a built-in long-life battery and shall not need replacement for at least 10 years with a continuous VT interruption of at least 2 years. Even under absence of VT input, energy meter display shall be available, and it shall be possible to download data from the energy meter. In case data downloading is not possible in absence of VT supply, meter with provision of 220V DC auxiliary supply shall be provided. Date and time of VT interruption and restoration shall be automatically stored in a non-volatile memory.

xv. Shall have an optical port on the front of the meter for data collection from either a hand-held meter reading instrument (MRI) having a display for energy readings or from a notebook computer with suitable software.

xvi. Meters must also comply with any other additional/latest requirements as notified by CEA/CERC even if not specified in relevant clauses.

1.2. Type Test Requirements

ENERGY METER: All type test reports as per IEC 62052-11/IEC 62053-22

2. Energy Metering Panel

2.01.00 Construction

2.01.01 The Metering Panels shall be totally enclosed, floor mounted free-standing, dead-front assemblies with IP42 degree of protection. Instruments/meters shall be mounted on the panel with annunciator windows on the top. All control switches, selector switches etc. shall be suitable for mounting on mosaic grid.

2.01.02 Design, material selection, and workmanship shall be such as to present a neat appearance outside and inside with no welds, rivets, screws or bolt heads apparent from the exterior surface of the Boards. The boards shall have a smooth and uniform matt finish, free from scratches, dents and other imperfections.

2.01.03 The panels shall be liberally sized so as to provide spacious layout of equipment and devices with sufficient working space in between.

2.01.04 Each board may consist of a number of panels mounted side-by-side, in which case, these shall be bolted together to form a compact unit. Where two panels meet, the joints shall be smooth, close-fitting and unobtrusive.

2.01.05 The boards shall be of folded sheet steel construction, assembled on channel/angle base plates with anti-vibration mountings.

2.01.06 The boards shall be fabricated of minimum 2 mm thick sheet steel, free from all surface defects. The boards shall have sufficient structural reinforcement to ensure a plane surface, to limit vibration and to provide rigidity during shipment and installation.

2.01.07 All doors and removable covers shall be provided with neoprene gaskets all around and latches sufficiently strong to hold them in alignment when closed. The door operating handle shall have locking arrangement.

2.01.08 All panels shall have rear door with concealed type hinges and pad-locking arrangement. Doors shall be grounded by flexible copper braid. Two-point earthing shall be provided in each panel.

2.01.09 The boards shall be complete with vibration damping pads, stainless steel kick plates, floor channel sills, anchor bolts, and other necessary hardware for mounting.

2.02.00 Equipment Mounting

2.02.01 All instruments, switches, etc. mounted on the front face of the panels shall be flush or semi-flush type. The relay panel shall have complete glass door in the front and relay mounting frame shall be inside the glass door. The mounting frame shall be hinged type front operable.

2.02.02 No equipment shall be mounted on panel door.

2.02.03 All equipment shall be so mounted that removal and replacement may be accomplished individually without interruption of service to others.

2.02.04 All equipment inside the panels shall be so located that their terminals and adjustments are readily accessible for inspection or maintenance.

2.02.05 In case cut-outs are provided on any panel for future mounting of equipment, the same shall be properly blanked off.

2.02.06 Working height shall be limited between 450mm and 1200mm from floor level.

2.03.00 Name Plate

2.03.01 Nameplates shall be provided on each panel and on each instrument or device mounted in the panel.

2.03.02 The material of the nameplates shall be lamicoid or approved equal, 3 mm thick, with white letters on black background.

2.03.03 The nameplates shall be held by self-tapping screws. The size of nameplate shall be approx. 20mm x 75mm for equipment and 40mm x 150mm for panels. The letter height for Main label plate at the front shall be 12mm, Apparatus labels on the front and inside shall have a letter height of 3mm.

2.03.04 Nameplates for panels shall be provided both on the front and the rear.

2.03.05 Nameplates for all devices shall be located below the respective devices.

2.03.06 Instrument and devices mounted on the face of the panels shall also be identified on the rear with the instrument or device number. The number may be painted on or adjacent to the instrument or device case.

2.04.00 Illumination, Space Heating and Receptacles

2.04.01 Each panel shall be provided with interior fluorescent tube with door switch, space heater with thermostat and switch and 5A, 3 pin receptacle with plug. Third pin of the socket shall be effectively grounded through the metallic structure.

2.04.02 Tube, heater and receptacle circuits shall be suitable for available A.C. supply and furnished with individual ON-OFF switch.

2.04.03 The tube shall be located at the ceiling and guarded with protective cage. Space heater shall be located near the floor so as not to pose any hazard to service personnel.

2.05.00 A.C. / D.C. Power Supply

2.05.01 Necessary A.C. and D.C. supplies to each protection panel, as required for service, shall be arranged by the Bidder. Single feeder may be arranged for A.C. supply but duplicate feeders shall be arranged for D.C. supply. These switches shall be mounted inside the panel.

2.05.02 Alarm relays with reverse flag shall be provided to annunciate failure of main incoming A.C. and D.C. supplies and annunciation D.C. supply in each panel.

Lamp indications shall be provided individually for main D.C. supply-1 fail, main D.C. supply-2 fail, and panel annunciation D.C. supply fail. A common A.C electric bell shall be provided to give an audible alarm in case of failure of D.C. supply-1/D.C. supply-2/annunciation D.C. supply in any panel.

A common push-button shall also be provided for cancellation of lamp indication and audible alarm.

2.05.03 MCB shall be provided for the incoming A.C./D.C. power supplies. Bus wires shall be run for power distribution to different panels. Power supply isolation switches shall be 4-pole, single throw, for A.C. (considering single feeder) and 2-pole, double throw with OFF for D.C.

2.05.04 Fuse and link shall be provided for individual circuits for protection and also for isolation from bus wire without disturbing other circuits.

2.05.05 The fuse requirements in each panel shall be grouped in easily accessible fuse locks or distribution panel. The groupings shall be done in a neat and orderly fashion.

2.06.00 Wiring

2.06.01 Each panel shall be fully wired at the factory to ensure proper functioning of protection and metering schemes.

2.06.02 All spare contacts of relays and switches shall be wired up to terminal blocks.
All interconnections between the panels shall be furnished.

2.06.03 Wiring shall be done with flexible, FRLS (fire resistant low smoke), 750 / 1100V grade, PVC insulated; switch board wires with stranded copper conductor. The minimum size of the wires shall be 2.5 Sq. mm. for current & voltage circuits and 1.5 Sq. mm. for control circuits. However, CT circuits with 5A secondary shall be wired with 4 sq.mm copper conductor as a minimum.

2.06.04 Each wire shall be ferruled by plastic tube with indelible ink print at both end having

terminal block no., terminal no. as per approved wiring diagram. Interlocking type ferrules shall be used for identification. A.C. /D.C. wiring shall have separate color-coding.

2.06.05 All wire terminations shall be made with insulated sleeve, solderless type tinned copper lugs. Wire shall not be tapped or spliced between terminals.

2.06.06 Wiring shall be neatly bunched in groups by non-metallic cleats or bands. Each group shall be adequately supported along its run to prevent sagging or strain on the termination.

