ANNEXURE - A

Detailed Specifications for 60kVA Modular UPS System (Scalable up to 150kVA)

1. SCOPE:

- The scope involves design, supply, installation, testing and commissioning of Modular UPS system along with two (02) nos of battery banks (Non-Modular type).
- Supply of 300mtrs suitable size Uninyvin Copper cables (MIRACLE make) shall be supplied for connecting between the UPS, DC breaker, Battery banks.
- The laying of Uninyvin Copper cables in good condition with supply of suitable size Steel wired reinforced (SWR) PVC flexible conduit pipes and necessary materials such as brackets, clamps, MS spacers including.
- Providing end terminations for Uninyvin cables including supply of PVC cable glands, 3D long barrel heavy duty tin plated copper lugs, neoprene bushes and other materials and tools required complete with terminal connection.
- Supply and installation of Remote display Panel (01 set)
- Supply of suitable communication cable (200 mtrs)
- Laying of communication cable through suitable conduit and end connections.
- Pre-dispatch inspection, packing, loading at factory, transportation, unloading at site, storing at site, shifting UPS with battery banks to UPS room where UPS has to be installed, installation including supply of all installation materials including minor civil works, UPS interconnection, initial charging batteries followed by two discharge test, conducting site test including load test, supplying load for the load test, commissioning checks, training the operators at site and handing over the documents as listed.
- Cost implication due to above needs to be included in the offer.

1.1 SUMMARY:

This specification describes the operation and functionality of a continuous duty, three-phase, solid-state, static modular Uninterruptible Power System (UPS) hereafter referred to as UPS. The UPS shall utilize rack-mounted redundant, scalable array architecture. The system power train shall be comprised of hot swappable / user replaceable power modules, which shall operate in parallel. Each power module contains a full rated input rectifier / boost converter (hereafter referred to as Input Converter), full rated output inverter and battery charging circuit. The system shall also comprise of a user-replaceable continuous duty hot swappable bypass static switch module, redundant control modules, redundant logic power supplies and LCD interface display. All

of the above system components shall be housed in a standard equipment rack. The UPS shall be designed to permit ready access to modules and assemblies in the front side only.

The placement of parts, test points and terminals shall be such that they are accessible for circuit checking, adjustment and maintenance without removal of any adjacent module or assembly. All power semiconductors in the module shall be protected by fast acting fuses so that failure of any one power semiconductor will not cause cascading failures. The UPS module shall not incur permanent damage to itself and the connected load under all predictable types of failure conditions within itself and the connected load.

The UPS and associated equipment shall operate in conjunction with a primary power supply and an output distribution system to provide quality uninterrupted power for mission critical, electronic equipment load.

All programming and miscellaneous components for a fully operational system as described in this specification shall be available as part of the UPS.

UPS shall be designed to interface and operate with DG set to maintain UPS supply in case of utility supply failure without any distortion on DG supply or hunting or de-rating DG set.

2 PRODUCTS: The UPS system shall operate in double-conversion mode, described in detail in this specification.

2.1 MODES OF OPERATION:

Normal: The input converter and output inverter shall operate in an on-line manner to continuously regulate power to the critical load. The input and output converters shall be capable of full battery recharge while simultaneously providing regulated power to the load for all line and load conditions within the range of the UPS specifications.

Battery: Upon failure of the AC input source, the critical load shall continue to supply by the output inverter, which shall derive its power from the battery system. There shall be no interruption in power to the critical load during both transfers to battery operation and retransfers from battery to normal operation.

Recharge: Upon restoration of the AC input source, the input converter shall simultaneously recharge the battery and output inverter provide regulated power to the critical load without any interruption or change in electrical parameters.

Static Bypass: The static bypass shall be **hot swappable**. The static bypass shall be used to provide transfer of critical load from the Inverter output to the bypass source. This transfer, along with its retransfer, shall take place with no power interruption to the critical load. UPS system shall transfer the load to the incoming AC mains supply bypassing the rectifier/charger unit, batteries and inverter without any interruption under the following conditions:

i. Malfunction or failure of any modules of the UPS system
ii. The batteries are drained to near depletion
iii. Over-temperature
iv. Overloads
v. Load current transients (inrush or fault clearing)
vi. On request, the UPS system may automatically transfer the load with a micro-interruption without any load outage or disturbance in supply of power. If a major fault occurs on the UPS system and if synchronization with the bypass source has not been established, the transfer shall be less than 20 msec.
vii. In all cases, to ensure load transfer in complete safety, the system shall simultaneously control all the static switches.

Maintenance Bypass Switch: The UPS system shall be equipped with inbuilt Maintenance Bypass Switch used to electrically isolate the UPS and supply the load directly from the mains supply, if the UPS system has to undergo maintenance or service.

If inbuilt Maintenance Bypass Switch facility is not available in the UPS system, the external bypass arrangement in the auxiliary cabinet for total uninterruptible isolation of the UPS shall be provided in order to isolate both the input side and the output side of the UPS system for the maintenance without interrupting the supply to the load.

