BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

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TYPE OF DOC.	**TECHNICAL SPECIFICATION**			**NAME**	**YLK**	**YLK**	**SKS**
TITLE				**SIGN**			
220V LEAD ACID BATTERY BANK				**DATE**	13.10.21	13.10.21	13.10.21
				GROUP	TBEM		

CUSTOMER	WBPDCL
PROJECTS	Extension of 400kV Switchyard at 1X660MW Unit-5 Sagardighi TPP

CONTENTS

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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 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:-

Name of the Customer : WBPDCL
Name of the Project : Extension of 400kV Switchyard at 1X660MW Unit-5 Sagardighi TPP
Consultant Development Consultants 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**
Nominal Voltage Rating (V)	220
Nominal Cell Voltage (V)	2.0
Cell Designation	Stationary, 1250AH 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 bank	108
Maximum Battery Bank Voltage	242
Minimum Battery Bank Voltage	199
Nominal float voltage per cell (V)	2.25
End Cell Voltage	1.85 Volt /Cell
Design Ambient temperature	50°C
Min. Electrolyte temp. for Battery Sizing	5°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	22m x 12m, bidder to confirm that battery banks can be suitably accommodated in room size with 1.5 meter clear space from inside wall surface.
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. Each 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 Annexure-1 of section-I.

1.3 BILL OF QUANTITIES

The following items are required for 400kV Sagardighi Switchyard Extn. S/s:-

1.3.1 Main Items

S. No.	Details	Unit	Qty (Nos)
1.	220V, 1250 AH, Lead Acid Plante Battery bank complete in all respect meeting the load cycle requirement as per technical specification	Sets	2

2.	Battery Fitting & Accessories as clause no. 1.3.3 below & of technical specification	Lot	2
3.	Mandatory Spares as per Cl. No. 1.3.2 below and of technical specification	Lot	1
4.	Supervision of erection at site for 220V, Lead Acid Plante Battery bank	Lot	2
5.	Supervision of testing & commissioning at site for 220V, Lead Acid Plante Battery bank	Lot	2

1.3.2 Mandatory Spares:

Bidder has to supply following items for 220V Battery as a mandatory spares.

S. No.	Details	Unit	Qty
1.	Hydrometer 1 set = 1 no. of each type	Set	2
2.	Vent plugs 1 set = 1 no. of each type	Set	5
3.	Inter-cell, connector 1 set = 1 no. of each type	Set	5
4.	Set of nuts,bolts and washer 1 set = 1 no. of each type	Set	5
5.	Insulated socket spanner with handle 1 set = 1 no. of each type	Set	2
6.	Thermometer 1 set = 1 no. of each type	Set	2
7.	Rubber gloves 1 set = 1 Pair of each type	Set	1
8.	Voltmeter for measuring cell voltage (Center zero type) 1 set = 1 no. of each type	Set	1

Please Note:-

i) Minimum size of batteries shall be as below:-
220V Battery - 1250AH Lead Acid Plante Type. If the specified size of Battery is not available, then next higher size is to be quoted by the bidder.

ii) 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. Please refer Annexure-B of specification for 220V Load duty.

iii) The battery size quoted by bidder shall be with sufficient margin as per TS.

1.3.3 Battery Fitting & Accessories

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	One no. 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	One no. 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 interbank connectors as required for complete installation.
17	Self adhesive PVC stickers for cell numberings
18	Goggles.
	NOTE: 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.

1.3.4 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 TECHNICAL PRE-QUALIFYING REQUIREMENT

As per Annexure- TQR.

1.5 TYPE TESTING

Bidder shall submit valid type test reports (as per relevant IEC/IS standard) on identical equipment in type and rating and carried out within last five years from the date of bid opening (i.e. 18.03.18). In case type test reports are more than five years old 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 any cost & delivery implication to BHEL.

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 Customer 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 ERECTION,TESTING & COMMISSIONING

Manufacturer of Battery shall supervise the erection, testing and commissioning and perform commissioning tests as recommended in O&M manual / or relevant standards. All necessary instruments, material, tools and tackles required for erection, 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.

2.0 PACKING

a) All equipments shall be suitably protected, coated, covered or boxed and crated. To prevent damage or deterioration during transit, handling and outdoor storage (for a minimum period of 1 year) at site till the time of erection. While packing all the materials, the limitations from the point of view of availability of transportation facilities in India should be taken into account. The bidder shall be responsible for any loss or damage during transportation, handling and storage.

2.1 DRAWING APPROVAL:

The successful bidder shall have to extend all possible support like timely submission/re-submission of drawings, visit to end customer to facilitate documents approval without any commercial implications to BHEL. Acceptance of bidder's documents shall be subject to end customer's approval. Date of Submission of first lot of drawings will be counted only from the date of submission of reasonably correct drawings.
Approval of the following drawings will be required for technical clearance of manufacturing for 220V Battery equipment along with accessories.

- GTP

- Bill of materials
- GA drawings & scheme
- Battery Sizing calculation

2.2 TITLE BLOCK

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

a) Project Name : Extension of 400kV Switchyard at 1X660MW Unit-5
b) Customer Name : WBPDCL
c) Consultant Name : Development Consultants Private Limited
d) Contractor : BHEL

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SECTION-IIIA

LEAD ACID PLANTE BATTERY

CONTENT

SECTION-IIIA

1.00.00 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. 1x100% set of 220V Lead Acid Plante batteries along with 2x100% float cum boost charger for each set of battery bank with one (1) DCDB for the following systems :-

a)	Main Plant	:	2 Set
b)	Switchyard	:	2 set
c)	AHP	:	2 set
d)	FGD	:	2 set

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 Following equipment/item shall also be provided:

i. One set of portable type battery discharge resistor Bank shall be provided for each battery set.
ii. DC insulation monitoring system in each DCDB.
iii. DC fuse board at output of each battery with Fuse monitoring relay, indication and remote annunciation facility.

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) set of special tools and tackle.

1.01.06 Mandatory Spare parts

1.01.07 Recommended spare parts for three (3) years operation

1.01.08 All relevant drawings, data and instruction manuals

2.00.00 CODES AND STANDARDS

2.01.00 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.

2.02.00 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.

2.03.00 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 emergency load duty cycle requirements. 220V D.C. system provides reliable sources of D.C. power for control, indication, protection and annunciation of power plant equipment. In addition, it provides for the following emergency loads/services on failure of A.C. supply.

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 and. Derating factor for prolonged float charging shall be duly taken into account, as applicable, in estimating battery capacity.

While estimating battery capacities, aging margin as per relevant standard, 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 The battery and battery charger capacity given in this specification and its annexure are minimum only. The bidders shall check the capacity and ratings based on the actual duty cycle requirement and other design stipulations and submit the offer accordingly. Sizing calculations along with relevant supporting document regarding selection of different factors shall be furnished with the bids.

3.01.09 During float operation of float cum boost charger, the charger shall be capable 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.

3.01.10 Each 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.

3.02.00 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 The Float Charger (FC) will be normally ON, supplying the DC load current and at the same time trickle charging the battery. The characteristics shall be such that if load is high and exceeds the charger capacity, the excess load shall be supplied by the battery.

3.02.04 The Float-cum-Boost charger will be normally in stand-by (Auto Float/ Charge) mode and will cut into the circuit automatically-

a) To provide occasional equalizing charge as required.

b) To take over the functions of float charger in case of its failure.

c) To operate in boost mode when battery voltage drops below a set value.

3.02.05 Each float-cum-boost charger shall also have provision for float, equalizing and boost charging the battery through proper selection.

3.02.06 On failure of A.C. supply both float-cum-boost chargers will go out of service and battery will take over to supply emergency loads without any interruption.

3.02.07 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.

3.02.08 Interlock shall be provided to ensure that the battery can be taken to boost mode only if the float charger of Float cum boost charger is healthy and running. Suitable defeating arrangement shall also be provided for initial charging of the battery.

3.02.09 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.

3.02.10 The batteries shall be so sized as to meet emergency load duty cycle requirements for one (1) hour. All momentary loads shall be treated as one-minute loads.

4.00.00 SPECIFIC REQUIREMENTS

4.01.00 Layout

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

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

a) Sufficient clearance space for attending individual cells.

b) Sufficient clear space to accommodate a battery of identical capacity in future.

4.01.03 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' type.

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 heat & electrolyte resistant, shock absorbing, tough translucent, polypropylene or equivalent plastic material having chemical and electrochemical compatibility. The cell shall be mechanically sturdy.

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. Open type cells shall be provided with suitable spray arrestors and separate perforated transparent plastic covers; anti-splash type vent plug shall be provided for sealed-in type cell.

f. 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.

g. The cells shall be supported on insulators fixed on to the rack with adequate clearance between adjacent cells.

h. The cell terminals posts shall be provided with connector bolts and nuts, made of copper/ brass effectively coated with lead to prevent corrosion.

i. Lead coated copper connectors shall be furnished to connect up cells of Battery set.

j. Positive and Negative terminal posts shall be clearly and indelibly marked for easy identification.

k. Bent copper plates, tubular copper lugs, teakwood clamp, bolts, nuts, washers, etc. shall be furnished for connection of outgoing Aluminum conductor cables.

l.. 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.

4.02.03 Battery Racks

Battery racks for supporting battery cells shall be constructed of best quality teakwood, forming a rigid structure. Racks shall be painted with at least three (3) coats of electrolyte-resistant paint of approved shade. 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

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 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. Each section of dual FCBC 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 DCS/ SCADA/ EDMS. ECP shall also have current & voltage measurement of each battery charger.

h. 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.

i. 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 two 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.

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 (±)2X2.5% 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 and bridge elements shall be liberally sized for forward current, minimum momentary overloads and voltage spikes. The current and 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 and 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 0.5A 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.

i. Fuses shall be HRC type and furnished complete with fuse bases and fittings of such design as to permit easy and safe replacement of fuse element. Semi conducting device fuses shall be fast acting. All upstream fuses shall be properly coordinated with corresponding downstream 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. Meters shall be 96 x 96 mm switchboard type, 90 deg scale, antiglare glass, ± 1% accuracy with zero adjuster on the front.

l. Transducers shall have twin-channel output of 4-20mA and shall be used to provide analog inputs to central control room.

m Ground fault relay shall be provided to detect DC system ground.

n. MCCB shall be provided to receive incoming AC supply.

o. 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-point alarm facia shall be provided on each 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 deices, 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 generate a group alarm signals.

f) The requirements of indication/metering/alarms are given in the annexure.

g) The alarm shall be compatible with central DCS/SCADA/PLC

4.03.05 Meters

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 inverter 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.

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 manual controls shall be provided on the front of each charger panel :-

a. Charger ON/OFF push button.

b. Selection of 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
- 3 pin6A receptacle with plug
- Communication plug.

b. Lamp, heater and receptacle circuits shall have individual ON-OFF switch fuse units/MCCBs 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, PVC insulated switchboard wires with stranded copper conductors of 2.5 mm^2 for control and current circuits and 1.5 mm^2 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 3 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^2 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.S. bolts, nuts and bimetallic washers for connecting to 50x6 mm G.S. 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 louvers 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..

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/ lamicoid, 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.

e. 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.

f. Caution notice of suitable metal plate shall be affixed at the back of each panel.

h. Bus bar clamp-on sensor, 2 x 4 In. (50 x 101mm) opening-maximum D current: 50A

4.04.00 Battery Discharge Resistor Unit

4.04.01 It shall be designed to perform periodic discharge tests. The Resistor Unit shall be made especially to check initial battery performance, guarantee smooth operation of backup 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.

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 test reports shall be submitted for approval:-

a. Discharge performance test at low temperature.

b. Ampere-hour test & watt-hour efficiency test.

c. Endurance test.

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 ±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.

5.02.00 Tests Witness

5.02.01 Tests shall be performed in presence of Purchaser's representative, if so desired by the Purchaser.

5.02.02 The supplier shall give at least seven (7) days' advance notice of the date when the tests are to be carried out.

5.03.00 Test Certificates

5.03.01 Certified reports of all the tests carried out at the works shall be furnished in six (6) copies for approval of the Purchaser.

5.03.02 The equipment shall be dispatched from works only after receipt of Purchaser's written approval of the test reports.

5.03.03 Bidder shall submit type test reports for the type tests as per relevant standards on identical equipment in type and rating. Reports older than five (5) years shall not be acceptable.

