

## **SPECIFICATION: SUPPLY, DELIVER AND INSTALL UPS**

### **1. LOCATION OF WORKS**

- The works will be in the Port of East London at CRD building.
- The area is access controlled and all security and safety protocols must be adhered to.

### **2. SPECIFICATION AND SCOPE OF WORK**

#### **2.1. Standards and specifications**

The work must be carried out strictly in accordance with:

##### **2.1.1 Standards adherence**

- The bidder shall be aware that the standards to be adhered to are not limited to the listed below ones, should the bidder be the successful bidder.

##### **2.1.1.1. Relevant standards and sans standards**

- SANS 10111 (Latest): Engineering drawing
- The Occupational Health and Safety Act and Regulations (Act no. 85 of 1993 as amended)
- Any municipal by-laws and regulations
- The local authority requirements
- The earthing of low voltage distribution systems – SANS 10292
- The National Building Regulations – SANS 10400
- SANS 10142 – Code of Practice for the wiring of Premises

#### **2.2. Scope of Works**

- This specification is for the supply, delivery, installation, testing and commissioning of 1x30KVA three phase uninterruptible power supply (UPS). The UPS unit shall consist of a rectifier/charger, inverter, and manual bypass switch.
- The application of the UPS shall be solely to supply power when it has been cut-off and ensure interference free power at CRD Server room and Security Control

room. The equipment requiring the power is a critical load, which is sensitive to frequency deviations, voltage transients and voltage dips. The UPS system shall compensate for the variations in the input supply as any irregularities will affect the load. The UPS shall comprise of the following major components:

- PFC Rectifier
  - Battery charger
  - Inverter
  - Battery
  - Automatic bypass (Via a static switch)
  - User and communications interface
  - Battery management system
- The UPS shall be based on six-pack IGBT technology with built-in thermal monitoring and frequency chopping mode to dynamically optimise efficiency and power quality.
- The UPS shall accept high crest factors (3:1) without derating to ensure correct operation with computer loads.
- The UPS machine shall be equipped with completely sealed; maintenance free 10-year batteries rated for 30 minutes at full load rated 0.8 pf. The battery bank shall be split into 4 strings each controlled via separate isolators, to allow each string to be serviced independently, without affecting operation of the UPS.
- The *Contractor* shall supply and install cabling, sub-DB and all accessories to ensure successful operation of UPS. The *Contractor* to calculate and provide the correct cable sizes as per SANS 10142-1.
- The *Contractor* will be responsible for making good in all trades, damage or disturbances to the building, installation, concrete surfaces, and other existing services may have been interrupted during installation.

## 2.3. Technical Specifications

- Input specifications
  - Nominal mains supply 400/231V  $\pm$  10% 50Hz  $\pm$  5%
  - System 3-phase, 4-wire, earthed neutral.
  - Input fault level 350 MVA at 400V (rms)
- Output specifications
  - Nominal load power factor 0.8
  - Output voltage tolerance Steady state: 400V  $\pm$  5%
  - Transient 400V +8%/-10% (30 cycles duration)
  - Frequency  $\pm$  1%
  - Load unbalance 30%
  - Maximum harmonic content 15%
  - Inverter overload capability 150% - 10 sec
  - Static: 110%-1 hour

## 4 TECHNICAL REQUIREMENTS

### 4.1. AC to DC Battery Charger

- The UPS system shall be provided with a supply via the normal incoming cable from the diesel-driven standby plant in the event of a mains failure.
- The UPS control system shall be arranged to limit boost charging of the battery system when UPS is supplied from the standby supply. A voltage free N/O contact shall be provided to signal operation of the standby plant.
- A Battery System of sufficient capacity to supply the specified inverter load for the required time shall be provided. Each single/modular UPS unit shall be equipped with its own battery of the sealed lead-acid type, mounted, and wired in a cabinet identical in aspect to that of the UPS and shall have a service life of 10-years.
- The *Contractor* shall state the 10-hour discharge capacity of the batteries and the battery voltage at its terminals under various conditions.