2.1.1 UPS maintenance:

1. All power and control electronics of the modular UPS units making up the UPS system shall be accessible **from the front of the UPS**. **UPS shall need no space in the rear end.**
2. For personnel safety during servicing or testing, this system shall be designed to isolate the UPS system while continuing to supply power to the load from the bypass AC source. The UPS shall also include a device making it possible to isolate the rectifier and the charger of each modular UPS unit from the normal AC source.

2.1.2 Battery maintenance:

For safe maintenance on the battery, the system shall include a circuit breaker to isolate the battery from the rectifier, the charger and the inverter. When the battery is isolated from the system, the UPS shall continue to supply the load without interruption or disturbance, except in the event of a normal AC source outage.

2.1.3 Cold start (normal AC source absent):

The battery shall be capable of starting the UPS if the normal AC source is absent and continue supplying power to the load within the specified backup time. Cold start on battery power shall be possible on the condition that the system shall have started at least once on normal AC power.

2.2 SIZING AND GENERAL CHARACTERISTICS:

a. **Technology:** UPS technology shall be based on **IGBT transistors** for all the power converters (rectifier, charger and inverter with variable chopping frequency).

b. **Rating:** The UPS shall be sized to continuously supply a load of 60kVA at Unity power factor. However, the UPS shall be **scalable up to 150kVA**.

c. **Battery backup time:** Each battery bank shall have a backup time of 15minutes in the event of a normal AC source outage for a unity power factor load.

d. Types of loads accepted:

i. The UPS system shall accept high crest factors without de-rating (kW) to ensure correct operation with computer loads and loads where the leading power factor can reach 0.9.

ii. The total harmonic voltage distortion at UPS output (THDU downstream) shall be ≤5% for non-linear loads and <3% for linear load in ph/ph.

e. **PFC sinusoidal-current input rectifiers**:

i. The UPS shall not draw a level of harmonic currents that could disturb the upstream AC system, i.e. it shall comply with the stipulations of guide IEC 61000-3-4.

ii. The PFC input rectifiers of the modular UPS units, using sinusoidal-current IGBTs, shall have the following performance levels:

1. Total harmonic current distortion (THDI) upstream of the rectifier not exceeding 5%.
2. Input power factor (PF) greater than 0.99 from 50% load upwards.

f. **Outputs without a transformer:** The output of UPS shall be of the transformer less type and the neutral shall be recreated electronically.

g. **Efficiency:** Overall efficiency (between the rectifier inputs and the UPS output) shall be greater than or equal to 94% from 50% load to full rated load (In).

h. **Noise level:** The noise level measured shall be as per standard ISO3746 and shall be less than 75 dBA.

2.3 AC SOURCES:

a. Normal AC source (rectifier input): The normal AC source supplying the UPS shall have the following characteristics under normal operating conditions:

i. Rated voltage: 415 V at full rated load three phase.

ii. Input voltage range: 415V ± 15%.

iii. Number of phases: 3 phases with a neutral

iv. Frequency: 50Hz ± 10%.

b. Bypass AC source (automatic-bypass input):

i. The characteristics of the bypass AC source supplying the UPS in the event of an inverter shutdown (maintenance, failure) or an overload (short-circuit, very high inrush current) shall be the following:

1. Voltage: 415volts, ± 10%
2. Number of phases: 3 ph + N + earth
3. Frequency: 50Hz ± 8% (adjustable up to ± 2 Hz)

2.4 ELECTRICAL CHARACTERISTICS

A. Rectifier and charger:

1. **Supply:** The PFC rectifier drawing sinusoidal current, shall be supplied by the normal AC source. It shall provide power for the load as well as charge or float charge the battery. The battery charger shall be supplied by the rectifier to avoid transmitting any AC fluctuations to the battery.
2. **Inrush current:** A device shall be provided to limit the inrush currents. When AC power fails and during DG set start, the rectifier shall limit the power drawn by implementing a walk-in for more than 10 seconds.
3. **Phase sequence:** A device shall check that the phase sequence is correct to protect the power system from the effects of incorrect connections. The device shall also check the bypass AC input.

4. **Operating mode:** The standard charger shall be sufficient to charge the battery rapidly for a backup time of **15 minutes**; battery recharging shall take less than 10 hours.
5. **Input power factor:** >0.99 from 50% load onwards.
6. Charger regulation and monitoring:
   - The battery recharge system shall include independent regulation and monitoring devices to ensure conformity with standard NFC 58311. Battery monitoring system shall be inbuilt in the UPS except sensors.
   - The battery recharge voltage shall be a function of the ambient temperature in the battery room/ battery cabinet.

B. Battery:

i. Two (02) nos of battery banks shall be provided.

ii. Each battery bank shall be designed for backup time of **15 minutes** in the event of a normal AC source outage given that the inverter is at load of 40kVA for a unity power factor.

iii. The UPS shall be equipped with a battery of the valve regulated leak proof AGM/ Gel of lead acid type, mounted and wired in a cabinet identical in aspect to that of the UPS and shall have a **service life of not less than 05 years**.

iv. Ambient temperature of 27° C shall be considered for battery sizing calculations.

v. The aging factor of 1.25 and design margin of 1.10 shall be considered in the battery sizing calculations as per IEEE 485 standards.

vi. The inverter efficiency (DC-AC) of 95% shall be considered for battery sizing calculations.

