



भारत हेवी इलेक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LIMITED

पारेषण व्यापार अभियांत्रिकी प्रबंधन
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

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	765/400/220 kV BHUJ NEW S/S & 765 KV BANASKANTHA EXTN S/S	Part No.	SECTION -1
	AIR CONDITIONING SYSTEM FOR SWITCHYARD PANEL ROOM		SHEET 1 OF 5

SECTION-1

INTENT, SYSTEM REQUIREMENT AND SCOPE

1.0.0 INTENT OF SPECIFICATION

- 1.1.0 This specification covers the manufacturing, inspection/testing, dispatch and erection, testing & commissioning at site of **Air-Conditioning System** as mentioned in different sections of this specification for **765/400/220 KV Sub-station at Bhuj and 765 KV Banaskantha Extn Substation** of Power Grid Corporation of India Limited (POWERGRID).
- 1.2.0 The requirements specified under '**SECTION 2, SECTION 3, SECTION 4 & SECTION 5**' of the specification shall be considered as part of this section. In case of variance between various sections, the requirements of **SECTION 1** shall prevail.
- 1.3.0 The Bidder shall be deemed to have understood completely all the tender drawings and documents and quoted accordingly.
- 1.4.0 The Contract shall be on unit rate basis for the quantities furnished by BHEL. During contract stage, quantities of various items of BOQ may vary to any extent and same rates will be applicable so far the resultant variation in total contract value is within $\pm 30\%$. Variations beyond $\pm 30\%$ shall be negotiated mutually.
- 1.5.0 It is recommended that Bidders have no deviation on technical requirement & scope. Bidder shall submit signed and stamped copy of "Certificate of No deviation" (Schedule 1 of Section 5) for 'NIL DEVIATION'.
- 1.6.0 The term '**Customer**' appearing in this specification shall refer to **Powergrid**, the term '**Purchaser**' shall refer to **BHEL** and the term '**Contractor**' shall refer to the successful Bidder.
- 1.7.0 The system / equipment shall be capable of performing the required duties as per the specification requirements.

2.0.0 AIR CONDITIONING REQUIREMENT

Air Conditioning System for Switchyard Panel Rooms

Air-conditioning units for switchyard panel room shall be set to maintain Dry Bulb temperature inside switchyard panel room below 24 °C.

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Air-conditioning units for Switchyard Panel Rooms shall be designed to meet the conditions mentioned in the Cl. No. 3 of Powergrid's specification attached to section-2.

Standard drawings of Switchyard Panel Rooms of size 4 x 9 sq. m & 4 x 6 sq. m are also enclosed as a part of the specification for bidder's reference.

Scope for Bhuj S/s

- i) 765 kV Switchyard panel rooms, Size 4 x 9 m, (3 Sets.)
 - 6 Nos. AC Units with free cooling of 3TR capacity i.e. 2 Nos. for each SPR.
- ii) 400 kV Switchyard panel rooms, Size 4 x 6 m, (4 Sets)
 - 8 Nos. AC Units with free cooling of 2TR capacity i.e. 2 Nos. for each SPR.

Scope for Banaskantha Extn S/s

- iii) 765 kV Switchyard panel room, Size 4 x 9 m, (2 sets.)
 - 4 Nos. AC Units with free cooling of 3TR capacity

Note – 2 nos. AC units with free cooling shall be installed in each of 765kV and 400kV switchyard panel rooms stated above.

3.0.0 ELECTRICAL SYSTEM REQUIREMENTS

Two nos. power supply units each of 32A, 3Ph shall be provided by BHEL in each of Panel rooms. Any MCB/TPN switch etc required to connect this power supply to AC units shall be supplied and installed by contractor. *All cabling between the indoor and outdoor unit shall be supplied & done by contractor.*

Interfacing:

Each Controller shall have the following annunciation locally as well as sufficient potential free contacts to repeat these annunciations to remote display through Sub-station Automation System (SAS)

- a) AC Compressor-1 On/Off
- b) AC Compressor-2 On/Off
- c) Switchyard panel room Temp. High alarm

4.0.0 SCOPE OF SUPPLY & SERVICES

The scope of equipment to be furnished and services to be provided under the contract are outlined hereinafter and the same is to be read in conjunction with the provisions contained in other sections/ clauses. The scope of work under the

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contract shall be deemed to include all such items, which although are not specifically mentioned in the bid documents and / or in Bidder's proposal, but are required to make the equipment/ system complete for its safe, efficient, reliable and trouble free operation. **NO EXTRA COST** implication to BHEL shall be considered during contract stage on account of supply & installation of these unaccounted items.

4.1.0 SCOPE OF SUPPLY

- i. The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, General and Special Conditions of Contract, Technical Specifications, and Drawings.
- ii. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Purchaser and valued at the rates and prices bid in the priced Bill of Quantities.
- iii. A rate or price shall be entered against each item in the priced Bill of Quantities. The cost of Items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.
- iv. The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the priced Bill of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.
- v. General directions and descriptions of work and materials are not necessarily repeated nor summarized in the Bill of Quantities. References to the relevant sections of the Contract documentation shall be made before entering prices against each item in the priced Bill of Quantities.
- vi. Miscellaneous items like hardware, fixtures etc. shall be deemed to be included under the relevant BOQ items and bidders shall consider the same while quoting for BOQ items.

Bill of Quantity for Airconditioning units in Switchyard Panel Rooms

Sl. No.	Item Description	Unit	Quantity
1.	Air Conditioning Unit with free cooling of 2TR capacity with microprocessor based Controller for switchyard panel room of size 4 x 6 sq.m.	Nos.	8
2	Air Conditioning Unit with free cooling of 3TR capacity with microprocessor based Controller for switchyard panel room of size 4 x 9 sqm.	Nos.	10

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NOTE: BIDDER SHOULD COMPLY ALL REQUIREMENTS GIVEN IN THIS SPECIFICATION AND ALSO SPECIAL CARE FOR TECHNICAL REQUIREMENT MENTIONED IN THE POWERGRID'S SPECIFICATION, CL NO-3 ATTACHED WITH THE SECTION-2 WHILE QUOTING FOR ABOVE ITEMS.

4.2.0 SERVICES TO BE PERFORMED BY CONTRACTOR

4.2.1 Erection, Testing & Commissioning (ETC) requirements

- a) The scope of ETC shall include erection, system testing and commissioning of the system. Unloading and storage is excluded from contractor's scope.**
- b) Laying and termination of power and control cables for the equipment under the scope of this specification.
- c) Bidder shall arrange all machinery tools & tackles and consumables required for erection of the system.
- d) PVC drain piping for the condensate drain.
- e) Refrigerant piping connections as required.
- f) Earthing of all equipments through GI Flat/Wire of suitable size shall be done by contractor, however earthing material shall be supplied by BHEL as a free issue item.
- g) Bidder shall ensure that sufficient quantity of commissioning spares is made available for timely completion of commissioning of the system. These commissioning spare shall be in addition to mandatory spares.
- h) Submission of following documents for approval.
 1. Data sheet for 2TR/3TR Air-conditioning units with free cooling along with catalogue for the model being offered inline with Cl No. 3 of Powergrid's specification
 2. Layout showing Location with all wall cut-out details for installation of Air-conditioning units with free cooling in the Panel rooms.
- i) Any other service not explicitly illustrated herein but which may be required to complete the system with its desired functionality shall be deemed to be included in the scope of the bidder.

4.2.2 Civil Works

Following is covered under contractor's scope:

- 4.2.2.1 Wall openings at suitable locations for refrigerant and drain piping, if applicable.
- 4.2.2.2 Any other damage caused to civil works during ETC work of the equipment/system shall be made good to the original finish at no extra cost to the Purchaser.

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5.0.0 QUALITY & INSPECTION

The inspection of AC units shall be done as per technical specification/ approved technical data sheet/ GA before dispatch clearance.

Contractor shall ensure to produce test certificates of AC units inline with technical requirement to satisfy customer.

6.0.0 HANDING & TAKING OVER

After successful commissioning, All the Air-Conditioning units will be put through a run test for a week as per the specification requirement. After successful completion, they will be handed over to customer. Any defect noted during this period shall be rectified by the contractor without any cost implication to BHEL/ Customer.

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SECTION-2
EQUIPMENT SPECIFICATION

Customer's (POWERGRID) standard specification is attached to this section. Kindly refer the applicable clauses for air conditioning system of control room building.

TECHNICAL SPECIFICATION FOR
AIR CONDITIONING SYSTEM

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TECHNICAL SPECIFICATION FOR

AIR CONDITIONING SYSTEM

1 GENERAL

1.1 This specification covers supply, installation, testing and commissioning and handing over to POWERGRID of Air conditioning system for the control room building and switch-yard panel rooms.

1.2 Air conditioning units for control room building shall be set to maintain the inside DBT at $24^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and the air conditioning system for switch-yard panel rooms shall be set to maintain DBT inside switch-yard panel rooms below 24°C .

~~1.3 Controllers shall be provided in Control room and Battery room for controlling and monitoring the AC units in these rooms as detailed in clause no.2.3.4.~~

~~1.4 Each switch yard panel room shall be provided with temperature transducer to monitor the temperature of the panel room. The Temperature transducer shall have the following specification:~~

Sensor	: Air temperature sensor (indoor use)
Output	: 4 to 20mA
Temperature range	: 5°C to 60°C
Resolution	: 0.1°C
Accuracy	: 0.5°C or better.