2.07.00 Terminal Block

2.07.01 All internal wiring is to be connected to external equipment shall terminate on terminal blocks. Terminals shall be 1100V grade and have 10Amps continuous rating, moulded piece, complete with insulated barriers, stud type terminals, washers, nuts and locknuts. Marking on terminal blocks shall correspond to wire number and terminal numbers on wiring diagram. All wiring meant for power supply to transducers, recorders shall be suitably fused or designed to limit short circuit currents. Means for detection of blown or open circuited fuses shall be provided.

2.07.02 Disconnecting type terminal blocks for current and Voltage transformer secondary leads shall be provided. Terminals for C.T. secondary leads shall have provision of shorting and earthing. All PT circuits shall be provided with HRC fuses having special holders such that they cannot be interchanged with other types of fuse holders and other fuse holders cannot be introduced within them.

2.07.03 Not more than two wires shall be connected to one terminal. If necessary, a number of terminals shall be jumpered together to provide wiring points. Separate terminal blocks shall be used for A.C./ D.C. wiring termination.

2.07.04 Unless otherwise specified, terminal blocks shall be suitable for connecting the following conductors of external cable on each side

- All CT : 4 Sq. mm. Cu
- All PT circuits : 2.5 Sq. mm. Cu
- A.C./D.C. Power supplies Circuits : 6 Sq. mm. Cu
- All other circuits : minimum 2x 2.5 sq. mm. Cu

2.07.05 Each terminal shall be identified with designation as per approved schematic. Spare terminals equal in number of 20% active terminals shall be furnished.

2.07.06 The wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.

2.07.07 The terminal blocks shall be located to allow easy access and also to suit floor openings for cable entry.

2.07.08 Unless otherwise specified, terminal blocks shall be mounted vertically with adequate spacing (not less than 100mm) between adjacent rows. The insulation between any two terminals and terminal to frame work shall withstand 2kV rms for one minute.

2.07.09 The bottom of the terminal block shall be at least 200mm above the incoming cable gland plate.

2.08.00 Cable Entry

2.08.01 The panels shall have provision of cable entry from the bottom. Bottom plate shall be provided to make entry dust-tight.

2.08.02 The panels shall have provisions inside for fixing the multi-core cable glands. Cable glands shall be double compression type. Cable gland support plate shall be 4mm thick and mounted not less than 200mm above floor level.

2.09.00 Grounding

2.09.01 50x6mm tinned copper ground bus shall be provided in each panel, extending along the entire length of the assembly. All the panels shall be equipped with a continuous earth bus with connectors and clamps between panels for inter-panel connection of the earth bus.

All the metallic cases of relays, instruments and other panel-mounted equipment shall be connected to the earth bus by 2.5 sq.mm copper wires. CT and PT secondary neutral or common lead shall be earthed at one point only at the terminal block and such earthing shall be made through links. Separate copper earthing shall be made through links. Separate copper earthing flat shall be provided in the panel for cable screens of static equipment.

2.09.02 The ground bus shall have two-bolt drilling with GI bolts and nuts at each end for connection to the station earthing system.

2.09.03 The ground bus shall be bolted to the panel structure and effectively ground the entire assembly. The cases of meters, relays and switching devices shall be grounded through the steel structure.

2.09.04 Whenever a circuit is grounded, a single wire from the circuit shall be run independently to the ground bus and connected to it.

2.10.00 Painting

2.10.01 All steel surfaces shall be sand blasted to remove all rust, scale and foreign adhering matters. The steel surfaces shall be then chemically cleaned, rinsed, phosphated, rinsed and dried.

2.10.02 Immediately after phosphating, the surfaces shall be given two coats of high quality primer and stoved after each coating.

2.10.03 The panels shall be finished with two coats of synthetic enamel paints unless otherwise specified, white inside and approved shade of paint outside. The panels shall be stoved after spraying of each of the finish coatings. Base frame shall be painted black. Alternatively powder coating can be adopted.

2.10.04 The panels shall have a smooth and uniform matt finish, free from scratches, dents and any other imperfections. Sufficient quantity of touch-up paints shall be furnished for application at site.

2.10.05 The Bidders are requested to furnish the details process adopted by them for pre-treatment and painting of sheet metal for the panels.

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

	Particular	**Details**
a)	Customer	Uttar Pradesh Rajya Vidyut Utpadan Nigam Ltd.
b)	Engineer Consultant	DCPL
c)	Engineer Review Consultant/ Inspector	NTPC Ltd.
d)	Project Title	Panki Thermal Power Project (3x660 MW): 400kV Switchyard
e)	Project Location	Place: Panki District: Kanpur State: Uttar Pradesh
f)	Latitude & Longitude	North N26028'20" East E 80014'32"
g)	Nearest Railway Station	Panki
h)	Distance of project location from the Railway station	5 Km
i)	Nearest Major Town	Kanpur
j)	Distance of the town from the project site	16 Km.
k)	Nearest Highway from the project site	National Highway - 25
l)	Nearest airport	Kanpur – 25 Km Lucknow – 80 Km
m)	Nearest commercial airport	440 Km
n)		
	SITE CONDITIONS (for design purposes)	
a)	Design ambient temperature	50°C
b)	Maximum Relative humidity	85 %
c)	Height above mean sea level	Less than 1000 meters
d)	Pollution Severity	Heavily polluted (With Coal dust & Fly ash) and Highly Corrosive environment.
e)	Criteria for Wind Resistant design of structures and equipment	Standard Applicable - IS 875 (Part 3) 1987
f)	Basic Wind speed "Vb" at ten meters above the mean ground level.	47 m/ sec
g)	Siesmic data	Zone-III as per IS: 1893

3.1.1 **SYSTEM PARAMETERS:**

Sl.No.	Parameters	400 kV
1	Highest system voltage	420 kV rms
2	Lightning Impulse voltage	±1425kVp
3	Switching impulse voltage	±1050kVp
4	Power frequency withstand for 1 min (rms)	630 kV(rms)
5	Max. fault level (1 sec.)	50 kA
6	Minimum creepage distance	13020 mm

3.1.2 **AUXILIARY POWER:**

Sl.No.	Nominal Connection Voltage	Variations in Voltage	Frequency	Phase	Neutral
1	415V	±10%	50 (+5% -5%)	3Phase , 4 Wire	Solidly Earthed
2	240V	±10%	50 (+5% -5%)	1 phase	Solidly Earthed

Combined variation of voltage and frequency shall be + 10%. Design fault level of 415V system shall be restricted to 50kA rms for 1 second & for 25kA for 1 sec. for 220V DC system.

The operational limits for variation of DC voltage are (+) 10% to (-) 15%.

3.1.3 The various minimum heights of the switchyard shall be as given below from plinth level:

Voltage	**Equipment /1st Level**	**Main Bus Level**	**Jack Bus Level**	**Peak**
400kV	8000mm	15000mm	23000mm	7500mm

The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or support insulators to the bottom of the equipment structure, where it rests on the foundation pad shall be 2550mm.

3.1.4 The minimum clearances for 400kV switchyard shall be as given below:

Phase to earth clearance	3500 mm
Phase to phase clearance	4200 mm
Section clearance	6500 mm

3.2 INSTRUCTION TO BIDDERS

The bidders shall submit the technical requirements, data and information as per the technical data sheets, provided in Section-4.

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification.

