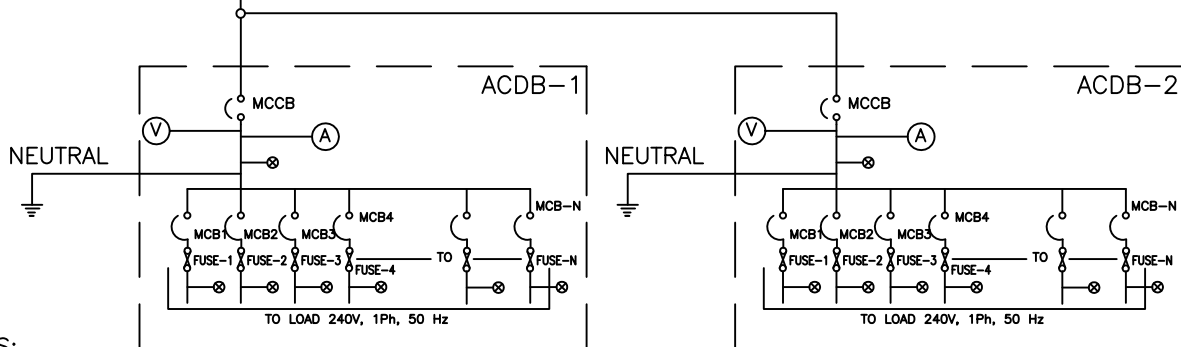
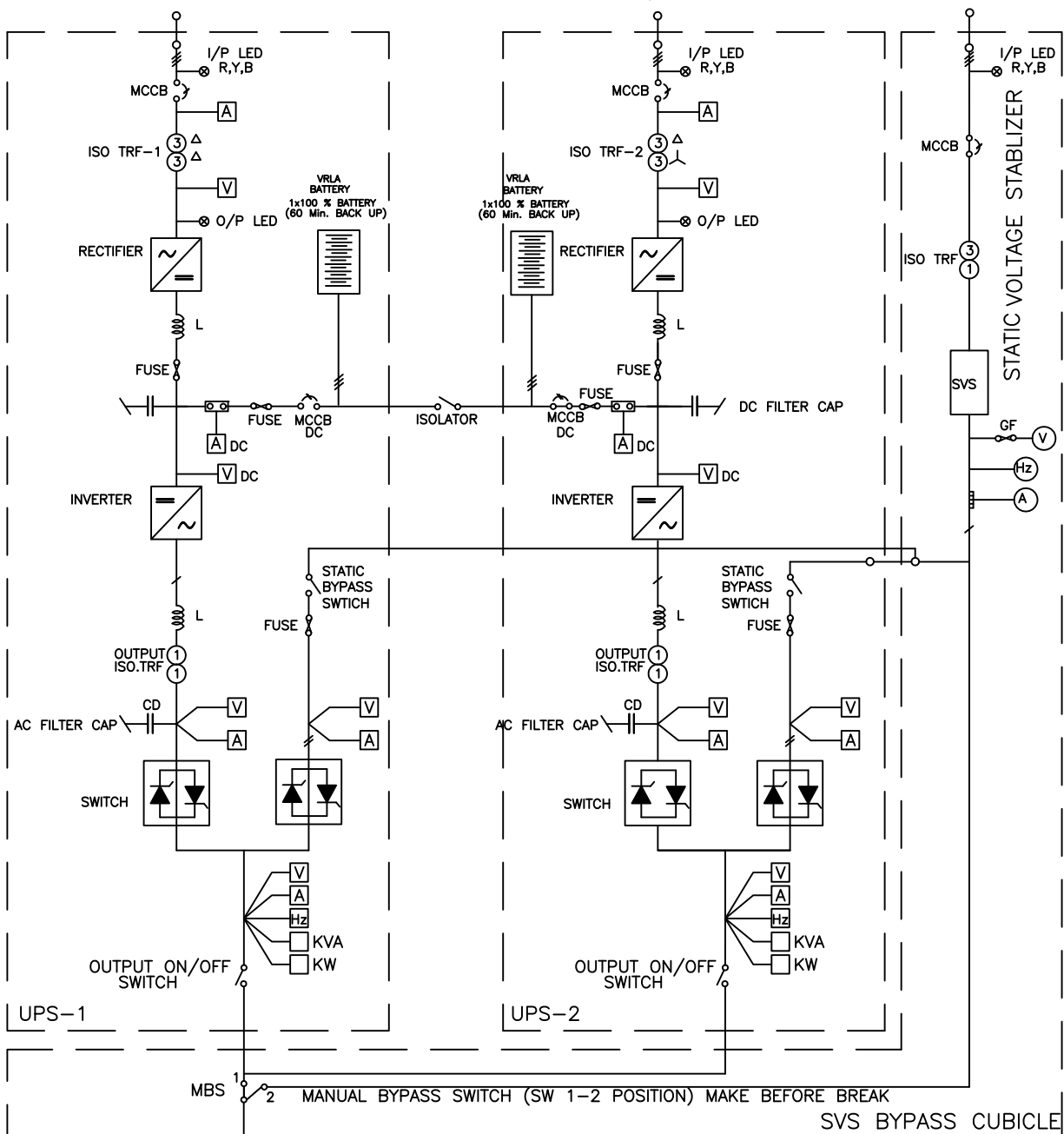