~~**2 AIR CONDITIONING SYSTEM FOR CONTROL ROOM BUILDING.**~~

~~2.1 Air conditioning requirement of control room building shall be met using a combination of following types Air Conditioning units as required.~~

- ~~a) Ductable Split unit of 8.5TR.~~
- ~~b) Cassette type split AC units of 3TR.~~
- ~~c) High wall type split AC units of 2TR.~~

~~**2.2 Scope**~~

~~The scope of the equipment to be furnished and services to be provided under the contract are outlined hereinafter and the same is to be read in conjunction with the provision contained in other sections/ clauses. The scope of the work under the contract shall be~~

~~deemed to include all such items, which although are not specifically mentioned in the bid documents and/or in Bidder's proposal, but are required to make the equipment/system complete for its safe, efficient, reliable and trouble free operation.~~

~~2.2.1 Required number of Ductable split type AC units of 8.5 TR capacity with air cooled outdoor condensing unit with semi hermetic/hermetic compressors including refrigerant pipes, controls, thermostats, filters, outlet dampers, etc.~~

~~2.2.2 Required number of Cassette type split AC units of 3TR capacity each complete with air cooled outdoor condensing unit having hermetically sealed compressor unit with cordless remote controller.~~

~~2.2.3 Required number of High wall type split AC units of 2TR capacity each complete with air cooled outdoor condensing unit having hermetically sealed compressor and high wall type indoor evaporator unit with cordless remote controller.~~

~~2.2.4 Copper refrigerant piping complete with insulation between the indoor and outdoor units as required.~~

~~2.2.5 First charge of refrigerant and oil shall be supplied with the unit.~~

~~2.2.6 GSS/Aluminium sheet air distribution ducting for distributing conditioned dehumidified air along with supply air diffusers and return air grilles with volume control dampers and necessary splitters etc., suitable fixtures for grilles/diffusers and supports for ducting complete with insulation.~~

~~2.2.7 Local start/stop facility for local starting/ stopping of all electrical equipment/ drives.~~

~~2.2.8 All instruments and local control panels alongwith controls and interlock arrangements and accessories as required for safe and trouble free operation of the units.~~

~~2.2.9 PVC drain piping from the indoor units upto the nearest drain point.~~

~~2.2.10 Supply and erection of Power and control cable and earthing.~~

~~2.2.11 MS Brackets for outdoor condensing units, condensers as required.~~

2.3 Technical specifications.

~~2.3.1 Ductable split type AC units.~~

~~2.3.1.1 Each Split Air conditioner shall have an indoor unit and an outdoor unit, designed to provide free delivery of conditioned air to the conditioned space. The indoor unit shall be suitable for mounting on the ceiling concealed above the false ceiling. Outdoor unit can be placed on the roof. Each unit shall include a primary source of refrigeration for cooling and dehumidification, means for circulation and cleaning air.~~

~~2.3.1.2 Cabinet~~

~~The cabinets housing the components of indoor units & outdoor units shall be of heavy gauge sheet steel and suitable for floor mounting/mounting from ceiling. The access panels shall be of easily removable type. The entire casing shall be lined with 25mm thick insulation of totally flame proof type. Suitable drain connection shall be provided for removal of condensate collected inside a tray under cooling coil.~~

~~2.3.1.3 Compressor~~

~~The compressor shall be Semi hermetically/hermetically sealed type and complete with drive motor. The compressor shall be mounted on spring inside the lower most section of the unit so that it is easily accessible for servicing.~~

~~2.3.1.4 Condenser~~

~~Air cooled condenser of adequate surface area shall be offered. The air cooled condenser shall be made of copper tubes with external fins.~~

~~2.3.1.5 Air Handling Fan~~

~~The air handling fan shall be centrifugal type complete with belt drive and electric motor.~~

~~2.3.1.6 Filter~~

~~Pre filter at the suctions to remove dust particles down to 10 micron size with 90% efficiency and fine filters to remove dust particles down to 5 micron size with 99% efficiency at the outlet. All filters shall be of panel type.~~

~~2.3.1.7 Cooling Coil~~

~~Cooling coils shall be of direct expansion type and made of heavy gauge copper with aluminium fins. Rows shall be staggered in the direction of air flow. Separate tubings from the distributor shall feed refrigerant uniformly to different sections of the coil.~~

~~2.3.1.8 Refrigerant Piping~~

~~Refrigerant piping shall be of heavy gauge copper to IS:2501 or IS:1239 heavy class seamless M.S. pipe complete with thermostatic expansion valve, liquid strainer, dehydrator, liquid line shut off valve, high and low pressure gauges.~~

~~2.3.1.9 Condensate Trays~~

~~An adequate method of condensate removal shall be provided. Condensate tray of adequate size, made of corrosion resistant material or suitably treated with corrosion resistant coating shall be provided. The tray shall be adequately insulated to avoid condensation over its external surface.~~

~~2.3.1.10 Refrigerant Strainer~~

~~A refrigerant strainer shall be provided in the liquid line immediately before the expansion device.~~

~~2.3.1.11 Vibration Isolator~~

~~A minimum of six 25 thick neoprene rubber pads shall be supplied for each unit.~~

~~2.3.1.12 Cooling capacity of 8.5TR unit shall not be less than 102000 btu/hr.~~

~~2.3.2 Cassette type split AC units.~~

~~The Cassette type AC units shall be complete with indoor evaporator unit, outdoor condensing units and cordless remote control units.~~

~~2.3.2.1 Outdoor unit shall comprise of hermetically/ semi hermetically sealed compressors mounted on vibration isolators, fans and copper tube aluminium finned coils all assembled in a sheet metal casing. The casing and the total unit shall be properly treated and shall be weatherproof type. They shall be compact in size and shall have horizontal discharge of air.~~

~~2.3.2.2 Indoor units shall be of 4 way, ceiling mounted cassette type. The indoor unit shall be compact and shall have elegant appearance. They shall have low noise centrifugal blowers driven by suitable motors and copper tube aluminium finned cooling coils. Removable and washable polypropylene filters shall be provided. They shall be complete with multi function cordless remote control unit with special features like programmable timer, sleep mode etc.~~

~~2.3.2.3 Cooling capacity of 3TR AC units shall not be less than 36000btu/hr.~~

and their EER shall not be less than 2.7.

~~2.3.3 High wall type split AC units~~

~~2.3.3.1 The split AC units shall be complete with indoor evaporator unit, outdoor condensing units and cordless remote control units.~~

~~2.3.3.2 Outdoor unit shall comprise of hermetically/semi hermetically sealed compressors mounted on vibration isolators, propeller type axial flow fans and copper tube aluminium finned coils all assembled in a sheet metal casing. The casing and the total unit shall be properly treated and shall be weatherproof type. They shall be compact in size and shall have horizontal discharge of air.~~

~~2.3.3.3 The indoor units shall be high wall type. The indoor unit shall be compact and shall have elegant appearance. They shall have low noise centrifugal blowers driven by suitable motors and copper tube aluminium finned cooling coils. Removable and washable polypropylene filters shall be provided. They shall be complete with multi function cordless remote control unit with special features like programmable timer, sleep mode and soft dry mode etc.~~

~~2.3.3.4 Cooling capacity of 2TR AC units shall not be less than 22000btu/hr. and shall have energy efficiency rating of 3star or above.~~

~~2.3.4 Controllers shall be provided in Control room and Battery room, one controller for each room, to control and monitoring of AC units and shall have the following facilities;~~

- ~~• Standby units shall come in to operation automatically when the running main unit fails~~
- ~~• Main and standby units shall be changed over periodically which shall be finalised during detailed engineering.~~
- ~~• Following alarms shall be provided:~~
 - ~~a. Compressor On/OFF condition of each unit~~
 - ~~b. Compressor failure of each unit~~
 - ~~c. Power OFF to AC unit~~
 - ~~d. High temperature in room.~~

~~2.4 The Split AC units shall be of Carrier, Voltas, Blue Star, Hitachi, Daikin, LG, National, O'General or Samsung make.~~

2.5 Warranty

All compressors shall have minimum 5 years Warranty from the date

of commissioning.

3 AIR CONDITIONING SYSTEM FOR SWITCHYARD PANEL ROOMS.

3.1 Air conditioning system shall be provided in the switchyard panel rooms used for housing control and protection panels. These panel rooms will be located in the switchyard area and generally unmanned. Therefore, the air-conditioning system shall be rugged, reliable, maintenance free and designed for long life.

3.2 Air conditioning system is required for maintaining the temperature below 24°C for sub-station control and protection panels. This shall be achieved using Packaged AC units with free cooling arrangement as per clause 3.4. The system shall be designed for 24 Hours, 365 Days of the year operation to maintain the inside Switchyard panel rooms temperature for proper operation of the critical equipment.

3.3 Number and rating of the units for each panel room shall be as follows:

- i. For panel room of length not more than 6 metres.: 2 nos. (1 working + 1 standby) AC units of 2TR capacity each.
- ii. For panel room of length more than 6 metres.: 2 nos. (1 working + 1 standby) AC units of 3TR capacity each.

3.4 Technical specification for Packaged AC units with Free Cooling.

3.4.1 Each AC unit shall be complete with air cooled condensing unit with scroll compressor, direct expansion type evaporating unit and microprocessor controller. AC units shall be provided with free cooling arrangement. In free cooling mode, the refrigerant cycle of AC unit shall be switched off and outside air (after filtration) shall be circulated inside the conditioned space through the operation of dampers provided with suitable sensors. This mode shall come into operation in the following conditions;

- i. When the ambient temperature is below a preset value, which is to be decided during detailed engineering.
- ii. In case of failure of refrigeration system of both the units.

3.4.2 One of the air-conditioners shall be running at a time and shall maintain the required temperature. On failure of the running air-conditioner, the other air-conditioner shall start automatically. To ensure longer life of the system and to keep the AC units healthy, change over of the standby unit shall be done periodically through

the controller. Further, if inside temperature of the room reaches 35°C due to any emergency condition, the standby air-conditioner shall also start running to maintain the temperature less than 24°C and system shall generate an alarm for such a situation. After achieving this temperature, the standby unit shall again shut off. However any hunting situation shall be reported. No heating or humidification is envisaged for the air conditioning system inside the Switchyard panel rooms.

3.4.3 Packaged AC units with free cooling shall be designed for high sensitive cooling with sensible heat factor of 90% or above.

3.4.4 Each air conditioner shall be completely self-contained. All components of the units shall be enclosed in a powder coated cabinet. The unit shall be assembled, wired, piped, charged with refrigerant and fully factory tested as a system to ensure trouble free installation and start up. Suitable isolation or other by-passing arrangement shall be provided such that any unit/component could be maintained/ repaired without affecting the running standby unit.