It is recognized that the bidders may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously. All deviations from the specification shall be clearly brought out in the respective

schedule of deviations. Any discrepancy between the specification and the catalogues or the bid, if not clearly brought out in the schedule, will not be considered as valid deviation.

Equipment furnished shall be complete in every 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 Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment under supply shall be inter-changeable with one another.

'Make' of brought-out items are subject to Owner/Purchaser's approval.

The bidder shall furnish relevant details to the Owner/Purchaser for his concurrence before procurement. Makes approved by owner shall only be acceptable.

The bidder shall supply type tested (including special tests as per tech. specification) equipment and materials. The test reports shall be furnished by the bidder along with equipment/ material drawings. In the event of any discrepancy in the test reports, (i.e., if any test report is not acceptable due to any design/ manufacturing changes or due to non-compliance with the Technical Specification and/ or applicable standard), the tests shall be carried out without any additional cost implication to the BHEL. BHEL reserves the right to get any or all type/tests conducted/repeated.

3.3 CODES AND STANDARDS

The Design, manufacture, erection, testing and performance of items and services provided under this specification shall comply with the latest edition including all applicable official amendments and revisions as on date of award of the following standards. In case of conflict between this specification and code (IS Code, standards, etc.) referred herein, the more stringent of both shall prevail. All work shall be carried out as per the codes and standards listed out in the description of each equipment/item.

Indian Electricity Act and Indian Electricity Rules can be obtained from bureau of Indian Standards.

Equipment complying with other internationally accepted standards such as IEC, BS, USA, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision amendments and revision in force on date of opening of bid and shall clearly bring out the salient features for comparison.

The supplier is required to follow local statutory regulations stipulated in the latest amended Electricity Supply Act 1948 and Indian Electricity Rules 1956 (latest), and other local rules and regulations.

3.4 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

The 400 kV system is being designed to limit the power frequency over voltage of 1.5 p.u. and the switching surge over voltage to 2.5 p.u. In 400 kV system the initial value of temporary over voltage could be 2.0 p.u. for 1-2 cycles. All the equipment/materials covered in this specification shall perform all its function satisfactorily without undue strain, restrike etc. under such over voltage conditions. All equipment shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation. All 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, (not applicable for this project) short circuit etc for the equipment .
The equipment shall also comply with the following:

a) All equipments shall be suitable for hot line washing.
b) To facilitate erection of equipment, all items to be assembled at site shall be "match marked".
c) Piping, if any, between equipment control cabinet or operating mechanism to marshalling box of the equipment shall bear proper identification to facilitate the connection at site.
d) All equipment shall be supplied with necessary inter-pole cabling, and its cost shall be included in the cost of equipment.

3.5 ENGINEERING DATA

3.5.1 Drawings

All drawings submitted by the supplier 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 interconnections between various portions of equipment and any other information specifically requested in the specifications.

Each drawing submitted by the Contractor (including those of sub-vendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing number and revisions. 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.

After the approval of the drawings, further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Purchaser, if so required.

The review of these data by the purchaser will cover only general conformance of the data to the specification and documents, interfaces with the equipment provided under specification, external connections and of the dimensions which might affect plan layout. This review by the purchaser may not indicate a thorough review of the dimensions, quantities and details of the equipment, material, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by the purchaser shall not be considered by the contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Contractor's risk. The 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 Purchaser. Approval of Contractor’s drawing or work by the Purchaser shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

All engineering data submitted by the contractor after final process including review and approval by the purchaser shall form part of the contract document and the entire work performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the purchaser in writing.

3.5.2 Approval Procedure

The following procedure for submission and review/approval of the drawings, data, reports, information, etc. shall be followed by Contractor:

a. All data/information furnished by Vendor in the form of drawings, documents, Catalogues or in any other form for NTPC's information/interface and/or review and approval are referred by the general term "drawings".
b. The 'Master drawings list' indicating titles, Drawing Number, Date of submission and approval etc. shall be finalised mutually between Contractor and Employer before the award of contract. This list shall be updated if required at suitable interval during detailed engineering.
c. All drawings (including those of subvendor's) shall bear at the right hand bottom corner the 'title plate' with all relevant information duly filled in. The Contractor shall furnish this format to his subvendor along with his purchase order for subvendor's compliance.
d. Contractor shall submit all the drawings in five (5) copies for review of Employer. Employer shall forward their comments within four (4) weeks of receipt of drawings.
e. Upon review of each drawings, depending on the correctness and completeness of the drawings, the same will be categorised and approval accorded in one of the following categories:

CATEGORY I	Approved
CATEGORY II	Approved subject to incorporation of comments/modification as noted. Resubmit revised drawing incorporating the comments
CATEGORY III	Not approved. Resubmit revised drawings for Approval after incorporating comments/modifications as noted
CATEGORY IV	For information and records

f. Contractor shall resubmit the drawings approved under Category II, III within one (1) week of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision number enclosed in a triangle (e.g 1.2.3. etc.).
g. In case Contractor does not agree with any specific comment, he shall furnish the explanation for the same to Employer consideration. In all such cases Contractor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work.
h. It is the responsibility of the Contractor to get all the drawings approved in the Category I or IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule.
i. Contractor shall not make any changes in the portion of the drawing other than those commented. If changes are required to be made in the portions already approved, the Contractor shall resubmit the drawings identifying the changes (along with reasons for changes) for Employer's review and approval. **Drawings resubmitted shall show clearly the portions where the same are revised marking the relevant revision numbers and Employer shall review only such revised portion of documents.**
j. Approval of drawings will not in any way relieve the Contractor of his obligations of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if such equipment is later found to be defective.

3.5.3 Erection Drawings.

a. Contractor shall furnish erection drawings for the guidance or commencement of erection or the first shipment, whichever is earlier. These shall generally comprise of fabrication/assembly drawings, various component/part details drawing, assembly, clearance data requirements, etc.

The drawings shall contain details of components/ equipment with identification number, match marks, bill of materials, assembly procedures etc.

b. For all major equipment apart from above details, assembly sequence and instructions with check-lists shall be furnished in the form of erection manuals.

3.5.4 Instruction Manual

a. The Contractor shall submit to the Employer preliminary instruction manuals for all the equipments for review. The final instructions manuals incorporating Employer's comments and complete in all respect shall be submitted at least sixty (60) days before the first shipment of the equipment. The instruction manuals shall contain full details and drawings of all the equipments, the transportation, storage, installation, testing, operation and maintenance procedures, etc. separately for each component/equipment along with log record format. These instruction manuals shall be submitted in five (5) copies for approval.

b. If after commissioning and initial operation of the plant, the instruction manuals require any modifications/additions/changes, the same shall being corporate and the updated final instruction manuals shall be submitted.

c. The operating and maintenance instructions together with drawings (other than shop drawings) of the equipment, as completed, shall have sufficient details to enable the Employer to maintain, dismantle, reassemble and adjust all parts of the equipment. They shall give a step by step procedure for all operations likely to be carried out during the life of the plant/equipment, including erection, testing, commissioning, operation, maintenance dismantling and repair. Each manual shall also include a complete set of approved drawings together with performance/rating curves of the equipment and test certificates, wherever applicable. The contract shall not be considered completed for purpose of taking over until such instructions and drawings have been supplied to the Employer.

d. A separate section of the manual shall be for each size/type of equipment and shall contain a detailed description of construction and operation, together will all relevant pamphlets.

e. The manuals shall include the following
   a) List of spare parts along with their drawing and catalogues and procedure for ordering spares.
   b) Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation.

f. A collection of the manufacturer's standard leaflets will not accepted to be taken as a compliance of this clause. The manual shall be specifically compiled for the concerned project.