In case the type test reports are not submitted or the reports are not approved by the Purchaser, the Bidder shall conduct the type tests on the offered equipment at Bidder's risk and cost within the schedule specified herein. No deviation in this regard is acceptable.

5.03.04 Routine test certificates for components like contactors, relays, instruments, SCR / PWM transistors, Diodes, Condenser, Potentiometer, semi-conductors, push buttons etc. shall also be furnished for Purchaser's review and approval.

6.00.00 SPECIAL TOOLS & TACKLE

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

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 Information (I) / Approval (A)

8.03.01 Guaranteed technical particulars (A) and quality assurance plan (A)

8.03.02 Battery and Charger sizing calculation. (A)

8.03.03 Sizing calculation of charger main equipment, viz. SCRs, rectifier transformer etc. (A)

8.03.04 Fault current calculation for battery & battery charger. (A)

8.03.05 Dimensional battery layout drawings in plan & sections. (I)

8.03.06 Take-off terminals connection details. (I)

8.03.07 Dimensional general arrangement drawings of Battery charger clearly showing device dispositions, cable entry, space requirements etc. (I)

8.03.08 Charger foundation plan and loading. (I)

8.03.09 Sectional views of battery charger panels. (I)

8.03.10 Charger schematic diagram along with write-up. (A) and wiring diagrams with wire no., equipment / device no. etc (I)

8.03.11 Detailed bill of materials (I)

8.03.12 Test reports. (I)

8.03.13 Transport / shipping details such as method of packaging, dimension & weight of package, part list etc. (I)

8.03.14 Any other relevant drawing or data necessary for satisfactory installation operation and maintenance (I) or as required by purchaser.

8.03.15 Instruction manuals on Battery, Battery Charger and Battery discharge resistor unit (I)

The manual shall clearly indicate the salient features of each equipment, storage and installation method, operation and maintenance procedure, check–up and tests to be carried out before commissioning of the equipment and during maintenance.

8.04.00 The Bidder may note that the drawings, data and manuals listed are minimum requirement only. The Bidder shall ensure that all the necessary write-ups, curves and information required to fully describe the equipment offered are submitted with his bid.

8.05.00 The Purchaser may also review the documents marked (I) if found necessary. The Bidder shall note that the approval of drawings & documents by the Purchaser does not relieve him of his contractual obligation.

8.06.00 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	BATTERY		Lead-Acid
1.1	Application	:	Station Battery
1.2	Design Ambient temperature	:	
	a. Maximum	:	$50^{o}C$
	b. Minimum	:	$5^{o}C$
1.3	Type	:	Plante
1.4	Nos. of Cells per Battery	:	To be decided by Bidder
1.5	Battery nominal voltage	:	2 V/Cell
1.6	Battery capacity at 27ºC	:	To be decided by bidder, however, Calculation shall be furnished for Approval.
1.7	Proposed Method of working	:	
	a. Float charging (normal)	:	2.20 Volt / cell.
	b. Equalising Charge (occasional)	:	2.33 Volt / cell.
	c. Boost charging (after complete discharge)	:	2.75V / cell (max'm.)
1.8	Intermediate tapping	:	As required
1.9	Mounting	:	Wooden racks
1.10	Terminal Connection	:	Through single core fire survived cables. Actual size of cable shall be based on approved sizing calculation.

NOTE: Items 1.4, 1.6 & 1.7– Bidder to justify with details, if his recommended values are different from the values specified in this specification.

2.0	BATTERY CHARGER		
2.1	Charger	:	Dual float-cum-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, 4 wire.
	b.	Voltage variation	:	±10%
	c.	Frequency variation	:	± 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 + the DC load of largest DC motor +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 ± 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.

2.7	Fault Level for DC system	:	25kA [Minimum, Actual fault level shall be substantiated through calculation]
3.0	DISCHARGE RESISTOR BANK		
3.1	Type	:	Potable
3.2	Construction	:	Sheet steel enclosed,
3.3	Resistor material	:	Copper-nickel alloy/stainless steel
3.4	Enclosure Protection Class	:	IP30

3.5	Cooling	:	Natural air-cooled
3.6	Rating	:	To meet the functional requirement C10
3.7	Control	:	Using rotary switches for step control of current against falling voltage with ON-OFF facility
3.8	Painting	:	
	Interior		Glossy white
	Exterior		RAL 7032

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	One no. 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	One no. 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.
NOTE:	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 & 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.

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. Separate contacts shall be provided for “Battery earth fault” annunciation at respective control room of Main Plant, Switchyard, FGD, CHP, AHP etc.

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 0.5A at 220V DC and 5 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:

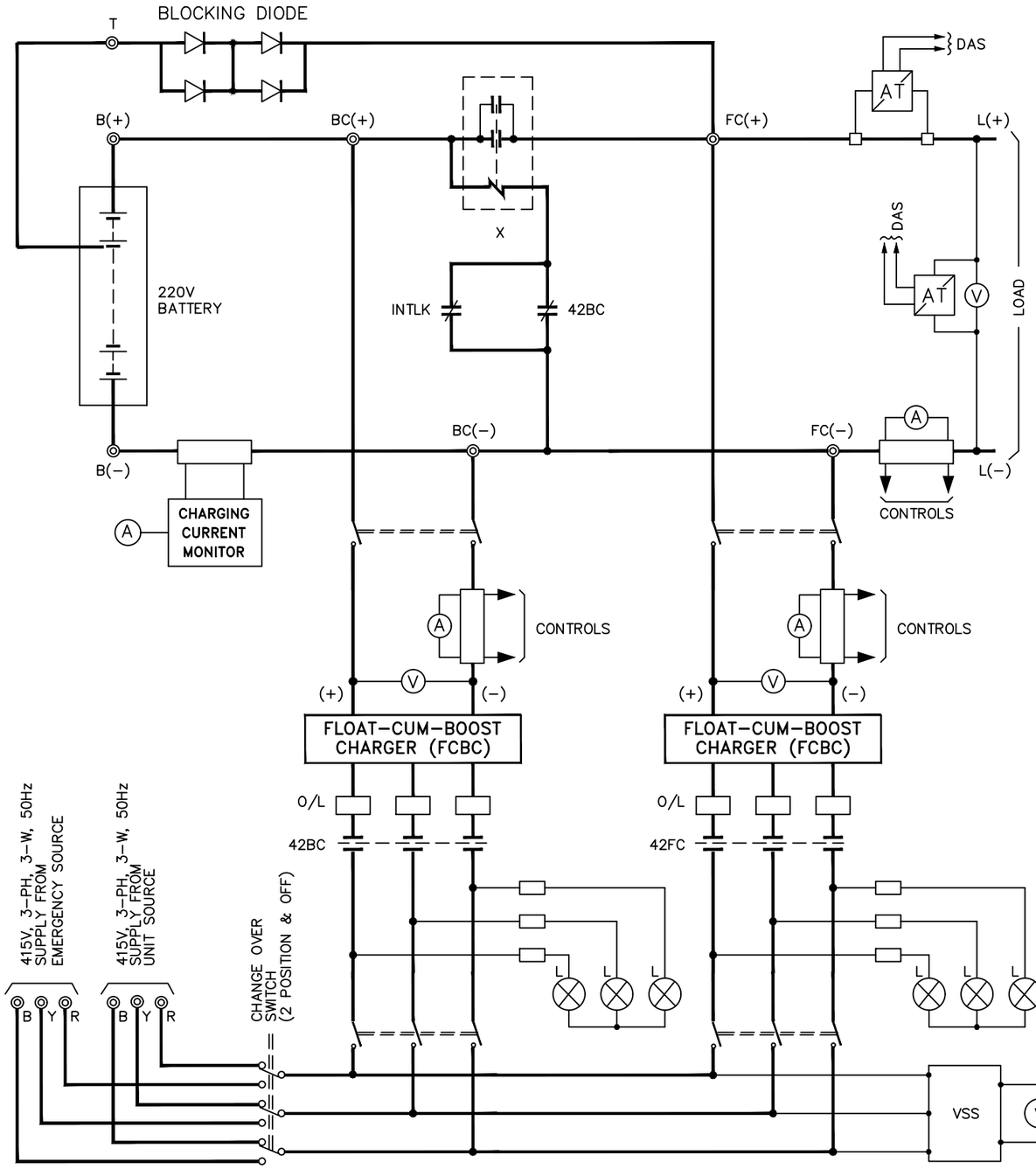
a. Charger power supply ON (at all three phases)

b. Charger DC output healthy.

c. Control supply ON.

d. DC supply healthy.

e. Float / boost charger in operation (in float-cum-boost charger)



OPERATION:--

THE SYSTEM CONSISTS OF TWO NUMBERS IDENTICAL FLOAT CUM BOOST CHARGER (FCBC−I & FCBC−II) WITH EACH SET OF BATTERY.

FLOAT OPERATION:
NORMALLY FCBC−I & FCBC−II IN FLOAT MODE WILL WORK IN PARALLEL I.E BOTH CHARGERS WILL SUPPLY THE TRICKLE CHARGING CURRENT REQUIRED FOR THE BATTERY & ALSO FEED THE DC CONTINUOUS LOAD AS REQUIRED.

BOOST OPERATION:
DURING POWER FAILURE, BATTERY WILL MEET THE DC LOADS. WHEN POWER RESUME, BATTERY WILL TAKE HIGHER CHARGING CURRENT DUE TO DISCHARGE. THEN ONE CHARGER WILL BOOST THE BATTERY & THE OTHER CHARGER WILL BE IN FLOAT OPERATION. INTERLOCK SHALL BE PROVIDED SUCH THAT HIGH VOLTAGE OF BOOST MODE DOES NOT AFFECT THE VOLTAGE AT DCDB. AFTER COMPLETION OF BOOST CHARGING, CHARGER WILL AUTOMATICALLY RETURN TO FLOAT MODE AFTER VOLTAGE COMES DOWN TO NORMAL RANGE. SELECTION OF FCBC FOR BOOST CHARGING WILL BE DONE MANUALLY.

EQUALISING OPERATION:
FLOAT CHARGING CURRENT OF THE BATTERY WILL BE CONTINUOUSLY MONITORED TO ASCERTAIN THE BATTERY CONDITION. IF THE FLOAT CHARGING CURRENT EXCEEDS A PRESET VALUE, FCBC WILL BE AUTOMATICALLY SWITCHED ON FOR CHARGING THE BATTERY AT A SLIGHTLY HIGHER RATE (EQUALIZING CHARGE)

AUTO OPERATION:
IF THE SELECTED CHARGER (FCBC) FAILS TO OPERATE DURING FLOAT CHARGING, WHILE THE OTHER CHARGER IS SELECTED FOR BOOST CHARGING OF BATTERY, THEN THE SECOND CHARGER WILL STOP BOOSTING THE BATTERY AND WILL RETURN AUTOMATICALLY BACK TO FLOAT MODE.

AUTO/MANUAL OPERATION:
BOTH THE CHARGERS CAN BE OPERATED IN AUTO OR MANUAL MODE BY SELECTING THE AUTO/MANUAL SELECTOR SWITCH IN AUTO OR MANUAL POSITION RESPECTIVELY.

OVER VOLTAGE PROTECTION:
BOTH THE CHARGERS WILL HAVE OVERVOLTAGE PROTECTION. CHARGER WILL BE TURNED OFF DUE TO SUSTAINED OVER VOLTAGE BY THE OPERATION OF OVER VOLTAGE PROTECTION RELAY. HOWEVER DURING BOOST VOLTAGE OPERATION, THIS PROTECTION SHALL BE BYPASSED THROUGH ONE 'BOOST ON' NC CONTACT SO THAT CHARGER SHOULD NOT BE TURNED OFF DURING BOOST MODE FOR SUCH OVERVOLTAGE CONDITION.

