



# BHARAT HEAVY ELECTRICALS LIMITED

## TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-377-316-006	Rev. No.	00	Prepared	Checked	Approved	
TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	MVK	AS	
TITLE	220V & 48V LEAD ACID BATTERY BANK			SIGN	<i>[Signature]</i>	<i>[Signature]</i>	
				DATE	18.03.16	18.03.16	18.03.16
				GROUP	TBEM		
CUSTOMER	TELANGANA STATE POWER GENERATION CORPORATION LTD						
PROJECTS	400 kV Switchyard at 1X800MW Kothagudem TPS, Stage-VII, Unit#12 400 kV Switchyard at Bhadradri TPS, Units 1 to 4 (4x270MW)						

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS	
				Distribution	TBMM	TBQM
				Copies	2	-
					TBCM	TBTS
					-	-

## SECTION - 1

### 1.1 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing, dispatch and supervision of installation & commissioning of DC Lead acid vented type batteries (plante). Notwithstanding the details included in this specification, the battery banks shall be supplied complete with spares and accessories like Rack, interconnecting links, cables lug etc at site as may be required for erection, commissioning and trouble free operation of batteries. The battery banks complete with accessories shall be freestanding on floor.

This section covers the scope, quantities & project specific technical requirements as specified by the customer for 220V & 48 V DC Batteries. The Specific Technical Requirements for the above item are given in Section-2. The offered equipment shall also comply with the General Technical Requirements for the project as detailed under section-3 of this specification.

In case of any discrepancies between the requirements mentioned under Section-1, Section-2 and those specified in the Section-3, the specifications given in this section shall prevail and shall be treated as binding requirements.

No deviation from the requirements specified in various clauses of this specification shall be allowed. A certificate to this effect shall have to be furnished along with the offer.

The equipment is required for the following project's:

Name of the Customer : Telangana State Power Generation Corp. Ltd.  
Name of the Project1 : 400 kV Switchyard at 1X800MW Kothagudem TPS, Stage-VII, Unit#12  
Consultant : Development Consultants Private Limited  
Name of the Project2 : 400 kV Switchyard at Bhadradi TPS, Units 1 to 4 (4x270MW)  
Consultant : Desein Private Limited

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

### 1.2 SPECIFIC TECHNICAL REQUIREMENTS

Nominal voltage of main DC system shall be 220V. DC batteries shall be designed for continuous float operation with trickle charging, hence all the associated components like batteries, battery chargers, DC motors, relays, contactors, timers etc shall be suitable for continuous operation at the maximum continuous battery float voltage including suitable temperature correction factors.

Parameter	220V DC	48V DC
Nominal Voltage Rating (V)	220	48
Nominal Cell Voltage (V)	2	2
Cell Designation	Stationary, Lead Acid Type with plante positive Plates, High Discharge Rate type	
Charging method	As per requirement to meet the technical specification	

No. of Cells per battery	108	24
Maximum Battery Bank Voltage	242	52.8
Minimum Battery Bank Voltage	187	40.8
Nominal float voltage per cell (V)	2.25	
End Cell Voltage	1.8Volt /Cell	
Design Ambient design temperature	50°C	
Min. Electrolyte temp. for Battery Sizing	7.9°C	
Battery Charging Requirement	Battery shall be such that it can be charged from fully drained state to fully charged condition within 10 Hrs.	
Battery Room Size	13.5mx10m, bidder to confirm that battery banks can be suitably accommodated in room size with 1.0 meter clear space from inside wall surface. Refer sketch of Battery Room attached along with this Section.	
Design Margin %	1.2	
Ageing factor	1.25	
Temperature correction factor	As per Battery Manufacturer Data	
Intermediate tapping	As required	

1. Procedure for estimating battery capacities shall be as per guide-lines stipulated in latest revision of IEEE Std. 485 for Lead acid Battery. Derating factor for prolonged float charging shall be duly taken into account, as applicable, in estimating battery capacity.
2. Float charger shall be sized to carry the total DC continuous load and the trickle charging current of the battery plus a 25% margin. The charger shall also be capable of delivering the rated load under the specified voltage and frequency variations of incoming AC supply (for information)
3. Boost/Float-cum-boost charger shall be sized to restore the fully discharged battery to full charge condition in ten (10) hour for 220V lead-acid battery with 25% margin over maximum charging rate or to operate as a float charger with duty requirement, whichever is greater. (for information)
4. Size of cable between battery & distribution board shall be intimated during detailed engineering stage. Bidder to provide TB's of appropriate size as per the input.

For detailed technical requirement for Lead Acid Battery, please refer Section-1, Annexure-1.

### 1.3 BILL OF QUANTITIES

The following items are required for Kothagudem & Bhadradi S/s.

#### 1.3.1 Main Items

S. No.	Details	Unit	Qty (Nos) (Kothagudem)	Qty (Nos) (Bhadradi)
1.	220V, Lead Acid Plante Battery bank complete in all respect meeting the load cycle requirement as per technical specification	Sets	2	2

2.	48V, Lead Acid Plante Battery bank complete in all respect meeting the load cycle requirement as per technical specification	Sets	2	2
3.	Mandatory Spares as per Cl. No. 1.3.2 below	Lot	1	-
4.	Supervision of erection at site for 220V, Lead Acid Plante Battery bank	Sets	2	2
5.	Supervision of erection at site for 48V, Lead Acid Plante Battery bank	Sets	2	2
6.	Supervision of testing & commissioning at site for 220V, Lead Acid Plante Battery bank	Sets	2	2
7.	Supervision of testing & commissioning at site for 48V, Lead Acid Plante Battery bank	Sets	2	2
8.	<u>Battery Type Test</u> : Discharge performance test at low temperature.	Lot	1	1
9.	<u>Battery Type Test</u> : Ampere-hour test & watt-hour efficiency test.	Lot	1	1
10.	<u>Battery Type Test</u> : Endurance test.	Lot	1	1
11.	<u>Battery Type Test</u> : Container (shall be type tested as per IS:1146)	Lot	1	1
12.	<u>Battery Type Test</u> : Sealing compound (shall be type tested as per IS:3116)	Lot	1	1

### 1.3.2 Mandatory Spares:

Bidder has to supply following items for 220V Battery (Kothagudem Project) as a mandatory spares

S. No.	Details	Unit	Qty
1.	Battery Cell (Uncharged, Dry)	Nos	20
2.	Inter connecting cell strips	Nos	20
3.	Vent plug	Nos	20
4.	Teak wood cable clamps with hardware	Nos	10
5.	Hydrometer	No	1
6.	Rubber gloves	Pair	1
7.	Voltmeter for measuring cell voltage (Center zero type)	No	1
8.	Insulated socket spanner with handle	No	1
9.	Thermometer	No	1

Please Note:-

- i) Refer Annexure-2 of Section-1 for 220V & 48V Load duty.
- ii) Minimum size of batteries shall be as below (for sl no. 1, 2 above)  
 220V Battery - 645AH Lead Acid Plante Type (Kothagudem & Bhadradi)  
 48V Battery - 125AH Lead Acid Plante Type (Kothagudem & Bhadradi)
- iii) Bidder to quote battery size meeting the load duty cycle requirement. The sizing calculation in the format of IEEE 485 shall be submitted with offer for review.

- iv) The battery size quoted by bidder shall be with sufficient margin.  
v) Each set of battery shall be equipped with fittings and accessories as listed below:

1	One battery log book.
2	Two copies of printed instruction sheet.
3	Two nos. cell testing voltmeter (3-0-3 volts) complete with leads.
4	One no. rubber syringe type hydrometer suitable for specific gravity reading.
5	Three nos. pocket thermometer.(Digital type)
6	Two nos. thermometer (0 to 100°) with specific gravity correction scale.
7	One set cell bridging connector.
8	Two nos. each Electrolyte resistant plastic funnels and plastic jugs
9	Battery racks suitable for accommodating the cells coated with paint.
10	Insulator (with 5% extra), rubber pad etc. for rack.
11	Two nos. plastic filling bottle for filling up.
12	One pair of spanners.
13	Requisite quantity of electrolyte with 10% extra in non-returnable containers.
14	Two pairs of rubber hand gloves.
15	Two nos. cell lifting straps.
16	One set of inter cell, inter tie and inter bank connectors as required for complete installation.
17	Self adhesive PVC stickers for cell numberings
18	Goggles.
	<b>NOTE:</b> Any other accessories if required for satisfactory operation of the complete battery system shall also be included in Bidder's offer and to be supplied accordingly.

#### Special Tools & Tackles

A set of special tools & tackle which are necessary or convenient for erection, commissioning, maintenance and overhauling of the equipment shall be supplied.

The tools shall be shipped in separate containers, clearly marked with the name of the equipment for which they are intended.

Recommended Spares:- The Bidder shall submit a list of recommended spare parts for five (5) years satisfactory and trouble free operation, indicating the itemized price of each item of the spares. The prices of these shall be indicated in separate schedules and these shall not be considered for the purpose of evaluation.

#### **1.4 QUALIFYING REQUIREMENT**

The Bidder should have manufactured and supplied at least two (2) numbers of highest offered rating or above of high discharge type Plante positive plate type battery at least one (1) each at two (2) different industrial installations, which should be in successful operation for at least two (2) years as on date of Techno-Commercial bid opening.

## 1.5 TYPE TESTING

Bidder shall submit valid type test reports (as per relevant IEC/IS standard) for the tests carried out within last ten years from the date of LOA (i.e. 27.12.2014 for Kothagudem S/s & 21.03.2015 for Bhadradri S/s). The reports should have been conducted on identical or similar equipment/components to those offered. In case type test reports are more than 10 years old (from the date of LOA) or the reports of type tests are found to be technically unacceptable to BHEL/Customer, the type test shall be conducted by the vendor without cost and delivery implication to BHEL.

### 1.5.1 Optional Type Test Requirement

**Type test charges will be optional. These charges shall be valid for the entire tenure of the contract. BHEL/TSGENCO reserves the right to delete the optional type tests at time of contract.**

The contractor shall successfully carry out the following type tests (but not limited to) on two cells of the battery, even if the Bidder submits type test certificates for Purchaser's review and approval. The bidder shall indicate the charges for each of these type tests separately and the same shall be considered for the evaluation of the bids. The type test charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by BHEL/TSGENCO engineer.