3.5.5 Operation & Maintenance Manuals

The manual shall be a two rim PVC bound stiff sided binder able to withstand constant usage or where a thicker type is required it shall have locking steel pins, the size of the manual shall not be larger than international size A3. The cover shall be printed with the Project Name, Services covered and Volume / Book number Each section of the manual shall be divided by a stiff divider of the same size as the holder. The dividers shall clearly state the section number and title. All written instructions within the manual not provided by the manufacturers shall be typewritten with a margin on the left hand side.

3.5.6 As Built Drawings

After final acceptance of individual equipment/system by the Owner, the Bidder will update all original drawings and documents for the equipment/ system to "as built" conditions in requisite number.

Drawings must be checked by the Bidder in terms of its completeness, data adequacy and relevance with respect to engineering schedule prior to submission to the Owner. In case drawings are found to be submitted without proper endorsement for checking by the Bidder, the same shall not be reviewed and returned to the Bidder for re-submission. The Bidder shall make a visit to site to see the existing

facilities and understand the layout completely and collect all necessary data/drawings at site which are needed as an input to the engineering. The Bidder shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Owner's scope and submit all necessary drawings/ documents for the same.

3.5.7 Final Submission of drawings and documents:

The Contractor shall furnish the following after approval of all drawings /documents and test reports:

a. List of drawings bearing the Employer's and Contractor's drawing number.
b. Two (2) bound sets alongwith 4 CD-ROMs of all drawing.
c. All documents/designs in two (2) copies as noted above.
d. Contractor shall also furnish six (6) bound sets of all as-built drawings including the list of all as-built drawings bearing drawing numbers. The Contractor shall also furnish two (2) sets of CD-ROMs/ DVD/Portable hard disk of all as-built drawings as decided by the Employer.
e. The Contractor shall also furnish four (4) copies of instruction/ operations & maintenance manuals (after approval) for all the equipments.

3.5.8 TEST REPORTS

Four (4) copies of preliminary test results shall be supplied for approval prior to despatch of the equipment. Bound copies of complete test results shall be furnished later, in number of copies as per attached Distribution Schedule. These shall incorporate all tests carried out on the equipment and its auxiliaries as well as characteristic curves of current transformers including reports on the official test waves, failure detection data and copies of final test oscillograms of both voltage and current with calibration.

3.6 MATERIAL /WORKMANSHIP

Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential 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 and shall ensure satisfactory performance throughout the service life.

In case where the equipment, materials or components are indicated in the specification as "similar" to any special standard the purchaser shall decide upon the question of similarity. When required by the specification or when required by the purchaser the contractor shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Contractor.

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. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill 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 the 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 also be interchangeable 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.

The equipment offered in the bid only shall be accepted for supply, with the minimum modifications as agreed/accepted.

3.7 TROPICAL PROTECTION

All electrical equipment, accessories and wiring shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

Fine mesh screen of corrosion resistant material shall be furnished on all ventilating openings to prevent entry of insects.

3.8 SPACE HEATERS

The heaters shall be suitable for continuous operation at 230 V as supply voltage. On –off switch and fuse shall be provided.

One or more adequately rated thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the compartment and electrical connections shall be made sufficiently away from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and the air and shall consist of coiled resistance wire centered in a metal sheath and completely encased in a highly compacted powder of magnesium oxide or other material having equal heat conducting and electrical insulation properties or they shall consist of resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and the air. Alternatively, they shall consist of a resistance wire mounted into a tubular ceramic body built into an envelope of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in vitreous glaze. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

3.9 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.

3.10 **VENTILATION OPENING**

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

3.11 DEGREE OF PROTECTION

Degree of protection for various enclosures as per IS: 13947 shall be as follows:

1. LT Switchgear/MCC/DBs/Fuse Boards

i. Compartments and busbar chambers upto 1600A	:	IP52
ii. Compartments and busbar chambers above 1600A	:	IP42
iii. Switchgear located outdoor	:	IP55

2. Motors

i. Indoor motors	:	IP55
ii. Outdoor motors	:	IP55 with canopy

3. Transformers

i. Indoor Transformer	:	IP22
ii. Cable box-indoor area	:	IP52
iii. Cable box-outdoor area	:	IP54
iv. Indoor kiosks and marshalling boxes	:	IP54
v. Outdoor kiosks and marshalling boxes	:	IP55
4. Push Button Stations and any other kiosk/box/panel/ enclosure		
i. Indoor	:	IP54
ii. Outdoor	:	IP55
iii. In dusty areas, e.g. conveyor galleries, transfer points, crusher house, bunker floor etc.	:	IP65
5. Junction boxes for cables/wires	**:**	**IP55**
6. Outdoor lighting fixtures	**:**	**IP55**

The degree of protection shall be in accordance with IS: 13947 (Part –I) / IEC-947 (Part-I) / IS 12063/IEC 529. Type test report for degree of protection test, on each type of the box shall be submitted for approval.

3.12 PRESERVATIVE SHOP COATING

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be finish-painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer.

Transformers and other electrical equipment if included shall be shop finished with one or more coats of primer and two coats of high grade epoxy. The finished colours shall be as per manufacturer's standards, to be selected and specified by the Owner at a later date.

Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Contractor after obtaining specific approval of the Employer regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Employer.

All other steel surfaces which are not to be painted shall be coated with suitable rust preventive compound subject to the approval of the Owner.

3.13 RATING PLATES, NAME PLATES AND LABELS

3.13.1 Each equipment shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Employer.

3.13.2 Such nameplates or labels shall be of white non hygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back.

3.13.3 The rated current, extended current rating and rated thermal current shall be clearly indicated in the name plate in case of current transformer.

3.13.4 Rated voltage, voltage factor and intermediate voltage shall be clearly indicated on the nameplate in case of capacitor voltage transformer.

3.13.5 Each switch shall a clear inscription identifying its function. Switches shall also have a clear inscription of each position indication.

3.13.6 All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system.

3.13.7 All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.

3.14 GALVANISING

3.14.1 The galvanised surface shall consist of a continuous film adhering to the steel. The finished surface shall be clean and smooth, and shall be free from defects like dissolved patches, base, spot, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surfaces, flaking or peeling off, etc. The presence of any of these defects shall render the material liable to rejection.

3.14.2 All exposed ferrous parts shall be hot dip galvanised as per IS:2629 & IS:2633, Galvanising shall be uniform, smooth continuous and free from acid spots. Should the galvanising of the sample be found defective, the entire batch of steel shall have to be re-galvanised at Contractor's cost. The amount of zinc deposit shall be not less than 610 gms. per sq.m. of surface area and in addition, the thickness of zinc at any spot shall not be less than 85 microns. The Employer reserves the right to measure the thickness of zinc deposit by Elkometer or any other instrument acceptable to Employer and reject any component which shows thickness of zinc at any location less than 85 microns. The testing on the galvanised materials shall be carried out as per IS:2633.