Note: Battery sizing calculation sheet shall be submitted along with technical bid.

C. Inverter:

1. Output voltage:

a. **Rated voltage:** 415 volts RMS, adjustable via the user interface, within tolerances of +/- 3% in order to take into account voltage drops in the cables.

b. **Number of phases:** 3 phases + neutral + earth.

c. **Steady-state conditions:** Variations in the rated voltage shall be limited to ± 1% for a balanced load between 0 and 100% of the rated load, whatever the voltage level on the normal AC source and the DC voltage level, within the defined limits.

d. **Voltage variations for load step changes:** Output voltage transients shall not exceed ± 5% of rated voltage for 0 to 100% or 100 to 0% step loads. In all cases, the voltage shall return to within steady-state tolerances in less than 100 milliseconds.

e. **Unbalanced conditions:** For a load unbalance between phases, the variation in the output voltage shall be less than 2%.

2. Output frequency

a. Rated frequency: 50Hz

b. Variations in the free-running frequency: ± 0.01 Hz

D. Synchronisation with bypass power:

1. **When bypass power is within tolerances:** To enable transfer to bypass power, the inverter output voltage shall be synchronised with the bypass source voltage whenever possible. To that end, during normal operation, a synchronisation system shall automatically limit the phase deviation between the voltages to 3 degrees, if the bypass source frequency is sufficiently stable (within adjustable tolerances of 0.5% to 8% with respect to the rated frequency).
2. **Synchronisation with an external source:** It shall be possible to synchronise with all types of external source.
3. **Autonomous operation following loss of synchronisation with bypass power:** When the bypass source frequency deviates beyond these limits, the inverter shall switch over to free-running mode with internal synchronisation, regulating its own frequency to within ± 0.01 Hz. When bypass power returns to within tolerances, the inverter shall automatically resynchronise.
4. **Variation in frequency per unit time:** To avoid transmitting to the inverter any excessive frequency variations on the bypass AC source when it is within tolerances, inverter frequency variations per unit time (dF/dt) shall be limited to 1 Hz/s.

E. Overload and short-circuit capacity: The UPS shall be capable of supplying for at least:

1. 10 minutes at 125% of the rated load
2. 60 second at 150% of the rated load

F. Automatic Bypass:

1. **Load transfer to the Static Bypass:**
    a. The UPS shall be equipped with an Automatic Bypass comprising a Static Switch.
    b. Instantaneous transfer of the load from the inverter to bypass power and back shall take place without a break or disturbance in the supply of power to the load, on the condition that the bypass source voltage and frequency are within the specified tolerances and that the inverter is synchronised.
    c. Transfer shall take place automatically in the event of a major overload or an internal inverter fault. Further, manually initiated transfer shall also be possible.
    d. If the bypass power is outside the specified tolerances or is not synchronised with the inverter, automatic transfer of the load from the inverter to bypass power shall take place seamless transfer with micro interruption.
2. **Static-switch protection:** The static switch shall be equipped with an RC filter for protection against switching over voltages and lightning strikes.
3. **Static-switch withstand:** The static switch shall be capable of handling an over current of 08 times the rated current of the UPS to facilitate discrimination within the electrical installation.

G. Discrimination and short-circuit capacity:

1. If the bypass power is within the specified tolerances, the static switch shall make it possible to use the short-circuit power of the bypass source to trip the downstream protection devices of the inverter.
2. To ensure tripping in a selective manner, the total available power shall be sufficient to trip protection devices with high ratings (circuit breaker rated In/2 or UR fuses rated In/4, where In is the rated inverter current).
3. If the bypass source is outside the specified tolerances, all the inverters in operation shall, for the same discrimination requirements, be capable of tripping circuit breakers rated In/2 or UR fuses rated In/4, irrespective of the type of short-circuit.

2.5 MECHANICAL CHARACTERISTICS:

A. Mechanical structure: The UPS and batteries shall be installed in cabinet(s) with an IP 20 degree of protection as per standard IEC 60529. Access to the subassemblies making up the system shall be exclusively through the front.

B. Dimensions: The UPS shall require as little floor space as possible. To gain space, it shall be possible to install the UPS with the back to the wall or back to back.

C. Connection:

1. To facilitate connections, all terminal blocks must be easily accessible from the front when the modular UPS units are installed with the back to the wall. Entry of upstream and downstream power cables, as well as any auxiliary cables, shall be possible through the bottom without requiring a false floor.
2. The UPS shall be equipped with an earth-circuit connector, in compliance with the IS or any international standards. The cables shall comply with IS or any international standards and be mounted in compliance with the safety stipulations.

D. Ventilation:

1. System cooling shall be by forced-air ventilation. To facilitate layout (particularly when installed back to the wall), air input shall be through the front and bottom, exit through the top.
2. All power electronics shall be equipped with a redundant ventilation system including fault detection.