LEGEND :−

	DISCONNECTING SWITCH	X	D.C. CONTACTOR
	HRC CARTRIDGE FUSE		SHUNT
	CONTACT	42	A.C. CONTACTOR (RATED COIL VOLTAGE − 415V)
	COIL	L	NEON LAMP
V / A	VOLTMETER / AMMETER	AT / VT	CURRENT/VOLTAGE TRANSDUCER WITH DUAL OUTPUT
VSS	VOLTMETER SELECTOR SWITCH (RY−YB−BR−OFF)		
O/L	OVER LOAD RELAY (RATED COIL VOLTAGE − 415V)		

FOR TENDER PURPOSE ONLY

REVIEWED										
			DS	RD	RD	GD	FOR TENDER ONLY		−	07.06.2017
			APPROVED	REVIEWED	CHECKED	DRAWN	DESCRIPTION	RELEASE STATUS	REV.	DATE

BATTERY CHARGER SCHEME (220V)

WEST BENGAL POWER DEVELOPMENT CORPN. LTD.
WEST BENGAL, INDIA

SAGARDIGHI THERMAL POWER EXTENSION PROJECT
PHASE−III, UNITS # 5 (1 x 660 MW)

DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS

JOB NO. 12A05 | SCALE : NTS

DWG.NO. 12A05−DWG−E−1206 | REV._

SHEET 1 OF 2

07.06.2017 | 12A05-DWG-E-1206 | SHEET 1 OF 2

A3 (9−96) [420x297]

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:
a) Manufacturer's type and trade name
b) AH capacity at 30 minute rate.
c) Upper & lower electrolyte level in case of transparent containers.
d) Month & Year of manufacture
e) Country of origin
f) 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 -

SECTION-3

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.
The provisions under this section are intended to supplement general requirements for the materials, equipments and services covered under other respective sections and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

a)	Customer/ Purchaser/ Owner	The West Bengal Power Development Corporation Ltd.
b)	Consultant/Owner's Engineer	Development Consultants Private Ltd. Kolkata
c)	Project Title	1X660MW thermal power extension project Unit-5 at Sagardighi- 400KV Switchyard
d)	Location	Site is located at Manigram village of Murshidabad district in West Bengal and around 240kM from Kolkata. 13kM north of Sagardighi town by the side of the SMGR(Sagardighi Manigram –Gankar –Raghunathganj) road at a distance of 20kM from National Highway 34 . Nearest railway station is Manigram adjacent to the site on Bandel-Barhawara branch line and 6.5kM from Sagardighi railway station on Sainthia-Azimhunj line of eastern railway. Nearest Airport –Kolkata. Nearest Seaport-Kolkata/Haldia
e)	Altitude	34 m above MSL
f)	Transport Facilities	Road/Rail
g)	Postal Address	To follow
SITE CONDITIONS		
a)	Maximum Design ambient dry bulb temperature	50°C
b)	Minimum Design ambient dry bulb temperature	5°C
c)	Average Relative humidity (for design)	73 %
d)	Maximum relative humidity	84%
e)	Pollution Severity	Heavily Polluted
f)	Seismic zone	III

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

SYSTEM PARAMETERS

Nominal system voltage	**400 kV**
Highest system voltage	420 kV
System voltage variation	-5% to +5%
Basic Impulse level(dry /wet)	1425kVp
Power frequency withstand voltage dry/wet	630kVrms
Switching Impulse withstand voltage (Phase to Earth)	1050kVp
Switching Impulse withstand voltage (Phase to Phase)	1575kVp
Lightning impulse withstand voltage (kVp between live terminals and earth.)	1425kVp
Lightning impulse withstand voltage (kVp impulse on one terminal and other terminal earthed) (across isolating distance).	1665kVp
Maximum radio interference voltage at 320kV rms phase to ground voltage	1000 micro volts for frequency between 0.5 MHZ and 2.0 MHz
Rated short time current	50 kA for 1 sec
Frequency	50 Hz, +3% to -5%
Creepage distance	31 mm/kV
System Earthing	Effectively earthed

AUXILIARY POWER SUPPLY

3 phase A.C power supply	415V ±10%, 50 Hz±5%, 3-phase 4 wire,50kA, solidly earthed, combined voltage and frequency variation ±10%
1 phase A.C power supply	240V±10%, 50 Hz +3% to -5%, 1-phase AC supply
D.C. power supply	220V +10% to -15%, 2-wire , ungrounded 48V ±10%, 2 wire system positively earthed

3.2 GENERAL TECHNICAL REQUIREMENT

3.2.1 TYPE TESTS

All equipment/systems to be supplied shall conform to type tests as per relevant standards and proven type. The Bidder / Contractor shall furnish the reports of all the type tests carried out in within last **five years from date of bid opening i.e. 18.03.2018.** as listed in relevant clauses in respective electrical specification and relevant standards for all components / equipment / systems. These reports should be for the tests conducted on identical/similar components/equipment/systems to those offered/proposed to be supplied under this contract.

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

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

3.2.2 CODES AND STANDARDS

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

3.3 MATERIAL/WORKMANSHIP

3.3.1 General Requirements

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

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

Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall be interchangeable with, and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type 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 modem practices will be accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances and instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture’s limits suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.
The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him. All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

3.3.2 Provisions For Exposure to Hot and Humid climate

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

3.4 PAINTING

The painting of equipment shall be as follows:

Epoxy based with suitable additives. The thickness of finish coat shall be minimum 80 microns (minimum total DFT shall be 100 microns). However in case electrostatic process of painting is offered for any electrical equipment, minimum paint thickness of 80 microns shall be

acceptable for finish coat.

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

3.5 PROTECTION

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

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

3.6 FUNGISTATIC VARNISH

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

3.7 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be throughly 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. All external painting shall be as per shade no. 631 of IS:5.

3.8 GALVANIZING

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

3.9 PACKING

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

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

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

3.10 HANDLING, STORING AND INSTALLATION

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

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

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser’s information only. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. The Contractor shall be fully responsible, for the equipment/material until the

same is handed over to the purchaser in an operating condition after commissioning.

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

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

3.11 DEGREE OF PROTECTION

The enclosures to be installed shall be provided with degree of protection as detailed here under:

a) Installed out door: IP-55

b) Installed indoor in air conditioned area: IP-31

c) Installed in covered area IP:52

d) Installed indoor-in non-air-conditioned area where possibilities of entry of water is limited:IP-41

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

f) 11kV & 3.3kV Switchgears: IP4X

g) 415V MCC / DBs / Fuse Board IP52 for indoor and IP65 for outdoor.

h) Motor (Indoor/Outdoor): IP55

i) Motor Actuator: IP65

j) Control and Relay Panel in AC area: IP3X

k) Control and Relay Panel in normal area: IP42

l) Pushbutton Station/Kiosk/Panel - Indoor IP55

m) Pushbutton Station/Kiosk/Panel -Outdoor IP65

n) Indoor Junction boxes for cables / wires: IP55

o) Outdoor lighting fixtures: IPW65

p) Battery Charger Panel: IP42

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

3.12 RATING PLATES, NAME PLATES AND LABELS

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

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

3.13 EARTHING

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

3.14 TERMINAL BLOCKS AND WIRING

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

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

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

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

The terminal blocks shall be fully enclosed with removable covers of transparent, non

deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

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

All circuits except CT circuits :	Minimum of 2 nos. of 2.5 sq.mm, copper flexible.
All CT circuits :	Minimum of 4 nos. of 2.5 sq.mm, copper flexible..

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

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

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

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

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

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

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

All door, removable covers and plates shall be gasketed all around with suitably profiled

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

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

3.16 SPACE HEATERS

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

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

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

3.17 QUALITY

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

3.18 DOCUMENTATION

3.18.1 LIST OF DOCUMENTS

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

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

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

3.18.2 DRAWINGS

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

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

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

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

3.18.3 APPROVAL PROCEDURE

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

generally for approval.

i.	Initial submission of drawings and data sheet	Within 2 (two) weeks from PO date.
ii.	Approval/comments/by employer on Initial submission	Within 2 (two) weeks of receipt
iii.	Resubmission	Within 1 (one) weeks (whenever from date of comments required) Including both ways postal time.
iv.	Approval or comments	Within 1 week of receipt of resubmission
v.	Furnishing of distribution copies	1 week from the date of last approval.

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

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

3.18.4 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

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

3.18.5 DOCUMENTATION SCHEDULE

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

O & M Manuals shall be submitted 3 months prior start of unit commissioning,
The manual shall be submitted as follows-

1. 1 soft copy + 12 sets of hard copy to WBPDCL Sagardighi site.
2. 1 soft copy + 3 sets of hard copy to WBPDCL Corporate office.

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

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

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

SECTION-4 (GTP)

BATTERY

A.	BATTERY		
1.0	General		
1.1	Make		:
1.2	Cat No.		:
1.3	Type		:
1.4	Reference Standard		:
2.0	Rating		
2.1	Rated Voltage	Volt	:
2.2	10-hour rating at 27 ^{0}C to 1.85 Volt per cell	AH	:
2.3	1-hour discharge rate to 1.75 Volt per cell	Amp	:
2.4	1-minute discharge rate to 1.75 Volt per cell	Amp	:
3.0	Performance		
3.1	Does the battery meet the Required duty cycle curve?	Yes/No	:
3.2	Cell voltage characteristics during duty cycle furnished?	Yes/No	:
3.3	Minimum cell voltage during duty cycle	Volt	:
3.4	AH efficiency at 10-hour discharge rate	%	:
3.5	Expected life of Battery	Hr.	:
3.6	Design margin considered	Yes/No	:
3.7	Ageing compensation Factor considered	Yes/No	:

4.0	Battery Characteristics			
4.1	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	Recommend specific gravity at 27 ^{0}C			
	a)	For first filling		:
	b)	At full charge		:
	c)	At end of 10-hour discharge		:
4.3	Short-circuit current for a dead-short Across battery terminals, when			
	a)	Float charge at 2.15 Volt/Cell	KA	:
	b)	Boost charge at 2.75 Volt/Cell	KA	:
4.4	Battery internal resistance		Ohm	:
4.5	Cell voltage characteristics during charging furnished?			:
5.0	Cells			
5.1	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	Overall dimension of each cell		mm	:
5.6	Weight of complete cell			
	a)	Without acid	Kg	:
	b)	With acid	Kg	:
5.7	Internal resistance of cell		Ohm	:

6.0	Inter-cell Connector			
6.1	Inter-cell connector furnished?			:
6.2	Type of inter-cell connector bolted/burned			:
6.3	Material of inter-cell connector			:
7.0	Plates			
7.1	Number of positive plates per cell			:
7.2	Type of positive plate			:
7.3	Type of negative plate			:
8.0	Separator			
8.1	Type			:
8.2	Material			:
8.3	Thickness			:
9.0	Electrolyte			
9.1	Amount of electrolyte for first filling			
	a)	Per cell	litre	:
	b)	Per set	litre	:
9.2	First filling with10% extra furnished?			:
9.3	Electrolyte conforms to			:
10.0	Racks			
10.1	Number of racks per battery			:
10.2	Number of cells per rack			:
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	Dimension & Weights			
11.1	Overall dimension (L x B x H) mm			:
11.2	Approx. Weight		Kg	:
11.3	Battery layout drawing furnished?			:
12.0	Ventilation requirements			:
12.1				
12.2				
12.3				
12.4				
12.5				
13.0	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	Bidder's Confirmation	Reasons for non compliance
1.	Manufacturer's Identification System		YES/NO	
2.	Battery Type	Lead Acid plante	YES/NO	
3.	Battery Voltage	220V	YES/NO	
4.	Design Ambient Temperature	50deg. C	YES/NO	
5.	Max. Battery Bank Voltage	242V	YES/NO	
6.	Min Battery Bank Voltage	199V	YES/NO	
7.	Nominal float voltage per cell	2.25V	YES/NO	
8.	End Cell Voltage for specified duty cycle	1.85V/cell	YES/NO	
9.	No. of Cells per battery bank	108	Bidder to specify	
10	Cell container	As per spec	YES/NO	
11.	Type of Stand offered (freestanding on floor complete with necessary hardware)	As per spec	YES/NO	
12.	Arrangement for connection for cell tapping provided for continuity during boost charging?	As per spec	YES/NO	
13.	Applicable standard	IS-1651 / IS-1652	YES/NO	
14.	Accessories as per clause 1.3.3 of section-1 included in the scope of supplies	YES	YES/NO	
15.	Mandatory spares quoted in line with clause 1.3.2 of section-1	YES	YES/NO	
16.	All routine & acceptance tests to be conducted	As per Cl. 5.00.00, Annexure-1	YES/NO	
17.	Qualifying requirement - Documentary proof against the Qualifying requirement has been attached along with offer. Note: Bidder to ensure completeness of offer in this regard. No further	Attached & Confirmed	YES/NO	

	communication regarding Qualifying requirement documentary proof is envisaged during tender evaluation.			
18.	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/NO	
19.	Intermediate tapping arrangement provided	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 five years from the date of bid opening **(Date of bid opening is 18.03.18)** and valid reports are available.