- a) Discharge performance test at low temperature.
- b) Ampere-hour test & watt-hour efficiency test.
- c) Endurance test.
- d) Container shall be type tested as per IS:1146
- e) Sealing compound shall be type tested as per IS:3116

The type test shall be carried out in presence of BHEL/TSGENCO representative for which minimum 15 days' notice shall be given by Supplier. The Supplier shall obtain Purchasers approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc for the type test(s) to be carried out.

## 1.6 INSPECTION & TESTING

Before being fitted on the equipment, all components shall be subjected to routine tests at the Contractors factory, provided by the relevant IEC/IS standards. A detailed test report proving the successful passing of such tests shall be provided.

Prior to dispatch, the routine & acceptance tests shall be carried out on each item in accordance with the applicable IEC/IS and the material shall be offered for final inspection by BHEL and TSGENCO in accordance with agreed quality plan with 3 weeks advance information. The charges for these shall be deemed to be included in the equipment price.

## 1.7 QUALITY PLAN

The contractor shall carry out contract works in accordance with sound quality management

principles which shall include such as controls which are necessary to ensure full compliance to all requirements of the specification & applicable international standards. These quality management requirement shall apply to all activities during design, procurement, manufacturing, inspection, testing, packaging, shipping, inland transportation, storage, site erection & commissioning. Contractor shall submit detailed Quality Plan for BHEL / customer's approval. It will be the bidder's responsibility to get its QP approved from the ultimate customer.

## 1.8 SUPERVISION OF INSTALLATION & COMMISSIONING

Manufacturer of Battery shall supervise the installation and commissioning and perform commissioning tests as recommended in O&M manual / or relevant standards. All necessary instruments, material, tools and tackles required for installation, testing at site and commissioning are to be arranged by Battery manufacturer.

## 1.9 SCHEDULE OF PRE-COMMISSIONING TESTS OF BATTERY

The following tests (but not limited to the same) are a general guideline. Other tests as necessary shall also be conducted.

- a) Physical checking of various parts/connections/loose components to be mounted.
- b) Acid filling, charging/discharging cycles.
- c) Checking of Electrolyte position in each cell.
- d) Checking of polarity, voltage, specific gravity, temperature etc.

## 1.10 TITLE BLOCK

The drawings / documents submitted shall be project and product specific and shall incorporate following details:

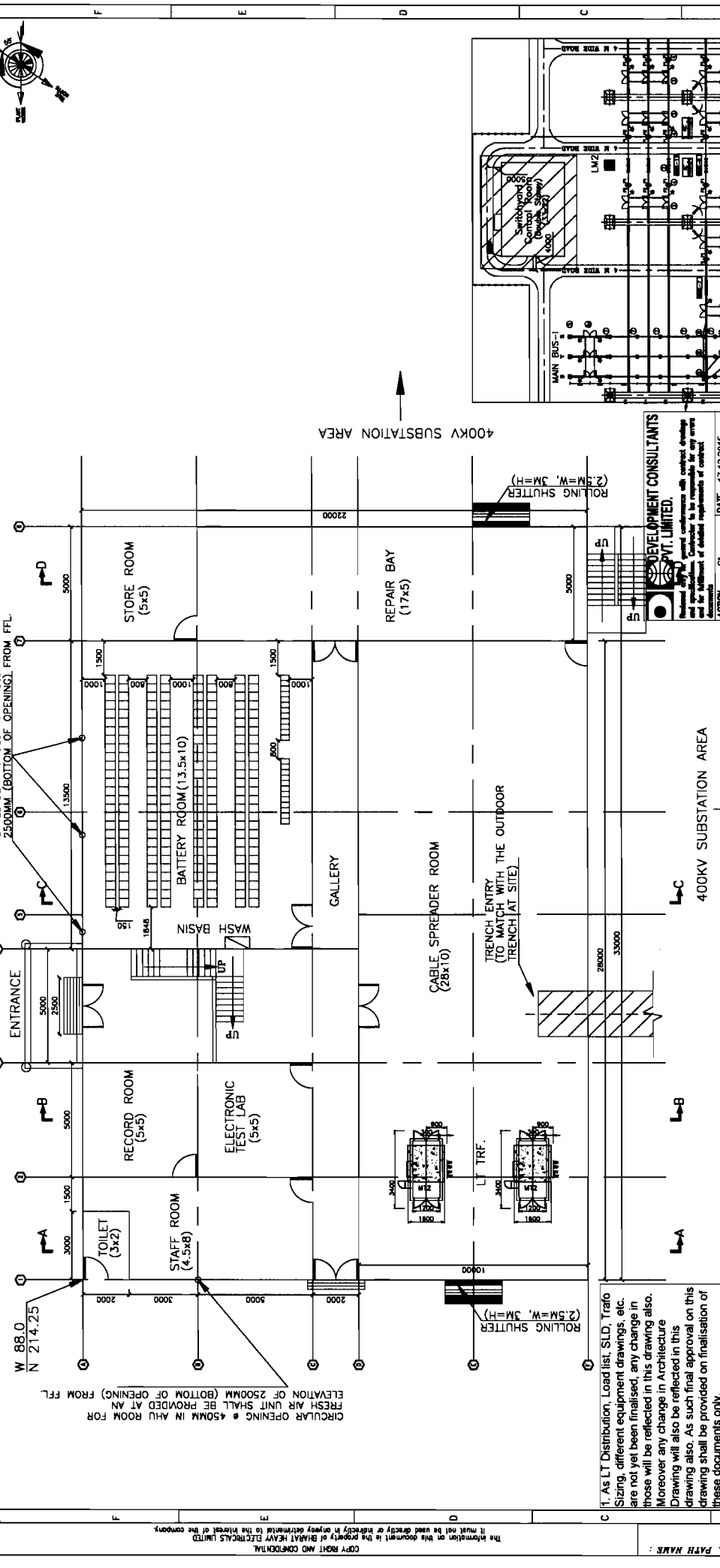
### A) Kothagudem TPS

- a) Project Name : 400 kV Switchyard at 1X800MW Kothagudem TPS, Stage-VII, Unit#12
- b) Customer Name : Telangana State Power Generation Corp. Ltd.
- c) Consultant Name : Development Consultants Private Limited
- d) Contractor : BHEL
- e) Customer LOA no.: CEE/111/KTPS-VII(1X800MW)/D.No.150/14, Dt.: 27/12/2014

### B) Bhadradi TPS

- a) Project Name : 400 kV Switchyard at Bhadradi TPS, Units 1 to 4 (4x270MW)
- b) Customer Name : Telangana State Power Generation Corp. Ltd.
- c) Consultant Name : Desein Private Limited
- d) Contractor : BHEL
- e) Customer LOA no.: CEE/SE-IV/BHADRADRI TPS (4X270MW)/D.No.72/15, Dt.: 21/03/2015

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**NOTES:-**

1. As LT Distribution, Load list, SLD, Tratto Sizing, different equipment drawings, etc. are not yet been finalised, any change in those will be reflected in this drawing also. Moreover any change in Architecture Drawing will also be reflected in this drawing also. As such final approval on this drawing shall be provided on finalisation of these documents only.
2. ALL DIMENSIONS ARE IN MM. DIMENSIONS SPECIFIED FOR ROOMS ARE IN METRES.
3. +0.00M SHALL BE READ AS FGL OF SWITCHYARD.
4. 400KV SWITCHYARD CONTROL ROOM BUILDING IS A DOUBLE STOREY BUILDING WITH TRENCHES BELOW FLOOR LEVEL FOR CABLE LAYING.
5. CONTROL ROOM, OFFICE ROOM'S & CONFERENCE ROOM ON FIRST FLOOR SHALL BE AIR-CONDITIONED & WITH NO FALSE CEILING.
6. PARTS OF BUILDING SHALL BE NON AIR-CONDITIONED & WITH NO FALSE CEILING.
7. DIMENSIONS AND ARRANGEMENT OF PANELS INSIDE CONTROL ROOM BUILDING ARE INDICATIVE AND SHALL BE FINALISED DURING DETAILED ENGINEERING.
8. ACDB ROOM, BATTERY ROOM, PANTRY AND TOILETS SHALL BE PROVIDED WITH EXHAUST AIR FANS.
9. ALL ROOM EXCEPT AHU ROOM SHALL BE PROVIDED WITH WINDOW.
10. ALL THE DIMENSIONS OF THE ROOMS ARE WALL CENTRE TO CENTRE DIMENSIONS.
11. SEPARATE DRAWING SHALL BE SUBMITTED FOR DETAILED ARCHITECTURE AND TRENCH LAYOUT OF CONTROL ROOM BUILDING.
12. PROTECTION/BAY CONTROL PANELS WILL BE LOCATED IN OUTDOOR SWITCHYARD AC KIOSK.
13. ALUMINIUM GLAZED WINDOW SHALL BE PROVIDED IN CONTROL ROOM TO HAVE A CLEAR VIEW OF SWITCHYARD EQUIPMENTS.
14. PROTECTIVE GRILL SHALL BE PROVIDED FOR ALL THE GLASS WINDOWS FACING SWITCHYARD.
15. BATTERY ROOM DOOR SHALL BE PVC TYPE. SWITCHGEAR ROOM DOOR SHALL BE FIRE-PROOF TYPE.

**KEY PLAN**

REV.	DATE	ALTERED	MVK	SD/-	REV.	DATE	ALTERED	MVK	SD/-
03	23.11.15	DELETED	MVK	SD/-	02	11.10.15	DELETED	MVK	SD/-
01	21.08.15	APPROVED	AS	SD/-	01	21.08.15	APPROVED	AS	SD/-

ZONE H) REVISAS AS PER CUSTOMER COMMENTS & LOCATION OF AHU ROOM MODIFIED.

ZONE I) REVISAS AS PER CUSTOMER COMMENTS.

