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|----------------------------------------------------|----------------------------------------------------------------------------|----------------|----------------|-------------------------------------------------------------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|
| <b>BHEL Document No.</b><br>TB-348-510-010IP       |                                                                            |                |                | <b>Rev.</b><br>00                                                                   |                         | <b>Prepared by</b><br>SB | <b>Checked by</b><br>VK | <b>Approved by</b><br>VK |
| <b>Type of Document</b><br>Technical Specification |                                                                            |                |                | <b>Sign</b>                                                                         |                         |                          |                         |                          |
| <b>Title</b><br>INTERFACE PANEL                    |                                                                            |                |                | <b>Date</b>                                                                         | 29.01.2020              | 29.01.2020               | 29.01.2020              |                          |
|                                                    |                                                                            |                |                | <b>Group</b>                                                                        | TBEM                    |                          |                         |                          |
|                                                    |                                                                            |                |                | <b>W.O. No</b>                                                                      | 80010                   |                          |                         |                          |
| <b>CUSTOMER</b>                                    |                                                                            |                |                | The West Bengal Power Development Corporation Ltd                                   |                         |                          |                         |                          |
| <b>CONSULTANT</b>                                  |                                                                            |                |                | Development Consultants Private Ltd. Kolkata                                        |                         |                          |                         |                          |
| <b>PROJECT</b>                                     |                                                                            |                |                | 2X500MW Thermal Power Extension Project Unit-3 & 4 at Sagardighi - 400KV Switchyard |                         |                          |                         |                          |
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| <b>Rev No.</b>                                     | <b>Date</b>                                                                | <b>Altered</b> | <b>Checked</b> | <b>Approved</b>                                                                     | <b>REVISION DETAILS</b> |                          |                         |                          |
| <b>Distribution</b>                                |                                                                            |                |                | <b>To</b>                                                                           |                         |                          |                         |                          |
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**SECTION 1**  
**SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES**

**1.0 SCOPE**

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of Indoor Interface Panel for 400kV Bus Bar Protection System. In case of any discrepancies between the requirements mentioned in this section and those specified in the following sections of this specification, the specifications given herein shall prevail and shall be treated as binding requirements.

**1.1** The equipments are required for the following project:

**Name of the Customer:** West Bengal Power Development Corporation Limited

**Name of the Consultant:** DCPL, Kolkata

**Name of the Project:** 400 kV Switchyard at 2 x500MW SAGARDIGHI TPP

Refer Section -3 for Project Details and General Specifications

**1.2 SPECIFIC TECHNICAL PARTICULARS**

Two (2) Nos floor mounted indoor Interface Panel shall be used to re-terminate the existing cables (CT leads, CB status etc) from old 400kV bays of Phase I and II switchyard.

There shall be 120 nos. TBs in each Interface Panel (80Nos Disconnecting stud type and 40Nos Non-disconnecting stud type).

The IP class of Interface Panel (IP) shall be IP54. This IP is intended to be placed besides existing Busbar protection panel in existing control room.

Each Panel shall be capable of terminating 50 Nos of cables (With max Dia of Cable 25mm).

Each Panel shall have pedestal of at least 300mm height for the ease of cable termination.

**1.3 QUANTITIES**

| Sl.No. | DESCRIPTION            | QUANTITY<br>(Nos.) |
|--------|------------------------|--------------------|
| 1.     | Indoor Interface Panel | 2                  |

**1.4 TYPE TESTS**

All the equipment shall have valid type test certificates as per relevant IS/IEC from recognized and reputed test laboratory. In case any of Type tests have not been conducted on the offered design or there has been a change in the design after the type tests the requisite tests shall be conducted by bidder on the offered design without any extra cost and delivery impact to BHEL.