YES /NO

2. 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

ANNEXURE - A
SCHEDULE OF TECHNICAL DEVIATIONS

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

S.No.	Page No.	Clause No.	Deviation	Reason / Justification

Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date: Tenderer's Stamp & Signature

ANNEXURE-B

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-DC-445-316-E057	Rev no.-03	Prepared	Checked	Approved
TYPE OF DOC.	**DESIGN DOCUMENT**	**NAME**	**NKT**	**MVK**	**SKS**
TITLE		**SIGN**	-do-	-do-	-do-
SIZING OF BATTERY AND CHARGER		**DATE**	11.02.21	11.02.21	11.02.21
		GROUP	TBEM	**Job. No**	**445**
CUSTOMER/ CONSULTANT	**The West Bengal Power Development Corporation Ltd. / Development Consultants Private Ltd. Kolkata**				
PROJECT	**1X660MW thermal power extension project Unit-5 at Sagardighi- 400KV Switchyard**				

CONTENT ***SHEETS***

03	27 .09.21	NKT	MVK	SKS	Based upon customer's comments on Rev-02
02	16.07.21	NKT	MVK	SKS	Based upon customer's comments on Rev-01
01	12.03.21	NKT	MVK	SKS	Based upon customer's comments on Rev-00
Rev No.	**Date**	**Altered**	**Checked**	**Approved**	**REVISION DETAILS**

Distribution	**To**	*TBTS*	*O/C*	*TBMM*	*TBQM*	*TBCM*
	Copies	**-**	**1**	**-**	**-**	**-**

Calculation for sizing of high discharge Lead acid Plante battery for -400kV Substation at Sagardighi Unit-5

DC CONTINUOUS LOAD (220V DC)

For phase-3 Switchyard Loads

1 DC Emergency Load

DC emergency Lights will be provided with 100 Watts GLS lamp fittings in the following areas for design purpose as applicable

Area	No. of fittings
LT switchgear room Room	4
Battery Room	2
BCR-2 nos	4
R3 Charger cum DCDB room	2
Total Fittings	12
Total Emergency DC Supply Load	**1200 W**

2 Indication Lamp Load

2a There are total 10 panels/module for ACDB and DCDB corresponding to 10 nos air circuit breaker . Due to presence of SAS , There will be no Control panel for individual feeders . R3

Name of Bay / Circuit	No. of Panels	Lamps per Panel(Tentative)	Total no. of Lamps	Load of Each lamp (W)	Total Load (W)
415V ACDB					
Incomer + Bus coupler	3	10	30	2	60
R3 220V FCBC Charger O/G feeder	4	5	20	2	40
Spare	2	5	10	2	20
Total ACDB Load					120
220V DCDB					
Incomer + Bus coupler	3	5	15	2	30
R3 Ph-1 and Ph-2 DCDB O/G	2	5	10	2	20
Spare	2	5	10	2	20
Total DCDB Load					70.00
Total indication lamp load					**190.00**

2b Batery charger indication 150 W

Total indication lamp load **340.00 W**

3 Alarm Facia Load(Annunciation load)

3a There are total 10 panels/module corresponding to 10 nos air circuit breaker. Due to presence of SAS , There will be no Control panel for individual feeders .

Name of Bay / Circuit	No. of Panels	Alarm Facia per Panel	Total no. of Alarm Facia	Load of Each Alarm Facia (W)	Total Load (W)
415 ACDB/220 DCDB	10	48	480	1	480
Total Load					480.00 W

3b Batery charger Annunciation load 50.00 W

Total annunciation load 530.00 W

4 DC Load for Bell (W) 80 W

5 Trip Circuit Supervision DC Load for CB

5a Trip Circuit Supervision DC Load for CB

No. of circuit breakers (3-Phase)	4	
No. of trip circuit supervision relay per 3-Phase circuit breaker	6	
DC Load for each coil (W) as per Alstom relay data.	5.73	
Trip Circuit Supervision DC Load (W)	137.52	
Total trip Circuit Supervision DC Load		**137.52 W**

6 Isolator interlocking

DC load requirement of one three phase Isolator	35 W	
Total Nos. of 3 phase isolator including Future bay of 400kV substation (For total see note-)	3	
Total DC load requirement for Isolator Interlocking	**105 W**	

Note-
(1) Assuming in worst case 400kV main bus -2 fault , then total nos. of 400kV Isolator ready for operation = 3 nos.

7 **DC load for relay panels , Substation Auxiliary panels and Tariff metering panels**

7a **DC load requirement for Main relays, switches and BCU**

Name of Bays	No. of feeders	Main relay per feeder	No.of BCU	Total No. of Relays	Load of Each Relay (W)	Total Load (W)
400 KV Line Bays	0	2	1	0	40	0
400 KV GT Bays	1	1	1	2	40	80
400 KV ST Bays	1	2	1	3	40	120
400 kV Tie Bays	2	0	1	2	40	80
400 kv Bus Reactor Bay	0	1	1	0	40	0
400 kV Busbar Protection	2	1	1	4	40	160
Ethernet switches	2	0	0	4	40	160
BCU loads for power distribution system	3	1	1	3	40	120
R3 AUX BCU load	1	1	1	1	40	40
Total Load for main relay, BCU and Aux BCU=						760

Note-There will be one BCU in each feeder. Maximum load of BCU i.e 40W is considered for above relay loads

7b **DC load requirement for Aux relays**

Name of Bays	No. of feeders	Relays per feeder	Total No. of Relays	Load of Each Relay (W)	Total Load (W)
400 KV Line Bays	0	6	0	6	0
400 KV GT Bays	1	6	6	6	36
400 KV ST Bays	1	6	6	6	36
400 kV Tie Bays	2	6	12	6	72
400 kv Bus Reactor Bay	0	6	0	6	0
400 kV Busbar Protection	2	23	46	6	276
R3 Aux relay for PMCC	3	2	6	6	36
Total Load for Aux. relay =					456

7c Load for Substation Auxiliary panels (located in control room) 2620 W

Operator Work Station	1 nos	600	600
DR Work Station	1 nos	600	600
A-3 Laser Printer	1 nos	800	800
A- 4 Laser Printer	1 nos	80	80
GPS Receiver	1 nos	40	40
Margin			500

7d Load for Tariff metering panels 100 W

7e Trip Circuit Supervision DC Load for 3 phase operated (three pole) CB

415V ACB

No. of circuit breakers (3-Phase) including future	6	R3
No. of trip circuit supervision relay per 3-Phase circuit breaker	2	
DC Load for each coil (W) as per Alstom relay data	5.73	
Trip Circuit Supervision DC Load (W)	68.76	
Total trip Circuit Supervision DC Load for 3-POLE CB	**68.76**	

Total DC load for relay panels , Substation Auxiliary panels and Tariff metering panels	**4004.76 W**

Continuous DC Load for PH-3 switchyard	**6397.28 W**
DC Continuous Current for PH-3 switchyard	**29.08 Amp**

Refer WBPDCL documents for below mentioned existing DC loads-

	CONT.	MOMENT.		Remark
PHASE-1 DC LOADS	**74**	74	Amps	As per inputs received from doc no: TB-DC-445-316-E057 Rev-00
PHASE-2 DC LOADS	**22**	114	Amps	
PGCIL LOAD-LINE BAY	**22**	114	Amps	
TOTAL EXISTING LOAD	**118**	302	Amps	

Total Continous DC load for complete swithyard(Ph-1,Ph-2 and Ph-3)

C1= 29.08 + 118 = 147.08 Amps

DC MOMENTARY LOAD FOR Phase-3 SWITCHYARD

8 Momentary DC Load for tripping

8a 415V PMCC (For 1 minute)

DC Load requirement of the trip relay		150
DC Load requirement of the trip coil		250
No. of trip coils in a Breaker		1
DC Load requirement of the trip relays for 6 breakers	R3	900
DC Load requirement of the trip coils for 6 breakers		1500
Total DC Load		**2400 W**

8b For 400kV switchyard(For 1 minute)

Assuming that in worst case 2 nos. out of 2 breakers are connected to main bus-2 and this bus trip in 400kV system

DC Load requirement of the one trip relay	150 W
DC Load requirement of the one trip coil	1800 W
No. of trip coils per 3-Phase Circuit Breaker	6 nos.
No. of trip relay per 3-Phase Circuit Breaker	2 no.
DC Load requirement of the trip relays for 2 no. 3-phase Circuit breakers	600 W
DC Load requirement of the trip coils for 2 nos. 3-phase breakers	21600 W
Total DC Load	22200 W

Total Momentary DC Load for tripping(8a+8b) **24600 W**

Total Momentary DC Load Current for tripping **111.82 Amp**

Momentary DC load current for PH-3 Switchyard **111.82 Amp** R3

Refer WBPDCL documents for below mentioned existing(Ph-1 and Ph-2) DC loads-

	CONT.	**MOMENT.**		Remark
PHASE-1 DC LOADS	74	**74**	**Amps**	As per inputs received from doc no: TB-DC-445-316-E057 Rev-00
PHASE-2 DC LOADS	22	**114**	**Amps**	
PGCIL LOAD-LINE BAY	22	**114**	**Amps**	
TOTAL EXISTING LOAD	118	**302**	**Amps**	

Total Momentary DC load for complete switchyard(Ph-1,Ph-2 and Ph-3)

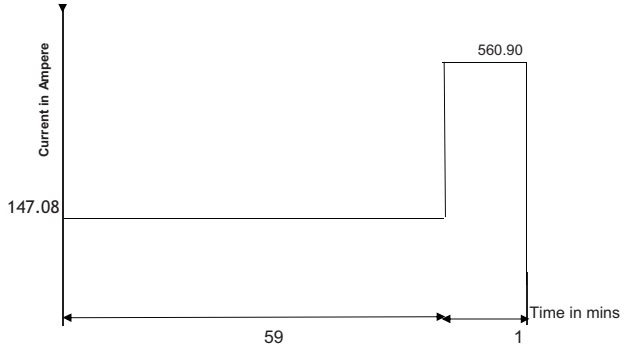
M1= 111.82 + 302 = 413.82 R3

For designing of battery and battery charger for complete switchyard loads (PH-1,PH-2 and PH-3), following dc load shall be considered

Continuous DC Load Current C1	**147.08 Amp**
Momentary DC Load Current (M1+C1)	**560.90 Amp**

HIGH DISCHARGE Lead Acid Plante BATTERY FOR -400kV Substation at Sagardighi Unit-5

Duty Curve for 220 V Battery



LOAD & CORROSPONDING DURATIONS		
LOAD A1(Amps.)	147.08	59min
LOAD A2(Amps.)	560.90	1 min

System Voltage =	220	VDC at Battery end
Max. Voltage = (Sys. Vol. + 10%) =	242	VDC at Battery end
Min. Voltage = (Sys. Vol. - 15%) =	187	VDC at Battery end
Cell Float Voltage =	2.25	VDC R3
Nominal Cell Voltage =	2.00	VDC
End cell voltage	1.85	V
Minimum expected electrolyte Temperature -t	5.0	degree C R3
Maximum ambient design temperature	50.0	degree C
Mimimum ambient design temperature	5.0	degree C
No. of Cells = Max. DC / Float Voltage =	107.56	nos.
Hence no. of cells =	108	nos. R3
No. of cell selected	108	nos.
End voltage of battery =end cell voltage X nos. of cells)	199.80	VDC R3

Hence,

Maximum Battery Bank Voltage =	242 VDC
Minimum Battery Bank Voltage =	199.8 VDC
No. of Cells =	108.00 Nos.
End Cell Voltage =	1.85 VDC

(1) Period	(2) Load Amps	(3) Change in Load Amps	(4) Duration of period (min)	(5) Time to end of section	(6) Capacity rating factor at t Min rate (Kt)	(7) Temperature derating factor for t Min(Ti)		(8) Required Section Size (Rated Amp. - Hr) (3)×(6)/(7)	
								+ive Value	-ive Value