E. Safety:

1. For the safety of maintenance personnel, the cabinet shall be provided with a manually operated mechanical bypass designed to isolate the rectifier, charger, inverter and static switch while continuing to supply the load from the bypass AC source.
2. The UPS shall be equipped with a terminal block for reception of an external EPO order resulting in opening of the battery circuit breaker and shutdown of all converters.

2.6 ENVIRONMENT CONDITIONS:

A. UPS (not including battery):

1. Operation: The UPS shall be capable of operating under the following environmental conditions without loss of performance:

a. Ambient temperature range: 0° C to +35° C
b. Maximum temperature: 40°C for eight hours
c. Recommended temperature range: +20° C to +25° C

d. Maximum relative humidity: 95% at 25° C

e. Maximum altitude without de-rating: 1000 meters

2. Storage: The UPS shall be designed for storage under the following conditions: ambient temperature range: -25° C to +45° C.

2.7 DISPLAY:

A. **User interface:** UPS operation shall be facilitated by a user interface comprising:

1. A graphic display (at least quarter VGA and high resolution);
2. ON and OFF control buttons (independent of the display);
3. Status indications with mimic panel.

B. **Graphic display:** The mimic diagram shall enable display of installation parameters, configuration, operating status and alarms and indication of operator instructions for switching operations (e.g. bypass). It shall be capable of supervising a single UPS unit as well as a parallel system with the external bypass.

1. **Display of measurements:** It shall be possible to display the following measurements for any one of the modular UPS units and/ or for the entire system:
    a. Inverter output phase-to-phase voltages
    b. Inverter output currents
    c. Inverter output frequency
    d. Battery charge or discharge current
    e. Active and apparent power
    f. Power factor of the load
    g. Battery percentage charge
    h. Available backup time

2. **Display of status conditions and events:** It shall be possible to display the following indications:
    a. Load on battery power
    b. Load on UPS
    c. Load on automatic bypass
    d. General alarm

e. Battery fault
f. Remaining battery backup time
g. Low battery warning
h. Bypass AC source outside tolerances
i. Battery temperature
j. Additional information shall be provided in view of accelerating servicing of the system.

3. **Display of operating graphs:** It shall be possible to graphically display the measurements mentioned above on the screen over significant periods.
4. **Log of time-stamped events:** This function shall store in memory and make available, for automatic or manually initiated recall, time-stamped logs of all important status changes, faults and malfunctions, complete with an analysis and display of troubleshooting procedures. It shall be possible to time stamp and store at least 2500 events.

C. **Controls:** The UPS shall comprise the following controls:

1. **Two ON and OFF buttons:** Located on the front panel of the UPS, they shall control UPS unit ON/OFF status. It shall be possible to turn OFF the UPS externally via an isolated dry contact.
2. **Emergency Power OFF (EPO):** The UPS shall be equipped with an Emergency power off (EPO) terminal block for complete system shutdown following reception of an external control signal. The EPO switch with break glass provision shall be provided. The EPO command shall result in:
    a. Shutdown of UPS units;
    b. Opening of the static switches on the bypass line and of the battery circuit breaker;
    c. Opening of an isolated dry contact on the programmable card.
3. **Alarm reset button:** This button shall turn off audio alarms (buzzer). If a new alarm is detected after clearing the first, the buzzer sounds again.

D. **Status indications with mimic panel:** Indication of status conditions shall be distinct of the graphic display.

1. Three LEDs on the control panel on each modular UPS unit indicate the following status conditions:
    a. Load protected;
    b. Minor fault;

c. Major fault.

2. The mimic panel shall represent the modular UPS and indicate the status of the load supply using five two-colour (red and green) LEDs:
    a. Load supplied (LED at UPS output on mimic panel),
    b. Inverter on (inverter LED on mimic panel),
    c. Operation on battery power (LED between battery and inverter on mimic panel)
    d. Bypass activated (bypass LED on mimic panel),
    e. PFC rectifier on (rectifier LED on mimic panel).
3. A buzzer shall warn the user of faults, malfunctions or operation on battery power.

2.8 ACCESSORIES: Network interface card / module shall be provided for remote monitoring.

2.9 COMMUNICATION:

A. **Standard communication:** It shall be possible to remote the following controls, indications and measurements. UPS shall have a programmable card with four inputs and six outputs.

B. **Communications:** The UPS shall be designed to enable the extension of communications, without system shutdown to the following types of cards:
1. Multi-standard communications card with two outputs:
    a. An RS485 serial-link implementing the ModBus protocol for connection to a Building Management System (BMS)/ SCADA.
    b. Ethernet 10/100 Mbps using one of the protocols below:
2. XML-Web for direct UPS connection without connection to a server, capable of supplying information via a standard web browser SNMP for connection to a computer-network management system.

3 EXECUTION:

3.1 PROTECTION:

A. **UPS:** The UPS shall include protection against AC-source over voltages (as per standard IEC 60146), excessive external or internal temperature rise and vibrations and impacts during transport.