INVENTORY No.	CONCEPTUAL 400KV SWITCHYARD CONTROL ROOM BUILDING LAYOUT
SGN. & DATE	30/08/15
REF. DRG. No.	
COMPUTER DRG. PATH NAME :	

ADDITIONAL INFORMATION	84005
STATUS OF DRAWING	CONTRACT
DISTRIBUTION OF PRINTS	
LETTER REF. NO.	0942
DATE	17.12.2015

NAME OF CUSTOMER/PROJECT	TSGENCO 400KV SWITCHYARD AT 1x800 MW KOTRAGUDEM TPS
CONSULTANT:-	DEVELOPMENT CONSULTANTS PVT. LTD.
PROJECT TEAM	
DRG. CODE	422
SCALE	30/01R / SCALE
CARD CODE	

DATE	20.06.15	DATE	20.06.15
PR/RSKS	AS	PR/RSKS	SD/-
PR/RSKS	AS	PR/RSKS	SD/-
PR/RSKS	AS	PR/RSKS	SD/-

DATE	20.06.15	DATE	20.06.15
PR/RSKS	AS	PR/RSKS	SD/-
PR/RSKS	AS	PR/RSKS	SD/-
PR/RSKS	AS	PR/RSKS	SD/-

DATE	20.06.15	DATE	20.06.15
PR/RSKS	AS	PR/RSKS	SD/-
PR/RSKS	AS	PR/RSKS	SD/-
PR/RSKS	AS	PR/RSKS	SD/-

DATE	20.06.15	DATE	20.06.15
PR/RSKS	AS	PR/RSKS	SD/-
PR/RSKS	AS	PR/RSKS	SD/-
PR/RSKS	AS	PR/RSKS	SD/-



**VOLUME : V-B**

**SECTION-III**

**TECHNICAL SPECIFICATION  
FOR  
BATTERY AND BATTERY CHARGERS**

Battery Charger data is provided for information

**CONTENT**

<b>CLAUSE NO.</b>	<b>DESCRIPTION</b>
1.00.00	SCOPE OF WORK
2.00.00	GENERAL REQUIREMENTS
3.00.00	DESIGN CRITERIA
4.00.00	SPECIFIC REQUIREMENTS
5.00.00	TESTS
6.00.00	SPECIAL TOOLS & TACKLES
7.00.00	SPARES
8.00.00	DRAWINGS DATA & MANUALS

**ATTACHMENTS**

ANNEXURE-A	RATINGS AND REQUIREMENTS
ANNEXURE-B	FITTINGS AND ACCESSORIES
ANNEXURE-C	LIST OF ALARMS & INDICATIONS

**SECTION-III**

**TECHNICAL SPECIFICATION  
FOR  
BATTERY AND BATTERY CHARGERS**

- 1.00.00 **SCOPE OF WORK**
- 1.01.00 **Scope of Supply**
- 1.01.01 Type, rating and connections of the equipment listed below are detailed in the subsequent clauses of the specification and attached Annexure. The equipment shall be offered in strict compliance with the same.
- a) ~~220 V Lead Acid Plante Battery and Battery chargers for main plant. [2 x 100% Battery & 1 x 100% Float & Float cum Boost Charger with each set of Battery and 1x100% Standby Boost Charger]~~
  - b) ~~Separate 220V DC system complete with 2x100% Lead Acid Plante Battery and 1 x 100% Float and Float cum boost Battery chargers with each set of Battery for other plant areas like CHP area, AHP area, Water system and other plant area as required [to be decided by EPC bidder]~~
  - c) 220 V Lead Acid Plante Battery and Battery chargers for 400kV Switchyard. [2 x 100% Battery & 1 x 100% Float and Float-cum-boost Battery chargers with each set of Battery].
  - d) ~~24V Lead Acid Plante Battery and battery chargers for Plant DCS System. [2 x 100% Battery & 1 x 100% Float and Float cum boost Battery chargers with each set of Battery].~~
- 1.01.02 Each set of battery and battery charger shall be supplied complete with fittings and accessories as per list furnished elsewhere in this specification.
- 1.01.03 ~~One set of portable type battery discharge resistor bank and one set of portable type single cell charger shall also be provided common for the above batteries.~~
- 1.01.04 Base channel frame, floor channel sill and kick plates for all floor-mounted charger panels, complete with holding down bolts and nuts.
- 1.01.05 One (1) sets of special tools and tackles.
- 1.01.06 Mandatory Spare parts
- 1.01.07 All relevant drawings, data and instruction manuals.
- 2.00.00 **GENERAL REQUIREMENTS**
- 2.01.00 **Codes and Standards**
- 2.01.01 All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

- 2.01.02 Equipment and material conforming to any other standard which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.
- 2.01.03 The electrical installation shall meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.
- 3.00.00 **DESIGN CRITERIA**
- 3.01.00 **Design Basis**
- 3.01.01 DC system shall provide reliable sources of DC power supply for control, indication, protection and annunciation of plant equipment. In addition, it shall also provide emergency DC loads and emergency lighting loads on failure of AC supply.
- 3.01.02 The battery shall be sized to meet all emergency load duty cycle requirements including DC EOP & JOP load for the entire duration of load cycle.
- 3.01.03 The procedure for estimating battery capacities shall be as per guide-lines stipulated in latest revision of IEEE Std. 485 for Lead acid Battery. Derating factor for prolonged float charging shall be duly taken into account, as applicable, in estimating battery capacity.
- While estimating battery capacities, aging margin shall be taken as 1.25, temperature correction factor as per manufacturer's standard and a design margin of 20% shall be considered.
- 3.01.04 The battery and charger combination shall be such as to ensure continuity of DC supply at load terminals at all times without even momentary interruption.
- 3.01.05 Further the voltage at Battery terminals shall not exceed the limits of + 10% and - 15% of the nominal system voltage at any time during the duty cycle.
- 3.01.06 For continuous operation at specified ratings, temperature rise of the various components of battery & battery charger shall be limited to the permissible values stipulated in the relevant standards and/or this specification.
- 3.01.07 The equipment will be installed indoor in a clean but hot, humid and tropical atmosphere.
- 3.01.08 Capacity of Main Plant area batteries shall be so chosen that with one battery out of service, the other shall be capable of carrying the total on the two batteries' load, without any restriction in plant operation. Sizing calculation along with relevant supporting document regarding selection of different factors shall be furnished with the bids.
- 3.01.09 The battery shall be so sized as to meet emergency load duty cycle requirements for ten (10) hours for 220V Battery & three (3) hours for 48V Battery.

Sizing of all batteries shall be done based on different types of continuous and intermittent loads including motor starting for the complete emergency duration specified as per the system requirement.

The duty cycle imposed on the battery shall include the following :

All momentary loads shall be treated as one minute load. Continuous loads due to Meters, Indication lights, Continuous energized coils, Control Panels, Relays etc. are considered for the entire duty cycle.

Momentary loads due to circuit breaker tripping & DC motor starting are considered in 1st minute load duty cycle. Circuit breaker closing and breaker spring charging motor are considered in last minute of duty cycle.

- 3.01.10 The float charger shall be sized to carry the total DC continuous load and the trickle charging current of the battery plus a 25% margin. The charger shall also be capable of delivering the rated load under the specified voltage and frequency variations of incoming AC supply.
- 3.01.11 The float-cum-boost charger shall be sized to restore the fully discharged battery to full charge condition in ten (10) hours for lead-acid battery with 25% margin over maximum charging rate or to operate as a float charger with duty requirement, whichever is greater.
- 3.01.12 The batteries & charger shall be so designed that the maximum fault level on DCDB is limited to 25kA for 1 sec. (Indicative only; the actual value will be decided by the Bidder after substantiating the same by calculation.)
- 3.01.13 For the purpose of design an ambient temperature of 50°C and relative humidity of 85% shall be considered.
- 3.02.00 **System Concept**
- 3.02.01 The basic system configuration along with a write-up on operation is given in the enclosed scheme diagram.
- 3.02.02 The battery charger shall be capable of providing the initial charging current as required for the battery.
- 3.02.03 For the Main Plant /Switchyard
- a) One (1) no. float and float cum boost battery chargers will be provided for each set of battery which is normally ON in float charging mode, supplying the DC load current and at the same time float charging the battery. Both the float chargers are in parallel mode of operation. Due to failure of one charger, the other charger will take full load requirement and the characteristics shall be such that if load is high and exceeds the charger capacity, the excess load shall be supplied by the battery.
  - b) When the float-cum-boost charger will be in boost charging mode (when battery voltage drops below a set value) and in boost charging mode it will boost charge a fully discharged battery to fully charged condition in 10 hours. The other float charger will supply DC load current.
  - c) Float-cum-boost charger shall also have provision for float, equalizing and boost charging the battery through manual selection.

- d) On failure of A.C. supply both chargers will go out of service and battery will take over to supply emergency loads without any interruption.
- e) Suitable electrical interlock shall be provided in the charger to ensure that boost charging can commence only after the relevant load-isolating switch in the DCDB open. This ensures availability of both redundant feeders to the loads when any charger is isolated from the system for boost charging. However in case of failure of any charger, the other charger shall feed both sections of the DCDB and provided trickle charging to both sets of battery.
- f) Output of the chargers shall be controlled automatically as well as manually. AUTO/MANUAL selector switch along with voltage/current setter shall be provided for this purpose.
- g) For ungrounded DC system, suitable ground fault detection system shall be provided in the battery charger panel to detect ground fault on either polarity for annunciation in charger panel.

4.00.00 **SPECIFIC REQUIREMENTS**

4.01.00 **Layout**

4.01.01 The battery and battery charger will be located indoor only.

4.01.02 The Bidder shall confirm the suitability of the enclosed layout with the equipment offered. Alternatively the Bidder may propose his own layout to suit the space available.

4.01.03 While proposing the battery room layout, Bidder shall consider the following:

- a) Sufficient clearance space for attending individual cells.

4.01.04 The Bidder shall also indicate his recommendation for battery room ventilation.

4.02.00 **Battery**

4.02.01 **General**

- a) Each set of battery shall consist of number of cells assembled together on mounting racks.
- b) The battery shall be flooded cell with Plante Lead acid. In the event of failure of any cell, there shall be no interruption in power supply to load.
- c) The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuation of load.