A2 > A1, So go to section 3

1	147.08	147.08	M1 =59	T=(M1+M2)=60	1.88	1.29	214.35
2	560.90	413.82	M2 = 1	T = M2 = 1	1.2	1.29	384.95
					Total Capacity	599.29 AH R3	

Ageing Factor	1.25	
Design Margin	1.20	
Therefore Capacity required=(AH x Ageing Factor x Design Margin)=	898.94	AH
Battery Selected =	**1250.00**	AH

220 V DC BATTERY CHARGER

Calculation for Float mode Charger

Float Charger current rating=Total Continous load current +Trickle charging current (Trickle charging is taken as 2.5 mA per AH capacity of the Battery) i.e. (147.08+2.5*1250/1000) R3 — 150.20 A R3

Hence Float Charger selected Rating= 150.20 A (1)

Calculation for Boost mode Charger-

In boost mode the charger will be capable of boost charging a fully discharges battery within 10 hours with DCDB load connected with respective battery (tap cell arrangement shall be provided in battery, i,e charger in boost mode feed the battery in boost and DCDB load is feed by battery with tap cell arrangement)= 14% of Capacicity of Battery i.e (0.14*1250) — 175.00 A

(2)

If Float cum boost charger is used then higher of (1) and (2) is used for design purpose — 175.00 A

Design Margin — 1.25

Therefore Total calculated Capacity required =(A x Design Margin)= — 218.75 A

As per Data provided by WBPDCL,

Existing Charger rating (catering Ph-1 & Ph-2 loads) in Amps = **350**

Calculated phase-3 continous current(with 25% margin) = **36.35** R3

Thus,

Required current rating of 220V Dual FCBC considering(existing charger rating + (phase-3 continous loads with 25% margin)) = **386.35**

Hence selected DUAL FLOAT CUM BOOST Battery Charger rating is 400.00 A

NOTE –

As per contract requirement ,We propose to use the following for 220 V DC system

- 2 sets of 220 V Lead Acid Plante Battery of 1250 **AH**
- 2 sets of Dual Float-cum-Boost Battery Charger of 400 **A**

Reference Standard

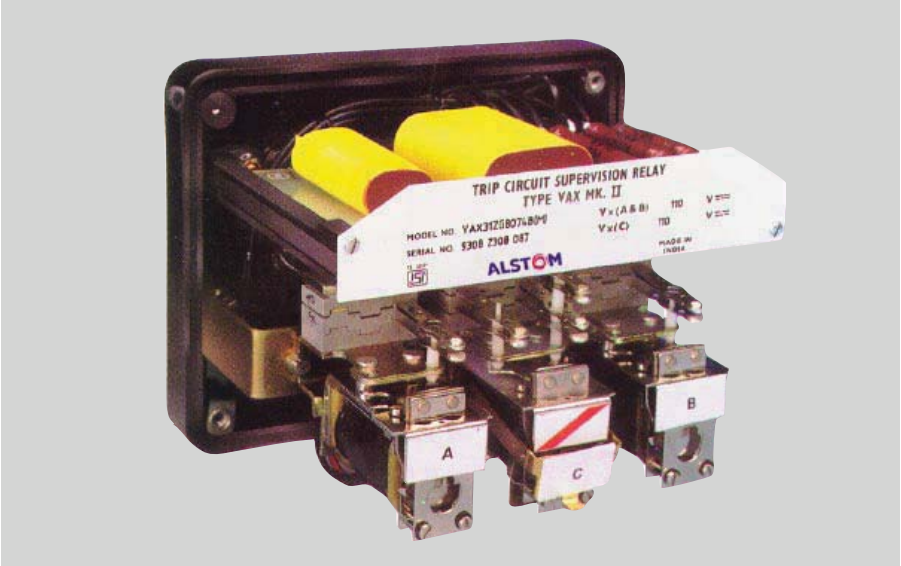
IEEE485 (1997) Lead-Acid Battery Sizing Calculation

ANNEXURE-A

Types VAX / MVAXM
Trip circuit supervision relays

ALSTOM

Types VAX & MVAXM
Trip circuit supervision relays



VAX 31 Relay
withdrawn from case

Features

- Simple and robust construction.
- Positive action without chatter.
- Choice of pre-closing and post-closing supervision.

Application

Post-closing or continuous supervision of the trip circuit of circuit breakers.

General description

Type VAX and MVAXM relays are of simple and robust construction. They are arranged to initiate an audible alarm and visual indication if the trip circuit of a circuit breaker fails or the breaker tripping mechanism does not operate.

Two versions of type VAX and MVAXM relays are available. Type VAX 21 and MVAXM 21 relays monitor the trip circuit only when the circuit breaker is closed (post-closing supervision only) while type VAX 31 and MVAXM 31 relays monitor the trip circuit continuously (both pre-closing and post-closing supervision). Both versions detect the following conditions.

- Failure of trip supply
- Open circuit of trip coil or trip circuit wiring
- Failure of mechanism to complete the tripping operation

Type VAX 21 and MVAXM 21 relays consist of two units connected as shown in figures 1(a) and 1(b). Under healthy conditions with the circuit breaker closed, both units are energised. If the trip circuit gets open or the trip supply fails, unit A drops-off and opens contact A-1 to de-energise unit C. When the circuit breaker is open the auxiliary switch of the circuit breaker shorts contact A-1 to hold-in unit C.

Type VAX 31 and MVAXM 31 relays consist of three units connected as shown in figures 2(a) and 2(b). Under healthy conditions with the circuit breaker closed, units A and C are energised and the operation is the same as that of type VAX 21 and MVAXM 21 relays. When the circuit breaker is open unit B is also energised via the normally closed auxiliary switch of the circuit-breaker and unit C is held-in by contact B-1. Unit B will detect trip circuit abnormalities with the circuit breaker open in a similar manner as unit A with the circuit breaker closed.

The C unit in both the versions are delayed on drop-off by means of RC circuit for a total time of 350 to 800 milliseconds, to prevent a false alarm due to voltage dips caused by faults in other circuits or during a normal tripping operation, when unit A is momentarily short circuited by the self reset tripping relay contact. If the trip relay fails to reset possibly due to failure of the circuit breaker tripping mechanism, the alarm is initiated.

The alarm unit is designed to operate via pilot wires, if required.

Technical data

Coil ratings

For VAX relay:

24, 30, 48, 50, 110/125 or 220/250 volts dc operating band 80% - 120% of rated voltage

Maximum loop resistance - 50 ohms for nominal alarm supply - 24 to 50V.

Other alarm supplies - 400 ohms.

When rated for a 110V alarm supply the unit 'C' will not operate at a current less than 25 milliamperes. It is therefore suitable for use with anti-corrosion negative potential biasing device.

For MVAXM relay:

110/125 and 220/250 volts dc as standard and other coil ratings are available on request.

Maximum loop resistance is 400 ohms for nominal alarm supply.

Operating time

0.35 to 0.8 sec. at 80% of rated volts (between failure of trip circuit and operation of alarm contact).

Thermal rating

120% of rated voltage continuous.

Operation indicator

Hand reset operation indicator provided when required.

Contacts

3 pairs of self reset contacts one make and two 'break' as standard.

Insulation

The relays meet the requirements of IS 3231/IEC 255-5 Series C-2 KV for 1 minute.

MVAXM relay withdrawn from case

Burdens

For VAX :

	DC voltage	24	30	48/50	110/125	220/250
Maximum watts	Trip supply	0.52	0.56	0.62	1.56	3.13
	Alarm supply	0.37	0.38	0.44	1.12	2.6

For MVAXM :

	DC voltage	110/125	220/250
Maximum watts	Trip supply	1.56	3.13
	Alarm supply	1.12	2.6

Contact ratings

	Make and carry continuously	**Make and carry for 3 seconds**	**Break**
AC	1250VA with maxima of 5A and 660V	7500VA with maxima of 30A and 660V	1250VA with maxima of 5A and 660V
DC	1250W with maxima of 5A and 660V	7500W with maxima of 30A and 660V	100W (resistive) 50W (inductive) with maxima of 5A and 660V

MVAAM
Auxiliary Relays

The Type MVAAM is a low burden auxiliary relay, the contacts of which are capable of circuit breaker tripping. The relays can be used where a scheme demands several contacts for event recording, alarm initiation, contact logic arrangements, etc.

The relay can be supplied fitted with normal duty contacts and/or with heavy duty blow-out contacts.

Features

- Compact design.
- Mechanically stable.
- Hand and self reset versions available.
- Wide voltage range.
- Optional operation indicator.

Description

These relays are attracted armature units of compact design with a positive action and a high degree of mechanical stability. They are voltage operated. All relays comply with BS142.

Contacts

Contacts are of a silver/copper alloy, shaped and positioned to ensure a very reliable, low resistance make or break type.

Normal duty changeover contacts are also available.

Alternatively, heavy duty magnetic blowout contacts are recommended for breaking heavy or highly inductive dc loads. Breaking capacity curves for these contacts are shown in Figure 1. Where these are fitted the number of contacts available is reduced.

Technical data

Standard coil rating

24/30V, 48/50V, 110/125V or 220/250V dc
or 220/240V, 240/250V 50Hz ac.

Other coil ratings are available on request.

DC relays operate satisfactorily between 75%-120% of rated volts.

AC relays operate satisfactorily between 80%-115% of rated volts.

Burdens

3W per element at all rated voltages.

Operating times

The operating times of type MVAAM relays are dependent on the coil rating and the number of contacts. The typical operating time is 25 ms.

Customer Benefits

- Wide voltage setting range
- High degree of me chanical stability
- Selection of hand reset or self reset contacts

AREVA T&D

AREVA

Siemens standard equipment list

420kV, 3150A, 50kA, SF6 CB.

S

S.No.	Description	Equipment Details	Quantity		Tag No.	Remarks
			Per CB	Total		
1.0	Space Heater	X'pose/Velico Make, 240V AC,100W	4x		R1LA,R1LB,R1LC R2	
2.0	Thermostat	X'pose/Velico Make, (0 - 75degC)	1x		B1	
3.0	Auxilliary Contactor	Siemens, Type 3TH 2NO+2NC,220 V DC	1x 1x		K10 K12	General Lockout SF6
4.0	Auxilliary Contactor	Siemens, Type 3TH 2NO+3NC, 220 VDC	3x		K75LA,K75LB,K75LC	Anti-Pumping
5.0	Pressure Gauge	Wika/Brinda Make	3x			
6.0	Auxilliary Contactor	Siemens, Type 3TH 4NO, 220 VDC	1x 1x		K77 K88	Manual Trip
7.0	Auxilliary Contactor	Siemens, Type 3TH 4NO, 220 VDC	2x		K61 & K62	Trip Ckt
7.0	Auxilliary Contactor	Siemens, Type 3TH 2NO+2NC, 220 VDC	1x 1x		K13 K14	DC Supply monitoring
7.0	Auxilliary Contactor	Siemens, Type 3TH 2NO+2NC, 220 VAC	1x 1x 1x		K15 K17 K18	AC Supply monitoring
8.0	TNC Switch	Kaycee / Switron / Equivalent 4 Pole-3Way,Non Lockable	1x		S3	
9.0	Indicating Lamp Assembly	Siemens / Teknic / Essen Deinki Equivalent 220V DC, LED type	1x 1x 1x		H0 H1 H2	OFF Indication (Green) ON Indication (Red) Spring charged (Blue)
10.0	MCB	Siemens/Equivalent 2Pole, 250 V DC,16A	1x 1x		F19 F21	DC Supply
11.0	MCB	Siemens/Equivalent 415 V AC,3PN,10A	1x		F20	Spring Charging Motor
12.0	MCB	Siemens/Equivalent 240 V AC,SPN,10A	1x		F 16	AC Supply
13.0	On/Off Switch	Anchor / Equivalant Make 5A,240 V AC	1x		F11	Illumination
14.0	Local/Remote Selector Switch	Kaycee / Switron / Equivalent 5 Pole-2Way,Non Lockable	1x		S13	L/R Selector
15.0	Plug Socket with Switch	Anchor / Equivalant Make 15A,240 V AC	1x		X 20	
16.0	Illumination Lamp without door s	Orient,Filament 15 W	1x		E1	Panel Lamp
17.0	Operational Counter	GIC/Selec/Equivalent Make, 220V DC	3x		P1LA, P1LB, P1LC	Electrical impulse
18.0	CB Aux. Switch	20 NO+19NC+4Wi	3x		S1LA, S1LB, S1LC	
19.0	Limit Switch for spring charging	4NO+8NC	3x		S16LA, S16LB, S16LC	
20.0	Trip Coil	220V DC,max 1800W	3x 3x		Y3LA, Y3LB, Y3LC Y4LA, Y4LB, Y4LC	Trip Coil-1 Trip Coil-2
21.0	Closing Coil	220V DC,max 1300W	3x		Y1LA, Y1LB, Y1LC	
22.0	Spring Charging Motor	240V AC / 220V DC, 1000W max. KPT/Agni/Equivalent Make	3x		M1LA, M1LB, M1LC	
23.0	Density Monitor	COMDE/Trafag Setting @20 degC falling Pressure Contacts-11/12/13-6.2 bars Contacts-21/22/23 and 31/32/33 -6.0 bars	3x		B4LA, B4LB, B4LC	SF6 Monitoring
24.0	Timer	Siemens / Equivalent 220V DC, On dealy, 0.05 sec - 100 Hrs. 1 No. Changeover Contact	1x 1x		K16 K19	Enforced Tripple Pole operation