#### **4.2. DC to AC Inverter**

- A solid-state DC to AC inverter providing a three-phase output within the specified output requirements from a DC source originating from the rectifier or battery output shall be provided. Self-commutated or load commutated and three single phase units phase controlled within 120 electrical degrees or three phase inverter bridges are acceptable. The inverter shall be fully rated to provide the specified output power between the upper and lower battery voltage limits.
- The inverter shall be adequately protected against excessive overloads or short circuits that may occur in the load.
- The UPS shall be capable of supplying for at least 10 minutes a load representing 125% of the rated load and 30 seconds a load is representing 150% of the rated load.
- The overload capacity shall be capable of considering temperature conditions for more than ten minutes, by allowing a continuous, 10% overload when the temperature is less than or equal to 200 C. The output of the inverters is of the transformer less type and the neutral shall be recreated electronically.
- The IGBT inverter bridge shall contain the necessary auxiliary circuitry to ensure satisfactory operation with non-linear loads such as saturating transformers or other rectifier bridges as well as loads with low power factors.
- The inverter shall be switched off as soon as the DC input reaches a predetermined minimum value.
- The output of the inverter shall be connected through a very high-speed electronic switch to the output busbar. The switch shall be capable of disconnecting the inverter when operating at full load at any power factor from the output busbar in less than 1 msec.
- The operation of the electronic switch shall be such that failure of the inverter will cause the switch to isolate the faulty inverter from the busbar without any disturbance to the load.
- A soft start circuit shall be provided at the input to the inverter to limit inrush current at switch on. The DC input to the inverter shall be fuse protected.
- An isolator shall be provided allowing the inverter and electronic switch to be isolated from the output busbar for maintenance purposes.

- The instrumentation, alarms and controls may be placed on either an inverter panel or the bypass switch front panel. All controls shall be arranged on a system schematic provided on the front panel to simplify the control and identification.

#### **4.3. Auto Bypass Switch**

- A very high-speed electronic bypass switch (static switch) shall be connected in parallel to the rectifier/inverter between the mains and output busbar. Transfer shall take place automatically without a break in the event of a major overload or on an internal inverter fault on the condition that bypass source voltage and frequency are within specified tolerances and that the inverter is synchronised. Manually initiated transfer shall also be possible.
- The Static switch shall be equipped with an RC filter for protection against switching overvoltage's and lightning strikes. An input and output isolator shall isolate the switch for maintenance purposes.

#### **4.4. Mechanical Bypass**

A manually operated, quick make, quick break, fault break load make isolator rated for the full output load of the system, shall be provided as bypass circuit from load to mains, enabling maintenance of the rectifier/inverter system and electronic switch.

#### **4.5. Indications Controls and Alarms**

- UPS system operation shall be facilitated by a user interface on each of the modular UPS units, comprising:
- The UPS should have a simple, user friendly system of control and indication.
- Start-up shall be limited to a few actions such as closing the input circuit breaker to automatically start the charger/ rectifier, closing the battery circuit breaker and a push-button to start the inverter.
  - A graphic display [at least quarter VGA and high resolution are preferable.
  - ON and OFF control buttons [independent of the display]
  - Status indications with mimic panel.

#### **4.5.1. Alarm Indications**

- Low Battery / Shutdown imminent
- Charger Fault
- Rectifier Fault
- Inverter Fault
- Mains 2 Fault
- Phase Rotation Fault
- Rectifier Temperature
- Inverter Temperature Fault
- Battery Circuit Open
- Thermal Overload
- Inverter Shutdown on Low Battery
- Overload
- Battery Fault
- Load Protected / Power Supply OK
- Load Protected / Minor Fault
- Load Protected / Battery Discharging
- Load on Automatic Bypass

#### **4.5.2. Measurement Display**

- Inverter output currents
- Inverter output frequency
- Voltage across battery terminals
- Battery charge or discharge current.
- Rectifier/charger input phase-to-phase voltages
- Rectifier/charger input currents
- Crest factor
- Active and apparent power
- Power factor of the load
- Battery temperature
- Battery percent charge
- Available backup time

- 
- The remaining battery service life

#### **4.6. Battery Monitoring**

- The UPS shall be standard with the following enhanced battery protection.
- The charger cycle shall adapt to ambient temperature charges.
- The UPS via the battery monitor shall be protected against deep discharges.
- The battery monitor shall precisely measure the remaining backup time.
- The battery monitor shall do the following tests:
  - Battery circuit test every 12 hours.
  - Open circuit battery tests every month.
  - Partial discharge tests every 3 months.
  - Alarm indicating the end of battery service life.
- All the features of the battery monitoring testing shall be done automatic and manually.
- Any negative results or faults indications shall produce visual indications and shall send messages via the remote diagnostic service.

#### **4.7. Advanced Communications**

The UPS shall be supplied with management hardware and software for remote monitoring facilities via local area network i.e.