3.4.5 The AC units shall be mounted on the wall and the maintenance of unit shall be possible from outside the Switchyard panel room.

3.4.6 Required Features of Various Components

The compressor shall be very reliable, trouble free and long life i.e. hermetically sealed Scroll type of reputed make suitable for continuous operation. Compressor should be installed on vibration isolated mountings or manufacturer's recommended approved mounting. Valve shall be provided for charging/topping up of refrigerant. The bidder shall furnish details of their compressor indicating the MTBF, life of compressor and continuous run time of compressor without failure. The contractor shall also furnish details of all accessories i.e. refrigeration system, evaporator coil, condenser coil, evaporator blower, filter, cabinet, indoor supply and return grill etc. during detailed engineering.

3.5 **Warranty**

All compressors shall have minimum 5 years Warranty from the date of commissioning

3.6 For owner's remote monitoring purposes, necessary digital inputs shall be provided for 'ON' and 'OFF' condition of each compressor.

SECTION 3

PROJECT DETAILS AND GENERAL SPECIFICATION

SITE INFORMATION

S.N.	Particular	Details
a)	Owner	POWERGRID
b)	Customer	POWERGRID
c)	Project Title	Substation Package – Substation Package -SS01 for Construction of 765/400/220kV Bhuj Pool (New) S/S and Extension of 765kV Banaskantha S/s under Green Energy Corridors: Inter-State Transmission Scheme (ISTS) – Part C.
d)	Location	Bhuj, Gujrat Banaskantha , Gujrat
e)	Transport Facilities	ROAD/TRAIN, For Bhuj Nearest Rail Head: Bhuj ROAD/TRAIN, For Banaskantha Nearest Rail Head: Palanpur
SITE CONDITIONS		
a)	Max. ambient air temp.	50°C
b)	Min. ambient air temp.	0°C
c)	Max. design ambient temp.	50°C
d)	Design reference temp.	50°C
e)	Average Humidity	Max. 100%
f)	Special corrosion conditions	No
g)	Solar Radiation	1.2kW/Sq. mtr
h)	Atmospheric UV radiation	High
i)	Altitude above sea level	Less than 1000 meter
j)	Pollution Severity	High Pollution level (31mm/kV) For Bhuj High Pollution (25mm/kV) for Banaskantha
k)	Seismic Zone	As per the seismic zone defined in the relevant BIS / IEC-62271-300 but not less than 0.3g horizontal
WIND DATA		
	Wind velocity	As per IS
	Average No. of thunderstorm days per annum	As per IS

1.0 GENERAL

This Chapter covers Technical Requirements and requirements of auxiliary items.

- 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 unless included in the list of exclusions.
- Material and components not specifically stated in this specification but which are necessary for satisfactory operation of the equipment and accessories specified in this specification shall be deemed to be included unless specifically excluded and shall be supplied at no extra cost.

- c) Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific name mentioned shall be understood as establishing type, function and quality and not as limiting competition.
- d) In case any Deviation Schedule, Bid Proposal Sheet, Schedule of Data Requirements (DRS), test reports or any other document/information are not furnished along-with the bid, the bid is liable to be rejected. Unless brought out clearly, the Bid will be deemed to conform to the specification scrupulously. All deviations from the specification shall be clearly brought out in the respective deviation schedule.

Auxiliary supplies as described below would be available at site.

Normal	Variation	Frequency	Phase	Neutral
Voltage	in voltage	(Hz)		connection
(Volts)				

415	+ 10 %	50 + 5 %	3 Ph. - 4wire	Solidly earthed
240	+ 10 %	50 + 5 %	1 Ph-2wire	Solidly earthed
220	+ 10 %	DC		Isolated (2 wire system)
48		DC		Isolated (2 wire system) (+ Earthed)

- f) The Bidder shall clearly indicate in the bid, the specific standards in accordance with which the works will be carried out.
- g) The equipment must be new, of highest grade, the best quality of their kind, to best engineering practice and latest state of art, and in accordance with purpose for which they are intended and ensure satisfactory performance throughout the service life.
- h) All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same materials and workmanship as the corresponding parts of the equipment. Where feasible, common components, units shall be employed in different pieces of equipment in order to optimize the spare part stock-up and utilization.
- i) The requirement regarding external RIV as specified for equipment shall include the terminal fittings and the equipment shall have been tested preferably with fittings, if any.

2.0 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

- a) The equipment furnished under this specification shall perform all its functions and operate satisfactorily without showing undue strain, restrike etc.
- b) The equipment shall be able to withstand forces due to wind load, short circuit, system over voltages, fluctuations, frequency variations etc., all forces considered together.

3.0 SUPPORT STRUCTURES (If in the scope of Bidder)

- a) The support structures should be hot dip galvanised with minimum 610 gram/m² net of zinc.
- b) The design calculations taking into account the environmental conditions of the substations shall be furnished for sizing of the structures.

4.0 STANDARDS

- a) The equipment to be furnished under this specification shall conform to latest issue with all amendments of standard specified under respective Chapters of this Specification. The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other. The bidder shall also note that list of standards presented in this specification is not complete. Whenever necessary the list of standards shall be considered in conjunction with specific IS/IEC. When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.
- b) Other internationally accepted standards which ensure equivalent or better performance than that specified in the standards referred shall also be accepted.
- c) In case governing standards for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in additional information schedule along with English language version of standard or relevant extract of the same. The equipment conforming to standards other than IS/ IEC shall be subject to POWERGRID's approval.

5.0 ENGINEERING DATA AND DRAWINGS

- 5.1 The list of drawings/documents which are to be submitted to the Purchaser shall be discussed and finalised by the Purchaser at the time of award. The supplier shall necessarily submit all the drawings/ documents unless anything is waived.
- 5.2 The Contractor shall submit 4 (four) sets of drawings/ design documents /data / detailed bill of quantity and 1 (one) set of test reports for the approval of the Purchaser. The contractor shall also submit the softcopy of the above documents in addition to hardcopy.

5.3 Drawings

- 5.3.1 All drawings submitted by the Contractor 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, dimensions, internal & the external connections, fixing arrangement required and any other information specifically requested in the specifications.
- 5.3.2 Drawings submitted by the Contractor shall be clearly marked with the name of the Purchaser, the unit designation, the specifications title, the specification number and the name of the Project. POWERGRID has standardized a large number of drawings/documents of various make including type test reports which can be used for all projects having similar requirements and in such cases no project specific approval (except for list of applicable drawings along with type test reports) is required. However, distribution copies of standard drawings/documents shall be submitted as per provision of the contract. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in SI units.
- 5.3.3 The review of these data by the Purchaser will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under the specifications, external connections and of the dimensions which might affect substation layout. This review by the Purchaser may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, 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.

5.4 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.

5.5 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 works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the Purchaser in Writing.

5.6 Approval Procedure

The scheduled dates for the submission of the drawings as well as for, any data/information to be furnished by the Purchaser would be discussed and finalised at the time of award. The following schedule shall be followed generally for approval and for providing final documentation.

- | | |
|--|--|
| i) Approval/comments/ | As per agreed by Purchaser on initial schedule submission |
| ii) Resubmission | Within 3 (three) weeks (whenever from date of comments) |
| iii) Approval or comments | Within 3 (three) weeks of receipt of resubmission. |
| iv) Furnishing of distribution copies (5 hard copies per scanned Copy (pdf format) for Corporate Centre) | 2 weeks from the date of approval substation and one |
| v) Furnishing of distribution copies of test reports | |
| (a) Type test reports
(one scanned softcopy in corporate centre)
& one hardcopy per substation) | 2 weeks from the date of final approval pdf format per substation plus one for |
| (b) Routine Test Reports
(one copy for each substation) | -do- |
| vi) Furnishing of instruction/ per substation and one softcopy (pdf format) for corporate centre & per substation) | As per agreed schedule operation manuals (2 copies |
| (vii) As built drawings (two sets of substation & one Soft copy (pdf format) for corporate centre& per substation) | On completion of entire works hardcopy per |

NOTE:

- (1) The supplier may please note that all resubmissions must incorporate all comments given in the

earlier submission by BHEL/POWERGRID or adequate justification for not incorporating the same must be submitted failing which the submission of documents is likely to be returned.

- (2) All drawings should be submitted in softcopy form, however substation design drawings like SLD, GA, all layouts etc. shall also be submitted in AutoCAD Version. SLD, GA & layout drawings shall be submitted for the entire substation in case of substation extension also.
- (3) The instruction Manuals shall contain full details of drawings of all equipment being supplied under this contract, their exploded diagrams with complete instructions for storage, handling, erection, commissioning, testing, operation, trouble shooting, servicing and overhauling procedures.
- (4) If after the commissioning and initial operation of the substation, the instruction manuals require any modifications/ additions/changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the supplier to BHEL/POWERGRID.
- (5) The manufacturer shall furnish to the Purchaser catalogues of spare parts.
- (6) All As-built drawings/documents shall be certified by site indicating the changes before final submission.

6.0 MATERIAL WORKMANSHIP

6.1 General Requirement

- 6.1.1 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.
- 6.1.2 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 supplier.
- 6.1.3 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 BHEL/POWERGRID.
- 6.1.4 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.
- 6.1.5 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 considered as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, levelling, aligning, coupling of or bolting down to previously installed

equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances, instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacturer's limits suitable guards shall be provided for the protection of personnel on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purposes. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

- 6.1.6 The supplier 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 supplier shall apply all operational lubricants to the equipment installed by him.
- 6.1.7 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 POWERGRID in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.
- 6.1.8 Corona and radio interference voltage test and seismic withstand test (for 132kV and above voltage level) procedures for equipments shall be in line with the procedure given at Annexure-A and B respectively.

6.2 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 favourable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

6.2.1 Space Heaters

- 6.2.1.1 The heaters shall be suitable for continuous operation at 240V as supply voltage. On-off switch and fuse shall be provided.
- 6.2.1.2 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.
- 6.2.1.3 Suitable anti condensation heaters with the provision of thermostat shall be provided.