415V +/- 10%, 50Hz +/- 5%,
NORMAL 3 ϕ , 3 WIRE FEEDER

415V +/- 10%, 50Hz +/- 5%,
NORMAL 3 ϕ , 3 WIRE FEEDER

415V +/- 10%, 50Hz +/- 5%,
NORMAL 3 ϕ , 3 WIRE FEEDER



NOTES:

1. ACDB-1&2 NEUTRAL TO BE GROUND TO A DEDICATED GROUND.
2. ALL OUTPUT FEEDERS OF ACDB SHALL BE PROVIDED WITH AN LED AFTER THE FUSE FOR FEEDER ON INDICATION WITH FEEDER DESCRIPTION.
3. REDUNDANT FEEDERS SHALL BE LOCATED IN DIFFERENT ACDBs.



1x800 MW WANAKBORI THERMAL POWER STN

TITLE:-

UPS SCHEME

DRG.
No.

REV.
No.

01

DATE

SHEET

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	SCOPE OF SUPPLY
2.00.00	CODES AND STANDARDS
3.00.00	DESIGN CRITERIA
4.00.00	SPECIFIC REQUIREMENTS
5.00.00	TESTS
6.00.00	DRAWINGS DATA & MANUALS

ATTACHMENTS

ANNEXURE-A	RATINGS & REQUIREMENTS
ANNEXURE-B	SET OF ACCESSORIES TO BE PROVIDED FOR EACH BATTERY BANK

SECTION-XIV

**TECHNICAL SPECIFICATION
FOR
UNINTERRUPTIBLE POWER SUPPLY**

1.00.00 SCOPE OF WORK

1.01.00 Scope of Supply

The scope of supply shall include Uninterruptible Power Supply (UPS) Systems with parallel redundant arrangement as specified below.

- i) Each set of UPS system will consist of :
 - a. 2x100% capacity static inverter & input isolation transformer
 - b. 100 % capacity static switches (2 nos.)
 - c. One manual bypass switch
 - d. 2x100% capacity float-cum-boost chargers
 - e. 2x100% capacity UPS system battery (VRLA Type) with back up time of 1 hour
 - f. One step down transformer; (415 V three phase to 240 V single phase) for bypass
 - g. One static voltage regulator
 - h. Two AC distribution boards (ACDB-1A and ACDB-1B)
 - i. Interconnecting cable between UPS Equipment, battery and ACDB.
 - j. Two (2) nos. input output isolation transformer

Any other equipment necessary for complete of the system
- ii) One (1) set of special tools and tackle.
- iii) Mandatory Spare parts.
- iv) List of recommended spare parts for three (3) years satisfactory and trouble-free operation of the equipment.
- v) All relevant drawings, data and instruction manuals.

2.00.00 CODES AND STANDARDS

- a) All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) except where modified and/or supplemented by this specification.
- b) Equipment and materials 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.
- c) The electrical installation shall meet the requirements of Indian Electricity Rules as amended up to date and relevant IS Codes of Practice. In addition, other rules or regulations applicable to the work shall be followed.

3.00.00 DESIGN CRITERIA

3.01.00 Design Basis

- a) UPS System provides a regulated and uninterrupted single phase A.C. power, within specified tolerances, to critical station loads during normal and emergency operation. Capacity of inverter output shall be computed by the contractor considering the above requirement. 25% spare margin shall be kept on the total of above requirement.
- b) The UPS system excluding its battery shall be installed indoors in A.C. environment.
- c) UPS shall be worked at its full capacity even battery is not connected with the system.
- d) UPS system shall be compatible for satisfactory and well-coordinated operation with other related equipment as well as with input and output systems.
- e) Energizing or de-energizing any portion of the system serviced by the UPS shall not cause output changes which will affect the operation or integrity of the remaining portions of the system in any way.
- f) The equipment shall be self-protecting against all A.C. and D.C. transients, voltage surges and steady state abnormal voltages and currents.
- g) The circuit protection shall be coordinated with UPS short circuit capacity and protective device characteristics so that a fault on any circuit shall result in minimum loss of function.
- h) All non-interrupting components of UPS system shall be capable of withstanding the prevailing short circuit current without damage.
- i) All circuit interrupting components shall be capable of withstanding and interrupting the prevailing short circuit currents without damage.