3.14.3 The amount of zinc deposit over threaded portion of the bolts, nuts and screws shall not be less than 300 gms. per sq. meter of surface area. The amount of zinc deposit on washers shall not be less than 340 gms. per sq. meter of surface area. The threads having extra deposit of zinc shall be removed by die cutting after the completion of galvanising. The removal of extra zinc shall be carefully done so that threads shall have minimum deposits of zinc on them as specified.

3.15 PAINTING

3.15.1 All surfaces to be painted including interior and exteriors of enclosures and other metal parts shall be shot or sand blasted or chemically treated to remove all rust, scale, grease and other adhering foreign matters. If not specified or approved otherwise later, colour of finishing paint shall be RAL 7032 with glossy finish except for panels which shall have matt finish. The paints used shall be epoxy-based or of suitable type to withstand the salty atmosphere prevalent in the coastal areas.

3.15.2 All metal parts not accessible for painting shall be made of corrosion resistant materials. All machine finished or bright surfaces shall be coated with a suitable rust preventive compound and wrapped or otherwise protected.

3.15.3 Paints shall be carefully selected to withstand tropical heat and extremes of weather specified herein. It shall not scale-off or crinkle or be removed by abrasion due to normal handling.

3.15.4 Should finished paint chip-off or crinkle during transit or installation, the Contractor shall arrange for re-painting the equipment at site at his own cost.

3.16 QUALITY ASSURANCE

The Contractor shall follow his standard procedures for quality assurance and control. This shall be in standard format indicating test witness and customer hold point shall be submitted for approval by the successful bidder. A copy of the said standard procedures shall be submitted to the Owner/Purchaser for his reference. However, Owner/Purchaser reserves the right to review the same and give his observations, if any, for compliance.

The procedures shall be in such a form as to clearly delineate the manufacturing sequence, inspection points, tests and test procedures, acceptable ranges/values, reference drawings etc.

Test shall be performed in presence of Owner/Purchaser's representative so desired by the Owner/Purchaser. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

Manufacturing and quality control procedures shall be available for audit to the Owner/Purchaser and/or its representative at the place of manufacture.

The Owner/Purchaser reserves the right to inspect the equipment at the point of manufacture and witness factory and other such tests as may be necessary to ensure conformance to the specification.

The Owner/Purchaser may inspect the Contractor's facilities prior to award of contract.

The Owner/Purchaser may witness any or all of the tests stipulated in the relevant standards and this specification.

The Owner/Purchaser may conduct surveillance of the Contractor's facilities for compliance to his standard procedures of Quality Assurance and Quality Control while work on the specified equipment is in progress.

3.17 QUALITY ASSURANCE PROGRAMME

To ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance program to control such activities at all points, as necessary. Such programs shall be outlined by the Contractor and shall be finally accepted by the Employer/authorised representative after discussions before the award of the contract. The QA program shall be generally in line with ISO-9001/IS-14001. A quality assurance program of the contractor shall generally cover the following:

i. His organisation structure for the management and implementation of the proposed quality assurance programme
ii. Quality System Manual
iii. Design Control System
iv. Documentation Data Control System
v. Qualification data for Bidder's key Personnel.
vi. The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
vii. System for shop manufacturing and site erection controls including process, fabrication and assembly.
viii. Control of non-conforming items and system for corrective actions and resolution of deviations.
ix. Inspection and test procedure both for manufacture and field activities.
x. Control of calibration and testing of measuring testing equipments.
xi. System for Quality Audits.
xii. System for identification and appraisal of inspection status.
xiii. System for authorising release of manufactured product to the Employer.
xiv. System for handling storage and delivery.
xv. System for maintenance of records, and
xvi. Furnishing quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per format enclosed as Annexure-I.

3.18 GENERAL REQUIREMENTS - QUALITY ASSURANCE

13.18.1 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 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 contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities should 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.

13.18.2 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 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. floppy or E-mail in addition to hard copy, for review. Once the same is finalised, hard copies shall be submitted for approval. After approval the same shall be submitted in compiled form on CD ROM.

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

13.18.4 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.

13.18.5 These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), 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/Authorised representative 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 and dispositioning.

13.18.6 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of MDCC.

13.18.7 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.

13.18.8 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.

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

13.18.10 All brazers, welders and welding operators employed on any part of the contract either in Contractor's/his 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.

13.18.11 Test results or qualification tests and specimen testing shall be furnished to the Employer for approval. However, where required by the Employer, tests shall be conducted in presence of Employer/authorised representative.

13.18.12 For all pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. Similarly, any other statutory requirements for the equipments/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding.

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

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

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

13.18.16 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 Society of non-destructive examination). NDT shall be recorded in a report which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job.

13.18.17 In general all plates of thickness greater than 40mm & for pressure parts plates of thickness equal to or greater than 25mm shall be ultrasonically tested otherwise as specified in respective equipment specification. All bar stock/Forging of diameter equal to or greater than 50mm shall be ultrasonically tested.

13.18.18 The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the subcontractor proposed by the 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 Contractor and finalised with the Employer, shall be subject to Employer's approval. The 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 subcontractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion and identified in "DR" category prior to any procurement. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.

13.18.19 For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor’s purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the subcontractor 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.

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

13.18.21 The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractors 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. Contractor shall carry out all tests/inspection required to establish that the items/equipments 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.

13.18.22 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 Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.

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

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

3.19 Environmental Stress Screening

All solid state electronic system / equipment / sub assembly shall be free from infant mortile components. For establishing the compliance to this requirement, the contractor / sub – contractor should meet the following.

1. The Contractor / Sub – contractor shall furnish the established procedure being followed for eliminating infant mortile components. The procedure followed by the Contractor / Sub – contractor should be substantiated along with the statistical figures to validate the procedure being followed. The necessary details as required under this clause shall be furnished at the stage of QP finalization.

Or

2. In case the Contractor / Sub – contractor do not have any established procedure to eliminate infant mortile components then two or 10% whichever is less, most densely populated Panels shall be tested for Elevated Temperature Cycle Test as per the following procedure.

Elevated Temperature Test Cycle

During the elevated temperature test which shall be for 48 hours, the ambient temperature shall be maintained at 50° C. The equipment shall be interconnected with devices and kept under energized conditions so as to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service.

During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature at 50° C.

In case of any failure during the test cycle, the further course of action should be mutually discussed for demonstrating the intent of the above requirement.

Burn In Test Cycle

The test shall be conducted on all the panels fully assembled and wired including the panels having undergone the above mentioned elevated temperature test.

The period of Burn in Test Cycle shall be 120 hrs and process shall be similar to the elevated temperature test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time.

During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems, the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable.

During the Burn in Test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature.

The Contractor / Sub-contractor shall carry out routine test on 100% item at contractor / sub-contractor's works. The quantum of check / test for routine & acceptance test by employer 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 stage.

3.20 QUALITY ASSURANCE DOCUMENTS

The Contractor shall be required to submit two hard copies and two sets on CDROM of the following Quality Assurance Documents as identified in respective quality plan with tick (√) mark.

Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.

The QA Documentation file shall be progressively completed by the Supplier's sub-supplier 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 dispatch. However CD-Rom may be issued not later than three weeks.