4.02.02 **Construction**

- a) Cell container shall be made of transparent glass, hard rubber, suitable robust, heat resistant, leak proof, non-absorbent, acid resistant, non-bulging type and free from flaws, such as wrinkles, cracks, blisters, pin holes, etc. The cell shall be mechanically sturdy. Container shall be closed/sealed lid type. Lid and sealing compound shall be non-cracking type.
- b) The cell shall be provided with visual electrolyte level checks for ease in of maintenance. Electrolyte level markings shall be for upper and lower limits.
- c) Sufficient sediment space shall be provided so that the cells will not have to be cleaned out during normal life.
- d) Separator between plates shall permit free flow of electrolyte. Proper arrangement to keep end plates in position shall be furnished.
- e) For flooded cell, suitable mechanism and / or Ceramic Vent plug shall be provided to eliminate emission of acid mist during the float operation. The bidder shall also indicate the Gas emission rate of the battery in their offer for necessary design of the ventilation of the Battery Room. Anti-splash type vent plug shall be provided in each cell.
- f) The cells shall be supported on insulators fixed on to the rack with adequate clearance between adjacent cells.
- g) The cell terminals posts shall be provided with connector bolts and nuts, made of copper/ brass effectively coated with lead to prevent corrosion.
- h) Lead coated copper connectors shall be furnished to connect up cells of Battery set.
- i) Positive and Negative terminal posts shall be clearly and indelibly marked for easy identification.
- j) Bent copper plates, tubular copper lugs, teakwood clamp, bolts, nuts, washers, etc. shall be furnished for connection of outgoing single core, stranded Aluminum conductor, XLPE insulated cables to end take-off connections at positive and negative plate. All connectors and lugs shall be capable of continuously carrying the discharge current of the battery for the entire load cycle and let through fault current which the battery can produce and withstand for the period declared.
- k) The battery shall be shipped uncharged for flooded cell with the electrolyte furnished in a separate non-returnable container. 10% extra electrolyte shall be furnished to cover spillage in transit or during erection.
- l) The pole sealing arrangement should be such that no acid particle gets entrapped due to acid creep as a result of capillary action and it should be possible to remove and refix the sealing to carry out the maintenance.

4.02.03 **Battery Racks**

Battery racks for supporting battery cells shall be constructed of best quality FRP forming a rigid structure. Racks shall be painted with at least three (3) coats of electrolyte-resistant paint of approved shade. Batteries shall be preferably be located in single tier arrangement. Racks shall be free standing type, mounted on porcelain / electrolyte-resistant high impact plastic insulators. Numbering tags for each cell shall be attached on to the racks.

4.03.00 **Battery Charger** (Battery Charger data is provided for information)

4.03.01 **General**

- a) The charger shall be natural air cooled, solid-state type with full wave, fully controlled, bridge configurations.
- b) The charger shall be provided with (but not limited to) microprocessor based automatic voltage control, current limiting circuitry, smoothing filter circuit and soft-start feature, under/ over voltage protection and earth fault detection.
- c) Voltage/current control shall be stepless, smooth and continuous. Voltage control shall be possible either in "Auto" mode or in "Manual" mode. An "Auto-Manual" selector switch shall be provided for this purpose.
- d) The charger shall be self-protecting against all AC and DC transients and steady state abnormal currents and voltages.
- e) Charger AC input and DC output shall be electrically isolated from each other and also from panel ground.
- f) Isolation shall also be provided between power and control circuits.
- g) Radio frequency suppressor/screening shall be provided with the charger to limit the noise level/interference to radio and other communication equipment to be installed in the same building.
- h) The design of the equipment will be such that during the period both trickle charger unit and boost charger units are working independently, the tap connection from various taps of the battery cell to the load circuit should not involve any circulating current.

4.03.02 **Construction**

- a) The charger shall comprise a continuous line up of free-standing, floor mounted sheet steel panels, with access from both from front as well as from rear.
- b) In between float and float-cum-boost charger panels, a central panel shall be provided. This panel shall house the battery terminals, load terminals, battery blocking diodes, meters, annunciator and indicating lamps.

- c) The panel shall conform to the degree of protection IP 42. Minimum thickness of sheet metal used shall be 2 mm for load bearing members and 1.6 mm for non-load bearing members.
- d) Access doors shall be with concealed hinges and neoprene gaskets. Ventilating louvers shall be covered with fine wire mesh. Door over 600 mm width shall be of double-leaf design.
- e) All equipment within the panels shall be arranged in modular units and laid out with sufficient space for easy maintenance.
- f) All indicating instruments, control switches etc. shall be flush mounted on the front face of the panels. However potentiometer shall be provided inside the panel. Nameplates of approved size and type shall be provided for all circuits and devices both at front & inside of the panel.
- g) All bus bar and bus connections shall be of high conductivity copper and adequately sized to limit the maximum temperature within the permitted value. All bus connection shall be silver plated.
- h) Heat –shrinkable insulating sleeves shall be provided for bus bars. All bus connections shall be color coded for easy identification.
- i) Bus bars shall be supported and braced to withstand the stress due to maximum short circuit current and also to take care of any thermal expansion.

**4.03.03 Charger Equipment**

- a) All power diode and control rectifiers shall be silicon type. Rectifier transformer shall be resin impregnated in vacuum, dry type, double wound with copper conductor and class-F insulated with temperature rise limited to class-B having off-circuit tap  $\pm(-)2 \times 2.5\%$  on primary side. LC filter suppressor shall be provided in the output to minimize ripple content and to keep the value within the specified limit.
- b) The diode & bridge elements shall be liberally sized for forward current, minimum momentary overloads & voltage spikes. The current & peak inverse voltage (PIV) should be chosen accordingly. Wherever necessary power semiconductor device shall be provided with over current and over temperature protection by using special fuses.

Blocking diodes shall be fully rated and shall have redundancy so that failure of a single diode shall not incapacitate the system in any way.

- c) Isolating switches shall be heavy duty, load break type, operated by an external handle with provision for padlocking in ON & OFF position.
- d) AC Changeover switch shall be 3 position, 4 pole, load break type with 2 NO + 2 NC auxiliary contacts. The switch shall be installed in such a manner that the operating handle shall be accessible only after opening the front door.

- e) Double pole, double throw DC switch shall be load break type with 2 NO + 2 NC auxiliary contacts.
- f) Control switches shall be dust protected, heavy duty, switchboard type complete with escutcheon plates. Contacts shall be silver plated, rated 10A at operating voltage.
- Selector switch shall be maintained contact, lockable stay-put type with knob handle. Meter selector switch shall be four-position type.
- Ground fault detection switch shall be three-position type spring return to neutral.
- g) Push button shall be heavy duty, shrouded, push to actuate type with colored button and inscription plate. Each push button shall have 2 NO + 2 NC contacts, rated 10A at 240V AC and 5.0A at 220V DC.
- h) Contactor shall be air-break type with hand reset type thermal overload relays having in built temperature compensator and single phase preventor. Contactor duty class shall be AC-3.
- i) Fuses shall be HRC type, mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of base. In such cases, one set of insulated fuse pulling handles shall be supplied with each board. Kick-off fuses (trip fuses) with alarm contacts shall be provided for all DC fuses. Semi conducting device fuses shall be fast-acting. All upstream fuses shall be properly coordinated with corresponding down stream fuses.
- j) Indicating lamps shall be clustered of LEDs suitable for the duty involved. The body shall be made of polycarbonate Unbreakable lens. LEDs shall be protected by inbuilt fuse with surge suppressor or leakage voltage glow protection. Both lamps and lens shall be replaceable from front.
- k) Each battery charger shall be provided with one (1) no. voltage transducer and one (1) no. current transducer for monitoring the DC output. These transducers shall have twin-channel output of 4-20mA and will be used for analog inputs to central DDCMIS/ EDMS.
- l) Ground fault relay shall be provided to detect DC system ground leakage current.
- m) Switch fuse shall be provided to receive incoming AC supply.
- n) Charger shall be equipped with LCD display, so the system or particular module operation parameters can be locally or remotely viewed / monitored. Following parameters to be displayed:
- Input AC voltage
  - Input AC current
  - Charging voltage

- Charging current
- Load voltage
- Load current
- Battery voltage
- Battery current

4.03.04 **Alarms**

- a) Solid-state, audio visual annunciation system shall be provided for battery chargers. Annunciation system shall operate on 220V DC.
- b) One (1) minimum twelve-points alarm facia shall be provided on float-cum-boost charger panel, complete with proper actuating devices, circuitry, legends, push buttons (Accept, Reset and Test) and hooter.
- c) Each central panel shall be provided with one (1) minimum eight point alarm facia complete with proper actuating devices, circuitry, legends, push- buttons (Accept, Reset and Test) and hooter.
- d) The arrangement shall be such that on occurrence of a fault the corresponding window will light up and stays lighted until the fault is cleared and reset button is pressed.
- e) Each time a window lights up, a master relay will get energized to provide group alarm signals for Owner/Purchaser's remote panel.
- f) The requirements of indication/metering/alarms are given in the annexure.
- g) The alarm shall be compatible with central DCS/SCADA

4.03.05 **Meters**

Meters shall be 96 x 96 mm switchboard type, 90 deg scale, antiglare glass, accuracy class 2.0, with zero adjuster on the front. Charger panel shall be provided with the following meters:

- a) Input voltmeter (0 – 500 V AC) with voltmeter selector switch.
- b) Output DC voltmeter at each charger output.
- c) Output DC voltmeter at battery output.
- d) Output DC ammeter at each charger output (0 – 150% of rated full load charger output)
- e) Battery charging / discharging ammeter.

4.03.06 **Transducers**

Each battery charger shall be provided with one (1) no. voltage transducer and one (1) no. current transducer for monitoring the DC output. Transducer shall have 4-20mA dual output.

Charger panel shall be provided with the following transducers:

- a) DC voltage transducer at each charger output.
- b) DC current transducer at each charger output.
- c) DC voltage transducer at battery output.

#### 4.03.07 Controls

The following (but not limited to) manual controls shall be provided on the front of each charger panel :

- a) Charger ON/OFF push button.
- b) Selection of float or boost charge in case of float-cum-boost charger.
- c) Voltage setters for setting the output of float/ equalizing / boost charge. Setting shall be independent of each other so that setting of one voltage shall not require resetting other.
- d) Ground fault detection switch with indicating lamps.
- e) Current limit setter/ charging rate.
- f) Under/Over voltage relay including battery earth fault monitoring relay.
- g) Acknowledge-Reset-Test push buttons for annunciation system. The color of reset buttons shall be BLACK.

#### 4.03.08 Lamp/Space heaters/receptacles

- a) The charger panels shall be provided with :-
  - Internal illumination lamp with door switch, the lamp shall be located in the ceiling and guarded with protective cage.
  - Space heater with thermostat control
  - 5 pin 6A receptacle with plug
  - Communication plug.
- b) Lamp, heater and receptacle circuits shall have individual ON-OFF switch fuse units and shall be suitable for 240V AC supply.

#### 4.03.09 Wiring/Cabling

- a) The panels shall be completely wired-up. All wiring shall be routed through wiring troughs.