- j) The procedure for battery sizing calculation shall be generally as per IS 15549, considering design margin as 15% and aging factor as 1.25
- k) For continuous operation at specified ratings, temperature rise of the various components of UPS system shall be limited to the permissible values stipulated in the relevant standards and/or this specification.
- l) The chargers, inverters, static switches, regulating transformers and voltage stabilizers should be arranged in such a way that any equipment can be fully isolated for maintenance without affecting in any way the operation of other panels/components.
- m) The chargers, inverters, static switches, regulating transformers and voltage stabilizers should be arranged in such a way that any equipment will be fully isolated for maintenance without affecting in any way the operation of other panels/ components.
- n) In the A.C. Distribution Board, the Bidder shall provide 10% or minimum one (1) no. spare feeder of each size and type of the outgoing feeders.

3.02.00 System Concept

A D.C. power source and an A.C. power source are available to the UPS system. The system is so designed that its load shall be served without interruption as long as one of the above power sources is available within specified limit of voltage and/or frequency.

Two inverters, each of 100% capacity will normally work, each sharing 50% UPS load. On failure of any inverter, its load gets automatically transferred to the other inverter through static transfer switch.

If one inverter is out of service for any reason then the second inverter will be working with 100% UPS load. On failure of this inverter the standby A.C. source will back up to supply the 100% UPS load automatically through static transfer switch.

3.03.00 Layout Criteria

The UPS system will be located indoor.

The Contractor shall indicate the space requirement for the equipment offered by them separately for UPS cabinet, UPS battery and UPS distribution board.

Battery room ventilation shall be under the scope of the Contractor.

4.00.00 SPECIFIC REQUIREMENTS

4.01.00 Static Inverter

- a) The static inverters shall be static type consisting of IGBT PWM type inverter, static filters, integrated control modules including necessary oscillators, voltage regulators, current limiting and surge suppression.

- b) The inverter equipment shall include all necessary circuitry and devices to conform requirements like voltage regulation, soft start, transient recovery, protection, automatic synchronisation, wave shaping, etc. as specified herein.
- c) Upon transfer of full load, the inverter output voltage shall not drop below 80% of nominal voltage during the first half cycle after transfer and 90% of nominal voltage in the next half cycle. The recovery to within $\pm 2\%$ of voltage shall be in less than 50 milli-seconds.
- d) On occurrence of a fault in branch circuit, the inverter shall be capable of clearing the highest rated branch circuit fuse in 4 milli-seconds or less.
- e) The inverter shall be protected against overload, short circuit, 100% loss of load, as well as excursions, loss or restoration of D.C. input voltage and synchronising voltage. The overload capacity shall be 125% for 10 mins., 150% for 60 secs. and 300% for 4 msecs.
- f) The D.C. input current shall never exceed twice the full load current except for a short circuit within the inverter.
- g) For any value of the load and load power factor drawn by the equipment served, the inverter shall not impose on D.C. source any voltage oscillations in excess of 5 volts (RMS total all frequencies) or any current oscillations in excess of 3 percent (RMS total all frequencies) of the D.C. current at full load.
- h) The inverter will be self protecting against A.C. and D.C. Transients, voltage surges and steady state abnormal voltage and currents likely to be encountered in the plant.

4.02.00 Automatic Synchronisation

- a) Inverter equipment shall include stable solid state oscillator devices designed to automatically maintain the inverter output in phase and in synchronism with the stand-by A.C. source.
- b) Facility shall be provided for automatic transfer to internal oscillator operation when the stand-by source frequency is beyond specified limits and the frequency shall be automatically controlled within 50 Hz plus or minus 0.5 Hz when the inverter operates in this mode.
- c) Retransfer to stand-by A.C. source for synchronisation shall be automatic after the stand-by source frequency is restored to permissible limits and remains within this limit for an adjustable time delay period (up to 5 seconds).
- d) Provision shall be made for stepless adjustment of synch- disconnect frequency range from 50 Hz $\pm$ 0.5 Hz to 50 Hz $\pm$ 2 Hz.
- e) Automatic adjustment of phase relationship between inverter output and stand-by A.C. source shall be gradual at a controlled slow rate, which shall not exceed one hertz per second.