- Graphic monitoring of UPS status
- Detailed UPS parameter display
- Events log and graphical display
- Block and functional diagrams
- Notification of alarms via e-mail, SMS etc.

#### **4.8. PCB Coating**

The PCBs must be conformably coated to provide superior protection against:

Dust, Dirt, Abrasion, Fungus, Moisture, Chemicals, Mechanical stress, Shock and vibration, and salt air environment.

#### **4.9. Service conditions**

All electrical equipment shall be suitable for operating under the following conditions.

#### **Environmental Conditions**

Altitude	0 to 1800m without de-rating
Ambient temperature	0 to 40° C (Continuous)
Relative Humidity	Up to 95% (non-condensing)

### **5 ADDITIONAL REQUIREMENTS**

- The system shall be offered complete in all respects, including all standard equipment normally offered by manufacturers, users manuals. Layout and interconnection diagrams, to all of which shall be specified in detail during the tendering stage.
- Any further items of equipment and accessories not listed above but considered essential by the tenderer, shall be detailed, and quoted for separately under the heading "Additional Requirements".
- Whether all essential renewable parts for the system will be readily available in the Republic of South Africa.

### **6 INSTALLATION**

- Tenderers shall be required to install and commission the units.
- The Contract includes the provision of all connectors, mounting brackets, cable ducts and trays etc., required by the system.
- The *Contractor* will be responsible for making good in all trades, and damage or disturbance to the buildings, installation, tarred surface, concrete surfaces, drains



and other services, which he or his employees may have caused during the construction of the system.

- The *Contractor* will be responsible for keeping the site tidy during the construction of the system and shall remove from the site all rubble and litter resulting from the work.

## 7 GENERAL

- The UPS equipment shall provide continuous interference free power to essential equipment.
- The equipment requiring the power is a critical load, which is sensitive to frequency deviations, voltage transients and voltage dips. The UPS system shall compensate for the variations in the input supply as any irregularities will affect the load.
- This aspect shall be carefully considered when proposing UPS machines as the static UPS machines will be deployed to supply computers, building energy management systems and data processing equipment which has shown to have an extremely aggressive load profile.
- The UPS shall accept high crest factors (3:1) without derating to ensure correct operation with computer loads.
- The UPS shall comprise of the following major components for each system as numbered in the Detailed Technical section of this document:
  - PFC Rectifier
  - Battery charger
  - Inverter
  - Battery
  - Automatic bypass [via a static switch]
  - User and communications interface
  - Battery management system
- The UPS shall be based on six-pack IGBT technology with built-in thermal monitoring and a Frequency chopping mode to dynamically optimise efficiency and power quality.
- Input power factor (pf) greater than or equal to 0.99

---

## 8 GUARANTEES

All equipment offered shall be guaranteed to be free of defects for a minimum period of 36 months or as per OEM supplier. Full details must be provided.

## 9 COMPLETION, TESTING AND CORRECTION OF DEFECTS

The work to be done by the Completion Date stipulated:

- On or before the Completion Date the *Contractor* shall have done everything required to provide the works including the work listed as per the scope of work which is to be done before the Completion Date and in any case before the dates stated.
- The *Employer* cannot certify completion until all the work listed on the scope of work has been done and is also free of defects, which would have, in his/her opinion, prevented the *Employer* from using the works and others from doing their work.
- All remedial work regarding the closing of holes and making right any areas affected by the works will be done by the *Contractor* and approved by the Civil Supervisor before sign-off for the works.

## 10 SAFETY

The *Contractor* shall:

- shall accept his obligation to complying fully with Transnet safety requirements.
- provide a written Health and Safety plan.
- provide a basic risk assessment that covers the work to be undertaken.
- Always keep a safety file.
- provide proof of induction before the commencement of the work.
- keep a site diary and instruction book.
- be responsible to arrange occupations.
- TNPA reserves the right to audit the Tenderer's office and workshop.
- allow for induction before starting with the works.

---

## 11 ENVIRONMENTAL RESPONSIBILITY

The *Contractor* shall:

- separate hazardous or non-hazardous waste and where practical, waste for recycling prior to disposing thereof.
- also undertakes to minimize the amount of waste generated or released, whether it is hazardous or non-hazardous waste, as far as possible to reduce the impact on the Environment.
- undertake to dispose of all waste generated, albeit hazardous or non-hazardous waste in a responsible manner and submit proof of all disposal documents to the Project Engineer.