6.2.2 FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant 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.

6.2.3 Ventilation opening

Wherever ventilation is provided, the compartments shall have ventilation openings 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 and suitable provision shall be made so as to avoid any communication of air / dust with any part in the enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc.

6.2.4 Degree of Protection

The enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall provide 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 possibility of entry of water is limited: IP-41.
- e) For LT Switchgear (AC & DC distribution Boards): IP-52

The degree of protection shall be in accordance with IS: 13947 (Part-I) / IEC-60947(Part-I) / IS 12063 / IEC-60529. Type test report for degree of protection test, shall be submitted for approval.

6.3 RATING PLATES, NAME PLATES AND LABELS

Each main and auxiliary item of substation is to have permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of the loading conditions under which the item of substation in question has been designed to operate, and such diagram plates as may be required by the Purchaser. The rating plate of each equipment shall be according to IEC requirement.

All such nameplates, instruction plates, rating plates of transformers, reactors, CB, CT, CVT, SA, Isolators, C & R panels and PLCC equipment 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.

6.4 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment covered under the scope of the specifications, into successful Operation, shall be furnished by the supplier unless specifically excluded under the exclusions in these specifications and documents.

7.0 DESIGN IMPROVEMENTS / COORDINATION

- 7.1 The bidder shall note that the equipment offered by him in the bid only shall be accepted for supply. However, the Purchaser or the Contractor may propose changes in the specification of the equipment or quality thereof and if the Purchaser & contractor agree upon any such changes, the specification shall be modified accordingly.
- 7.2 If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.
- 7.3 The supplier shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic design requirements are detailed out in this Specification. The design of various components, sub-assemblies and assemblies shall be so done that it facilitates easy field assembly and maintenance.
- 7.4 The supplier has to coordinate designs and terminations with the agencies (if any) who are Consultants/Contractor for the Purchaser. The names of agencies shall be intimated to the successful bidders.
- 7.5 The supplier will be called upon to attend design co-ordination meetings with the Engineer,

other Contractor's and the Consultants of the Purchaser (if any) during the period of Contract. The Contractor shall attend such meetings at his own cost at POWERGRID Corporate Centre, Gurgaon (Haryana) or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

8.0 QUALITY ASSURANCE PROGRAMME

- 8.1 To ensure that the equipment and services under the scope of this Contract whether manufactured or performed within the supplier's Works or at his Sub- contractor's premises or at the Purchaser's site or at any other place of Work are in accordance with the specifications, the supplier shall adopt suitable quality assurance programme to control such activities at all points necessary. The detailed programme shall be submitted by the contractor after the award for reference. A quality assurance programme of the supplier shall generally cover the following:
- His organization structure for the management and implementation of the proposed quality assurance programme;
 - Documentation control system;
 - Qualification data for bidder's key personnel;
 - The procedure for purchases of materials, parts components and selection of sub-Contractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
 - System for shop manufacturing and site erection controls including process controls and fabrication and assembly control;
 - Control of non-conforming items and system for corrective actions;
 - Inspection and test procedure both for manufacture and field activities.
 - Control of calibration and testing of measuring instruments and field activities;
 - System for indication and appraisal of inspection status;
 - System for quality audits;
 - System for authorizing release of manufactured product to the Purchaser.
 - System for maintenance of records;
 - System for handling storage and delivery; and
 - A quality plan detailing out the specific quality control measures and procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services rendered.

POWERGRID/BHEL or his duly authorized representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the supplier/his vendor's quality management and control activities.

8.2 Quality Assurance Documents

The supplier would be required to submit all the Quality Assurance Documents as stipulated in the Quality Plan at the time of POWERGRID/ BHEL inspection of equipment/material.

9.0 TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

- 9.1 All equipment being supplied shall conform to type tests as per technical specification and shall be subject to routine tests in accordance with requirements stipulated under respective sections.

- 9.2 The reports for all type tests as per technical specification shall be furnished by the supplier alongwith equipment / material drawings. However, type test reports of similar equipment/ material already accepted in POWERGRID shall be applicable for all project with similar requirement. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by POWERGRID or representative authorized by POWERGRID or Utility or representative of accredited test lab or reputed consultant.

The test reports submitted shall be of the tests conducted within last 10 (ten) years prior to the date of bid opening i.e. **07.04.15**. In case the test reports are of the test conducted earlier than 10 (ten) years prior to the date of bid opening, the contractor shall repeat these test(s) at no extra cost to BHEL.

However, in case of instrument transformers, the following type tests should have been conducted within 5 (five) years prior to the date of bid opening.

- i) Lightning Impulse Test
- ii) Switching Impulse Test
- iii) Multiple Chopped Impulse Test (For CT)
- iv) Chopped Impulse Test (For CVT)

In case the test reports are of these tests (for instrument transformers) as mentioned above are conducted earlier than 5 (five) years prior to the date of bid opening i.e. 07.04.15, the contractor shall repeat these test(s) at no extra cost to the purchaser.

Further, in the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/ manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the Technical Specification or any/all type tests not carried out, same shall be carried out without any additional cost implication to the Purchaser.

The supplier shall intimate the BHEL/ POWERGRID the detailed program about the tests atleast two (2) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies.

Further, in case type tests are required to be conducted/repeated and the deputation of Inspector/Purchaser's representative is required, then all the expenses shall be borne by the supplier.

- 9.3 The Purchaser intends to repeat the type tests on Power Transformer and Shunt Reactor except Dynamic short circuit tests on transformers, for which test charges shall be payable as per provision of contract. The price of conducting type tests shall be included in Bid price and break up of these shall be given in the relevant schedule of Bid Proposal Sheets. These Type test charges would be considered in bid evaluation. In case Bidder does not indicate charges for any of the type tests or does not mention the name of any test in the price schedules, it will be presumed that the particular test has been offered free of charge. Further, in case any Bidder indicates that he shall not carry out a particular test, his offer shall be considered incomplete and shall be liable to be rejected. BHEL/POWERGRID reserves the right to witness any or all the type tests. The BHEL/ POWERGRID also reserves the right to waive the repeating of type tests partly or fully and in case of waiver, test charges for the same shall not be payable.

The Purchaser shall bear all expenses for deputation of purchaser's representative(s) for witnessing the type tests under this clause except in the case of re-deputation if any, necessitated due to no fault of the purchaser.

For outdoor receptacles, trefoil clamps, diesel engine, alternator, motors, cable glands, lighting fixtures, ACSR/AAC conductor, IPS aluminum tube and junction boxes, type test reports are not required to be submitted for the makes indicated at Annexure-E /POWERGRID approved list of sub-vendors. For the new makes(other than those indicated at Annexure-E / POWERGRID approved list of sub-vendors), type test reports as per relevant standard shall be submitted for POWERGRID's approval.

- 9.4 The Purchaser, his duly authorised representative and/or outside inspection agency acting on behalf of the Purchaser shall have at all reasonable times free access to the Contractor's/sub-vendors premises or Works and shall have the power at all reasonable times to inspect and examine the materials and workmanship of the Works during its manufacture or erection if part of the Works is being manufactured or assembled at other premises or works, the Contractor shall obtain for the Engineer 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. Inspection may be made at any stage of manufacture, despatch or at site at the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.
- 9.5 The supplier shall give the Purchaser /Inspector fifteen (15) days written notice for on-shore and six (6) weeks' notice for off-shore material being ready for joint testing including contractor and POWERGRID. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Purchaser/inspector, unless witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date of which the equipment is notified as being ready for test/inspection, failing which the Contractor may proceed alone with the 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 tests in triplicate.
- 9.6 The Purchaser or Inspector shall, within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Purchaser /Inspector giving reasons therein, that no modifications are necessary to comply with the Contract.
- 9.7 When the factory tests have been completed at the Contractor's or Sub- Contractor's works, the Purchaser/inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Purchaser /Inspector, the certificate shall be issued within fifteen (15) days of receipt of the Contractor's Test certificate by the Engineer/Inspector. Failure of the Purchaser /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 certificate shall not bind the Purchaser to accept the equipment should, it, on further tests after erection, be found not to comply with the Contract. The equipment shall be dispatched to site only after approval of test reports and issuance of CIP by the Purchaser.
- 9.8 In all cases where the Contract provides for tests whether at the premises or at the works of the Contractor or of any Sub-Contractor, the Contractor except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Purchaser /Inspector or his authorized representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Purchaser /Inspector or to his authorized representative to accomplish testing.

- 9.9 The inspection by Purchaser 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.
- 9.10 The Purchaser will have the right of having at his own expenses any other test(s) of reasonable nature carried out at Contractor's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.
- 9.11 The Purchaser reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipment for these tests shall be provided by the Purchaser.

10.0 TESTS

10.1 Pre-commissioning Tests

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Purchaser and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The list of pre-commissioning tests to be performed are given in respective chapters and shall be included in the Contractor's quality assurance programme.

10.2 Commissioning Tests

- 10.2.1 The available instrumentation and control equipment will to be used during such tests and the Purchaser will calibrate, all such measuring equipment and devices as far as practicable.
- 10.2.2 Any special equipment, tools and tackles required for the successful completion of the Commissioning Tests shall be provided by the Contractor, free of cost.
- 10.2.3 The specific tests requirement on equipment have been brought out in the respective chapters of the technical specification.
- 10.3 The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning the equipment and the switchyard. However necessary fee shall be reimbursed by POWERGRID on production of requisite documents.

11.0 PACKAGING & PROTECTION

- 11.1 All the equipment 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. While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken into account. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. Purchaser takes no responsibility of the availability of the wagons.
- 11.2 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 and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

12.0 FINISHING OF METAL SURFACES

12.1 All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hot-dip galvanized after fabrication. High tensile steel nuts & bolts and spring washers shall be electro galvanized to service condition 4. All steel conductors including those used for earthing/grounding (above ground level) shall also be galvanized according to IS:2629.