4.03.00 **Static Transfer Switch**

- a) The static transfer switch shall be solid-state type using SCR for automatic/manual transfer of load from "inverter" to "stand-by" source and vice-versa.
- b) Stand-by source can be either of the inverter or A.C. source depending on whether both the inverters are supplying 50% load each or one of the inverter is carrying 100% load.
- c) The transfer time including sensing shall not be more than one-fourth cycle. Further the transition shall be make-before-break in both directions.
- d) The capacity of static transfer switch shall be equal to the continuous full-load capacity of the inverter. The switch shall be provided with protective devices in both normal and alternate power source.
- e) Static transfer switch shall be furnished with contact to alarm failure of the alternate source or opening of any fuse protecting the static switch.
- f) Static transfer switch shall include all necessary circuitry and devices to meet the functional requirements of transfer initiation, transfer inhibit and re-transfer back to normal as detailed below
- g) **Transfer Initiation**
 - i) The transfer of static switch from normal 'Inverter' position to 'stand-by' position shall be initiated by one of the following causes.
 - Inverter failure and UPS system trouble
 - Inverter output voltage failure.
 - Manual push button operation
 - ii) The UPS bus shall be monitored by two voltage detectors. One fast acting circuit shall be used for detecting a complete and instantaneous voltage loss while the other slower acting averaging circuit with adjustable trip level shall be employed to detect voltage deviation beyond selected limits. Both voltage detector circuits shall automatically initiate operation of transfer switch.
 - iii) The static switch shall automatic transfer the load from inverter to stand-by source when the maximum I^2t capability of the inverter is reached and when the inverter output drops below 90%.
- h) **Transfer Inhibit**

Automatic or manual transfer from inverter to stand-by A.C. source vice versa shall be inhibited when the inverter frequency is not synchronised to the alternate source.

- i) Retransfer to Normal
 - 1) The return to inverter mode shall be manual in all cases.
 - 2) Manual transfer shall be initiated by push button actuation.

4.04.00 Manual By-pass Switch

- a) Manual by-pass switch is used to isolate any static transfer switch for maintenance or repair without interruption to the UPS load.
- b) The switch has also the facility of by-passing both the static transfer switches during start-up at the option of the operator.
- c) Switch contact shall be make-before-break type.
- d) The switch shall have current rating equal to the full load inverter current and necessary short time load carrying and interrupting capacity to meet the requirement of UPS system.

4.05.00 Battery

- a) General
 - i. Each set of battery shall consist of number of cells assembled together on mounting racks.
 - ii. The battery shall be Valve Regulated Lead Acid (VRLA) maintenance free batteries. Each battery set will have sufficient capacity to maintain output at full rated load. The battery in normal case is not allowed to discharge beyond 80% of rated capacity at 10 hrs rate of discharge.
 - iii) The battery sets will meet the requirement of IS 15549 and will be suitable for continuous operation. The batteries will be suitable for float /boost charging
- b) Constructional Requirement

The design of battery will be as per field proven practices. Partial plating of cells is not permitted. Paralleling of cells externally for enhancement of capacity will not be permitted. Protective transparent front covers with each module will be provided to prevent accidentally contact with lie module / electrical connections.
- c) Container

Each cell will be assembled in heat resistant, acid resistant, shock absorbing robust, clear glass or lead lined wooden container having chemical and electro-chemical compatibility. The material will meet all the requirements of VRLA batteries and be consistent with the life of the battery. The container will be fire retardant. The porosity of the container will be such as not to allow any gases to escape except from the regulation valve. The tensile strength of the material of the container will be such as to handle the internal cell pressure of the cells in the worst working conditions. The container will be capable of withstanding the rigours of transport, storage and handling.

d) Cell covers

The cell covers will be made of suitable material compatible with the container material and permanently fixed with the container it will be fire retardant. Fixing of Pressure Regulated Valve terminal posts in the cover will be such that the seepage of electrolyte gas escapes and entry of electro static spark are prevented.

e) Plates

Positive grid will be of pure lead calcium tin alloys and maintenance free characteristics. Positive plate will be free from cadmium. The positive & negative plates will be flat pasted.

Both positive & negative plates will be tanked formed to ensure that plates are fully formed.

f) Grid Growth Provision

This Provision should be made in the cell design to prevent failure due to internal shorting / rupture of cell because of grid growth.

g) Separators

The separator cells will be glass mat or synthetic material having high acid absorption capability, resistant to Sulphuric acid and good insulating properties. Proper arrangement to keep the separator plates in position will be furnished.

h) Pressure Regulating Valve

Each cell will be provided with a pressure-regulating valve. The valves will be self re-sealable and flame retardant. The valve unit will be such that it cannot be opened without a proper tool. The valve will be capable to withstand the internal cell pressure specified by the manufacturer.

i) Terminal posts

Both the positive and the negative terminals of the cells will be capable of proper termination and will ensure its consistency with the life of the battery. The surface of the terminal post extending above the cell cover including bolthole will be coated with an acid resistant and corrosion and retarding material. Terminal posts of any other metal part, which is in contact with the electrolyte, will be made of same alloy as that of the plates or of a proven material that does not have any harmful effects on cell performance. Both positive and negative posts will be clearly and unambiguously identifiable.

j) Connectors, Nuts, Bolts, Heat Shrinkable Sleeves

Nuts and bolts for connecting the cells will be made of copper, brass or stainless steel. Copper or brass nuts and bolts will be lead coated.