- b) Wiring shall be done with flexible, 1100V grade, fire resistance PVC insulated switchboard wires with stranded copper conductors of 2.5 mm<sup>2</sup> for control and current circuits and 1.5 mm<sup>2</sup> for voltage circuits.
- c) Each wire shall be identified, at both ends, with interlocking type permanent markers bearing wire numbers as per Bidder's Wiring Diagrams. AC / DC wiring shall have separate color-coding.
- d) Wire termination shall be made with crimping type connectors with insulating sleeves. Wires shall not be spliced between terminals.
- e) All spare contacts of relays, timers, auxiliary switches and other devices shall be wired up to the terminal block.
- f) Gland plate shall be of 4 mm thick, non-magnetic material and suitable for single-phase cable entry from bottom. Cable terminal board with cable lugs and double compression cable glands shall be provided in each panel for termination of incoming and outgoing cable.

**4.03.10 Terminal Block**

- a) 1100V grade, multi way terminal block complete with mounting channel, binding screws and washers for wire connections and marking strip for circuit identification shall be provided for terminating the panel wiring. Terminals shall be stud type, suitable for terminating 2 nos. 2.5 mm<sup>2</sup> stranded copper conductor and provided with acrylic insulating cover.
- b) Not more than two wires shall be connected to any terminal. Spare terminals equal in number to 20% active terminals shall be furnished. Separate terminal blocks shall be used for AC/ DC wiring termination.
- c) Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.
- d) Terminal blocks used for interface with DDCMIS via termination cabinet shall be suitably sized to facilitate proper termination of interconnecting cables.

**4.03.11 Grounding**

- a) The charger panels shall have fully rated ground bus with two ground terminals, one at each end.
- b) Each terminal shall comprise two-bolt drilling with G.I. bolts, nuts and bimetallic washers for connecting to 50x6 mm G.I. flat. Ground bus shall be bolted to the panel structures, effectively grounding the entire assembly. The cases of meters, relays and switching devices shall be grounded through sheet steel structure.
- c) Wherever, the schematic diagrams indicate a definite ground at the panel, a single wire for each circuit thus grounded shall be run independently to the ground bus and connected thereto.

**4.03.12 Tropical protection**

- a) All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.
- b) Screens of corrosion resistant material shall be furnished on all ventilating louvres to prevent the entrance of insects.

**4.03.13 Painting**

- a) The sheet metal of the panels shall be thoroughly cleaned by chemical agents (7-tank process) as required to produce a smooth clean surface free of scales, grease and rust.
- b) Both interior and exterior surfaces of the panels shall be powder coated and finished with two (2) coats of paints of approved shades. Refer Section-3 for details.
- c) The paint shall be carefully selected to withstand tropical heat, rain etc. The paint shall not scale off or crinkle or removed by abrasion due to normal handling.
- d) Sufficient quantity of touch up paint shall be furnished for application after installation at site.

**4.03.14 Nameplate**

- a) Name plate shall be provided for each panel and for each equipment/device mounted on it.
- b) The material shall be anodized aluminum/ lamicoïd, 3mm thick, with white letter on black background.
- c) Name plate shall be held by self-tapping screws. The size of name plates shall be approximately 20mm x 75mm for equipment and 40mm x 150mm for panels.
- d) Name plates for panels shall be provided both on the front, rear and also inside the panels.
- e) Control and meter selection switches shall have integral nameplates. Nameplates for all other devices shall be located below the respective devices both inside and outside the panel.
- f) Instrument and devices mounted on the face of the panels shall also be identified on the rear with the instrument / device number. The number may be painted on or adjacent to the instrument or device case.
- g) Caution notice of suitable metal plate shall be affixed at the back of each panel.
- h) Bus bar clamp-on sensor, maximum DC current: 50A

**4.04.00 Battery Discharge Resistor Unit / Portable Single Cell Charger**

- 4.04.01 It shall be designed to perform periodic discharge tests. The Resistor Unit shall be made specially to check initial battery performance, guarantee smooth operation of back up system during emergencies and improve overall health and life of Battery system.
- 4.04.02 Resistor Unit shall be an assembly consisting of copper-nickel alloy wire grid elements supported by stainless steel tie rods. The resistor bank shall have adequate trimming facility (coarse and fine) to maintain a constant current against falling voltage during discharge operation. An ammeter shall be provided on the unit to monitor discharge current of battery.
- 4.04.03 Portable single cell charger shall be supplied with all accessories like input & output cables, ammeter, etc. It will be used for charging a cell while operating as part of a battery bank, even if another charger is connected, without removing it from service
- 5.00.00 **TESTS**
- 5.01.00 All equipment and components thereof shall be subject to shop tests as per relevant IS standards. The tests shall included but not limited to:
- 5.01.01 Following type tests (but not limited to) on two cells of the battery shall be carried out by the Bidder, even if the Bidder submits type test certificates for Purchaser's review and approval.
- a) Discharge performance test at low temperature.
  - b) Ampere-hour test & watt-hour efficiency test.
  - c) Endurance test.
  - d) Container shall be type tested as per IS:1146
  - e) Sealing compound shall be type tested as per IS:3116
- 5.01.02 Following minimum tests shall be performed on each battery charger.
- a) Dielectric tests.
  - b) Voltage regulation check from 0 to 100% load with  $\pm 10\%$  input voltage variation.
  - c) Ripple content measurement.
  - d) Heat run test on current limiting value.
  - e) Functional test.
- 5.01.03 All other routine tests shall be carried out on each equipment as per relevant standard.
- 6.00.00 **SPECIAL TOOLS & TACKLES**
- 6.01.00 A set of special tools & tackle which are necessary or convenient for erection, commissioning, maintenance and overhauling of the equipment shall be supplied.

- 6.02.00 The tools shall be shipped in separate containers, clearly marked with the name of the equipment for which they are intended.
- 7.00.00 **SPARES**
- 7.01.00 The Bidder shall submit a list of recommended spare parts for five (5) years satisfactory and trouble free operation, indicating the itemized price of each item of the spares.
- 7.02.00 Mandatory spares shall be furnished as per list furnished elsewhere in this specification.
- 8.00.00 **DRAWINGS, DATA & MANUALS**
- 8.01.00 Drawings, Data and Manuals shall be submitted with the bid and in quantities and procedures as specified in general Conditions of Contract and/or elsewhere in this specification for approval and subsequent distribution after the issue of Notice to Proceed.
- 8.02.00 **To be submitted with the Bid**
- 8.02.01 Proposal sheets duly filled in.
- 8.02.02 Dimensional Battery room layout drawing.
- 8.02.03 General Arrangement drawing of Charger panels & Discharge Resistor Unit.
- 8.02.04 Typical foundation plan.
- 8.02.05 Bill of material.
- 8.02.06 Battery cell voltage characteristics and data for different discharge rates.
- 8.02.07 Battery Sizing calculation in the format of IEEE 485
- 8.02.08 Type test certificates as per requirement of this specification.
- 8.02.09 List of makes of various items / components shall be submitted for Purchaser's approval.
- 8.02.10 Leaflets and catalogues of different equipment and accessories including write up on features of different components along with data sheets, curves, tables etc.
- 8.03.00 **To be submitted for Purchaser's Approval and Distribution**
- 8.03.01 Bidder shall submit all relevant drawings and data pertaining to the equipment like GTP, sizing calculations of battery/battery charger, GA drawing, foundation plan, BOM, QAP, wiring diagrams, etc. for the approval of Owner/Owner's consultant.

- 8.03.02 All drawings shall be prepared by using Auto CAD, approved version and documents shall be generated using MS Office. The paper copy of the drawings & document shall be submitted for approval & reference. All final drawings and documents shall be submitted in CD in Auto CAD (approved version) and MS office format as applicable for Purchaser's future reference.

**ANNEXURE-A**

**RATINGS & REQUIREMENTS**

1.0	<b>BATTERY</b>		<b>Lead Acid</b>
1.1	Application	:	Power Plant /Switchyard
1.2	Design Ambient temperature	:	
	a) Maximum	:	50°C
	b) Minimum	:	Refer General Specification
1.3	Type	:	Plante
1.4	Nos. of Cells per Battery	:	To be decided by the bidder
1.5	Battery nominal voltage	:	2 V/Cell
1.6	End Cell Voltage	:	1.8 4.75 Volt/Cell
1.7	Battery capacity at 27°C	:	To be decided by the bidder
1.8	Proposed Method of working	:	
	a) Float charging (normal)	:	2.25 2.20-Volt / cell.
	b) Equalising Charge (occasional)	:	2.33 Volt / cell
	c) Boost charging/cell (after complete discharge)	:	2.75 V / cell (max'm.)
1.9	Intermediate tapping	:	As required
1.10	Mounting	:	FRP Rack
1.11	Terminal Connection	:	Through single core fire survival cables. Actual size of cable shall be as per design calculation
2.0	<b>BATTERY CHARGER</b>		
2.1	Charger	:	Float & Float-cum-Boost charger and standby Boost Charger
2.2	Type	:	Solid-state, full wave, fully controlled with microprocessor based AVR, three-phase bridge, suitable for continuous duty application.
2.3	Enclosure	:	Sheet steel enclosure, IP-42.

#### 2.4 A.C. Input

- a) Supply : 415V, 3 phase, 50 Hz, 3 wire.
- b) Voltage variation : -15% to +10%
- c) Frequency variation : +3% to -5%
- d) Combined volt + frequency variation : 10% (absolute sum)
- e) Short-circuit level : 50KA r.m.s. symmetrical.
- f) System earthing : Solidly earthed.

#### 2.5 D.C. Output

- a) Float charger : (Maximum Continuous DC load + float charging battery) plus 25% margin. Output voltage adjustable between 230-240 V.
- b) Boost charger : Restoring fully discharged battery to full charge condition in 10 Hours for Lead-Acid battery, with 25% margin over maximum charging rate. O/p voltage adjustable between 260-285 V

#### 2.6 Performance Requirements

- a) The output voltage of the charger shall be regulated within  $\pm 1\%$  of the set value for any load variation from 0 to 100% and A.C. input voltage and frequency variations as indicated above in sl. No. 2.4 above.
- b) The ripple content in charger DC output shall be limited to 1% (rms) with or without battery.