12.2 HOT DIP GALVANISING

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

12.2.2 The galvanized surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

12.2.3 After galvanizing, no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization.

12.2.4 The galvanized steel shall be subjected to six one minute dips in copper sulphate solution as per IS-2633.

12.2.5 Sharp edges with radii less than 2.5 mm shall be able to withstand four immersions of the Standard Preece test. All other coatings shall withstand six immersions. The following galvanizing tests should essentially be performed as per relevant Indian Standards.

- Coating thickness
- Uniformity of zinc
- Adhesion test
- Mass of zinc coating

12.2.6 Galvanized material must be transported properly to ensure that galvanized surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

12.3 PAINTING

12.3.1 All sheet steel work shall be degreased, pickled, phosphated in accordance with the IS-6005 "Code of practice for phosphating iron and sheet". All surfaces, which will not be easily accessible after shop assembly, shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swarf shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

12.3.2 After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be "flash dried" while the second coat shall be stoved.

- 12.3.3 After application of the primer, two coats of finishing synthetic enamel paint shall be applied, each coat followed by stoving. The second finishing coat shall be applied after inspection of first coat of painting.
- 12.3.4 The exterior and interior colour of the paint in case of new substations shall preferably be RAL 7032 for all equipment, marshalling boxes, junction boxes, control cabinets, panels etc. unless specifically mentioned under respective sections of the equipments. Glossy white colour inside the equipments /boards/panels/junction boxes is also acceptable. The exterior colour for panels shall bematching with the existing panels in case of extension of a substation. Each coatof primer and finishing paint shall be of slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipments.
- 12.3.5 In case the Bidder proposes to follow his own standard surface finish and protection procedures or any other established painting procedures, like electrostatic painting etc., the procedure shall be submitted alongwith the Bids for Purchaser's review & approval.
- 12.3.6 The colour scheme as given below shall be followed for Fire Protection and Air Conditioning systems

S.N o.	PIPE LINE	Base colour	Band colour
Fire Protection System			
1	Hydrant and Emulsifier system pipeline	FIRE RED	-
2	Emulsifier system detection line – water	FIRE RED	Sea Green
3	Emulsifier system detection line – Air	FIRE RED	Sky Blue
4	Pylon support pipes	FIRE RED	
Air Conditioning System			
5	Refrigerant gas pipeline – at compressor suction	Canary Yellow	
6	Refrigerant gas pipeline – at compressor discharge	Canary Yellow	
7	Refrigerant liquid pipeline	Dark Admiralty Green	-
8	Chilled water pipeline	Sea Green	-
9	Condenser water pipeline	Sea Green	Dark Blue

- 12.3.7 For aluminum casted surfaces, the surface shall be with smooth finish. Further, in case of aluminium enclosures the surface shall be coated with powder (coating thickness of 60 microns) after surface preparation for painting.

13.0 HANDLING, STORING AND INSTALLATION

- 13.1 In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Purchaser or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented. Commercial use of switchyard equipment means completion of all site tests specified and energisation at rated voltage.

- 13.2 Contractor may engage manufacturer's Engineers to supervise the unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's supervisory Engineer(s) and shall extend full cooperation to them.
- 13.3 The contractor shall have to ensure that the hard and flat indoor and outdoor storage areas are in place prior to commencement of delivery of material at site. Contractor shall also ensure availability of proper unloading and material handling equipment like cranes etc. and polyester/nylon ropes of suitable capacity to avoid damage during unloading and handling of material at site. All indoor equipments shall be stored indoors. Outdoor equipment may be stored outdoors but on a hard and flat raised area properly covered with waterproof and dustproof covers to protect them from water seepage and moisture ingress. However, all associated control panels, marshalling boxes operating boxes etc. of outdoor equipments are to be stored indoors only. Storage of equipment on top of another one is not permitted if the wooden packing is used. Material opened for joint inspection shall be repacked properly as per manufacturer's recommendations. During storage of material regular periodic monitoring of important parameters like oil level / leakage, SF6 / Nitrogen pressure etc. shall be ensured by the contractor.
- 13.4 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.
- 13.5 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 breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense.
- 13.6 Supplier shall be responsible for examining all the shipment and notify the Purchaser immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. The Contractor shall submit to the Purchaser every week a report detailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.
- 13.7 The supplier shall be fully responsible for the equipment/material until the same is handed over to the Purchaser in an operating condition after commissioning. Contractor shall be responsible for the maintenance of the equipment/material while in storage as well as after erection until taken over by Purchaser, as well as protection of the same against theft, element of nature, corrosion, damages etc.
- 13.8 Where material / equipment is unloaded by Purchaser before the Contractor arrives at site or even when he is at site, Purchaser by right can hand over the same to Contractor and there upon it will be the responsibility of Contractor to store the material in an orderly and proper manner.
- 13.9 The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipment which requires indoor storage.
- 13.10 The words 'erection' and 'installation' used in the specification are synonymous.

- 13.11 Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.

18.0 CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

- 18.1 All types of boxes, cabinets etc. shall generally conform to & be tested in accordance with IS-5039/IS-8623, IEC-60439, as applicable, and the clauses given below:
- 18.2 Control cabinets, junction boxes, Marshalling boxes & terminal boxes shall be made of sheet steel or aluminum enclosure and shall be dust, water and vermin proof. Sheet steel used shall be atleast 2.0 mm thick cold rolled or 2.5 mm hot rolled or alternately 1.6 mm thick stainless steel can also be used. 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. In case of aluminum enclosed box the thickness of aluminum shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness.
- 18.3 A canopy and sealing arrangements for operating rods shall be provided in marshalling boxes / Control cabinets to prevent ingress of rain water.
- 18.4 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 the gasket shall be such that it does not get damaged/cracked during the operation of the equipment.
- 18.5 All doors, removable covers and plates shall be gasketed all around with suitably profiled EPDM/Neoprene gaskets. The gasket shall be tested in accordance with approved quality plan, IS: 11149 and IS:3400. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.
- 18.6 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 above 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 plate. Gland plate shall have provision for some future glands to be provided later, if required. The Nickel plated glands shall be dust proof, screw on & double compression type and made of brass. The gland shall have provision for securing armour of the cable separately and shall be provided with earthing tag. The glands shall conform to BS: 6121.
- 18.7 A 240V, single phase, 50 Hz, 15 amp AC plug and socket shall be provided in the cabinet with ON-OFF switch for connection of hand lamps. Plug and socket shall be of industrial grade.
- 18.8 For illumination, a fluorescent tube or CFL of approximately 9 to 15 watts shall be provided. The switching of the fittings shall be controlled by the door switch.
- For junction boxes of smaller sizes such as lighting junction box, manual operated earth switch mechanism box etc., plug socket, heater and illumination is not required to be provided.
- 18.9 All control switches shall be of MCB/rotary switch type and Toggle/piano switches shall not be accepted.
- 18.10 Positive earthing of the cabinet shall be ensured by providing two separate earthing pads. The earth wire shall be terminated on to the earthing pad and secured by the use of self-etching washer Earthing of hinged door shall be done by using a separate earth wire.
- 18.11 The bay marshalling kiosks shall be provided with danger plate and a diagram showing the

numbering/connection/feruling by pasting the same on the inside of the door.

18.12 a) The following routine tests alongwith the routine tests as per IS:5039 shall also be conducted:

- i) Check for wiring
- ii) Visual and dimension check

b) The enclosure of bay marshalling kiosk, junction box, terminal box shall conform to IP-55 as per IS:13947 including application of, 2.5 KV rms for 1 (one) minute, insulation resistance and functional test after IP-55 test.

20.0 TERMINAL BLOCKS AND WIRING

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

20.2 Terminal blocks shall be 650V grade and have continuous rating to carry the maximum expected current on the terminals and non-breakable type. These shall be of molded 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 of Elmex or Phoenix or Wagoor equivalent make.

20.3 Terminal blocks 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.

20.4 The terminal shall be such 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.

20.5 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.

20.6 The terminal blocks shall be of extensible design.

20.7 The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

20.8 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.

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

- | | | |
|----|------------------------------------|---|
| a) | All circuits except CT/PT circuits | Minimum of two of 2.5 sq mm copper flexible. |
| b) | All CT/PT circuits | Minimum of 4 nos. of 2.5 sq mm copper flexible. |

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

20.12 There shall be a minimum clearance of 250 mm between the First/bottom row of terminal block and the associated cable gland plate for outdoor ground mounted marshalling box and the clearance between two rows of terminal blocks shall be a minimum of 150 mm.

20.13 The supplier shall furnish all wire, conduits and terminals for the necessary interphase electrical

connections (where applicable) as well as between phases and common terminal boxes or control cabinets. For equipments rated for 400 kV and above the wiring required in these items shall be run in metallic ducts or shielded cables in order to avoid surge overvoltages either transferred through the equipment or due to transients induced from the EHV circuits.

- 20.14 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 Contractor 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.

21.0 LAMPS & SOCKETS

21.1 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.

21.2 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.

21.3 Switches and Fuses:

- 21.3.1 Each panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signalling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with miniature circuit breaker / 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.

- 21.3.2 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.

23.0 MOTORS

Motors shall be "Squirrel Cage" three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and shall be subjected to routine tests as per applicable standards. The motors shall be of approved make.

23.1 Enclosures

- Motors to be installed outdoor without enclosure shall have hose proof enclosure equivalent to IP-55 as per IS: 4691. For motors to be installed indoor i.e. inside a box, the motor enclosure, shall be dust proof equivalent to IP-44 as per IS: 4691.
- Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.
- Motors shall have drain plugs so located that they will drain water resulting from condensation or other causes from all pockets in the motor casing.
- Motors weighing more than 25 Kg. shall be provided with eyebolts, lugs or other means to facilitate lifting.

23.2 Operational Features

- Continuous motor rating (name plate rating) shall be at least ten (10) percent above the maximum load demand of the driven equipment at design duty point and the motor shall not be over loaded at any operating point of driven equipment that will rise in service.
- Motor shall be capable at giving rated output without reduction in the expected life span when operated continuously in the system having the particulars as given in Clause 15.0 of this Section.