Wherever required separate non-corroding lead or copper connectors of suitable size will be provided to enable connection of the cells. Copper connections will be suitable lead coated to withstand corrosion due to Sulphuric acid.

All inter cell connectors will be protected with heat shrinkable silicon sleeves for reducing environmental impact including a corrosive environment.

k) Flame Arrestors

Each cell will be equipped with a Flame Arrestor to defuse the Hydrogen gas escaped during charge and discharge.

l) Battery Bank Stand and cell orientation

All batteries will be mounted in a suitable metallic trays / frame. Cells will be housed in a ventilated & protected modular steel tray to facilitate airflow between the cells. The partitions will have grooves to facilitate airflow. The steel tray will have partitions for each cell to maintain consistent compression & single cell replacement. The steel trays will be powder coated for acid resistance. The Cell orientation in the steel trays will be horizontal (i.e. the positive & negative plates should be parallel to ground).

m) Capacity requirements

The battery will be capable to deliver the rated load of the UPS for 60 minutes.

When the battery is discharged at 10 hours rate, it will deliver 80% of rated capacity corrected at 27°C before any of the cells in the battery bank reaches 1.85 V / Cell.

4.06.00 Float-cum-Boost Charger

4.06.01 The charger shall be solid-state type with full wave fully controlled, bridge configurations. It shall be suitable for the inverter of IGBT type.

4.06.02 The charger shall be provided with automatic voltage regulation, current limiting, smoothing filter circuit and soft-start feature.

4.06.03 The charger shall have the provision of float, equalizing and boost charging. Further the charger shall be suitable for single and parallel operation.

4.06.04 Suitable circuitry shall be provided to ensure that the charging current is voltage regulated and current limited.

4.06.05 Each charger shall be rated to meet 100% UPS load plus recharge the fully discharged UPS battery within 8 hours.

4.06.06 Voltage control shall be stepless smooth and continuous. Float & equalizing control shall have an adjustable range of $\pm 5\%$.

For Other details as given in sub-section of Battery & Battery charger specification

4.07.00 Step-down transformer and voltage stabilizer

- a) A three phase to single phase transformer along with associated voltage stabilizer shall be furnished with the UPS system.
- b) The transformer and stabilizer shall be sized for 100% UPS load and shall coordinate with the largest branch circuit protection device for feeder short circuit current without sacrificing voltage regulation.
- c) The voltage stabilizer shall employ silicon solid state circuitry and shall maintain the specified output voltage for 0 to 100% load with maximum input voltage variation as indicated in the annexure.
- d) Provision shall be kept for dead closing of static transfer switch from stabilizer circuit to inverter when the output of the stabilizer is zero, but at that time the inverters are running.

4.08.00 A.C. Distribution Boards

- a) The distribution boards shall be fixed type, of modular design in freestanding gasketed sheet steel enclosure conforming to IP-52. Sheet steel thickness shall be 2 mm minimum for load bearing members and 1.6mm for non-load bearing members.
- b) Each module shall be housed in a separate compartment complete with individual front access door. Working height shall be limited to 1800 mm from floor level.
- c) A full height vertical cable alley shall be provided in each panel to facilitate module wiring. The alley shall be liberally sized and shall have removable cover at the front. Removable back covers shall be provided at the back of the panels.
- d) Incomer shall be provided with Moulded Case Circuit Breaker (MCCB) and outgoing feeders shall be provided with Switch-fuse units.

MCCB shall be suitable to make & break rated short-circuit current (25kA minimum) having in-built short circuit & over-load (adjustable type) protections.

- e) Switches shall be double pole, air break, heavy duty (AC 22) type, capable of safely making and breaking the full load current of associate circuit.
- f) Switch handle shall have position indicator and provision of padlocking in ON & OFF positions. Further it shall be interlocked with access door for safety.
- g) Fuses shall be HRC, preferably link type, design to permit easy & safe replacement. Visible indication shall be provided for indication of fuse.

- h) Incomer feeder shall be provided with Ammeter, Voltmeter, Power factor meter & bus energizes indicating lamp with fuse and outgoing feeders with feeder energizes indicating lamp with fuse.
- i) All indicating meters are 96 mm sq. digital type with LED display and all indicating lamps are clustered LED type so that lamp can be replaceable from front of the panel.