3.20.1 Typical contents of Quality Assurance Document are as below:-

i) Quality Plan,
ii) Material mill test reports on components as specified by the specification and approved Quality Plans.
iii) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.
iv) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
v) Heat Treatment Certificate/Record (Time- temperature Chart)
vi) All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure).
vii) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.
viii) Certificate of Conformance (COC) whoever applicable.
ix) MDCC

3.20.2 Similarly, the contractor shall be required to submit two hard copies and two sets on CD ROM of Quality Assurance Documents (in line with above) pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.

3.20.3 Before dispatch/ commissioning of any equipment, the Supplier 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 supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

i) If the result of the review carried out by the Inspector of the Quality document (or applicable section) is satisfactory. The Inspector shall stamp the quality document (or applicable section) for release.
ii) If the quality document is unsatisfactory, the Supplier shall endeavour to correct the incompleteness, thus allowing finalizing the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.
i) If a decision is made for dispatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier

Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the dispatch of equipment.

3.21 TRANSMISSION OF QUALITY DOCUMENTS

As a general rule, two hard copies of the quality document and Two CD ROMs shall be issued to the Employer after the delivery date for the corresponding equipment. One set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Site.

For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 1 month after the date of the last delivery similarly as stated above.

3.22 INSPECTION, TESTING & INSPECTION CERTIFICATE

3.22.1 The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.

3.22.2 The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

3.22.3 The Contractor shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.

3.22.4 The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.

3.22.5 When the factory tests have been completed at the Contractor's or subcontractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.

3.22.6 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.

3.22.7 The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.

3.22.8 To facilitate advance planning of inspection in addition to giving inspection notice, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

3.22.9 All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by cutomer/consultant. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipment in the presence of Project Manager / Inspector.

3.23 PACKAGING & TRANSPORTATION

3.24.1 Packing, Marking and shipping

The packing and shipping shall be carried out in accordance with the standard practice of Contractor and with the following additional requirements:

a) The equipment shall be prepared in such a manner as to protect the equipment from damage or deterioration during shipping or storage. The shipments can be exposed to heavy rains, hot sun, high humidity and sudden extreme changes of temperature. The equipment shall be packed and shipped so as to protect it from all such conditions and any other abnormal conditions, generally expected during shipping & storage. **Packing shall be done by high quality material suitable for at least 1 yr. storage at site.**

b) The metallic containers, if any, shall be considered as the property of the Contractor and he will be allowed to remove them from site once the contents are unpacked, inspected, documented and placed in temporary storage or in final position.

c) The equipment shall be shipped in such a manner as to facilitate unloading, handling and storage enroute and at the site. The Contractor shall provide lifting lugs and special lifting devices for proper handling and erection.

d) The Contractor shall be liable for any damage or loss resulting due to careless, improper, poor or insufficient packing and handling.

e) Spare parts and spare equipment shall be packed separately in containers adequate for long term storage, plainly marked “Spare Parts Only”. They shall be crated individually or in kits to be used in one single renewal or overhaul operation. Other spare part kits shall not be disturbed when using one set or kit.

f) The Contractor shall at all times protect and preserve from damage, loss, corrosion and all other forms of damage, all parts of the works.

3.24.2 Transportation

a) The Contractor shall make a careful examination of access rail/roadways to the site in order to confirm the practical maximum transport weight and dimensions as well as a careful examination of the ports of disembarkation particularly with respect to the capacity of the cranes installed and access roads.

b) All instruments and computer/microprocessor based equipment imported into India from overseas for the purpose of this contract shall be air freighted to the nearest possible point and further by rail/road taking due precautions as per manufacturer’s recommendations.

Employer shall have the right to decide the items that should be air freighted and Employer's decision shall be binding on Contractor.

3.24.3 Insurance

a) The Contractor shall insure all shipments and works at his own expense for not less than the full replacement cost plus any additional cost for accelerated manufacturing of the replacement parts.

b) Loss or the damage to equipment during shipping or transportation to the site(s) or otherwise shall not constitute groups for claims for extension in time or for extra payment.

3.24 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

3.24.1 The material of clamps and connectors shall be Aluminium alloy casting conforming to designation A6 of IS: 617 for connecting to equipment terminals and conductors of aluminium. In case the terminals are of copper, the same clamps/connectors shall be used with 2mm thick bimetallic liner.

3.24.2 The material of clamps and connectors shall be Galvanised mild steel for connecting to shield wire.

3.24.3 Bolts, nuts and plain washers shall be hot dip galvanised mild steel for sizes M12 and above. For sizes below M12, they shall be electro-galvanised mild steel. The spring washers shall be electro-galvanised mild steel.

3.24.4 All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be rounded off to meet specified corona and radio interference requirements.

3.24.5 They shall have same current rating as that of the connected equipment. All current carrying parts shall be at least 10 mm thick. The connectors shall be manufactured to have minimum contact resistance.

3.24.6 Flexible connectors, braids or laminated strips shall be made up of copper/aluminium.

3.24.7 Current rating and size of terminal/conductor for which connector is suitable shall be put on a suitable sticker on each component which should last atleast till erection time.

3.24.1 BUSHINGS, HOLLOW COLUMN INSULATORS, SUPPORT INSULATORS, AND DISC INSULATORS

3.25.1 Bushings shall be manufactured and tested in accordance with IS: 2099 & IEC: 137 while hollow column insulators shall be manufactured and tested in accordance with IEC 233/IS 5284. The support insulators shall be manufactured and tested as per IS: / IEC 168/IEC 273. The insulators shall also conform to IEC 815 as applicable.

3.25.2 Support insulators/ bushings/ hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

3.25.3 Porcelain used shall be homogenous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture. Hollow porcelain should be in one integral piece in green & fired stage.

3.25.4 Glazing of the porcelain shall be uniform brown in colour, free form blisters, burns and other similar defects.

3.25.5 When operating at normal rated voltage there shall be no electric discharge between conductor and insulators which would cause corrosion or injury to conductors or when operating at normal rated voltage.

3.25.6 The design of the insulator shall be such that stresses due to expansion and contraction in any part of the insulator shall be lead to deterioration. All ferrous parts shall be hot dip galvanised.

3.25.7 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps, the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All

portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.

3.25.8 All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued, porcelain parts by grinding and metal parts by machining. Insulator/ bushing design shall be such as to ensure a uniform compressive pressure on the joints.

3.25.9 Insulator shall also meet requirement of IEC - 815 as applicable, having alternate long & short sheds.

3.25 CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT.

3.26.1 All types of control cabinets, junction boxes, marshaling boxes, lighting panels, terminal boxes, operating mechanism boxes, Kiosks etc. shall generally conform to IS:5039, IS:8623 and IEC:439 as applicable.

3.26.2 Mechanism Box/ Control Cabinet/ Kiosks: A sheet steel (atleast 2.5 mm thick), dust and vermin proof M.Box/CCC/CMB shall be provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55. One dummy terminal block in between each trip wire terminal shall be provided. At least 20% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber.

3.26.3 Junction Boxes: The junction boxes shall be made of minimum 2 mm thick sheet steel. Gland plates shall be removable type and made of 3 mm thick sheet steel. The boxes shall be provided with detachable cover or hinged door with captive screws. Top of the box shall be arranged to slope towards the rear of the box. The box shall be hot dip galvanised and shall be provided with suitable neoprene gaskets to achieve requisite degree of protection. Adequate spacing shall be provided to terminate the external cables. The boxes shall be suitable for mounting on various types of steel structures. The terminal blocks provided shall be of 650 V grade, rated for 10 A for control cables. Suitable numbering for terminal blocks shall be done. In case of junction box for power cable, the box shall be rated for maximum current carrying capacity. Terminal blocks shall be of one piece, Klippon RSF-1 or ELMEX CSLT-1 type with insulating barriers.