23.3 Starting Requirements:

- All induction motors shall be suitable for full voltage direct-on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops down to 80% of the rated voltage.
- Motors shall be capable of withstanding the electrodynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.
- The locked rotor current shall not exceed six (6) times the rated full load current for all motors, subject to tolerance as given in IS:325.
- Motors when started with the driven equipment imposing full starting torque under the supply voltage conditions specified under Clause 15.0 shall be capable of withstanding atleast two successive starts from cold condition at room temperature and one start from hot condition without injurious heating of winding. The motors shall also be suitable for three equally spread starts per hour under the above referred supply condition.
- The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than starting time with the driven equipment of minimum permissible voltage by at least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement, the Bidder shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speed lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% of the rated speed in either direction of rotation.

23.4 Running Requirements:

- The maximum permissible temperature rise over the ambient temperature of 50 degree C shall be within the limits specified in IS:325 (for 3 - phase induction motors) after adjustment due to increased ambient temperature specified.
- The double amplitude of motor vibration shall be within the limits specified in IS: 4729. Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.
- All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes with rated load commencing from hot condition.

23.5 TESTING AND COMMISSIONING

An indicative list of tests is given below. Contractor shall perform any additional test based on specialties of the items as per the field Q.P./Instructions of the equipment Contractor or Purchaser without any extra cost to the Purchaser. The Contractor shall arrange all instruments required for conducting these tests along with calibration certificates and shall furnish the list of instruments to the Purchaser for approval.

- Insulation resistance.

Project	765/ 400/ 220 KV BHUJ (NEW) SUBSTATION
System	AIR CONDITIONING SYSTEM FOR SPR
Customer	POWER GRID CORPORATION OF INDIA LTD
Purchaser	BHEL (TRANSMISSION BUSINESS GROUP)

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REV. 0



- (b) Phase sequence and proper direction of rotation.
- (c) Any motor operating incorrectly shall be checked to determine the cause and the conditions corrected.

**BHARAT HEAVY ELECTRICALS LIMITED**

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

Doc. No.

TB-385-553-036**Rev. 00****765/400/220 kV BHUJ NEW S/S & 765 KV
BANASKANTHA EXTN S/S**

Part No.

SECTION -4

AIR CONDITIONING SYSTEM FOE SWITCHYARD PANEL ROOM

SHEET 1 OF 1**SECTION-4****GUARANTEED TECHNICAL PARTICULARS**

Following to be submitted by the bidders at the time of the bid which are minimum information, however bidder may also furnish the other important technical details.

1	Make	
2.	Model No. of unit	
3.	Capacity	2 TR/ 3TR
4	Type of AC	Package AC with free cooling
5	Power Supply	Three Phase, 16A current rating
6	Evaporator unit	As per system requirement
7	Compressor warranty	5 years
8	Power supply for fan under free cooling mode (AC or DC)	AC
9	Refrigerant Piping	As per system requirement
10	Filters	As per system requirement
11	Programmable timer (Y/N)	
12	Sleep Mode(Y/N)	
13	Dry mode(Y/N)	
14	Dimension of unit	
15	Weight of unit	
16	Microprocessor Controller (Y/N)	Yes
17	Annunciation in controller for compressor on and off	Yes
18	High temperature alarm	Yes
19	NO/NC contacts in controller for repeating the annunciations of Compressor-1 & 2 On/Off and high temp. inside switchyard panel room	Yes

Company Seal

Signature of the authorized representative of Bidder

Name _____

Designation _____

Place _____

Date _____

	BHARAT HEAVY ELECTRICALS LIMITED TRANSMISSION BUSINESS ENGINEERING MANAGEMENT	Doc. No.	TB-385-553-036 Rev. 00
	765 / 400 / 220 kV BHUJ NEW S/S & 765 KV BANASKANTHA EXTN S/S	Part No.	SECTION -5
	AIR CONDITIONING SYSTEM FOR SWITCHYARD PANEL ROOM		SHEET 1 OF 5

SECTION-5

SCHEDULES TO BE FILLED BY THE BIDDER

Schedule 1 Certificate of No deviation

Schedule 2 Schedule of unpriced quote

Schedule 3 Details of contact person both technical and commercial

Schedule 4 Enclosures to Specification

Drawings

**BHARAT HEAVY ELECTRICALS LIMITED**

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BANASKANTHA EXTN S/S**

Part No.

SECTION -5

AIR CONDITIONING SYSTEM FOR SWITCHYARD PANEL ROOM

SHEET 2 OF 5**SCHEDULE-1****CERTIFICATE OF NO DEVIATION**

We confirm that there are no deviations whatsoever and our offer is in full compliance with the specification. We also confirm that there are no deviations in any other form such as comments, variations/ GTP and/ or exceptions.

Signature of the authorized representative of Bidder

Name : _____

Designation : _____

Place : _____

Date : _____

Company Seal

**BHARAT HEAVY ELECTRICALS LIMITED**

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

Doc. No.

TB-385-553-036**Rev. 00****765/400/220 kV BHUJ NEW S/S & 765 KV
BANASKANTHA EXTN S/S**

Part No.

SECTION -5

AIR CONDITIONING SYSTEM FOR SWITCHYARD PANEL ROOM

SHEET 3 OF 5**SCHEDULE-2**Bidders shall attach signed and stamped **unpriced** copy of this BoQ with their technical offer:

Sl. No.	Item Description	Unit	Qty	Whether Unit Rates have been furnished in priced bid?	
1.	Air Conditioning Unit 2TR capacity with microprocessor based Controller as per CI No. 3 of customer specification attached to section-2	Nos.	08	YES	YES
2.	Air Conditioning Unit 3TR capacity with microprocessor based Controller as per CI No. 3 of customer specification attached to section-2	Nos.	10		

Signature of the authorized representative of Bidder

Name : _____

Designation : _____

Place : _____

Date : _____

Company Seal

**BHARAT HEAVY ELECTRICALS LIMITED**

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

**765/400/220 kV BHUJ NEW S/S & 765 KV
BANASKANTHA EXTN S/S**

AIR CONDITIONING SYSTEM FOR SWITCHYARD PANEL ROOM

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SECTION -5**SHEET 4 OF 5****SCHEDULE-3****DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL**

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Signature of the authorized representative of Bidder