4.09.00 UPS Cabinets/Enclosures

- a) The UPS system components shall be housed in a sheet steel freestanding IP-42 enclosure with all access from the front. Sheet steel thickness shall be 2 mm minimum.
- b) The enclosure shall consist of vertical cabinets housing modules in rack type sub-assemblies, connected mechanically and electrically to form a rigid, self-supporting, metal enclosed structure.
- c) The modular units shall be mounted in pull out and/or swing trays. Each module shall be capable of being easily removed to provide for the ready inspection of major solid-state devices.
- d) Vertical wiring trough shall be provided for the entire height of the UPS cabinet. Cable entry shall be from bottom only.
- e) Adequate ventilating louvers and screens shall be provided. The top of the panel shall be protected by a suitable drip cover to prevent entrance of falling liquid and foreign material.
- f) If the equipment supplied requires forced air cooling, the cooling system furnished shall meet the following requirement :
 - i) Two (2) nos. 100% cooling fans shall be provided for each vertical panel.
 - ii) Completely independent duplicate protection, control and wiring systems shall be provided for the cooling fans for redundancy.
 - iii) The cooling fans shall be powered from the output of the associated inverter. Normally one fan will be running while the other is on stand-by.
 - iv) Each cooling fan shall be equipped with an airflow switch having an alarm contact that closes upon failure of airflow.

4.10.00 Alarms

- a) Solid state audio-visual annunciation system shall be provided for inverters, static transfer switch, battery charger.
- b) Alarm facia shall be provided on each charger and inverter panel, complete with proper actuating devices, circuitry and legends.

- c) 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 pressed.
- d) Each time a window lights up a master relay will get energized to provide group alarm signals for remote DCS alarm system.
- e) The requirements of indication/metering/alarms are given in the annexure.
- f) Alarm contacts shall be rated 0.5 A at 220 V DC and 5A at 240 V A.C.
- g) All indicating meter shall be digital type with in-built transducers (4-20mA) for hooking up with DCS.

4.11.00 Lamp / Space Heaters / Receptacles

- a) The panels shall be provided with :
 - i) Internal illumination lamp with door switch.
 - ii) Space heater with thermostat control.
 - iii) 3-pin 6A receptacle with plug.
- b) Lamp, heater and receptacle circuits shall have individual switch fuse units.

4.12.00 Wiring / Cabling

- a) The panels shall be completely wired up. All wiring shall be done with flexible, 1100V grade, fire resistance PVC insulated wires with stranded 2.5 Sq.mm. copper conductors and routed through wiring troughs. Each wire shall be ferruled by plastic tube with indelible ink print at both end having terminal block No., terminal number as per approved wiring diagram.
- b) Panels shall have removable gland plate for cable entry. All incoming/outgoing cables shall be terminated in suitable terminal block.
- c) Control terminal blocks shall be box-clamp type, minimum 10 Sq.mm. 20% spare terminals shall be furnished.

4.13.00 Nameplate

- a) Engraved nameplates shall be provided for each panel and for each equipment/device mounted on it.
- b) The material shall be anodised aluminium / lamicaid, 3 mm thick, with white letters on black background.
- c) Nameplates shall be held by self-tapping screws. The size of nameplates shall be approximately 20 mm x 75 mm for equipment and 40 mm x 150 mm for panels.

- d) Nameplates for panels shall be provided both on the front and rear.
- e) Control and meter selection switches shall have integral nameplates. Nameplates for all other devices shall be located below the respective devices.
- f) Instruments and devices mounted on the face of the panels shall also be identified on the rear with the instrument/device number. The number may be painted on or adjacent to the instrument or device case.
- g) Caution notice on suitable metal plate shall be affixed at the back of each panel.

4.14.00 Grounding

- a) Normal 3-phase A.C power supply will be grounded at the source. For grounding other than this, isolation transformer shall be furnished with the U.P.S.
- b) The inverter D.C. input and A.C. output shall be electrically isolated from each other and from cabinet ground.
- c) Panels shall have fully rated ground bus with two ground terminals, one at each end.
- d) Each terminal shall comprise two-bolt drilling M10 G.I. bolts and nuts to receive ground connection of 50 x 6 mm G.S. flat.
- e) Separate electronic grounding shall be provided for each UPS system.

4.15.00 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.

4.16.00 Painting

- a) The panels shall be finished in light grey shade (RAL 7032) two coats of synthetic enamel paint. The panels shall have a matt finish to prevent any glare from surface due to illumination.