B. **Rectifier and charger:**

1. The rectifier shall automatically shut down if the temperature exceeds the specified limits.
2. The charger shall automatically shut down if the DC voltage reaches the maximum value specified by the battery manufacturer or if the temperature exceeds the specified limits.

C. **Inverter:** Inverters shall self-protect against overloads and short-circuits, irrespective of the operating mode (AC power or battery power).

D. **Batteries:**

1. Protection against deep discharge: The UPS shall comprise a device designed to protect the battery against deep discharges, taking into account the characteristics of the discharge cycles with isolation of the batteries by a circuit breaker.
2. Independent regulation and monitoring systems:
    a. A regulation system shall regulate the battery voltage and the charge current.
    b. A second system, independent of the regulation, shall monitor the battery voltage and the charge current. Consequently, if the regulation system fails, the monitoring system steps in to shut down the charger and avoid overcharging.
3. Regulation of the battery voltage depending on the ambient temperature:
    a. A temperature sensor adapts the charge voltage of each charger to the ambient temperature.
    b. This regulation system takes into account the chemical reaction and prolongs the battery service life and prevents thermal runaway.
    c. The permissible temperature range is set in the personalisation parameters.
    d. An alarm shall be issued for temperatures outside the permissible range.
4. Self-test:
    a. The battery shall be equipped with a self-test that can be run:
        - On request via a manual control
        - Automatically according to user-set time intervals.
    b. The self-test shall enable updating of battery parameters and detection of all abnormal conditions as part of preventive maintenance.

3.2 MAINTAINABILITY:

1. A manual bypass shall be available to completely isolate the UPS for maintenance purposes.
2. Local and remote diagnostics and monitoring: The UPS shall be equipped with a self-test system to check operation of the system as a whole each time it is started. To that end, the supply control/monitoring electronics shall offer:
    a. Auto-compensation of component drift;
    b. Acquisition of information vital for computer-aided diagnostics or monitoring (local or remote);
    c. Overall readiness for remote supervision services provided by the manufacturer.

3.3 STANDARDS:

A. Standards: All equipment shall be designed and built in accordance with accepted engineering practice and applicable international standards, in particular the standards listed below.

1. IEC 60896-22: Stationary lead acid batteries - Part 22: Valve regulated types – requirement.
2. IEEE 1189: Guide for selection of valve regulated lead acid batteries for stationary applications.
3. IEEE 1187: Recommended practice for installation design and installation for selection of valve regulated lead acid batteries for stationary applications.
4. IEEE 1188: Recommended practice for maintenance, testing and replacement of valve regulated lead acid batteries for stationary applications.
5. IEEE 485: Recommended practice for sizing lead acid batteries for stationary application.
6. The function of the UPS system is to supply critical loads independently of the mains supply and therefore the system offered shall conform to the following standards and provisions:
    - IEC 62040-3 or EN 50091-3 (VFI SS 111)
    - IEC 62040-2
    - IEC 62040-3 and EN 62040-3: UPS - Performance.
    - IEC 60140-4: UPS - Performance.
    - IEC 62040-1 and EN 62040-1: UPS - Safety.
    - IEC 62040-2 and EN 62040-2: UPS - Electromagnetic compatibility (EMC), level B.

- IEC 60950 / EN 60950: Safety of IT equipment, including electrical business equipment.
- IEC 61000-2-2: EMC, levels of compatibility.
- IEC 61000-3-4: Limits for harmonic current emissions (equipment input current > 16A/ph).
- IEC 61000-4: EMC – Immunity tests.
- IEC 439: Low-voltage switchgear and control gear assemblies.
- IEC 60529: Degrees of protection provided by enclosures (IP Code).
- ISO 3746: Sound power levels.
- CE marking.
- IS:3043 For earthing/ grounding and IE rules

3.4 QUALITY SYSTEM AND TEST PROCEDURES:

A. Test procedures:

1. The manufacturer shall provide proof of a Quality-assurance system. In particular, the main manufacturing steps must be subject to suitable tests such as:
    a. Inspection of incoming components, tests on discrete subassemblies.
    b. Complete functional checks on termination of manufacture.
2. The equipment shall be subject to burn-in under load conditions prior to shipping.
3. Final checks and adjustments shall be recorded in a report drafted by the quality-inspection department of the supplier.
4. Certification of the industrial facilities in compliance with ISO 9001 or 9002 shall be required.

B. Quality system: The UPS must be designed using an ISO 9001 quality system and a dependability study to ensure maximum reliability.

3.5 SERVICES:

A. System start-up:

The system and equipment shall be started up on site by the supplier or its authorised agent. The procedure shall include checks on the characteristics of the upstream and downstream protection devices and on the UPS installation parameters.

B. Replacement parts:

The supplier shall undertake to provide certified original replacement parts for at least ten years following the date of delivery.

C. Recycling and renovation/substitution:

At the end of the UPS service life, the supplier shall guarantee the continuity of service of the customer's installations if necessary, including dismantling of equipment and replacement of equipment, in compliance with applicable standards on environmental protection.