EXIDE INDUSTRIAL

PLANTÉ
STANDBY BATTERIES

Exide Industries Limited is the largest storage manufacturer in the country and has pioneered battery technology in India for over 70 years. It is the only company in South and South East Asia which designs and manufactures lead acid batteries from 2.5 Ah to 20400 Ah. Exide offers the latest series of Planté type stationary batteries in Transparent SAN containers for critical standby application, manufactured in its state of the art ISO 9001:2008 and ISO 14001: 2004 certified factory to fulfill its growing demand both in domestic and export market. The cells are designed to conform BIS specification IS 1652:2013

PRODUCT FEATURES

• Excellent high discharge performance • Transparent containers for easy maintenance • Expected service life is greater than 20 years in standby float application at 25°c • No ageing margin required as per IEEE485:1997 • Topping up frequency: once in 12/18 months

• Capable of rapid recharging • Superior all round voltage profile and energy (Wh) output • Much higher energy output compared to Tubular Cells of similar capacity • Higher Ah and Wh efficiencies • Conforms to BS 6290 : Part 2 : 1999, IS 1652 : 2013 and IEC 60896

Recommended Float Recharge

Temperature	Float Voltage
<5°C	2.300 ±0.02 VPC
5°C-19°C	2.27±0.02 VPC.
20°C-35°C	2.25±0.02 VPC.
36°C-45°C	2.23±0.02 VPC.

APPLICATIONS • Power Plants • Substations • Process industries • UPS System • C&I • Emergency Lighting • Telecommunication

Type of Cell	Capacity at 10 Hrs rate (Ah)	Charging Current (A)		Total Input during Initial Charging (Ah)	Weight of Cell +/- 5 % (KG)		Approx qty of Acid 1.205 sp gr (Litres)	Overall Cell Dimensions (mm)			Corresponding Cell Centres (mm)	Trickle Charge Current (mA)	
		Starting Rate	Finishing Rate		Without Acid	With Acid		Length +/-3	Breadth +/-3	Height+/-5		Min	Max
YAP													
YAP5	16	2	1	88	2.7	4.7	1.7	114	133	260	123	10	30
YAP7	24	3	2	132	3.5	5.4	1.6	114	133	260	123	15	45
YAP9	32	5	2.5	176	4.3	6.1	1.5	114	133	260	123	20	60
YAP11	40	6	3	220	5.4	8.8	2.9	190	133	260	199	30	90
YAP13	48	7	3.5	264	6.9	9.5	2.8	190	133	260	199	40	120
YAP15	56	8	4	308	7	10.2	2.7	190	133	260	199	45	135
YAP17	64	9	4.5	352	7.8	11	2.6	190	133	260	199	50	150
YKP													
YKP7	75	11	5.5	413	10.5	18.2	6.5	134	203	426	211	60	180
YKP9	100	14	7	550	13.5	21	6.3	134	203	426	211	80	240
YKP11	125	18	9	688	27.25	22.4	5.8	173	203	426	211	100	300
YKP13	150	21	10.5	825	18	24.4	5.4	173	203	426	211	125	375
YKP15	175	25	12.5	963	19.7	28.7	7.6	210	203	426	211	140	420
YKP17	200	28	14	1100	22	30.7	7.3	210	203	426	211	160	480
YKP19	225	32	16	1238	24.3	34.9	8.9	248	203	426	211	180	540
YKP21	250	35	17.5	1375	26.7	36.9	8.6	248	203	426	211	200	600
YKP23	275	39	20	1513	29.1	41.4	10.3	286	203	426	211	220	660
YKP25	300	42	21	1650	31.5	43.4	10	286	203	426	211	240	720
YKP27	325	46	23	1788	36.3	52.6	13.7	362	203	426	211	260	780
YKP29	350	49	24.5	1925	38.5	54.4	13.4	362	203	426	211	280	840
YKP31	375	53	26.5	2063	40.8	56.4	13.1	362	203	426	211	300	900
YKP33	400	56	28	2200	43.2	58.4	12.8	362	203	426	211	320	960
YKP35	425	60	30	2338	45.6	60.4	12.5	362	203	426	211	340	1020
YHP													
YHP11	535	75	37.5	2943	60.1	92.8	27.1	230	368	682	238	300	600
YHP13	645	90	45	3548	70.5	101.5	25.7	230	368	682	238	360	720
YHP15	750	105	52.5	4125	78.5	108.0	24.5	230	368	682	238	420	840
YHP17	860	120	60	4730	96.3	172.6	63.3	433	368	682	376	480	960
YHP19	965	135	67.5	5308	104.5	179.2	62	433	368	682	376	550	1100
YHP21	1070	150	75	5885	116.6	189.7	60.7	433	368	682	376	600	1200
YHP23	1180	165	82.5	6490	126.1	197.7	59.4	433	368	682	376	660	1320
YHP25	1285	180	90	7068	134	204.0	58.1	433	368	682	376	720	1440
YHP27	1395	195	67.5	7673	145.5	211.5	54.8	433	368	682	376	780	1560
YHP29	1500	210	105	8250	155	219.5	53.5	433	368	682	376	850	1700
YHP31	1605	225	112.5	8828	174	254.3	66.6	509	368	682	376	900	1800
YHP33	1715	240	120	9433	184	262.6	65.2	509	368	682	376	960	1920
YHP35	1820	255	127.5	10010	194	271.0	63.9	509	368	682	376	1025	2050
YHP37	1930	270	135	10615	208	300.5	76.8	585	368	682	376	1100	2200
YHP39	2035	285	142.5	11193	218	309.1	75.6	585	368	682	376	1150	2300
YHP41	2140	300	150	11770	230	319.3	74.1	585	368	682	376	1200	2400
YHP43	2250	315	157.5	12375	242	329.6	72.7	585	368	682	376	1250	2500

*Tolerance for Overall Height : +/- 5mm

EXIDE INDUSTRIAL

Head Office: Exide House, 59E, Chowringhee Road, Kolkata-700 020, Ph: (033) 2283 2120/33/36/50/51/71/2238/39, Fax: (033) 2283 2632/37, Corporate Marketing Office: 6a Hatibagan Road, Entally, Kolkata- 700014, Ph: (033) 2286 6158/6159, Fax: (033) 2286 6186, Factory: Shamnagar: Ph: (033) 2581 2146/47/48/49/7342/7343, Fax: (033) 2581 3930, Haldia: (03224) 252140/145/296/253, Fax: (03224)252145, R&d Centre: Ph: (033) 2500 5458/5225/5660, Central Service: Ph:(033) 2580 0113, Fax: (033) 2581 3930, Ahmedabad: (079) 6510 8207/06/05, Bangalore: (080) 4081 0800, 4081 0813, 4081 0809 Baroda: (0265) 2354240, Chandigarh: (0172) 265 4387/4553/7409 Chennai: (044) 2250 0726/1226/1216 Coimbatore: (0422) 211737/1846 Delhi: (011) 2362 7095/96/97/98, Guwahati: (0361) 220 500/119/486, Hyderabad: (040) 6516 3958, Indore: (0731) 6542293, Jamshedpur: (0657) 229 3022/0785, Kochi: (0484) 4149351/352, Kolkata: (033) 2284 3137/ 3169, Lucknow: (0522) 404 1895/1896/1899, Mumbai: (022) 2646 5283/84/5041, Nagpur: (0712) 253 9972/9973, Pune: (020) 323 04041-45

Note that the "margins" required by 6.3.1.5 and 6.3.3 of IEEE Std 323-1983 are to be applied during "qualification" and are not related to "design margin."

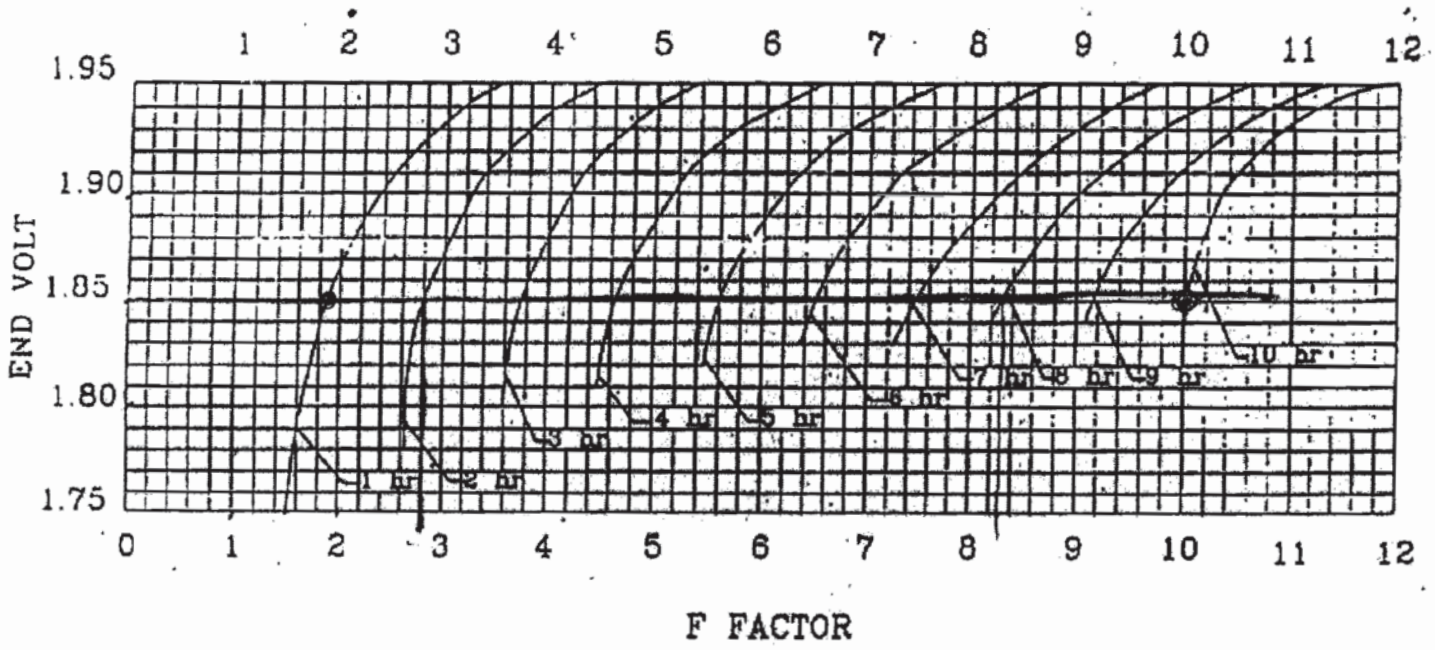
Table 1—Cell size correction factors for temperature

Electrolyte temperature		Cell size correction factor
(° F)	(° C)	
25	–3.9	1.520
30	–1.1	1.430
35	1.7	1.350
40	4.4	1.300
45	7.2	1.250
50	10.0	1.190
55	12.8	1.150
60	15.6	1.110
65	18.3	1.080
66	18.9	1.072
67	19.4	1.064
68	20.0	1.056
69	20.6	1.048
70	21.1	1.040
71	21.7	1.034
72	22.2	1.029
73	22.8	1.023
74	23.4	1.017
75	23.9	1.011
76	24.5	1.006
77	25.0	1.000

Electrolyte temperature		Cell size correction factor
(° F)	(° C)	
78	25.6	0.994
79	26.1	0.987
80	26.7	0.980
81	27.2	0.976
82	27.8	0.972
83	28.3	0.968
84	28.9	0.964
85	29.4	0.960
86	30.0	0.956
87	30.6	0.952
88	31.1	0.948
89	31.6	0.944
90	32.2	0.940
95	35.0	0.930
100	37.8	0.910
105	40.6	0.890
110	43.3	0.880
115	46.1	0.870
120	48.9	0.860
125	51.7	0.850

NOTE—This table is based on vented lead-acid nominal 1.215 specific gravity. However, it may be used for vented cells with up to a 1.300 specific gravity. For cells of other designs, refer to the manufacturer.