3.26.4 The cabinets/boxes/kiosks/panels shall be free standing or wall mounting or pedestal mounting type. They shall have hinged doors with padlocking arrangement. All doors, removable covers and plates shall be gasketed all around with neoprene gaskets.

3.26.5 The degree of protection of of all the outdoor boxes shall not be less than IP 55 as per IS 2147.

3.26.6 The cable entry shall be from bottom, for which removable gasketed cable gland plates shall be provided.

3.26.7 Suitable 240V, single phase, 50Hz ac heaters with thermostats controlled by switch and fuse shall be provided to maintain inside temperature 10deg. above the ambient.

3.26.8 The size of enclosure and the layout of equipment inside shall provide generous clearances. Each cabinet/box/kiosk/panel shall be provided with a 15A, 240V ac, 2 pole, 3 pin industrial grade receptacle with switch. For incoming supply, MCB of suitable rating shall be provided. Illumination of each compartment shall be with door operated incandescent lamp. All control switches shall be of rotary switch type.

3.26.9 Each cabinet/box/kiosk/panel shall be provided with two earthing pads to receive 75mmx12mm GS flat. The connection shall be bolted type with two bolts per pad. The hinged door shall be connected to body using flexible wire. The cabinets/boxes/kiosks/panels shall also be provided with danger plate, and internal wiring diagram pasted on inside of the door. The front label shall be on a 3mm thick plastic plate with white letters engraved on black background

3.26 TERMINAL BLOCKS

3.27.1 They shall be non-disconnecting stud type of extensible design equivalent to Elmex type CAT-M4.

3.27.2 The terminal blocks shall be of 650 V grade, and rated to continuously carry maximum expected current. The conducting part shall be tinned or silver plated.

3.27.3 They shall be of moulded, non-inflammable thermosetting plastic. The material shall not deteriorate with varied conditions of temperature and humidity. The terminal blocks shall be fully enclosed with removable covers of transparent, non deteriorating plastic material. Insulating barriers shall be provided between the terminal blocks so that the barriers do not hinder the wiring operation without removing the barriers.

3.27.4 The terminals shall be provided with marking tags for wiring identification.

3.27.5 Unless otherwise required (expected current rating) or specified, terminal blocks shall be suitable for connecting the following conductors on each side:

All CT & VT circuits - Min. four 2.5 sq.mm. copper flexible conductor
AC & DC power supply -Two 16 sq.mm. Aluminium conductor
Other control circuits - Min. two 2.5 sq.mm. copper flexible conductor.

3.27.6 The terminal blocks for CT and VT secondary leads shall be provided with test links and isolating facilities. CT secondary leads shall also be provided with short circuiting and earthing facilities.

3.27 Wiring

3.28.1 All wiring shall be carried out with 1100 V grade stranded copper wires. The minimum size of the stranded conductor used for internal wiring shall be as follows:

a) All circuits except CT circuits 2.5 sq.mm
b) CT circuits 4 sq. mm (minimum number of strands shall be 3 per conductor).

3.28.2 All internal wiring shall be securely supported, neatly arranged readily accessible and connected to equipment terminals and terminal blocks.

3.28.3 Wire terminations shall be made with solderless crimping type of tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with the wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wires shall not fall off when the wires and shall not fall off when the wire is disconnected from terminal blocks.

3.28.4 All wires directly connected to trip circuit breaker shall be distinguished by the addition of a red coloured unlettered ferrule. Number 6 & 9 shall not be included for ferrules purposes.

3.28.5 All terminals including spare terminals of auxiliary equipment shall be wired upto terminal blocks. Each equipment shall have its own central control cabinet in which all contacts including spare contacts from all poles shall be wired out. Interpole cabling for all equipment's shall be carried out by the Contractor.

3.28 CABLE GLANDS AND LUGS

3.29.1 Cable glands shall be Double compression type, tinned/Nicked plated (coating thickness not less than 20 microns in case of tin and 10 to 15 microns in case of nickel) brass cable glands for all power and control cables. They shall provide dust and weather proof terminations. They shall comprise of heavy duty brass casting, machine finished and tinned to avoid corrosion and oxidation. Rubber components used in cable glands shall be neoprene and off tested quality. Required number of packing glands to close unused openings in gland plates shall also be provided.

3.29.2 The cable glands shall be tested as per BS: 6121. The cable glands shall also be duly tested for dust proof and weather proof termination.

3.29.3 Cables lugs for power cables shall be tinned copper solder less crimping type conforming to IS:8309 and 8394 suitable for aluminum or copper conductor (as applicable). Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall

be provided with insulating sleeve and shall suit the type of terminals provided on the equipment. The cable lugs shall suit the type of terminals provided. The cable lugs shall be of Dowell make or equivalent.

3.29 CONDUITS, PIPES AND ACCESSORIES

3.30.1 The bidder shall supply and install all rigid conduits, mild steel pipes, flexible conduits, hume pipes, etc. including all necessary sundry materials, such as tees, elbows, check nuts, bushing reduces, enlargers, wooden plugs, coupling caps, nipples, gland sealing fittings, pull boxes, etc.

3.30.2 Rigid conduits shall be flow-coat metal conduits of Nagarjuna Coated Tubes or equivalent make. The outer surface of the conduits shall be coated with hot-dip zinc and chromate conversion coatings. The inner surface shall have silicone epoxy ester coating for easy cable pulling. Mild steel pipes shall be hot-dip galvanised. All rigid conduits/ pipes shall be of a reputed make.

3.30.3 Flexible conduits shall be heat-resistant lead coated steel, water-leak, fire and rust proof, and be of PLICA make or equivalent.

3.30 AUXILIARY SWITCH

The auxiliary switch shall conform of following type tests:

a) Electrical endurance test - A minimum of 1000 operations for 2A. D.C. with a time constant greater than or equal to 20 milliseconds with a subsequent examination of mV drop/ visual defects/ temperature rise test.
b) Mechanical endurance test - A minimum of 5000 operations with a subsequent checking of contact pressure test/ visual examination
c) Heat run test on contacts
d) IR/HV test, etc.

3.31 LAMPS AND SOCKETS

3.32.1 Lamps:
All incandescent lamps shall use a socket base as per IS-1258, except in the case of signal lamps.

3.32.2 Sockets
All sockets (convenience outlets) shall be suitable to accept both 5 Amp & 15 Amp pin round Standard Indian plugs. They shall be switched sockets with shutters.

3.32.3 Hand Lamp:
A 240 Volts, single Phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF Switch for connection of hand lamps.

3.32 SWITCHES & FUSES:

Each control panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signaling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with switch-fuse units. Selection of the main and sub-circuit fuse ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by HRC fuses.

All fuses shall be of HRC cartridge type conforming to IS 9228 mounted on plug-in type fuse bases. Miniature circuit breakers with thermal Protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage.

All control switches shall be of rotary type. Toggle/piano switches shall not be accepted.