#### 3.0 DISCHARGE RESISTOR BANK

- 3.1 Type : Portable
- 3.2 Construction : Sheet steel enclosed,
- 3.3 Resistor material : Copper-nickel alloy/stainless steel
- 3.4 Enclosure Protection Class : IP-32
- 3.5 Cooling : Forced air-cooled
- 3.6 Rating : To meet the functional requirement C10 Rate

- 3.7 Control : Using rotary switches for step control of current against falling voltage with ON-OFF facility.

**ANNEXURE-B**

**FITTINGS & ACCESSORIES**

**1.0 BATTERY**

Each set of battery shall be equipped with fittings and accessories as listed below.	
1	One battery log book.
2	Two copies of printed instruction sheet.
3	Two nos. cell testing voltmeter (3-0-3 volts) complete with leads.
4	One no. rubber syringe type hydrometer suitable for specific gravity reading.
5	Three nos. pocket thermometer.(Digital type)
6	Two nos. thermometer (0 to 100°) with specific gravity correction scale.
7	One set cell bridging connector.
8	Two nos. each Electrolyte resistant plastic funnels and plastic jugs
9	Battery racks suitable for accommodating the cells coated with paint.
10	Insulator (with 5% extra), rubber pad etc. for rack.
11	Two nos. plastic filling bottle for filling up.
12	One pair of spanners.
13	Requisite quantity of electrolyte with 10% extra in non-returnable containers.
14	Two pairs of rubber hand gloves.
15	Two nos. cell lifting straps.
16	One set of inter cell, inter tie and inter bank connectors as required for complete installation.
17	Self adhesive PVC stickers for cell numberings
18	Goggles.
<b>NOTE:</b>	Any other accessories if required for satisfactory operation of the complete battery system shall also be included in Bidder's offer and to be supplied accordingly.

**ANNEXURE-C**

**LIST OF ALARMS & AND INDICATIONS**

- 1.0 Following list of alarm / annunciation shall be provided at each charger.
  - a) AC supply failure.
  - b) Charger overload.
  - c) SCR fuse blown.
  - d) Filter fuse blown.
  - e) DC output fuse blown.
  - f) DC system under voltage.
  - g) DC system over voltage.
  - h) Battery earth fault.
  - i) AC Input fuse blown
- 2.0 Initiating contacts wired to two terminals at battery charger panel shall be provided for group annunciation "Battery Charger Trouble" of the events mentioned above, at central control room. Separate contacts shall be provided for "Battery earth fault" annunciation at central back-up panel.
- 3.0 Initiating contacts for all alarm points shall also have electrically separate spare set of contacts wired to the terminal block for future use.
- 4.0 All alarm contacts shall be rated 5.0A at 220V DC and 10 Amp. at 240V AC.
- 5.0 In addition to the alarm points mentioned above, any other alarm point, if required for battery charger, shall be provided.
- 6.0 Charger panel shall also have the following minimum indications:
  - a) Charger power supply ON (at all three phases)
  - b) Charger DC output healthy.
  - c) Control supply ON.
  - d) DC supply healthy.
  - e) Float / boost charger in operation (in float-cum-boost charger)

Project : 400kV Switchyard for 1x800W Kothagudem TPS **220V BATTERY**

For design of battery following dc load shall be considered

Continuous DC Emergency Load current E1	8.64 Amp
Continuous DC Load Current C1	26.93 Amp
Momentary DC Load Current due to tripping (M1)	47.20 Amp
Momentary DC Load Current due to closing (M2)	67.73 Amp

Battery Duty cycle	Load Type		
Duration			
0 min to 1 min	E1+C1+M1	82.77	Amp
1 min to 60 min	E1+C1	35.57	Amp
60 min to 599 min	C1	26.93	Amp
599min to 600 min	C1+M2	94.66	Amp
Actual Battery Sizing calculation shall be submitted by battery manufacturer based on the Battery Load cycle above			

1  
59  
539  
1

**REV02**

Project : 400kV Switchyard for 1x800W Kothagudem TPS **48V BATTERY****For Design of 48V Battery and Battery Charger following Load considered**

<b>Continuous DC current for 3 hrs</b>	<b>42.92</b> Amp
<b>Momentary DC Load Current for 15 Min ( Continuous + Momentary)</b>	<b>94.42</b> Amp

**Actual Battery Sizing calculation shall be submitted by battery manufacturer based on the Battery Load cycle above**

Project : 400kV Switchyard for 4x270W Bhadradi TPS **220V BATTERY**

For design of battery following dc load shall be considered

Continuous DC Emergency Load current E1	12.73 Amp
Continuous DC Load Current C1	29.69 Amp
Momentary DC Load Current due to tripping (M1)	77.85 Amp
Momentary DC Load Current due to closing (M2)	38.05 Amp

Battery Duty cycle	Load Type		
Duration			
0 min to 1 min	E1+C1+M1	120.26	Amp
1 min to 60 min	E1+C1	42.41	Amp
60 min to 599 min	C1	29.69	Amp
599min to 600 min	C1+M2	67.73	Amp
Actual Battery Sizing calculation shall be submitted by battery manufacturer based on the Battery Load cycle above			

1 min  
59 min Rev  
02  
539 min  
1 min

Project : 400kV Switchyard for 4x270W Bhadradi TPS **48V BATTERY****For Design of 48V Battery and Battery Charger following Load considered**

<b>Continuous DC current for 3 hrs</b>	<b>42.92</b>	<b>Amp</b>
<b>Momentary DC Load Current for 15 Min ( Continuous + Momentary)</b>	<b>94.42</b>	<b>Amp</b>

Actual Battery Sizing calculation shall be submitted by battery manufacturer based on the Battery Load cycle above

## SECTION – 2

### **2.1 GENERAL TECHNICAL REQUIREMENTS**

#### **APPLICABLE STANDARDS**

IS:1651	- Stationary Cells and Batteries, Lead-Acid Type (with Tubular Positive Plates)
IS:1652	- Stationary Cells and Batteries, Lead-Acid Type (with Plante Positive Plates)
IS:1146	- Rubber and Plastic Containers for Lead-Acid Storage Batteries
IS:6071	- Synthetic Separators for Lead-Acid Batteries
IS:266	- Specification for Sulphuric Acid
IS:1069	- Specification for Water for Storage Batteries
IS:3116	- Specification for Sealing Compound for Lead-Acid Batteries
IS:1248	- Indicating Instruments
IS:10918	- Vented type nickel Cadmium Batteries
IEC:60896-21&22	- Lead Acid Batteries Valve Regulated types – Methods of Tests & Requirements
IEC: 60623	- Vented type nickel Cadmium Batteries
IEC:60622	- Secondary Cells & Batteries – Sealed Ni-Cd rechargeable single cell
IEC:60623	- Secondary Cells & Batteries – Vented Ni-Cd rechargeable single cell
IEC:60896-11	- Stationary Lead Acid Batteries – Vented Type – General requirements & method of tests
IEEE-485	- Recommended practices for sizing of Lead Acid Batteries
IEEE-1115	- Sizing of Ni-Cd Batteries
IEEE-1187	- Recommended practices for design & installation of VRLA Batteries
IEEE-1188	- Recommended practices for design & installation of VRLA Batteries
IEEE-1189	- Guide for selection of VRLA Batteries

### **2.2 PACKING AND MARKING**

The cells shall be suitably packed as per applicable standards so as to avoid any loss or damage during transit.

Loose item such as connectors, copper rods, hardware, insulators and accessories etc. shall also be packed in cases.

For details / specific packing requirements for the project refer section-3.

### **2.3 Markings**

Each cell shall be marked with details as below:

- Manufacturer's type and trade name
- AH capacity at 30 minute rate.
- Upper & lower electrolyte level in case of transparent containers.
- Month & Year of manufacture
- Country of origin
- The cells and batteries may also be marked with the ISI certification mark.

### **2.4 SUBMISSION OF DOCUMENTS**

Bidders are required to submit the following drawings and documents along with the offer:

- a) General Technical Particular (GTP).
- b) GA & Internal Details of Battery Cells.
- c) GA of Stand.
- d) Layout of Batteries.
- e) Bill of materials indicating complete list of materials, accessories, spares, components, makes of components, quantities and rating.
- f) Cable Termination detail.
- g) Charging & Discharging Battery characteristic curves:
  - Curve showing cell volts Vs. time at different discharge rates.
  - Curve showing cell volts Vs. time at different charging currents.
  - Ampere - hours capacity Vs years of service.
- h) Complete technical literature supported by catalogues.
- i) Quality plan.
- j) Field Quality plan.
- k) Type Test Reports.
- l) Storage and Installation Instruction.
- m) Operation and Maintenance Manual

Note – Except for operation and maintenance manual, all other documents shall be submitted at the tender stage also.

- x -



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## SECTION - 3

### PROJECT DETAILS AND GENERAL SPECIFICATIONS

#### GENERAL TECHNICAL REQUIREMENTS

#### 1.0 PROJECT DETAILS

##### A) Kothagudem TPS

A)

Customer : M/s Telangana State Power Generation Corporation Ltd.  
Project Title : 1x800MW Kothagudem Thermal Power Station Stage VII, Unit 12  
Project Location : Paloncha Village, Khammam District, Telangana  
Nearest Railway station : Bhadrachalam Road railway station.  
Nearest Road Head : Khammam 16 km approx., Nearest Highway NH221  
(Vijaywada – Jagdalpur Highway).  
Nearest Airport : Hyderabad (about 200 Km)  
Chief Engineer (O&M), Kothagudem Thermal Power Station Stage  
Postal Address : VII, Unit – 12, TSGENCO, Village - Paloncha, Dist. – Khammam,  
Telangana -507115

##### B) Bhadradi TPS

Customer : M/s Telangana State Power Generation Corporation Ltd.  
Project Title : 4x270MW Bhadradi Thermal Power Station  
Project Location : Ramanujavaram Village, Khammam District, Telangana  
Nearest Railway station : Manuguru railway station.  
Nearest Road Head : Khammam  
Nearest Airport : Hyderabad (about 345 Km)  
Postal Address : Chief Engineer (O&M), Bhadradi Thermal Power Station Stage  
TSGENCO, Village - Ramanujavaram, Dist. – Khammam, Telangana



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## 1.1 SITE CONDITIONS (FOR DESIGN PURPOSES)

### 1.1.1 SITE CONDITIONS

- |     |                                   |   |         |
|-----|-----------------------------------|---|---------|
| a). | Average rainfall per year         | : | 1124 mm |
| b). | Maximum hourly rainfall intensity | : | 102 mm  |
| c). | Altitude                          | : | 1000 m  |