**1.5 INSPECTION AND TESTING**

Inspection, routine tests & Quality assurance shall be as per approved Quality Plan by WBPDC / DCPL/BHEL.

|                                                                                                                                                            |                                          |
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| <b>West Bengal Power Development Corporation Limited</b><br><b>2X500MW Thermal Power Extension Project Unit-3 &amp; 4 at Sagardighi - 400KV Switchyard</b> |                                          |
| <b>Technical Specification of Interface Panel</b><br><b>Section-2: Equipment Specification</b>                                                             | <b>TB-348-510-010IP</b><br><b>REV 00</b> |

## SECTION 2

### EQUIPMENT SPECIFICATION

#### SPECIFICATION OF INTERFACE PANEL

2.02.00 All the station transformers (ST#3 & ST#4) and 400 KV line feeders, shall be controlled through associated circuit breakers and isolators from switchyard /grid control room through a dedicated SAS system. Apart from controlling of equipment, this SAS system shall perform measurement, indication and annunciation functions also. This SAS system shall be hooked up with plant DCS. For details of Switchyard SAS refer Volume II-F/1 Section XIV. (Section - 2 A)

2.03.00 The 400 KV switchyard is provided with one and half breaker scheme as described in Volume : II-F/1 Section XIII. and shown in Dwg. No. K8A07-DWG-E-0101

Each 400 KV feeders shall have facility for live bus and dead bus closing. Live bus closing shall be ensured through synchro check relay and this synchro check relay is to be provided separately and shall not be built in SAS. Bidder is to indicate clearly in his offer as to the detail of the synchro check relay offered by him.

2.04.00 Control, indication, metering and annunciation of unit transformers (2 no/ unit) and unit auxiliary system, 11000V side of station transformers and 3300V station auxiliary system shall be provided in unit auxiliary control console (UACC) & station auxiliary control console (STCC) through DCS. All 11KV & 3.3KV breakers (except motor feeder), Auxiliary and LT transformers, all 415V switchgear incomer, all 415V outgoing feeders (except motor feeders) & bus coupler, fast & slow bus changeover of 11KV system, synchronization of 11KV & 3.3KV etc will be done through these consoles and DCS for remote operation. Motor feeders are controlled by separate process control boards. For details refer Volume II-E – Specifications for Controls & Instrumentations.

2.05.00 For coolers, Pumps & fans of Generator transformers & Unit transformers One (1) no control panel for each unit will be provided in the control equipment room. The control & indication for cooler can done from Generator Auxiliary Control console (GACC) through DCS. For the cooler & OLTC of Station transformers, separate console to be provided in control equipment room with hook up facility with plant DCS for remote operation from power house control room.

### 3.00.00 SPECIFIC REQUIREMENTS OF INTERFACE PANEL

#### 3.01.00 Construction

3.01.01 The Control and Relay Boards/panels shall be totally enclosed, floor mounted, free-standing, dead-front assemblies conforming to IP-4X degree of protection.

3.01.02 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.

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

- 3.01.04 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.
- 3.01.05 The control boards shall be of folded sheet steel construction, assembled on channel/angle base plates with anti-vibration mountings.
- 3.01.06 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.
- 3.01.07 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.
- 3.01.08 All control panels shall have rear door with concealed type hinges and pad-locking arrangement. Doors shall be grounded by flexible copper braid.
- 3.01.09 The boards shall be complete with vibration damping pads, stainless steel kick plates, floor channel sills, anchor bolts, and other necessary hardware for mounting.
- 3.02.00 **Equipment Mounting**
- 3.02.01 All instruments, relays, switches, etc. mounted on the front face of the panels shall be flush or semi-flush type.
- 3.02.02 No equipment shall be mounted on panel door.
- 3.02.03 All equipment shall be so mounted that removal and replacement may be accomplished individually without interruption of service to others.
- 3.02.04 All equipment inside the panels shall be so located that their terminals and adjustments are readily accessible for inspection or maintenance.
- 3.02.05 In case cut-outs are provided on any panel for future mounting of equipment, the same shall be properly blanked off.
- 3.03.00 **Name Plate**
- 3.03.01 Nameplates shall be provided on each panel and on each instrument or device mounted in the panel. Each panel shall also have circuit/ feeder designation name plate.
- 3.03.02 The material of the nameplates shall be lamicaid or approved equal, 3 mm thick, with white letters on black background.
- 3.03.03 The nameplates shall be held by self tapping screws. The size of nameplate shall be approx. 20 mm x 75 mm for equipment and 40 mm x 150 mm for panels.