5.00.00 TESTS

5.01.00 Shop Tests

5.01.01 Type and routine test for various components

5.01.02 Functional tests to demonstrate compliance with all specified requirements and published specifications such as frequency regulation, voltage regulation,

current limiting, fuse clearing capability of inverters, demonstration of phase and frequency control of inverter for synchronisation with range of adjustments, transfer and re-transfer of static switches under influence of under voltage and over current, tests on chargers, batteries and other system component to confirm compliance with specification.

5.01.03 All equipment provided under the specification shall be operated under rated conditions and maximum ambient temperature for not less than 120 hours prior to release of shipment.

In addition static switches shall be subjected to not less than 1000 transfer/re-transfer cycles at full load.

5.02.00 Test Witness

Tests shall be performed with presence of Owner's representative if so desired by the Owner. The Contractor shall give at least thirty (30) 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 Owner.

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

5.03.03 Type test certificates on any equipment, if so desired by the Owner, shall be furnished. Otherwise the equipment shall have to be type tested, free of charge, to prove the design.

6.00.00 DRAWINGS, DATA & MANUALS

6.01.00 To be submitted with the Bid

6.01.01 UPS panels, Battery Charger and Battery layout drawing with dimensions

6.01.02 General Arrangement drawing of UPS panels

6.01.03 Bill of Material

6.01.04 Schematic drawing of UPS circuits

6.01.05 Battery cell voltage characteristics and data for different discharge rates

6.01.06 Technical leaflets on :

- a) UPS System
- b) Battery
- c) Battery charger

- d) Inverter
- e) Static Switch
- f) Manual bypass Switch
- 6.01.07 Duty cycle diagram and battery sizing calculation in the format of relevant IS Standard
- 6.01.08 Sizing calculation of UPS system, charger main equipment, viz. SCRs, rectifier transformers etc
- 6.01.09 Type test certificates for similar equipment.
- 6.02.00 **To be submitted after Award of Contract**
- 6.02.01 Dimensional UPS, battery layout diagram in plan & section.
- 6.02.02 Connection details of take-off terminals.
- 6.02.03 Dimensional general arrangement drawings of UPS, battery charger, battery clearly showing device dispositions, cable entry, space requirement, etc.
- 6.02.04 Sectional views of UPS System panels
- 6.02.05 Panel foundation plan and loading
- 6.02.06 UPS system schematics and wiring diagrams
- 6.02.07 Test reports
- 6.02.08 Detailed bill of materials
- 6.02.09 Any other relevant drawing or data necessary for satisfactory installation, operation, and maintenance.
- 5.02.10 Cable schedule & Inter-connection charts.
- 6.02.11 Instruction manuals of UPS system
- The manual shall clearly indicate method of installation, check-ups, and tests to be carried out before commissioning of the equipment.
- 6.03.00 The Tenderers may note that the drawings, data and manuals listed above are minimum requirement only. Tenderers shall ensure that all other necessary write-ups, curves and information required to fully describe the equipment offered are submitted with their bids.

ANNEXURE-A

RATINGS & REQUIREMENTS

1.00.00	STATIC INVERTER	
1.01.00	Application	: UPS System for MMI, SWAS and CEMS etc.
1.02.00	Type	: static IGBT PWM type
1.03.00	Duty	: Continuous
1.04.00	Enclosure	: Sheet steel, IP42
1.05.00	Cooling	: Natural convection or forced cooling using redundant fans.
1.06.00	Design Ambient temperature	: 50 Deg.C
1.07.00	Inverter capacity	: To be decided by the Bidder
1.08.00	Overload capacity	: 300% for 4 m secs. 150% for 60 secs 125% for 10 mins 110% for continuous
1.09.00	Voltage	
	a) Inverter input, Battery output	: To be decided by the Bidder
	b) Nominal output	: 240 V, 50 Hz, 1-phase
1.10.00	Voltage Regulation :	
	a) Steady state (0-100% load at all input voltages and all power factors)	: $\pm 1.5\%$
	b) Transient voltage (On application or removal of 100% load)	: $\pm 10\%$
	c) Time to recover from transient to normal voltage	: 50 milliseconds.
1.11.00	Wave form :	
	a) Nominal frequency	: 50 Hz

- b) Frequency range for all : ± 0.05 Hz.
conditions of input supplies,
loads & temperature occurring
simultaneous or in any
combination (automatically
controlled)
 - c) Synchronisation limits (for : 49 Hz to 51 Hz (factory set)
maintenance of synchronism
between inverter and standby
A.C source)
 - d) Field adjustment range for (c) : 50 ± 0.05 Hz to 50 ± 2 Hz
above
 - e) Total Harmonic Content : 5% maximum at rated load
 - f) Harmonic content for any : 3% maximum
single harmonic
- 1.12.00 Rated output current at rated output voltage with current limit not operating
 - a) Current : 200%
 - b) Duration : 100 milliseconds.
- 1.13.00 Efficiency at full load : 90% or better.
(Watt output/watt input)
- 1.14.00 SCR derating from peak voltage : 50%
and peak rating
- 2.00.00 STATIC SWITCH
- 2.01.00 Type : Solid-state, SCR
- 2.02.00 Duty : Continuous
- 2.03.00 Enclosure : Sheet Steel, IP42
- 2.04.00 Cooling : Natural convection or forced cooling
using redundant fans.
- 2.05.00 Ambient Temperature : 50 Deg.C
- 2.06.00 Capacity
 - a) Continuous : Equal to full load capacity of the inverter.
 - b) Overload : 300% for 4 m secs.
150% for 60 secs
125% for 10 mins
110% for continuous