F-FACTOR CURVES FOR PLANTE RANGE OF BATTERIES



C10 CAPACITY = LOAD IN AMPS * F-FACTOR

FOR A GIVEN RATE OF DISCHARGE AND GIVEN END VOLT, READ F-FACTOR FROM GRAPH AND COMPUTE REQUIRED C10 CAPACITY FROM EQUATION GIVEN ABOVE

	NAME	SIGN.	DATE
DRN.BY	KRA		
CKD.BY	PNG		
APD.BY	DSC		
TRD.BY			

. ALL DIMS. ARE IN mm

UNSPECIFIED TOLERANCES			
FOR	>	1.0	5.0
DIMS	≤ 1.0	5.0	
TOL.	±0.05	±0.1	±0.2

MATERIAL :

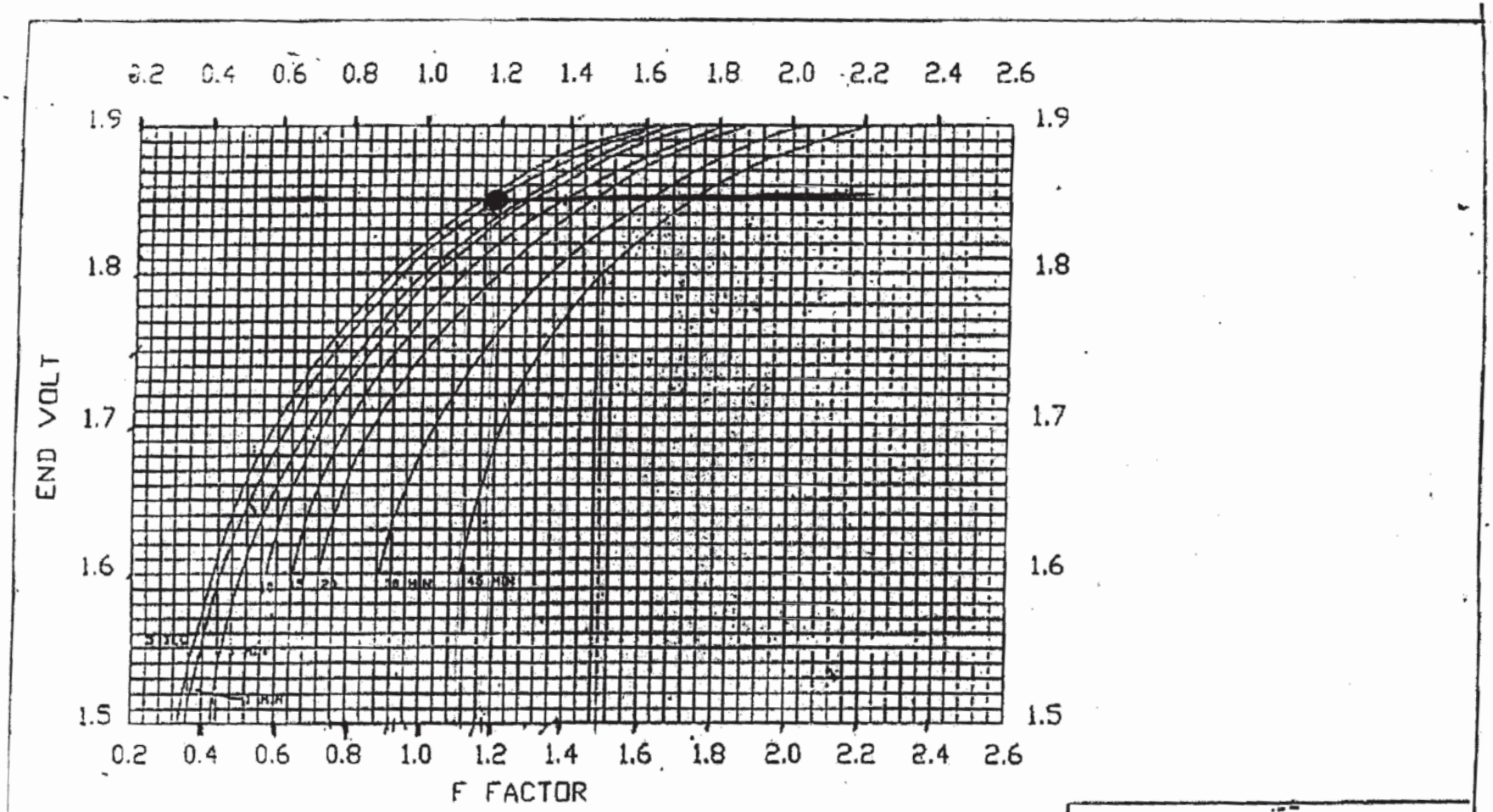
CAT.NO.:

TITLE : F-FACTOR CURVES FOR PLANTE BATT. (1 TO 10HR)

EXIDE INDUSTRIES LTD. R & D CENTRE

SCALE:

DRG NO: SB103


0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6
1.9
1.8
1.7
1.6
1.5
END VOLT
F FACTOR
C10 CAPACITY = LOAD IN AMPS x F-FACTOR
FOR A GIVEN RATE OF DISCHARGE
AND GIVEN END VOLT, READ F-FACTOR
FROM GRAPH AND COMPUTE REQUIRED C10
CAPACITY FROM EQUATION GIVEN ABOVE
R&D Centre
Chloride Industries Ltd
Exide
TITLE: CAPACITY CALCULATION CURVES FOR PLANTE CELLS. 5t - 45mn RATES
Drg No: S3/012
Dt of issue:

ANNEXURE – 6

EXIDE PLANTÉ

TECHNICAL SPECIFICATIONS

Type of Cell	Capacity when at 10 hr. rate to Ah	Charging Current		Total input during	Weight of Cell +/- 5%		Approx qty. of	Overall Dimensions of Containers			Overall Cell Height +/- 5 mm	Corresponding Cell Centres	Trickle Charge Current	
		Starting Rate A	Finishing Rate A	Initial charging Ah	Without Acid Kg	With Acid Kg	acid 1.19 sp gr Litres	Length +/- 2 mm mm	Breadth +/- 2 mm mm	Height +/- 2 mm mm	mm	mm	Min mA	Max mA
YAP														
YAP 5	16	2	1	88	2.7	4.7	1.7	114	133	212	260	123	10	40
YAP 7	24	3	1.5	132	3.5	5.4	1.6	114	133	212	260	123	15	45
YAP 9	32	4	2	176	4.3	6.1	1.5	114	133	212	260	123	20	60
YAP 11	40	5	2.5	220	5.4	8.8	2.9	190	133	212	260	189	30	90
YAP 13	48	6	3	264	6.2	9.5	2.8	190	133	212	260	189	40	120
YAP 15	56	7	3.5	308	7	10.2	2.7	190	133	212	260	189	45	135
YAP 17	64	8	4	352	7.8	11	2.8	190	133	212	260	189	50	150
YKP														
YKP 7	75	9	4.5	412	10.5	18.2	6.5	173	203	352	428	217	60	180
YKP 9	100	12	6	550	13.5	21	6.3	173	203	352	426	217	80	240
YKP 11	125	15	7.5	688	15.5	22.4	5.8	173	203	352	426	217	100	300
YKP 13	150	18	9	825	18	24.4	5.4	173	203	352	426	217	125	375
YKP 15	175	21	10.5	962	19.7	28.7	7.8	210	203	352	423	217	140	420
YKP 17	200	24	12	1100	22	30.7	7.3	210	203	352	423	217	160	480
YKP 19	225	27	13.5	1238	24.3	34.9	8.9	248	203	352	423	217	180	540
YKP 21	250	30	15	1375	26.7	36.9	8.6	248	203	352	423	217	200	600
YKP 23	275	33	16.5	1513	29.1	41.4	10.3	286	203	352	423	217	220	660
YKP 25	300	36	18	1650	31.5	43.4	10	286	203	352	423	217	240	720
YKP 27	325	39	19.5	1787	36.3	52.6	13.7	362	203	352	423	217	260	780
YKP 29	350	42	21	1925	38.5	54.4	13.4	362	203	352	423	217	280	840
YKP 31	375	45	22.5	2062	40.8	56.4	13.1	362	203	352	423	217	300	900
YKP 33	400	48	24	2200	43.2	58.4	12.8	362	203	352	423	217	320	960
YKP 35	425	51	25.5	2338	45.6	60.4	12.5	362	203	352	423	217	340	1020
YHP														
YHP 11	535	84	32	2942	64.3	98.7	27.1	230	368	597	682	255	300	600
YHP 13	645	77	38.5	3547	74.8	105.4	25.7	230	368	597	682	255	360	720
YHP 15	750	90	45	4125	93.8	170.6	64.6	433	368	597	682	394	420	840
YHP 17	860	103	51.5	4739	104.1	179.5	63.3	433	368	597	682	394	480	960
YHP 19	965	116	58	5307	114.4	188.2	62	433	368	597	682	394	550	1100
YHP 21	1070	128	64	5885	124.7	196.9	60.7	433	368	597	682	394	600	1200
YHP 23	1180	142	71	6490	135	205.7	59.4	433	368	597	682	394	660	1320
YHP 25	1285	154	77	7067	145.3	214.4	58.1	433	368	597	682	394	720	1440
YHP 27	1395	167	83.7	7672	155.8	220.8	54.8	433	368	597	682	394	780	1560
YHP 29	1500	180	90	8250	165.9	229.6	53.5	433	368	597	682	394	850	1700
YHP 31	1605	193	96.5	8827	181.7	261	66.6	509	368	597	682	394	900	1800
YHP 33	1715	206	103	9432	192	269.6	65.2	509	368	597	682	394	960	1920
YHP 35	1820	218	109	10010	202.3	278.3	63.9	509	368	597	682	394	1025	2050
YHP 37	1930	232	116	10625	215.9	307.3	76.8	585	368	597	682	394	1100	2200
YHP 39	2035	244	122	11192	225.9	315.7	75.8	585	368	597	682	394	1150	2300
YHP 41	2140	257	128	11770	238.2	324.4	74.1	585	368	597	682	394	1200	2400
YHP 43	2250	270	135	12375	246.6	333.1	72.7	585	368	597	682	394	1250	2500

Note : The length of a cell is measured at right angles to the plates. The width is measured parallel to the plates.

CAPACITY : Ampere-hour output as percentage of 10-hr capacity when discharging in :

Table : 3

Hour	1	2	3	4	5	6	7	8	9	10
Final Voltage	1.75	1.78	1.80	1.81	1.82	1.83	1.83	1.84	1.84	1.85
% of 10 hr. capacity	60%	76%	83.5%	88.5%	92.3%	95%	96.5%	98%	99%	100%

RECHARGE INSTRUCTIONS

All Planté cells should strictly be floated at voltages as mentioned in Table 4. In case of lower float voltage because of any system constraint, an equalisation charge must be given once in 3 months.

Trickle charging currents should be so adjusted, anywhere between the maximum and minimum allowed levels given in the Table 2, such that individual cells remain fully charged.

Max Trickle Charging Rate as per this catalogue = 2.5 mA per AH capacity of Battery.

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-348-316-061	Rev no.-02	Prepared	Checked	Approved
TYPE OF DOC.	DESIGN DOCUMENT	NAME	SK	SKS	AS
TITLE		SIGN	-SD-	-SD-	-SD-
LT AC AND DC CABLE SIZING		DATE	17.03.12		
		GROUP	TBEM	W.O. No	80010

CUSTOMER/ CONSULTANT	The West Bengal Power Development Corporation Ltd. / Development Consultants Private Ltd. Kolkata
PROJECT	2X500MW thermal power extension project Unit-3 & 4 at Sagardighi- 400KV Switchyard

CONTENTS

DEVELOPMENT CONSULTANTS PVT. LIMITED.