3.6 Testing and start up:

3.6.1 FACTORY ASSISTED START-UP:

Factory trained service personnel shall perform the following inspections, test procedures and on-site training:

A. Visual Inspection:

1. Inspect equipment for signs of damage.
2. Verify installation as per manufacturer’s instructions.
3. Inspect cabinets for foreign objects.
4. Inspect Battery Banks.
5. Inspect Power Modules.

B. Mechanical Inspection:

1. Check all UPS and Battery banks.

C. Electrical Inspection:

1. Verify correct input and bypass voltage.
2. Verify correct phase rotation of all mains connections.
3. Verify correct UPS control wiring and terminations.
4. Verify voltage of all battery modules.
5. Verify neutral and ground conductors are properly landed.

D. Site Testing:

1. Ensure proper system start-up.
2. Verify proper firmware control functions.
3. Verify proper firmware bypass operation.
4. Verify proper maintenance bypass switch operation.

5. Verify system set points.
6. Verify proper inverter operation and regulation circuits.
7. Simulate utility power failure.
8. Verify proper charger operation.
9. Document, sign, and date all test results.
10. On-Site Operational Training: During the factory assisted start-up, operational training for site personnel shall include key pad operation, LED indicators, start-up and shutdown procedures, maintenance bypass and AC disconnect operation, and alarm information.

1.7 SUBMITTAL:

Tenderer shall submit the following without which offer will not be considered:

3.7.1 Bill of materials clearly indicating the items considered in the offer.

3.7.2 Product catalogues or equipment brochures.

3.7.3 Product specifications.

3.7.4 System single-line operation diagram.

3.7.5 Installation information, including weights and dimensions.

3.7.6 Information about terminal locations for power and control connections.

3.7.7 The following documents shall be submitted along with Delivery in both hard copy and soft copy:

3.7.7.1 Installation manual, which includes instructions for storage, handling, examination, preparation, installation and start-up of UPS.

3.7.7.2 User manual, which includes operating instructions.

3.7.7.3 As built equipment drawings for the standard solution.

3.7.7.4 Test reports.

3.7.7.5 Warranty card for both UPS and battery.

3.7.7.6 Contact details for after sales service and call escalation details.

3.8 Notes to the vendor:

3.8.1 Vendor should carefully consider all the clauses in the specifications and should ensure that their offer is complete in all respects at the time of submission.

3.8.2 Complete technical documentation justifying the compliance should be enclosed along with their offer. Offers which are incomplete are liable to be considered non-compliant and are liable for rejection.

3.8.3 For all items in the list of deliverables offered by the vendor, the manufacturer's part number should be clearly indicated. Offer of items without clear specification of part number is not acceptable.

3.8.4 Specifications of the major items have been provided in the enclosed document. In case any additional accessories/ software media/licenses are required to complete the configuration for full functionality and/or better manageability, vendor should include such hardware accessories and related software elements or plug-ins in their offer.

3.8.5 The Unit should be latest products from the manufacturers. Obsolete/retired/on the verge of obsolescence system/ subsystem should not be configured/ not offered.

3.8.6 **The system is intended to be used in Mission Critical Applications and shall be of high reliability and quality.**

3.8.7 Systems from the manufacturers who primarily assemble systems by getting components/ subsystems from different suppliers and who do not have direct control over the production process/ quality of the items so obtained, will not be acceptable.

3.8.8 Vendors are requested to submit the technical offer as per the format enclosed.

3.8.9 Vendor shall submit details of escalation of call for service.

SPECIFICATION FOR VALVE REGULATED (SEALED) LEAD ACID STATIONARY BATTERY FOR UPS BACKUP

Valve regulated Lead Acid (VRLA) Battery: A lead acid battery with an immobilized electrolyte that is sealed in terms of electrolyte maintenance. The battery contains a pressure relief valve that releases internal pressure to the atmosphere when the cell pressure exceeds a manufacturer's prescribed level. The immobilizing electrolyte medium accommodates an oxygen recombination cycle thus minimizing gassing and water consumption.

1. This specification requires reference to the following standards:

IEEE 1189: Guide for selection of valve regulated lead acid batteries for stationary applications

IEEE 1187: Recommended practice for installation design and installation for selection of valve regulated lead acid batteries for stationary applications

IEEE 1188: Recommended practice for maintenance, testing and replacement of valve regulated lead acid batteries for stationary applications

IEEE 485: Recommended practice for sizing lead acid batteries for stationary application.

IEC 60896-22: Stationary lead acid batteries - part 22: Valve regulated types - requirement.

Battery design shall be in accordance with IEC 60896-21/22 & Eurobat classification.

1.1 Service life of the battery shall be not less than 05 years.

2. Constructions: VRLA battery shall be gel or absorbed glass mat construction.

2.1 Inter-cell connections: The inter-cell connections shall be sufficiently robust to withstand a 1minute short circuit condition without damage to either the connection or the container and the cover assembly.

2.2 Valve: The valve shall operate at the specified pressure and tolerance limits. The valve shall not allow ingress of air into the unit. All the cells shall be subjected to pressure test up to 10 psi. The vent plug used shall be explosion resistant and self-re-sealing and pressure regulating type. Vent plug shall be such that it cannot be opened without proper tool.