	c) Peak	:	1000% of continuous rating for 5 cycle.
2.07.00	Normal Voltage	:	240V, 50 Hz, 1-phase.
2.08.00	Transient Voltage Tolerance	:	340V peak above the nominal line voltage.
2.09.00	Transfer Time	:	less than 4 m secs.
3.00.00	MANUAL BY-PASS SWITCH/BREAKER		
3.01.00	Type	:	Maintained, make before break.
3.02.00	Voltage	:	600V
3.03.00	Rated Current	:	To meet the requirement as specified in clause no.: 3.04.00 d)
4.00.00	BATTERY		
4.01.00	Application	:	UPS Battery
4.02.00	Design Ambient Temperature	:	50 Deg.C
4.03.00	Type	:	VRLA type
4.04.00	Nos. of Cells per Battery	:	To be decided by the Bidder
4.05.00	Battery nominal voltage	:	To be decided by the Bidder
4.06.00	Battery AH rating	:	Bidder to compute considering 100% UPS load for 1 hour.
4.07.00	Method of working		
	a) Float charge (Normal)	:	2.23 Volts / Cell
	b) Boost charge (After complete discharge)	:	2.30 Volts / Cell
4.08.00	Mounting	:	Steel Rack
4.09.00	Connection	:	Cables
5.00.00	BATTERY CHARGER		
5.01.00	Charger	:	Float + Boost
5.02.00	Type	:	Solid-state, full wave, fully controlled.
5.03.00	Duty	:	Continuous
5.04.00	Enclosure	:	Sheet Steel, IP42

- 5.05.00 Cooling : Natural convection or forced cooling using redundant fans.
- 5.06.00 Design Ambient Temperature : 50 Deg.C
- 5.07.00 A.C. input :
- a) Supply : 415V, 3-phase, 50 Hz
 - b) Voltage variation : $\pm 10\%$
 - c) Frequency variation : $\pm 5\%$
 - d) Combined volt frequency variation : 10% (absolute sum)
 - e) Short-circuit level : 50 KA
 - f) System earthing : Solidly grounded
- 5.08.00 D.C. output : 100% UPS load plus restoring fully discharged battery to full charge condition in 8 hours.
- 5.09.00 Blocking Diode, Peak inverse voltage : 800 V (minimum)
- 5.10.00 Performance Requirement
- a) The output voltage of the charger shall be regulated within $\pm 1\%$ of the set value for any load variation from 0 to 100% and A.C input voltage and frequency variation as indicated above in 4.06.00
 - b) The ripple content in charger D.C. output shall be limited to less than $\pm 1\%$ with battery and less than $\pm 2\%$ without battery.
- 6.00.00 DISTRIBUTION BOARDS
- 6.01.00 Type : Fixed, Modular construction.
- 6.02.00 Enclosure : Sheet Steel, IP52
- 6.03.00 Mounting : Free standing
(can be attended from both front & back)

ANNEXURE-B

**SET OF ACCESSORIES TO BE PROVIDED
FOR EACH BATTERY BANK**

- a) One battery log book.
- b) Two copies of printed instruction sheet.
- c) One no. cell testing voltmeter (3-0-3 volts) complete with leads.
- d) One no. rubber syringe type hydrometer suitable for specific gravity reading.
- e) Three nos. pocket thermometer.
- f) One no. thermometer (0 to 100°) with specific gravity correction scale.
- g) One set cell bridging connector.
- h) Battery racks suitable for accommodating the cells coated with paint.
- i) Delrin insulator (with 5% extra), rubber pad etc. for rack.
- j) Two nos. plastic filling bottle for filling up.
- k) One pair of spanners.
- l) Two pairs of rubber hand gloves.
- m) Two nos. cell lifting straps.
- n) One set of inter cell, inter tie and inter bank connectors as required for complete installation.
- o) Apron.
- p) Goggles.
- q) 'No Smoking' Notice Board

NOTE: Any other accessories if required for satisfactory operation of the complete battery system shall also be included under the Scope of Contractor without any price implication.