- 3.03.04 Nameplates for panels shall be provided both on the front and the rear.
- 3.03.05 Control and meter selection switches shall have integral nameplates. Nameplates for all other devices shall be located below the respective devices.
- 3.03.06 Instrument and devices mounted on the face of the control boards 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.
- 3.04.00 **Illumination, Space Heating and Receptacles**
- 3.04.01 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.
- 3.04.02 Tube, heater and receptacle circuits shall be suitable for available A.C. supply and furnished with individual ON-OFF switch.
- 3.04.03 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.
- 3.05.00 **AC/DC Power Supply**
- 3.05.01 Necessary A.C and D.C supplies to each control board, as required for control and service, shall be arranged by the Contractor. 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.
- 3.05.02 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.
- 3.05.03 Isolating switch fuse units shall be provided for the incoming AC/DC 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.
- 3.05.04 Fuse and link shall be provided for individual circuits for protection & metering including voltage circuits and also for isolation from bus wire without disturbing other circuits. Suitable fuse failure relays shall be provided to give an alarm for

voltage circuits of protection/metering. Voltage selection scheme based on relays shall be provided for meters wherever possible.

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

3.05.06 Bus coupler shall be provided in the control bus such that while one bus section of HT/LT is under shut down then control bus section of that particular HT/LT bus section shall remain under dead condition.

### 3.06.00 **Wiring**

3.06.01 The boards shall be fully wired at the factory to ensure proper functioning of control, protection, and metering schemes. When panels are arranged to be located side-by-side, all inter-panel wiring shall be carried out by longitudinal troughs extending the full length of the board.

3.06.02 All spare contacts of relays and switches shall be wired upto terminal blocks. All interconnections between the panels of the control board shall be furnished.

3.06.03 Wiring shall be done with flexible, heat resistant, 1100V grade, PVC insulated, switch board wires with stranded copper conductor. The minimum size of the wires shall be 4 Sq. mm. for control and current circuits and 2.5 Sq. mm. for voltage circuits.

3.06.04 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.

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

3.06.06 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.

### 3.07.00 **Terminal Block**

3.07.01 Terminals shall be ~~box-clamp-and-clip-on-type~~ <sup>STUD</sup>, suitable for terminating upto two wires of 2.5 sq. mm. cross section and provided with marking strips. Terminals for CT secondary leads shall have built-in disconnecting links with facility for shorting. Terminals for CT leads should have adequate cross section for terminating associated CT leads.

3.07.02 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.

3.07.03 Each terminal shall be identified with designation as per approved schematic. At least 20% of the total number of active terminals shall be furnished as spare in each panel.

- 3.07.04 The wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.
- 3.07.05 The terminal blocks shall be located to allow easy access and also to suit floor openings for cable entry.
- 3.07.06 Terminal blocks shall generally be mounted vertically with adequate spacing (not less than 100 mm) between adjacent rows.
- 3.07.07 The bottom of the terminal blocks shall be at least 200 mm above the incoming cable gland plate.
- 3.08.00 **Cable Entry**
- 3.08.01 The panels shall have provision of cable entry from the bottom. Bottom plate shall be provided to make entry dust-tight.
- 3.08.02 The panels shall have provisions inside for fixing the multi-core (armoured) cable glands. Cable glands shall be made of brass & double compression type. Cable gland support plate shall be 4 mm thick and mounted not less than 200 mm above floor level.
- 3.09.00 **Grounding**
- 3.09.01 50 x 6 mm TINNED COPPER ground bus shall be provided in each panel, extending along the entire length of the assembly.
- 3.09.02 The ground bus shall have two-bolt drilling with GI bolts and nuts at each end and shall be suitable for connection to 50 x 6 mm G.S. flat.
- 3.09.03 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.
- 3.09.04 Whenever a circuit is grounded, a single wire from the circuit shall be run independently to the ground bus and connected to it.
- 3.09.05 Potential and current transformer neutrals shall be grounded only at the terminal blocks where they enter the control boards from the transformers.
- 3.10.00 **Painting**
- 3.10.01 The inside of all boards shall be painted white. The outside surface shall be finished with two coats of synthetic enamel paint, the shade of which shall be subject to approval by the Purchaser. Base frames shall be painted black.