2.3 Nuts and Bolts: Nuts and bolts for connecting the cells shall be made of copper, brass or stainless steel and effectively lead coated to prevent corrosion. Stainless steel bolts/nuts can be used without lead coating. Stainless steel used shall be of special grade which is resistant to sulphuric acid.

3. Performance:

3.1 Rated capacity: Batteries shall be rated in ampere hour at constant current discharge at 27^0C for 20 hour (C_{20}) discharge rate to 1.75V per cell. Ampere hour efficiency shall be better than 90% and Watt hour efficiency batter than 80%.

3.2 Storage life: The block shall have discharge of not more than 5% per month at 25ºC and shall be capable of being restored to full rated capacity after 6months storage at 25ºC utilizing the battery manufacturers recommended freshening charge practice.

3.3 Ripple current tolerance: The battery shall be able to withstand up to 5 ampere per 100Ah rated capacity at the 20 hour rate without significant heating less than 1^0C or degradation in the expected life.

3.4 Thermal runaway Resistance: The battery shall be capable of withstanding the following conditions without entering thermal runaway.

2.4 volts per cell charging voltage at 40^0C - indefinite

2.45 volts per cell charging voltage at 40^0C - 168hours

2.5 volts per cell charging voltage at 40^0C - 72hours

4. Acceptance test: The acceptance tests shall be performed at the manufacturer's premises before dispatch in the presence of department engineer if batteries manufactured in India or the acceptance test shall be conducted at site if batteries are imported.

The following shall constitute the acceptance tests

a) Test for capacity

b) Test for voltages during discharge.

5. Packing: Vendors/tenderers shall be responsible for safe transportation of cells/ battery, which should be packed and delivered in good condition to the respective site as indicated in the tender. If there is any damage, vendors/tenderers shall replace the damaged cell/ battery free of cost.

6. Manual of instructions: Two copies of instruction manual of initial treatment and routine maintenance during service shall be supplied by the manufacturer along with every set of battery.

Annexure-A

Information as per format given below is to be furnished by the tenderer in techno-commercial bid failing which offer will not be considered

Sl. No.	Tender specification	Compliance (Yes/ No)	Tenderer's specification	Remarks
1	The capacity of the Modular UPS shall not be less than 60kVA. The Modular UPS shall be scalable up to 150kVA.			
2	Single UPS cabinet of capacity not less than 150kVA shall be provided.			
3	UPS shall utilize rack mounted redundant scalable array architecture.			
4	UPS system power train shall be comprised of hot swappable/ user replaceable power modules, which shall operate in parallel. Each power modules shall be rated not less than 20kVA and not more than 30kVA.			
5	The No. of Power Modules offered shall not be less than 03.			
6	Each power module contains a full rated input rectifier / boost converter, full rated output inverter, and battery charging circuit.			
7	The system shall also comprise of a user-replaceable continuous duty hot swappable bypass static switch module rated for 150kVA, hot swappable / user replaceable battery modules, redundant control modules, redundant logic power supplies, and LCD interface display.			
8	All of the above system components shall be housed in a standard IT rack.			
9	The UPS shall be designed to permit ready access to modules and assemblies in the front only. The placement of parts, test points and terminals shall be			

Sl. No.	Tender specification	Compliance (Yes/ No)	Tenderer's specification	Remarks
	such that they are accessible for circuit checking, adjustment and maintenance without removal of any adjustment module or assembly.			
10	All power semiconductors in the module shall be protected by fast acting fuses so that failure of any one power semiconductor will not cause cascading failures.			
11	Each fuse shall preferably be provided with a blown fuse indicator on the control panel. The UPS module shall not incur permanent damage to itself and the connected load under all predictable types of failure conditions within itself and the connected load.			
12	UPS shall be designed to interface and operate with DG set to maintain UPS supply in case of utility supply failure without any distortion on DG supply or hunting or de-rating DG set.			
13	Qty.: 01 set (Each set consist of 60kVA Modular UPS System with 02 sets of Battery banks)			
14	Approved makes of Modular UPS: ABB, APC, DELTA, NUMERIC (LEGRAND), RIELLO, SOCOMEC and VERTIV.			
15	Series, Model			
16	Input rated voltage: 415V three phase 4wire AC system			
17	Input voltage range: 415V $\pm$15%			
18	Rated frequency: 50HZ and frequency range: 45-55HZ (autosensing)			
19	Input Current Harmonic Distortion: <5% at 100% non-linear load			