Date

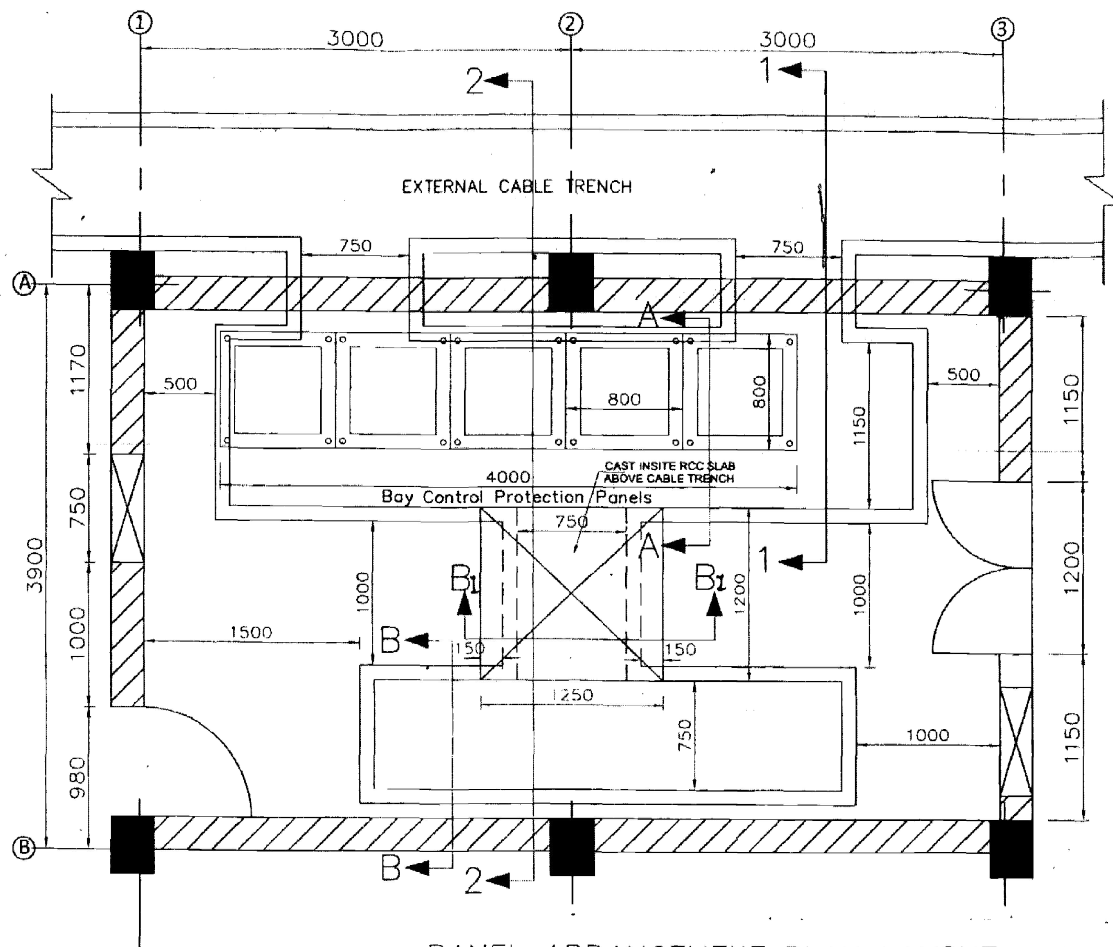
Name-----

Designation-----

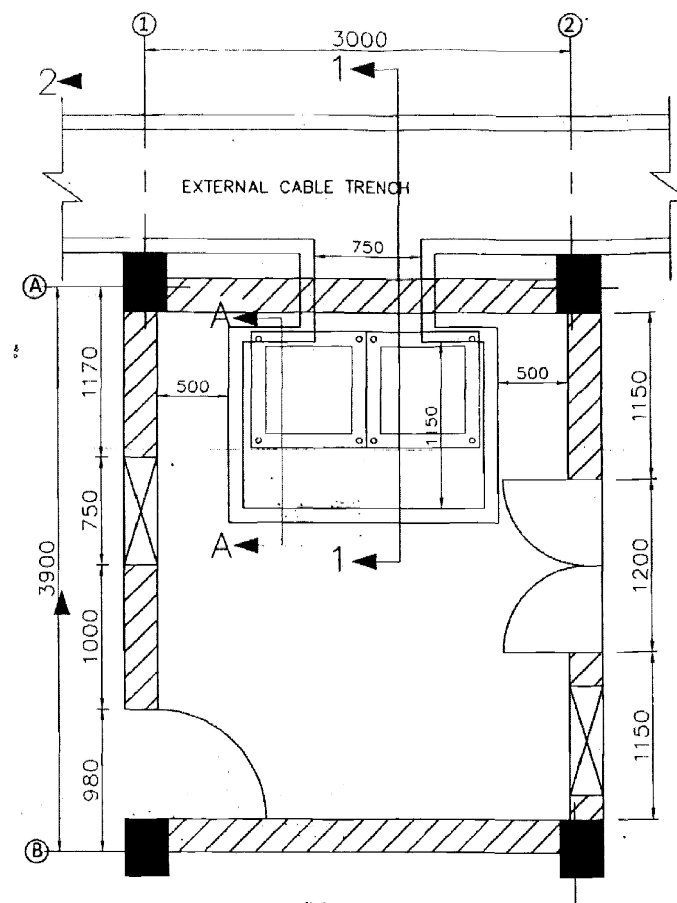
Company seal -----

Note: Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

	BHARAT HEAVY ELECTRICALS LIMITED TRANSMISSION BUSINESS ENGINEERING MANAGEMENT	Doc. No.	TB-385-553-036 Rev. 00
	765 / 400 / 220 kV BHUJ NEW S/S & 765 KV BANASKANTHA EXTN S/S	Part No.	SECTION -5
	AIR CONDITIONING SYSTEM FOR SWITCHYARD PANEL ROOM		SHEET 5 OF 5
SCHEDULE-4 DRAWINGS 1) Standard Switchyard panel room Drg. (C-ENGG-STD-SPR-STR-3012 Rev.01, Total sheets-05)			



PANEL ARRANGEMENT PLAN LAYOUT



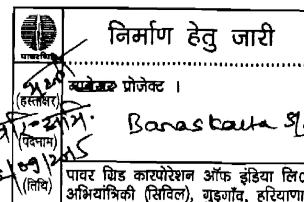
PANEL ARRANGEMENT PLAN LAYOUT

NOTES.:

- 1) ALL DIMENSIONS ARE IN MM. AND LEVEL ARE IN METER. UNTIL OTHERWISE SPECIFIED.
- 2) FOR INTERNAL CABLE TRENCH LAYOUT REFER APPROVED SUB-STATION SPECIFIC ELECTRICAL DRAWING.
- 3) PANELS SHOWN ARE INDICATIVE ONLY.
- 4) ALL CABLE ENTRIES SHALL BE PROVIDED WITH "CABLE TRANSIT SYSTEM".

REFERENCE DRG.:

STANDARD SWITCHYARD PANEL ROOM.
DRG. NO.: C-ENGG-STD-SPR-STR-3011 (Rev-01) DATED: 10.12.2010



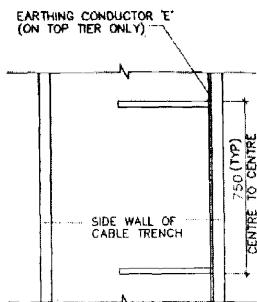
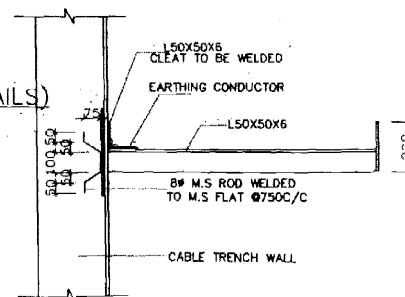
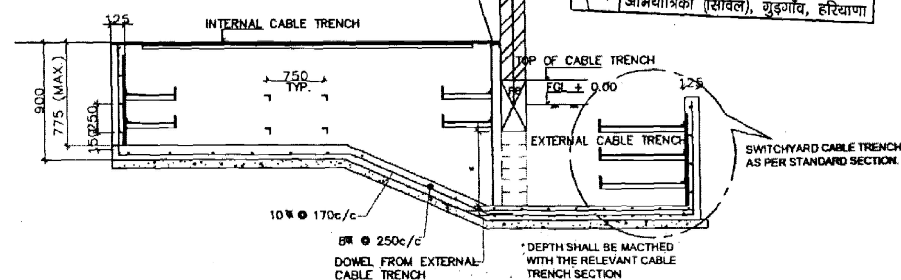
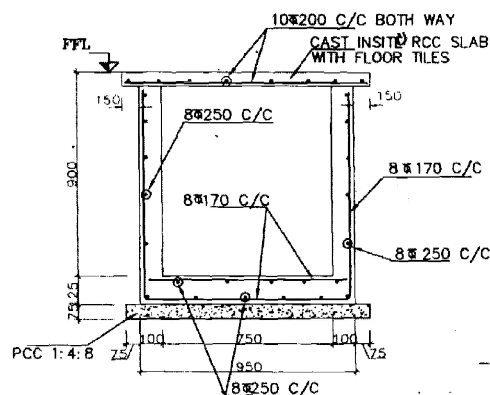
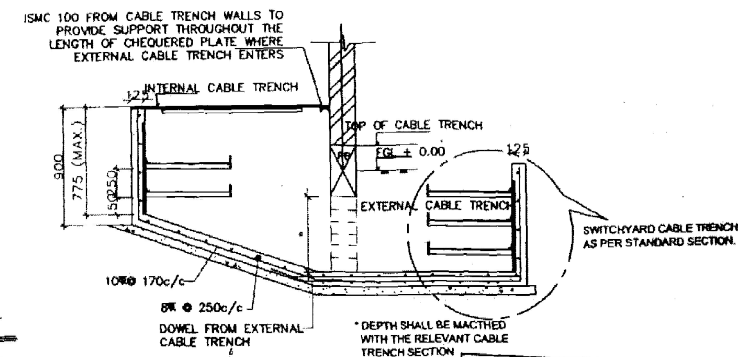
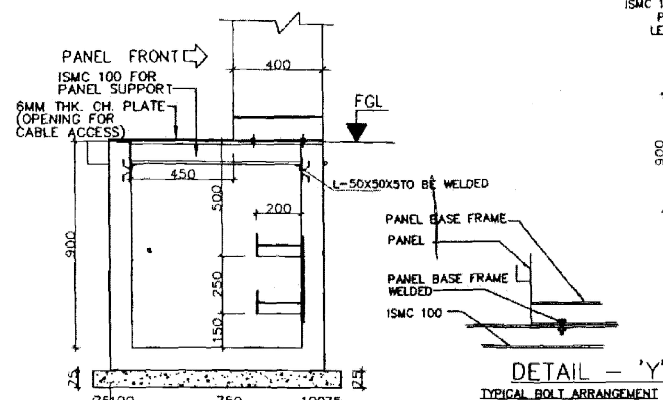
R1- SLAB FOR CABLE TRENCH ADDED

POWER GRID CORPORATION
OF INDIA LIMITED
(A Government of India Enterprise)

PROJECT : 765/400/220 KV SUB-STATION.....

TITLE : STANDARD SWITCHYARD PANEL ROOM
(FOR 6 & 3 METER.)
GA & R.C.C DETAIL OF INTERNAL CABLE TRENCH
DRAWING NO. C-ENGG-STD-SPR-STR-3012
(SH 2 OF 3) SCALE: 1/1

PREP BY: T.K. SONDIYA JE (CIVIL)	REVD BY: S. SHARMA CDE (CIVIL)	REVD BY: R. SIVASTAVAN DCM (S/S)	REVD BY: S. PANDEY DCM (CIVIL)	REVD BY: K. RAJURAM DCM (CIVIL)	DATE: 16.4.17
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SECTION 1-1

SECTION 2-2

NOTES :-

1. ALL DIMENSION ARE IN MM UNLESS NOTED OTHERWISE.
2. FOR NOTES REFER DRG. NO. : C-ENG-STD-SPR-STR-3011
3. FOR LAYOUT REFER DRG. NO. : C-ENG-STD-SPR-STR-3012 (SHEET 1 OF 2)
4. TOP OF CHEQUERED PLATE TO FLUSH WITH FINISHED FLOOR LEVEL
5. THIS DRAWING SHALL BE MATCHED WITH VENDORS APPROVED INTERNAL CABLE TRENCH LAYOUT DRAWING BEFORE START OF CONSTRUCTION
6. ALL WELDS ARE 6MM FILLET CONTINUOUS WELD UNLESS OTHERWISE SPECIFIED
7. ISMC 1000 SHALL BE PROVIDED @ 1000 C/C TO SUPPORT CHEQUERED PLATE WHEREVER CABLE TRENCH WIDTH EXCEEDS 1000 MM.
8. ISMC 1000 SHALL BE PROVIDED BELOW PANELS ALSO.
9. FOR CABLE TRENCH WITH LESSER WIDTH 150x50x5 STIFFENER SHALL BE WELDED WITH CHEQUERED PLATE @ 1000 C/C.