Reviewed only for general conformance with contract drawings and specifications. Contractor to be responsible for any errors and for fulfillment of detailed requirements of contract documents

ACTION 2		DATE 13.08.2012	
DISTRIBUTED BY. S.M.			
1	Distributed	4	Approved except as noted. Resubmission required
2 ✓	Approved	5	Disapproved see accompanying letter
3	Approved except as noted. Forward final drawings	6	For information only
SEE COVERING LETTER			
LETTER REF NO. 0850		DATE. 13.08.2012	

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS
02	02.03.12	SK	SKS	AS	As per DCPL comments letter dated 26.07.12
01	17.07.12	SK	SKS	AS	As per DCPL comments letter dated 28.03.12

Distribution	To Copies	TBTS	O/C	TBMM	TBQM	TBCM
		-	1	-	-	-

	Total Nos. of 3 phase isolator for present bays of 400kV substation (For total see note-)	4
	Total DC load requirement for Isolator Interlocking	**140 W**

Note-
(1) Assuming in worst case 400kV main bus -2 fault , then total nos. of 400kV Isolator ready for operation = 4 nos.

6 **DC load for relay panels , Substation Auxiliary panels and Tariff metering panels**

6a **DC load requirement for Main relays and BCU**

Name of Bays	No. of feeders	Main relay per feeder	No.of BCU	Total No. of Relays	Load of Each Relay (W)	Total Load (W)
400 KV Line Bays	2	2	1	6	40	240
400 KV GT Bays	2	1	1	4	40	160
400 KV ST Bays	2	2	1	6	40	240
400 kV Tie Bays	3	0	1	3	40	120
Total Load for main relay and BCU=						**760**

Note-There will be one BCU in ecah feeder

6b **DC load requirement for Aux relays**

Name of Bays	No. of feeders	Relays per feeder	Total No. of Relays	Load of Each Relay (W)	Total Load (W)
400 KV Line Bays	2	6	12	6	72
400 KV GT Bays	2	6	12	6	72
400 KV ST Bays	2	6	12	6	72
400 kV Tie Bays	3	6	18	6	108
Total Load for Aux. relay =					**324**

6c Load for Substation Auxiliary panels (located in existing control room) — 2800 W

Operator Work Station	2 nos	600	1200 W
DR Work Station	1 nos	600	600 W
A-3 Laser Printer	1 nos	800	800 W
A- 4 Laser Printer	2 nos	80	160 W
GPS Receiver	1 nos	40	40 W

6d Load for Tariff metering panels located in existing control room — 50 W

Total DC load for relay panels , Substation Auxiliary panels and Tariff metering panels	**3934 W**
Total Continuous DC Load	**4743.42 W**
DC Continuous Current	**21.56 Amp**

7 **Momentary DC Load for tripping**

7a **415V main PMCC**

DC Load requirement of the trip relay	150

5. BURDENS

5.1 Auxiliary Voltage

The MiCOM C264/C264C computer burdens are specified in the table below:

Version	Nominal	Maximum
C264C	15W	22W
C264	20W	40W

5.2 Power supply

The BIU241 board burden on the internal 5V bus is 1,25W. This takes into account watchdog, redundancy relays and communication ports.

The efficiency of the power supply is 78%.

5.3 CPU boards

The CPU260 board (also named CPU type 2 or CPU2) burden on the internal 5V and 12V bus is 3,3W.

The CPU270 board (also named CPU type 3 or CPU3) burden on the internal 12V bus is 2,7W.

5.4 Digital inputs

5.4.1 DIU200

The DIU200 inputs burdens are specified in the table below:

Version	Nominal voltage	Current at Un (mA)
A01	24 V_{DC}	3.5
A02	48 to 60 V_{DC}	5 for 48 V_{DC} 6.8 for 60 V_{DC}
A03	110 to 125 V_{DC}	2.5 for 110 V_{DC} 3 for 125 V_{DC}
A04	220 V_{DC}	2

The DIU200 board burden on the internal 5V bus is 75mW

5.4.2 DIU210

The DIU210 inputs burdens are specified in the table below:

Nominal voltage	Current at Un (mA)
24 V_{DC}	>25
48 to 60 V_{DC}	3.8
110 to 125 V_{DC}	4
220 V_{DC}	4.1

The DIU210 board burden on the internal 5V bus is 75mW.

Power consumption per input:

Un = 24VDC to 110V DC: 0,5W ± 30% per input
Un > 110VDC: 5mA ± 30%

From 48Vdc to 220Vdc voltage, a high current consumption is created on binary inputs during a short period and circulates through external binary contacts to clean them. See the peak current response curve.

ALL DIMENSIONS ARE IN MM – IF ANY DOUBT PLEASE ASK.

LEGEND (Designation)	DESCRIPTION	RATING	MAKE	QUANTITY	
				M (MASTER)	F (FOLLOWER)
S1	3Pole MCB (AC 3Φ 415V) for Motor	3Pole,MCB – 10Amps	Siemens/Schneider	1	0
OC	Open Contactor	(Coil: 220v DC)	Siemens/Schneider/Sprecher+Schuh	1	1
CC	Close Contactor	(Coil: 220v DC)	Siemens/Schneider/Sprecher+Schuh	1	1
OLR	Over Load Relay with SPP	Range: 1.1–1.6A / 1–1.6A	Siemens/Schneider/Sprecher+Schuh	1	1
M	Induction Motor	0.5HP, 3Φ,AC, 415V, 50Hz	Remi / Elcen	1	1
S3	AC PH&N MCB for 1Φ AC 230V supply	1Ph&N,MCB – 16Amps	Siemens/Schneider	1	0
CH	Cubilce Heater	1Φ,AC,240V, 80W	Kontact/Bajaj Engg./ Pyrosensors/Ramana Electricals	1	1
TH	Thermostat	Range: 30 – 85°C	BESL/Girish Ego	1	1
HS	1Pole MCB for Heater	1Pole,MCB – 6Amps	Siemens/Schneider	1	1
CL	Cubicle Lamp (CFL)	15watts	Halonix/Dolphin or Equivalent.	1	1
LS	Door Switch for Lamp	2 Amps	Suraj/Recom	1	1
PS	Power Socket (1Φ,3Pin Industrial type)	1Φ,AC,240V(3Pin)	Schneider/BCH	1	0
PSS	1Pole MCB for Power Socket	1Pole,MCB – 16Amps	Siemens/Schneider	1	0
CS	DC 2Pole MCB for Control supply	2Pole,DC,MCB – 10Amps	Siemens/Schneider	1	0
IC	InterLocking Contactor	2NO+2NC, Coil: 220vdc.	Siemens/Schneider/Sprecher+Schuh	1	0
S2	L/R/M Selector Switch	10A,250V(2L+2R+2M)	Recom / Switron	1	0
PBC	Close – Push button	1NO, 10A	Vaishno/BCH/Essen deinki/Schneider	1	1
PBO	Open – Push button	1NO, 10A	Vaishno/BCH/Essen deinki/Schneider	1	1
PB4	Emergency stop – Push button	1NC, 10A	Vaishno/BCH/Essen deinki/Schneider	1	1
TR	Pole discrepancy Timer (Contactor mounted)	Coil: 220vDC Range: 1–60Secs ON DELAY	Schneider/Sprecher+Schuh	1	0
MC	Master Control Switch	10A,250V(7M+2 I)	Recom / Switron	1	0
LS1	LSO–C: Limit Switch Opens when Disconnector Closes LSC–C: Limit Switch Closes when Disconnector Closes	10A,250V (1NO+1NC)	Jaibalaji	1	1
LS2	LSO–O: Limit Switch Opens when Disconnector Opens LSC–O: Limit Switch Closes when Disconnector Opens	10A,250V (1NO+1NC)	Jaibalaji	1	1
KIMC	Key Interlock Manual contact (Rotary/Cam switch) –1NC	1NC, 10A.	Recom / Switron	1	0
MPB	Manual Push Button for Interlocking release	1NO, 10A	Vaishno/BCH/Essen deinki/Schneider	1	0
MSC	Manual Interlocking Coil (Solenoid)	220v DC, 35W	Resistro/Approved MOM Manufacturer	1	*
AUX.SWITCH	Auxiliary Switch 15NO+15NC, Rated cont.current: 10A Breaking capability at 220VDC – 2Amps with L/R = 20milli secs.		MANI Enterprises/ IMAX	1	*
TB	Terminals (CTS–4UN / UBT–4) Terminals (CAT–M3) for incoming supply(TB1–1&2,TB2–41–45(7 nos)	750V, 32A	Connectwell / Elmex.	*	*
WIRE (CABLE)	Motor & Heater circuit wiring	2.5Sqmm Cu.stranded	ISI make	*	*
	DC Control supply & Aux.switch wiring	1.5Sq.mm ("do")	ISI make	*	*

NOTE: Make of all components shall be as per power grid QA&I approval

* REFER THE SUBSEQUENT DRAWINGS.

REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED
A	08.10.2011	Revised as per PGCIL Letter DT:04.10.2011	S.M.Singh	M.S.R	J.M.R

STANDARD DRAWING

TITLE

PART LIST AND THE TECHNICAL DATA

(MASTER & FOLLOWER CONTROL FOR DISCONNECTORS ELECTRICALLY GANGED)

SCALE	NTS
DATE	16.9.2011
DRAWN	s.mahender singh
CHECKED	murali
APPROVED	P.Ramamurthy

SIEMENS LIMITED
PTD,Division, Hyderabad Works
Plot No., 89 & 90, I.D.A Gandhi Nagar,
P.O Balanagar,Hyderabad –37

DRG.NO. PGCIL–OM–1402 sheet no.–1of6 A

CAD FILE: PGCIL–OM–1402–1of6

5. BURDENS

5.1 Auxiliary Voltage

The MiCOM C264/C264C computer burdens are specified in the table below:

Version	Nominal	Maximum
C264C	15W	22W
C264	20W	40W

5.2 Power supply

The BIU241 board burden on the internal 5V bus is 1,25W. This takes into account watchdog, redundancy relays and communication ports.

The efficiency of the power supply is 78%.

5.3 CPU boards

The CPU260 board (also named CPU type 2 or CPU2) burden on the internal 5V and 12V bus is 3,3W.

The CPU270 board (also named CPU type 3 or CPU3) burden on the internal 12V bus is 2,7W.

5.4 Digital inputs

5.4.1 DIU200

The DIU200 inputs burdens are specified in the table below:

Version	Nominal voltage	Current at Un (mA)
A01	24 V_{DC}	3.5
A02	48 to 60 V_{DC}	5 for 48 V_{DC} 6.8 for 60 V_{DC}
A03	110 to 125 V_{DC}	2.5 for 110 V_{DC} 3 for 125 V_{DC}
A04	220 V_{DC}	2

The DIU200 board burden on the internal 5V bus is 75mW

5.4.2 DIU210

The DIU210 inputs burdens are specified in the table below:

Nominal voltage	Current at Un (mA)
24 V_{DC}	>25
48 to 60 V_{DC}	3.8
110 to 125 V_{DC}	4
220 V_{DC}	4.1

The DIU210 board burden on the internal 5V bus is 75mW.

Power consumption per input:

Un = 24VDC to 110V DC: 0,5W ± 30% per input
Un > 110VDC: 5mA ± 30%

From 48Vdc to 220Vdc voltage, a high current consumption is created on binary inputs during a short period and circulates through external binary contacts to clean them. See the peak current response curve.

TECHNICAL PRE- QUALIFICATION REQUIREMENT

Name of customer: WBPDCL

Name of Project: Extension of 400kV Switchyard at 1X660MW Unit-5 Sagardighi TPP

Name of Item: 220 V, 1250AH Lead Acid Plante Battery Bank

PQR Sr. No	PQR Description
1.	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 notice to proceed (NTP) i.e 01.07.2020. (#) Successful operation means certificate issued by the Customer certifying the operation without any adverse remark.

Prepared & checked By: **Y.Latha Kumari** **(Sr. Mgr-TBEM)** 29/10/2021	**Approved By:** **S K Shukla** **(Sr. DGM-TBEM)** 29/10/21