### 1.1.2 DESIGN AMBIENT

- |     |                            |   |        |
|-----|----------------------------|---|--------|
| a). | Minimum Temperature        | : | 13.5°C |
| b). | Maximum Temperature        | : | 45°C   |
| c). | Design Ambient Temperature | : | 50 °C  |

### 1.1.3 RELATIVE HUMIDITY

- |     |         |    |     |
|-----|---------|----|-----|
| a). | Maximum | :: | 85% |
|-----|---------|----|-----|

### 1.1.4 WIND PRESSURE (AS PER IS:875-1987)

- |     |                   |   |           |
|-----|-------------------|---|-----------|
| a). | Design wind speed | : | 44 m/sec. |
|-----|-------------------|---|-----------|

### 1.1.5 SEISMIC FACTORS

- |     |                                |   |                         |              |
|-----|--------------------------------|---|-------------------------|--------------|
| a). | Horizontal Seismic Coefficient | : | As per latest IS : 1893 | } Zone - III |
| b). | Vertical Seismic Coefficient   | : | As per latest IS : 1893 |              |

### 1.1.6 ELECTRICAL DATA

		400 kV System	415V AC System	240V AC System	220 V DC System	48 V DC System
1.	Nominal Voltage	400 kV	415 V	240 V	220 V	48 V
2.	Highest System Voltage	420 kV	457 V	264 V	242 V	55 V
3.	No. of phases	3	3	1	NA	NA
4.	Frequency	50 Hz	50 Hz	50 Hz	NA	NA
5.	Voltage variation	± 5%	± 10 %	± 10 %	+10 % to -15%	± 10 %



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6.	Neutral Earthing	Effectively Earthed	Solidly Earthed	Solidly Earthed	-	-
7.	Fault Level	50 kA for 1 sec.	50 kA for 1 sec.	50 kA for 1 sec.	15 kA for 1 sec.	-

**1.1.7 SYSTEM PARAMETERS**

Dry and wet one minute power frequency withstand voltage	630 kVrms
Dry impulse withstand voltage positive and negative	1425 kVpeak
Minimum Total Creepage	25 mm/kV

**1.1.8 MINIMUM CLEARANCE (AS PER IS: 10118)**

Phase to phase (PP)	4200 mm
Phase to earth (PE)	3500 mm
Section clearance	6500 mm
Minimum ground clearance from plinth level (Plinth level : 300 mm)	8000 mm
Vertical ground clearance to nearest part not at earth potential of an insulator supporting live conductor/ equipment	2440 mm

**1.2 INSTRUCTION TO BIDDERS**

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

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification. It is recognised that the Manufacturer may have standardised on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously.

**1.3 STANDARDS**

The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

The equipment to be furnished under this specification shall conform to latest issue (with all amendments) of specified standards.



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In addition to meeting the specific requirement called for in Sections 1 and 2 of the Technical Specification, the equipment shall also conform to the general requirement of the applicable standards, which shall form an integral part of the 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. When the specific requirements stipulated in the specifications exceed or differ from those required by the applicable standards, the stipulation of the specification shall take precedence.

Other internationally accepted standards, which ensure equivalent or better performance than that specified in the standards referred, shall also be accepted. The bidder shall submit copies of such standards.

In case governing standard for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in the offer 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 Purchaser's / owner's approval. The bidder shall clearly indicate in his bid the specific standards in accordance with which the works will be carried out.

#### **1.4 TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE**

All equipment being supplied shall conform to type tests and shall be subject to routine and acceptance tests in accordance with requirements stipulated under respective sections. Purchaser reserves the right to witness any or all the tests. The Manufacturer shall intimate the Purchaser the detailed programme about the tests at least three (3) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies. Purchaser reserves the option for getting any or all the type tests repeated on the equipment. The Manufacturer shall also submit type test procedure for approval of the Purchaser.

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 additional type tests not carried out without any additional cost implication to the Purchaser.

The price of conducting all tests and additional type tests is deemed to be included in Bid price. 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.

The purchaser intends to repeat the type tests and additional type tests on cables for which test charges shall be payable as per provision of contract.



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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 Contractors 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 Manufacturer shall obtain for the Engineer and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the Manufacturer's own premises or works. Inspection may be made at any stage of manufacture, dispatch 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.

The Manufacturer shall give the Purchaser/inspector thirty (30) days written notice of any material being ready for testing. Such tests shall be to the Manufacturer's account except for the expenses of the inspector. Unless witnessing of the tests is virtually waived, the Purchaser/ inspector will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/ inspection, failing which the Manufacturer may proceed with the test which shall be deemed to have been made in the Inspector's presence and the Manufacturer shall forthwith forward duly certified copies of test reports in triplicate to the Inspector.

The Purchaser or Inspector shall, within fifteen (15) days from the date of inspection as defined herein, give notice in writing to the Manufacturer, 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 Manufacturer 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.

When the factory tests have been completed at the Manufacturer'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 Manufacturer's Test certificate by the Engineer/ Inspector. Failure of the Purchaser/inspector to issue such a certificate shall not prevent the Manufacturer from proceeding with the Works. The completion of this test 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 MICC by the Purchaser.

In all cases where the Contract provides for tests whether at the premises or at the works of the Manufacturer or of any Sub-Contractor, the Manufacturer 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 authorised 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 authorised representative to accomplish testing.



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The inspection by Purchaser and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Manufacturer in respect of the agreed quality assurance programme forming a part of the Contract.

The Purchaser will have the right of having at his own expenses any other test(s) of reasonable nature carded out at Manufacturer'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.

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.

## **1.5 MATERIAL/WORKMANSHIP**

### **1.5.1 GENERAL REQUIREMENT**

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

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfil their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from purchaser.

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

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be construed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting,



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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 manufacture's limits. Suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

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

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

#### 1.5.2 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.

### 1.6 COLOUR SCHEME AND CODES FOR PIPE SERVICE

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

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

All steel structures, plates etc. shall be painted with non-corrosive paint on a suitable primer. It may be noted that normally all electrical equipment in switchyard are painted with shade 631 of IS-5. All The indoor cubicles shall be of same colour scheme and for other miscellaneous items, colour scheme will be approved by the purchaser.



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### 1.7 PAINTING

- a) All sheet steel work shall be phosphated in accordance with the following procedure and in accordance with IS: 6005 "Code of practice for Phosphating Iron and Steel".
- b) Oil, grease, dirt and swerve shall be thoroughly removed from emulsion by cleaning.
- c) 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.
- d) After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute bichromate solution and over drying.
- e) The phosphate coating shall be sealed by the 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.
- f) After application of the primer, two coats of finishing epoxy paint shall be applied, each coat followed by stoving. The panel shall have colour conforming to shade 631 of IS-5 for outside and inside of the panel with black colour for base frame.
- g) Each coat of primer and finishing paint shall be of a slightly different shade to enable inspection of the painting.
- h) Finished painted appearance of panel shall present an asthetically pleasing appearance free from dents and uneven surface.
- i) A small quantity of finishing paint shall be supplied for minor touching up required at site after the installation of the panels.

### 1.8 PROTECTION

- a) All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.
- b) All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.
- c) The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.
- d) Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.



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### 1.9 FUNGISTATIC VARNISH

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

### 1.10 SURFACE FINISH

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

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

### 1.11 GALVANIZING

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

### 1.12 AUXILIARY POWER SUPPLY

1.12.1 A.C power supply for auxiliaries will be available at 240 V, 50 C/s 1-phase, 2 wire and 415V, 50 C/s, 3-phase, 4 wire, neutral solidly earthed with variation in frequency of +/-5% and variation in voltage +/-10%

1.12.2 D.C. power supply at 220 V, 2-wire ungrounded will be available 187 V to 242 V.

### 1.13 INSPECTION AND TESTING

All tests and inspection of the equipment specified shall be performed to the extent and in the manner as stipulated in the relevant standards and in this specification. All type tests/routine tests/acceptance tests as specified shall be conducted in the presence of purchaser. Wherever equipment similar to the one being offered has already been type tested within 5 years from the date



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of opening the bid. Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off. Otherwise the subcontractor will have to carry out the type tests without any extra cost and without any delivery implications.

#### **1.14 PACKAGING**

Aluminium Tube shall be partially packed with Hessians cloths. Similar items shall be grouped and tied with steel wires/strip for convenient handling during transits.

#### **MARKINGS**

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

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

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/material at a later date, in case the need arises, while packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage wagons 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.

#### **1.15 HANDLING, STORING AND INSTALLATION**

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



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oriented. Commercial use of switchyard equipment means completion of all site tests specified and energisation at rated voltage.

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.

In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser.

Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

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

Contractor shall be responsible for examining all the shipment 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, pilferage and other such charges claimed by the transporters, railways etc. shall be to the Contractor' account.

The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning. Contractor shall be responsible for the maintenance to 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 such nature, corrosion, damages etc.

The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipments which require indoor storage.

The words erection and installation used in the specification are synonymous. Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.



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

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

#### **1.16 TOOLS AND TACKLES**

The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly and maintenance of the equipment. However, these tools and tackles shall be separately, packed and brought on to Site.

#### **1.14 EQUIPMENT BASES**

A cast iron or welded steel base-plate shall be provided for all rotating equipment, which is to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base-plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units shall have a raised lip all around, and shall have threaded drain connections.

#### **1.15 QUALITY**

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

#### **1.16 DOCUMENTATION**

##### **1.16.1 DRAWINGS**

All drawings shall be prepared in AutoCAD and ultimate documentation would include drawings/documents on CDs. All dimensions and data shall be in SI metric units.

All items of the equipment should be clearly identified by proper part nos. in the contract drawings. Such parts, which are to be dispatched to site from works in dispatchable units and are reassembled at site, should be marked by proper identification marks at works and indicated in the drawings and quantified. The shipping list should be sent along with the general arrangement drawings for engineer's approval. All the items of the shipping list should be identified in the drawing.

The drawing submitted by the supplier shall be reviewed by the purchaser as far as practicable within two weeks of receipt of drawings and shall be modified by the sub-contractor if any modifications and/or corrections are required by the purchaser. The sub-contractor shall incorporate such modifications and / or corrections and submit the final drawings for approval. Any delay arising out of failure of the subcontractor to rectify the drawings shall not alter the contract completion date.



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Further work by the subcontractor shall be in strict accordance with these drawings and no deviation shall be allowed without the written approval of the purchaser.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at supplier's risk.