R1- SLAB FOR CABLE TRENCH ADDED

POWER GRID CORPORATION
OF INDIA LIMITED
(A Government of India Enterprise)

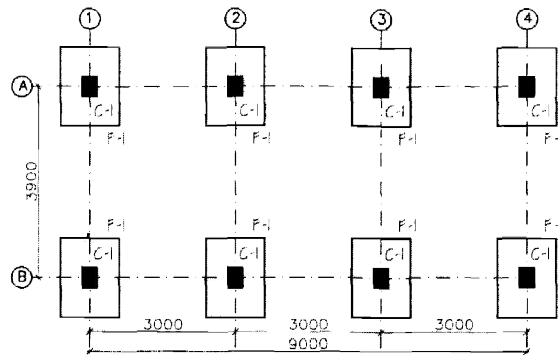
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TITLE : STANDARD SWITCHYARD PANEL ROOM
GA & R.C.C DETAIL OF INTERNAL CABLE TRENCH

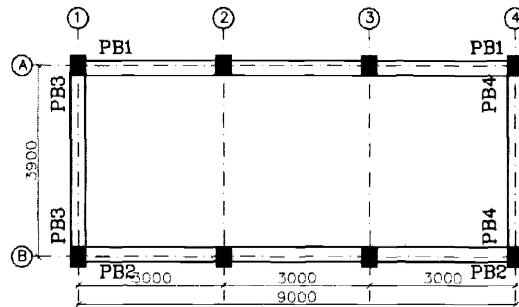
DRAWING NO.	C-ENGG-STD-.SPR-STR-3012 (REV. 1 OF 1)	SCALE NTS	REV 1
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PREP BY. T.K.SONDHIYA F. (CIVIL)	REVD BY. S. SHARMA P. (CIVIL)	REVD BY. R. SRIVASTAVA P. (CIVIL)	REVD BY. A.S. PANDEY P. (CIVIL)	REVD BY. K. RAGHURAM P. (CIVIL)	DATE
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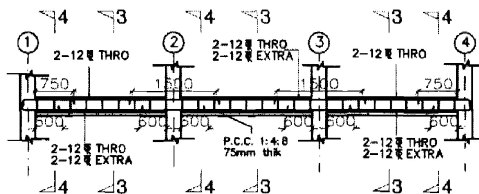
PROJECT :	400/220 KV SUB-STATION		
TITLE :	STANDARD SWITCHYARD PANEL ROOM ARCHITECTURAL DRAWING OF PANEL ROOM		
DRAWING NO.	C ENGG-STD-PR-ARCH-3000	SCALE NTS	RE C



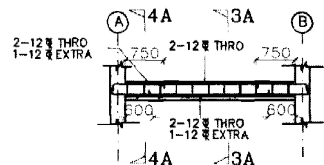
FOUNDATION PLAN



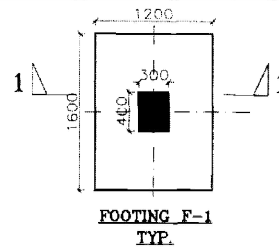
PLINTH BEAM PLAN



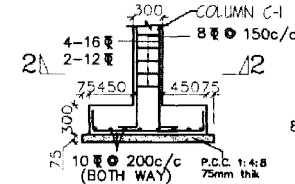
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ON GRID A & B



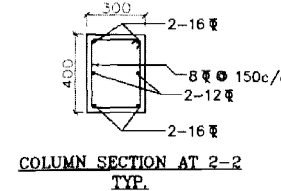
PB3 & PB4 (250 X 350)
ON GRID 1 & 4



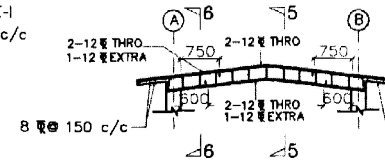
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TYP.



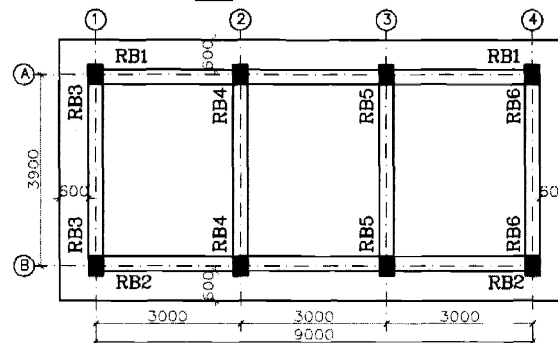
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TYP.



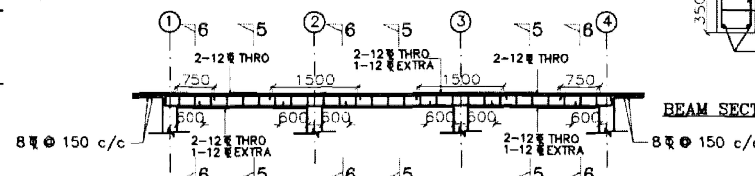
COLUMN SECTION AT 2-2
TYP.



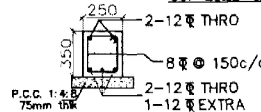
RB3, RB4, RB5 & RB6 (250 X 350)
ON GRID 1, 2, 3 & 4



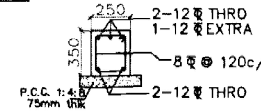
ROOF BEAM PLAN



RB1 & RB2 (250 X 350)
ON GRID A & B

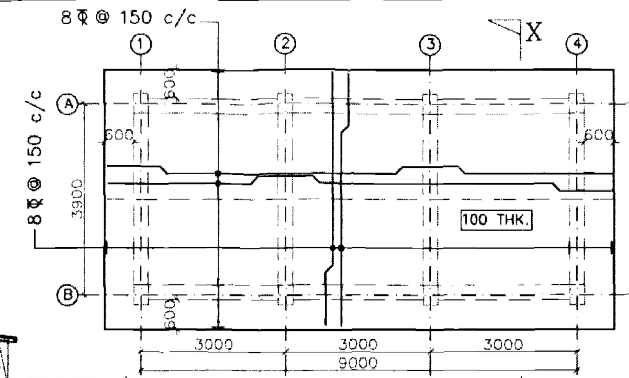


BEAM SECTION AT 3A-3A

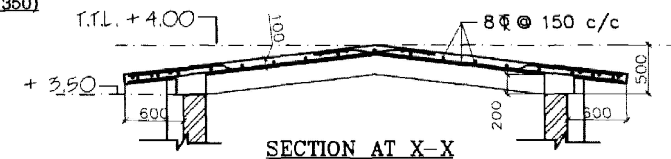


BEAM SECTION AT 4A-4A

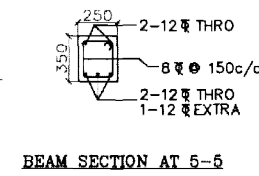
THIS DRAWING HAS BEEN REPRODUCED FROM EARLIER
APPROVED DRAWING NO. C-ENGG-STD-SPR-STR-3011



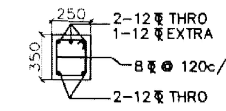
REINFORCEMENT ROOF PLAN
OF TOP SURFACE SLAB



SECTION AT X-X



BEAM SECTION AT 5-5



BEAM SECTION AT 6-6

NOTES :-

1. ALL LINEAR DIMENSION ARE IN MM AND LEVELS IN METERS.
2. THIS DRAWING IS NOT TO BE SCALED. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
3. ± 0.00 CORRESPONDS TO FINISHED GROUND LEVEL (F.G.L.)
4. ALL R.C.C. USED SHALL BE OF GRADE AS PER BPS.
5. ALL R/F STEEL SHALL BE HYSD CONFORMING TO IS:1786. /TMT BARS AS PER BPS. (EQUIVALENT GRADE)
6. CLEAR COVER FOR MAIN R/F BARS SHALL BE 40MM FOR COLUMN, 25MM FOR BEAMS, 15MM FOR SLAB, 50MM FOR FOOTINGS.
7. LAP LENGTH FOR R/F BARS SHALL BE 47 X DIA OF BAR.
8. LAP SHALL NOT BE PROVIDED WITHIN A JOINT, OR WITHIN A DISTANCE 2 X DEPTH FROM THE EACH JOINT FACE, OR 1/4 OF MEMBER LENGTH FROM JOINT FACE.
9. SPACING OF STIRRUPS PROVIDED OVER THE ENTIRE SPLICE LENGTH SHALL NOT EXCEED 150 MM.
10. ALL FOUNDATION SHALL BE TAKEN AT LEAST 500MM BELOW VIRGIN SOIL. LOOSE POCKET IF ANY SHALL BE COMPLETELY REMOVED AND BACK FILLED WITH P.C.C. (1:4:8)
11. REINFORCEMENT DETAILING SHALL BE AS PER SP - 34 AND IS 13920 LATEST.
12. NET SAFE BEARING CAPACITY AT A DEPTH OF M. BELOW FGL IS ASSUMED AS 9T/M2.
13. Ld DEVELOPMENT LENGTH = 47 DIAMETER OF BAR.
14. THE FOUNDATION SHOULD REST MINIMUM 500MM IN VIRGIN SOIL BY PROVIDING WELL COMPACTED STONE PACKING IF REQUIRED (SIZE 40mm TO 150mm) WITH INTERSTICES FILLED WITH SAND. STONE PACKING TO BE COMPACTED IN LAYERS OF 300mm AS PER CPWD SPEC.
15. SWITCHYARD PANEL ROOM IS A MODULAR STRUCTURE OF 3M LENGTH AND 3.9M WIDTH. THE CONSTRUCTION OF SWND PANEL ROOM SHALL BE CARRIED OUT IN MULTIPLES OF 3M LENGTH KEEPING WIDTH 3.9M AS CONSTRUCTED AS PER REQUIREMENT OF SITE SPECIFIED IN LDA/ LAYOUT APPD. BY S/S ENGG.

निर्माण हेतु जारी
प्रोजेक्ट 1
कॉन्सल्टिंग
(पैनल)
24/09/2015
(लिपि)
पावर ग्रिड कारपोरेशन ऑफ इंडिया लिमिटेड
अभियांत्रिकी (सिविल), गुरुग्राम, हरियाणा

RELEASED FOR TENDER/CONSTRUCTION

POWER GRID CORPORATION
OF INDIA LIMITED
(Government of India Enterprise)



PROJECT : 765/400/220 KV SUB-STATION

TITLE : STANDARD SWITCHYARD PANEL ROOM
G.A. AND RCC DETAIL OF PANEL ROOM

DRAWING NO. C-ENGG-STD-SPR-STR-3011

SCALE: N.T.S

REV.	DESCRIPTION	CIVIL.	REVD.	ELEC.	REVD.	REVD.	APPD.	DATE.

CLEARED BY