Annexure-A

Sl. No.	Tender specification	Compliance (Yes/ No)	Tenderer's specification	Remarks
20	Maximum input current at rated load & power factor			
21	Maximum input current with battery charging (line current)			
22	AC-AC efficiency for nonlinear loads			
23	Total Head Dissipation in BTU: At 100% load At 50% load			
24	Output nominal voltage: 415V three phase 4wire AC system			
25	Output frequency regulation: 50HZ when bypass input not present. Frequency synchronized to bypass when input frequency between 48.5 - 51.5 HZ with regulation of ±1%			
26	Transient Voltage Recovery time: <100msec			
27	Output voltage distortion factor: <3% with linear load, <5% with non-linear load			
28	Output wave form: Sinusoidal			
29	Overload capacity: 150% for 60 sec			
30	Overload capacity: 125% for 10min			
31	Maximum crest factor: 3:1			
32	Battery charging current (max)			
33	Walk in time:			
34	Converter output (DC Voltage) and ripple on DC bus			
35	Inverter Technology: Transformer less IGBT based PWM			
36	The Static Bypass Switch shall be **hot swappable**. The static bypass shall be used to provide transfer of critical load from the Inverter output to the bypass source. This transfer, along with its retransfer, shall take place with no power interruption to the critical load.			
37	Static Bypass Switch shall be rated for not less than 150kVA.			

Sl. No.	Tender specification	Compliance (Yes/ No)	Tenderer's specification	Remarks
38	Static Bypass Switch: rated voltage 415V			
39	Static Bypass Switch: Voltage tolerance ± 10%			
40	Static Bypass Switch: Rated frequency 50Hz			
41	Static Bypass Switch: Frequency tolerance ± 10%			
42	**Maintenance Bypass Switch:** The UPS system shall be equipped with inbuilt Maintenance Bypass Switch used to electrically isolate the UPS and supply the load directly from the mains supply, if the UPS system has to undergo maintenance or service. If inbuilt Maintenance Bypass Switch facility is not available in the UPS system, the external bypass arrangement in the auxiliary cabinet for total uninterruptible isolation of the UPS shall be provided in order to isolate both the input side and the output side of the UPS systems for the maintenance without interrupting the supply to the load.			
43	Cooling method adopted/ type of cooling			
44	Environmental protection			
45	Audible Noise in dbA at 1 Mtr			
46	Efficiency AC/AC (overall) a) At full load b) At 75% load c) At 50% load d) At 25% load			
50	MTBF			
51	MTTR			
52	Batteries: 12V VRLA Sealed Maintenance Free Battery of			

Sl. No.	Tender specification	Compliance (Yes/ No)	Tenderer's specification	Remarks
	AGM or GEL type			
53	**Approved makes of Battery:** AMARA RAJA, AMCO, EXIDE, PANASONIC and SONNENSCHEIN			
54	Battery Model:			
55	No. of battery banks: 02 sets			
56	No. of batteries per bank:			
57	Each Battery bank backup time: 15 minutes for full load of 40kVA			
58	Battery bank voltage			
59	Battery capacity in AH for 10 hour discharge rate			
60	Closed Battery stands with cover shall be provided			
61	Inter-cell/ Row/ Tier connection shall be included for battery connections.			
62	External battery breaker for each bank shall be provided			
63	Dimension of UPS cabinet a) Width (in mm.) b) Depth (in mm.) c) Height (in mm.)			
64	Dimension of Battery stand a) Width (in mm.) b) Depth (in mm.) c) Height (in mm.)			
65	Provide the list of tests offered: a. At factory: b. At site			
66	**Emergency Power OFF (EPO):** The UPS shall be equipped with an Emergency power off (EPO)			

Sl. No.	Tender specification	Compliance (Yes/ No)	Tenderer's specification	Remarks
	terminal block for complete system shutdown following reception of an external control signal. The EPO switch with break glass provision shall be provided.			
67	Supply of **300mtrs** suitable size Uninyvin Copper cables (MIRACLE make) shall be supplied for connecting between the UPS, DC breaker, Battery banks and Laying of Uninyvin Copper cables in good condition with supply of suitable size Steel wired reinforced (SWR) PVC flexible conduit pipes and necessary materials such as brackets, clamps, MS spacers including.			
68	Providing end terminations for Uninyvin cables including supply of PVC cable glands, 3D long barrel heavy duty tin plated copper lugs, neoprene bushes and other materials and tools required complete with terminal connection.			
69	Supply and laying of communication cable through suitable conduit and end connections - 200 mtrs			
70	**Supply and installation of Remote display panel:** The remote display shall display the measurements of Input and output parameters of Voltage, Current, Frequency and Battery current, Percentage charge, Back-up time available including indications.			
71	**Place of delivery and installation including packing, forwarding freight charges:** IRCDR building, ISTRAC Trivandrum Ground Station, VSSC, Veli, Thiruvananthapuram, Kerala.			
72	Documentary evidence			

Annexure-A

Sl. No.	Tender specification	Compliance (Yes/ No)	Tenderer's specification	Remarks
	(Installation & Commissioning Certificate) for having installed similar Modular UPS in any industry and their performance for the past 03 years **(Service reports)** has to be submitted. Failing which, the offer will be out rightly rejected.			
73	Vendors shall enclose an **Authorization certificate from the UPS manufacturer** that the vendor is authorised to quote for the offered product to ISTRAC and that the manufacturer will support the delivery and warranty. Failing which, the offer will be out rightly rejected.			
74	**Warranty:** The fully assembled Modular UPS system with Battery banks shall be warranted for a period of **03 years** from the date of commissioning.			