### 3.11.00 ~~Switches~~

(PCA.CD-003.E839ELE4\_ECRB)

V.II-F2/S-IV : 7

|                                                                                                |                         |
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| <b>Technical Specification of Interface Panel</b>                                              | <b>TB-348-510-010IP</b> |
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### SECTION-3

#### 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, equipments and services covered under other respective sections and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

#### 3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

|                        |                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| a)                     | Customer/ Purchaser/ Owner                  | The West Bengal Power Development Corporation Ltd.                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| b)                     | Consultant/Owner's Engineer                 | Development Consultants Private Ltd. Kolkata                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| c)                     | Project Title                               | 2X500MW thermal power extension project Unit-3 & 4 at Sagardighi- 400KV Switchyard                                                                                                                                                                                                                                                                                                                                                                                                                           |
| d)                     | Location                                    | Site is located at Manigram village of Murshidabad district in West Bengal and around 240km from Kolkata. 13km north of Sagardighi town by the side of the SMGR(Sagardighi Manigram –Gankar –Raghunathganj) road at a distance of 20km from National Highway 34 . Nearest railway station is Manigram adjacent to the site on Bandel-Barhawara branch line and 6.5km from Sagardighi railway station on Sainthia-Azimhunj line of eastern railway. Nearest Airport –Kolkata. Nearest Seaport- Kolkata/Haldia |
| e)                     | Altitude                                    | 34 m above MSL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| f)                     | Transport Facilities                        | Road/Rail                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| g)                     | Postal Address                              | To follow                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>SITE CONDITIONS</b> |                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| a)                     | Maximum Design ambient dry bulb temperature | 50°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| b)                     | Minimum Design ambient dry bulb temperature | 5°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| c)                     | Average Relative humidity ( for design)     | 73 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| d)                     | Maximum relative humidity                   | 84%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| e)                     | Pollution Severity                          | Heavily Polluted                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

**West Bengal Power Development Corporation Limited**  
**2X500MW Thermal Power Extension Project Unit-3 & 4 at Sagardighi - 400KV Switchyard**

**Technical Specification of Interface Panel**  
**Section-3: Project details & General Specification**

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|    |                        |              |
|----|------------------------|--------------|
| f) | Seismic zone           | III          |
| g) | Wind velocity          | 47m/sec.     |
| h) | Wind pressure          | 150kg/sq.mts |
| i) | Terrain category       | 2            |
| j) | Risk coefficient ( K1) | 1.07         |
| k) |                        |              |
| l) | Average rainfall       | 1389mm       |

**SYSTEM PARAMETERS**

|                                                                                |                     |
|--------------------------------------------------------------------------------|---------------------|
| Nominal system voltage                                                         | <b>400 kV</b>       |
| Highest system voltage                                                         | 420 kV              |
| Basic Impulse level( dry /wet)                                                 | 1425kVP             |
| Power frequency withstand voltage dry/wet                                      | 630kVrms            |
| Switching Impulse withstand voltage Phase to Earth                             | 1050kVP             |
| Switching Impulse withstand voltage Phase to Phase                             | 1575kVP             |
| Maximum radio interference voltage at 1MHz & 266kV rms phase to ground voltage | 1000 Micro volt     |
| Rated short time current                                                       | 40 kA for 1 sec     |
| Frequency                                                                      | 50 Hz               |
| Creepage distance                                                              | 25mm/kV             |
| System Earthing                                                                | Effectively Earthed |