3.33 TESTS

General

During manufacture, the Owner/Purchaser's representative(s) shall have the right to expedite and/or inspect design, materials, workmanship and progress of manufacture of the Contractor's and their Sub-Contractor's equipment and may reject defective materials considered unsuitable for the intended purpose or which do not comply with the intent of the tender specification. The Contractor, upon any such rejection by the Purchaser or his representative(s), shall replace the defective or unsuitable materials. The Contractor shall provide every reasonable inspection facility to the Purchaser's Inspector(s) or representative(s) at his own and his Sub-Contractor's works.

The Contractor shall give thirty (30) day notice of readiness for inspection of component parts and/or before final assembly and test, so that the Purchaser's representative(s) may inspect the materials and witness such tests before shipment. The Purchaser's representative(s) may, at any time, inspect and request copies of any or all test data of raw materials and finished components which shall be immediately furnished.

Material being furnished against this order shall only be shipped when factory inspection, satisfactory to the Purchaser and/or their representative(s) has been conducted. Such inspection and acceptance for shipment shall not, however, relieve the Contractor from his entire responsibility for furnishing equipment conforming to the requirement of the tender specification nor shall prejudice any claim, right or privilege which the Purchaser may have because of the use or supply of defective or unsatisfactory materials or equipment. Should the inspection be waived by the purchaser, such waival shall not also relieve the Contractor, in any way, from his entire obligations under the Contract.

The equipment shall, at the factory or after installation, be demonstrated capable of performing satisfactorily upto the Contractor's guaranteed performance. All tests required by the tender specification including retests and inspection that may be necessary owing the failure to meet any tests specified, shall be made at the Contractor's expenses. Additional tests, as necessary, shall be made to locate such failure(s) and after determining the causes of failure(s) and rectifying it, specified tests shall be repeated to establish that the rebuilt equipment meets the tender specification requirements in every respect.

Should the equipment ultimately fail to pass the specified tests, the Purchaser will have the option to reject the unit.

Tests during Manufacture

During the manufacture of equipment, tests specified in Standard Specification(s) shall be performed on each unit in addition to any of manufacturer’s standard tests and requisite number of copies of tests certificates as per Distribution Schedule shall be furnished.

Routine Tests

After completion of manufacture routine tests as specified in relevant Standards and in Standard Specification(s) shall be performed on equipment and requisite number of copies of test certificates as per Distribution Schedule shall be furnished.

All tests shall be conducted in accordance with Indian Standards in effect at the time of testing and in presence of representative(s) of the Purchaser/ Consulting Engineer.

Tests on Associated Components

Cast epoxy resin insulators, surge absorbers, current transformers, voltage transformers, control devices and other associated components as applicable, shall be tested in accordance with the relevant Indian standards and/or Manufacturer's Standards.

Type Tests

Contractor will have to submit Type test reports for all equipment for review. The test reports shall be of same or higher rating. In case the test reports are **older than 5 years from the date of techno commercial bid opening i.e. 02.11.15** or related to equipment of lower rating then fresh type tests have to be conducted without any implication.

Site Tests

The Bidder shall indicate tests recommended to be carried out at site during installation and commissioning to ensure satisfactory performance of all the equipment supplied.

Testing Facility

The Bidder shall state in the Proposal the testing facilities available at his works. Should full capacity testing equipment be not available, the Bidder shall state the method proposed to be adopted with detailed computations and justification for adopting such a method to reliably ascertain the equipment characteristics corresponding to full capacity testing.

3.4 Enclosures:

1. ANNEXURE- I – MQP (Customer format)
2. ANNEXURE- II – QUALITY ASSURANCE FOR SWITCHYARD

ANNEXURE-I

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS	MANUFACTURING QUALITY PLAN ITEM : SUB-SYSTEM:	QP NO.: REV.NO: DATE: PAGE: …. OF….	PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER :

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C/N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			11.

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER
SIGNATURE	

LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.** **M:** MANUFACTURER/SUB-SUPPLIER **C:** SUPPLIER/NOMINATED INSPECTION AGENCY, **N**: THE OWNER **P:** PERFORM **W**: WITNESS AND **V:** VERIFICATION. AS APPROPRIATE, **CHP:** THE OWNER SHALL IDENTIFIED IN COLUM "N"

FOR THE OWNER USE

DOC. NO.:
REV…… CAT…..

REVIEWED BY	APPROVED BY	APPROVAL SEAL

E2 : SWITCHYARD

ATTRIBUTES, CHARACTERISTICS → / ITEM, COMPONENTS, SUB SYSTEM ASSEMBLY ↓	Make, model, Type & Rating, Test Certificate	Routine & Acceptance Test as per IS / IEC	Functional requirements as per Owner Specification
Circuit Breaker (IEC: 56)	Y	Y	Y
Interruptor & hollow insulator (IEC: 233/ IS: 5284)	Y	Y	Y
Isolator (IEC: 129 / IEC: 694)	Y	Y	Y
Current Transformer (IEC: 185)	Y	Y	Y
Capacitor Voltage Trams former (IEC: 186 / 358)	Y	Y	Y
Bus Post Insualtor (IEC: 168 / 273 / IS:2544)	Y	Y	Y
Disc,Pin & String Insualtor (IEC: 383 / IS: 731)	Y	Y	Y
Long Rod Insualtor (IEC: 433)	Y	Y	Y
Surge Arrestor (IEC: 99-4)	Y	Y	Y
Hardware fittings for Insulator (IS: 2486 / BS: 3288)	Y	Y	Y
Spacer Clamps & Connector (IS: 10162 / 5561)	Y	Y	Y
Aluminum Tube (IS: 5082 / 2673 / 2678)	Y	Y	Y
Wave Trap (IEC: 353 / IS: 8792 / 8793)	Y	Y	Y
Conductor (IS: 398-P-II)(V)	Y	Y	Y
Galvanised Steel Structures (IS: 2062/2629/4759/6745)	Y	Y	Y
Vibration Damper (IS: 9708)	Y	Y	Y
Sag Compensating Spring DIN: 2089/2096 IS: 3195 / 7906	Y	Y	Y
Control & Relay Panel	Y	Y	Y
SF6 Gas filling & evacuating plant	Y	Y	Y
SF6 Gas Leak Detector	Y	Y	Y
Leakage Current Analyser	Y	Y	Y
Nitrogen Gas Filling Device	Y	Y	Y

Protection Relays	Y	Y	Y
Event Logger	Y	Y	Y
Operation Analyser	Y	Y	Y
Disturbance Recorder	Y	Y	Y
Tariff Metering System	Y	Y	Y
Synchronising Trolly	Y	Y	Y
Relay Test Kit	Y	Y	Y
LT Switchgear /LT Panels (IEC:947 / IS:13947)	Y	Y	Y
Battery IS:1652	Y	Y	Y
Lighting Panels	Y	Y	Y
Surge Monitor	Y	Y	Y

Notes:

1) This is an indicative list of test/checks. The manufacture is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents during QP finalisation for all items.

2) All major Bought Out Items will be subject to Owner/ Owner Engineer approval.

SCHEDULE OF TECHNICAL DEVIATIONS

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

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-B:
COMPLIANCE CERTIFICATE OF TECHNICAL SPECIFICATION

The bidder shall confirm compliance to the following by signing/ 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 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 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