Approval of drawing or work by the purchaser/consultant shall not relieve the subcontractor of any of his responsibilities and liabilities under the contract.

In case of any modifications that may be necessary during erection or commissioning of the equipment, the subcontractor shall carry out modifications in the original drawing & submit 'As Built drawings' and required no. of prints thereof.

#### 1.16.2 INSTRUCTION MANUALS

The supplier shall submit to the purchaser, draft instruction manuals for approval within 30 days of placement of order. The final instruction manuals complete in all respects shall be submitted 60 days before the first shipment of the equipment. The instruction manuals shall contain full details and drawings of all the equipment furnished, the erection procedures, testing, operation & maintenance procedures of the equipment.

If after the commissioning and initial operation of the plant, the instruction manuals require any modification/ addition / changes, the same shall be incorporated and the up- dated final instruction manuals shall be submitted as required.

#### 1.16.3 TITLE BLOCK & DRAWING/ DOCUMENT NUMBERING SCHEME

Title block for drawing / document should be followed as per ANNEXURE-3

#### 1.16.4 DOCUMENTATION SCHEDULE AT CONTRACT STAGE

A.	<u>For approval</u>	<u>No of Copies</u>
	Copies of all drawings with project details, dimension, shipping weights, No. of cases & dimensions, fixing details, tolerance etc.	10
	Copies of type test reports.	5
	Copies of works quality plan & field quality plan.	5



Project: 1x800 MW KOTHAGUEDEM THERMAL POWER STATION STAGE VII, UNIT 12 &  
4x270 MWBHADRADRI THERMAL POWER STATION.

Customer: TELANGANA STATE POWER GENERATION CORPORATION LTD

Section-3: Project Details & General Specifications

Rev. No. 00

Copies of installation, operation & maintenance manual. 5

Copies of drawings on floppies/CDs 1 set

B. After approval and for information / distribution

Copies of all drawings 15

Copies of installation, operation & maintenance manual  
including Routine test reports 15

Sets of RTF of drawings 2

CDs of Drgs. 3

C. As Built Drawings

Hard copies of Drawings 15

CDs 3

**NOTE:**

1. Any revision of drawings / documents shall be submitted in the same no. of copies submitted first time for approval
2. Final drawings / documents shall be submitted in bound volume with customer and project details etc. written on the top.

## SCHEDULE-IXC/12

## 220 V BATTERY

(Ψ): Additional data requirement after award of contract

## A. BATTERY

## 1.0 GENERAL

- 1.1 (Ψ) Make :
- 1.2 (Ψ) Cat No. :
- 1.3 Type :
- 1.4 Reference Standard :

## 2.0 RATING

- 2.1 Rated Voltage Volt :
- 2.2 (Ψ) 10-hour rating at 27°C  
to 1.85 Volt per cell AH :
- 2.3 (Ψ) 1-hour discharge rate  
to 1.75 Volt per cell Amp :
- 2.4 (Ψ) 1-Minute discharge rate  
to 1.75 Volt per cell Amp :

## 3.0 PERFORMANCE

- 3.01 (Ψ) Does the battery meet the  
required duty cycle curve ? Yes/No :
- 3.2 (Ψ) Cell voltage characteristics  
during duty cycle furnished? Yes/No :
- 3.3 Minimum cell voltage during duty cycle Volt :
- 3.4 (Ψ) AH efficiency at 10-hour  
discharge rate % :
- 3.5 Expected life of Battery Hr. :
- 3.6 15% margin considered Yes/No :
- 3.7 25% ageing compensation  
factor considered Yes/No :

4.0 BATTERY CHARACTERISTICS

- 4.1 (Ψ) Recommended charging rate for Volt/Cell Amp :
- a) Float charging :
  - b) Equalising Charge :
  - c) Boost charging in 10 hrs.
    - i) Start :
    - ii) Finish :

- 4.2 (Ψ) Recommend specific gravity at 27 Deg.C
- a) For first filling :
  - b) At full charge :
  - c) At end of 10-hour discharge :

- 4.3 (Ψ) Short-circuit current for a dead-short across battery terminals, when
- a) Float charge at rated Volt/Cell KA :
  - b) Boost charge at rated Volt/Cell KA :

- 4.4 (Ψ) Battery internal resistance Ohm :

- 4.5 (Ψ) Cell voltage characteristics during charging furnished ? :

5.0 CELLS

- 5.1 (Ψ) Number of cells per battery :

- 5.2 Type of the cell :

- 5.3 Cell designation as per I.S. :

- 5.4 Material of the container :

- 5.5 (Ψ) Overall dimension of each cell mm :

- 5.6 (Ψ) Weight of complete cell

- a) Without acid Kg :

- b) With acid Kg :

5.7 (Ψ) Internal resistance of cell Ohm :

6.0 **INTERCELL CONNECTOR**

6.1 Intercell connector furnished? :

6.2 Type of intercell connector bolted/burned :

6.3 Material of intercell connector :

7.0 **PLATES**

7.1 (Ψ) Number of positive plates per cell :

7.2 Type of positive plate :

7.3 Type of negative plate :

7.4 Terminal Stand Material

8.0 **SEPARATOR**

8.1 Type :

8.2 Material :

8.3 (Ψ) Thickness :

9.0 **ELECTROLYTE**

9.1 (Ψ) Amount of electrolyte for first filling

a) Per cell litre :

b) Per set litre :

9.2 First filling with 10% extra furnished? :

9.3 Electrolyte conforms to :

10.0 **RACKS**

10.1 (Ψ) Number of racks per battery :

10.2 (Ψ) Number of cells per rack :

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10.3	Type of racks	Rows/tiers :
10.4	Material of rack	:
10.5	Racks provided with	
	a) Numbering tags for cells	:
	b) Teakwood clamps for cables	:
10.6	Insulator with 5% extra furnished for	
	a) Cell	Yes/No :
	b) Stand	Yes/No :
10.7	Inter-row, Inter-tier connectors and end take-off furnished ?	:
10.8	Connection hardware with 5% extra furnished	:
11.0	<b>(Ψ) DIMENSION &amp; WEIGHTS</b>	
11.1	Overall dimension (L x B x H) mm	:
11.2	Approx. Weight	Kg :
11.3	Battery layout drawing furnished?	:
12.0	<b>(Ψ) VENTILATION REQUIREMENTS</b>	
12.1		
12.2		
12.3		
12.4		
12.5		

**13.0 (Ψ) ACCESSORIES FURNISHED WITH EACH BATTERY**

13.1

13.2

13.3

13.4

13.5

13.6

13.7

13.8

13.9

13.10

13.11

13.12

**SECTION-5**

**CHECKLIST FOR LEAD ACID BATTERY BANK**

Put a tick mark on 'YES' if the specified requirement is met, or put a tick mark on 'NO' if the specified requirement is not met and give comments in the remark column

**1. TECHNICAL REQUIREMENTS**

Sl. No.	Parameters	Required Value 220V BATTERY	Required Value 48V BATTERY	Bidder's Confirm- ation	Reasons for non compliance
1.	Manufacturer's Identification System			YES/NO	
2.	Battery Type	Lead Acid plante	Lead Acid plante	YES/NO	
3.	Battery Voltage	220V	48V	YES/NO	
4.	Design Ambient Temperature	50deg. C	50deg. C	YES/NO	
5.	Max. Battery Bank Voltage	242V	52.8V	YES/NO	
6.	Min Battery Bank Voltage	187V	40.8V	YES/NO	
7.	Nominal voltage per cell	2V	2V	YES/NO	
8.	End Cell Voltage for specified duty cycle	1.8V	1.8V	YES/NO	
9.	No. of Cells per battery bank	108	24	Bidder to specify	
10.	Cell container	As per spec	As per spec	YES/NO	
11.	Type of Stand offered (freestanding on floor complete with necessary hardware)	As per spec	As per spec	YES/NO	
12.	Arrangement for connection for cell tapping provided for continuity during boost charging?	As per spec	As per spec	YES/NO	
13.	Applicable standard	IS-1651 / IS-1652	IS-1651 / IS-1652	YES/NO	
14.	Accessories as per clause 1.3 of section-1 included in the scope of supplies	YES	YES	YES/NO	
15.	Mandatory spares quoted in line with clause 1.3 of section-1	YES	YES	YES/NO	
16.	Supply of electrolyte for first filling plus 10% extra with the battery bank	YES	YES	YES/NO	
17.	All routine & acceptance tests to be conducted	As per Cl. 5.00.00, Annexure-1	As per Cl. 5.00.00, Annexure-1	YES/NO	
18.	Qualifying requirement - Documentary proof against the Qualifying requirement	Attached & Confirmed	Attached & Confirmed	YES/NO	

	mentioned in clause 1.4 of section 1, has been attached along with offer. Note: Bidder to ensure completeness of offer in this regard. No further communication regarding Qualifying requirement documentary proof is envisaged during tender evaluation.				
19.	The design of the equipment will be such that during the period both trickle charger unit and boost charger units are working independently, the tap connection from various taps of the battery cell to the load circuit should not involve any circulating current.	YES	YES	YES/NO	
20.	Intermediate tapping arrangement provided	YES	YES	YES/NO	
21.	Special tools & tackles as per clause 1.3 of section-1 included in the scope of supplies	YES	YES	YES/NO	

**19. Sizing Calculation for deciding Ampere hour rating of battery as per specified duty cycle (Annexure B) has been submitted along with offer for review.**

**YES/NO**

## 2. TYPE TESTS

1. Whether the offered equipment has been type tested within ten years from the date of bid opening (**Date of bid opening is 27.12.2014**) and valid reports are available.

**YES /NO**

2. If yes, furnish the report number.

Sl. No.	TESTS	REPORT NO.	YES/NO
1.	Test for capacity and voltage during discharge		

2.	Ampere hour and watt-hour efficiency test		
3.	Test for loss of capacity		
4.	Endurance test		

3. If case, the reports are not found complete / valid at contract stage, such type tests shall be carried out without any cost / delivery implication.

**YES/NO**

-- X X --

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**ANNEXURE - A**  
**SCHEDULE OF TECHNICAL DEVIATIONS**

Bidder shall list below all technical deviation clause wise w.r.t. tender specifications:

<u>S.No.</u>	<u>Page No.</u>	<u>Clause No.</u>	<u>Deviation</u>	<u>Reason / Justification</u>
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Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date:

Tenderer's Stamp & Signature