**AUXILIARY POWER SUPPLY**

|                          |                                                                                                                                |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| 3 phase A.C power supply | 415V $\pm 10\%$ , 50 Hz $\pm 5\%$ , 3-phase 4 wire, 50kA, solidly earthed, combined voltage and frequency variation $\pm 10\%$ |
| 1 phase A.C power supply | 240V $\pm 10\%$ , 50 Hz $\pm 5\%$ , 1-phase AC supply                                                                          |
| D.C. power supply        | 220V $\pm 10\%$ , 2-wire , 25kA, ungrounded<br>48V $\pm 10\%$ , 2 wire system positively earthed                               |

**3.2 GENERAL TECHNICAL REQUIREMENT**

**3.2.1 TYPE TESTS**

All equipment/systems to be supplied shall conform to type tests as per relevant standards and proven type. The Bidder / Contractor shall furnish the reports of all the type tests carried out in within last **five years from the date of LOA ( i.e. 22.02.2011)** as listed in relevant clauses in respective electrical specification and relevant standards for all components / equipment / systems.

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These reports should be for the tests conducted on identical/similar components/equipment/systems to those offered/proposed to be supplied under this contract.

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

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

### **3.2.2 CODES AND STANDARDS**

All materials and equipment shall generally comply in all respect with the latest edition of relevant international electro-technical commission (IEC) or any other internationally accepted standard which ensure equal or better quality or relevant Indian standard(IS) mentioned against each equipment and this specification.

## **3.3 MATERIAL/WORKMANSHIP**

### **3.3.1 General Requirement**

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

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

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

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and rating shall be physically and electrically interchangeable.

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

The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him. All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

### **3.3.2 Provisions For Exposure to Hot and Humid climate**

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

### **3.4 COLOUR SCHEME AND CODES FOR PIPE SERVICE/PANELS**

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

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

|                                                                                                |                         |
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Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

Painting process shall be of powder coating type. All surface shall be cleaned, phosphated and given two coats of rust-resistant primer followed by two coats of finish paints. The interior of all panels cabinets and enclosures shall be finished with gloss white enamel. Two final powder coats of synthetic enamel paint of light grey shade (631 of IS-5) shall be given to exterior surface of all the panels. Sufficient quantities of touch paint shall be furnished for application at site. All The indoor cubicles shall be of same colour scheme and for other miscellaneous items, colour scheme will be approved by the purchaser.

### **3.5 PROTECTION**

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

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

### **3.6 FUNGISTATIC VARNISH**

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

### **3.7 SURFACE FINISH**

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

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be

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carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling. All external painting shall be as per shade no. 631 of IS:5.

### **3.8 GALVANIZING**

All ferrous parts including all sizes of nuts, bolts, Plain and spring washers, support channels, structures, shall be hot dip galvanised conforming to latest version of IS:2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvanized. Minimum weight of zinc coating shall be 610 gm/sq.m and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM.

### **3.9 PACKING**

The following details are to be clearly indicated in the material forwarding documents:

- a) Name and address of the consignee.
- b) Purchase order number.
- c) Name of supplier/s.
- d) Description of equipment / material.
- e) Net weight.
- f) Gross weight.

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/ material at a later date, in case the need arises. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost. The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbol i.e. fragile, handle with care, use no Hooks etc.

### **3.10 HANDLING, STORING AND INSTALLATION**

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

Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit

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breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning.

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

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

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

### **3.11 DEGREE OF PROTECTION**

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

- a) Installed out door: IP-55
- b) Installed indoor in air conditioned area: IP-31
- c ) Installed in covered area IP:52
- d) Installed indoor-in non air-conditioned area where possibilities of entry of water is limited:IP-41
- e) For LT switchgear ( AC & DC distribution Boards): IP-54

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

### **3.12 RATING PLATES, NAME PLATES AND LABELS**

Type or serial number together with details of the loading conditions under which the item of the substation in question has designed to operate and such diagram plates as may required by the Purchaser. The rating plate of each equipment shall be according to IEC requirements.

All such nameplate instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternately two separate plates one with Hindi and other with English inscriptions may be provided. All measurements shall be in M.K.S units.

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### 3.13 EARTHING

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

### 3.14 TERMINAL BLOCKS AND WIRING

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

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

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

The terminal shall be that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally. The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable. The terminal blocks shall be of extensible design. The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

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

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

All circuits except CT circuits :

Minimum of 2 nos. of 2.5 sq.mm, copper flexible.

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

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

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

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

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

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

Control cabinet, Junction boxes, Marshalling boxes & Terminal boxes shall be made of **CRCA** sheet steel of minimum 2 mm thickness. The thickness of door s/covers shall not be less than 1.6 mm. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

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

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

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

### **3.16 SPACE HEATERS**

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

One or more adequately rated, thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heater shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heater 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 air and shall consist of coiled resistance wire centered in metal sheath and completely encased in a highly compacted powder of Magnesium Oxide or other material having equal heat conduction and electrical insulation properties, or they shall consist of a resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and air. Alternatively, they shall consist of resistance wire mounted into a tubular ceramic body built into an envelop of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in 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.

### **3.17 QUALITY**

BHEL quality plan to be followed subject to TBEM / customer's approval.

### **3.18 DOCUMENTATION**

#### **3.18.1 LIST OF DOCUMENTS**

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

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

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

### 3.18.2 DRAWINGS

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

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

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

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

### 3.18.3 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Employer would be discussed and finalised at the time of award. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer. The following schedule shall be followed generally for approval.

|      |                                                     |                                                                                                 |
|------|-----------------------------------------------------|-------------------------------------------------------------------------------------------------|
| i.   | Approval/comments/by employer on Initial submission | Within 2 weeks of receipt                                                                       |
| ii.  | Resubmission                                        | Within 2 (two) weeks (whenever from date of comments required) Including both ways postal time. |
| iii. | Approval or comments                                | Within 2 weeks of receipt of resubmission                                                       |

T The West Bengal Power Development Corporation Ltd. Bharat Heavy Electricals Ltd.  
2X500MW Thermal power extension project Unit-3 & 4 at Sagardighi- 400KV Switchyard,  
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|     |                                   |                                         |
|-----|-----------------------------------|-----------------------------------------|
| iv. | Furnishing of distribution copies | 2 weeks from the date of last approval. |
|-----|-----------------------------------|-----------------------------------------|

**Note:** The contractor may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

The title block of drawings shall contain the following information incorporated in all contract drawings. Please refer enclosed sheet for details of Title block.

### 3.18.4 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

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

### 3.18.5 DOCUMENTATION SCHEDULE

| S. No. | DESCRIPTION                       | TENDER STAGE | CONTRACT STAGE FOR APPROVAL | FINAL DOCUMENTATION |                                  |
|--------|-----------------------------------|--------------|-----------------------------|---------------------|----------------------------------|
|        |                                   |              |                             | Prints              | CDs                              |
| 1      | Drawings and Data Sheets          | 1            | 6                           | 7                   | 4 nos of all drawings/ documents |
| 2      | Drawings "As Built "              | -            | -                           | 7                   |                                  |
| 3      | Type Test Reports                 | 1            | 6                           | 7                   |                                  |
| 4      | Erection Manuals                  | -            | 6                           | 7                   |                                  |
| 5      | Operation and Maintenance Manuals | -            | 6                           | 7                   |                                  |
| 6      | Manufacturing Quality Plan        | 1            | 6                           | 7                   |                                  |
| 7      | Field Quality Plan                | 1            | 6                           | 7                   |                                  |
| 8      | Inspection Test Reports           | -            | -                           | 7                   |                                  |

Soft copies of drawings at contract stage shall also be submitted in **PDF format**.

Drawings will also be submitted in mini cartridges in AUTOCAD Release -14 package or any other CAD package along with conversion files for all major items.

Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top.