

DETAILED SPECIFICATION

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PART V - DETAILED SPECIFICATION

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1. SCOPE OF WORK

1.1 General

The works to be carried out consists of the engineering, supply, erection, testing, commissioning into service, guarantee and maintenance of the UPS and electrical installation as described herein.

The engineering and quality control, equipment selection, shop drawings, testing, commissioning and preparation of operating and maintenance manuals, and inspections are to be executed in a systematic manner, once programmed, under the Engineer's general supervision and direction. The preparation and submission for approval by SANSA for:

- a) Equipment Selection
- b) Shop Drawings
- c) Testing and Commissioning Documentation
- d) Operating and Maintenance Manuals
- e) Inspection Reports/Check lists

shall be in accordance with the project management procedures defined by SANSA.

The Contractor shall familiarise himself with these project management procedures and submit the detailed cost breakdown of his engineering and management as listed in the Schedule of Quantities.

1.2 Specification and Drawings

1.2.1 Drawings and Specification

Any drawings issued to show general layout of all equipment and reticulation systems, complete with schematic arrangements, together with this specification, give sufficient information to enable the Tenderer to calculate the cost and to determine how the system must be installed, tested, inspected, operated, serviced and maintained.

These drawings are not dimensioned installation drawings, and cannot be used as construction/shop drawings. Location dimensions shown are only indicative of the routes and zones in which the service must be installed.

1.3 Installation Drawings

1.3.1 Structural Drawings

The Contractor shall supply to SANSA marked-up structural drawings or other drawings showing any changes or additional requirements to be made in the structure in order to fit apparatus and materials to be installed by him. However, it will be the Contractor's responsibility to ensure that sufficient installation clearance is provided for positioning the selected equipment into the building space provided.

1.3.2 Shop Drawings

Copies of shop drawings of all parts of the Contract works shall be submitted to SANSA for approval. These drawings shall indicate all equipment, reticulation and wire way requirements, testing/inspection/instrumentation positions, access and space requirements and builder's work requirements.

Builder's work requirements shall include all work by others (holes in concrete, frames, masonry holes, bases, etc.) as well as the sizes, capacities and positions of electrical connections.

The Contractor may, if he so desires, obtain copies of the plantroom drawings (either

electronically or by hard copy) for modifications and updating if required. These drawings shall be re-titled in accordance with the Contractor's system and shall thereafter be submitted as the Contractor's shop drawings. No portion of the Contractor's works shall be commenced until the shop drawing has been approved by SANSA.

'As built' drawings on CD and in paper copy format shall be furnished on completion. These shall comprise the shop drawings as specified above, embodying all modifications made during construction, and further system diagrams indicating the intended functioning, capacity data and control functioning of all systems. (The works shall not be certified as complete unless these drawings and the specified Operating and Maintenance Manuals have been submitted).

1.4 Submission

Submission for approval will consist of the following activities executed by the Contractor and other parties involved:-

The Contractor shall review, stamp, date and sign to signify his approval and submit in the manner required by SANSA with reasonable promptness and in orderly sequence so as to cause no delay in the work, all contractor's drawings and samples required by the Contract documents or subsequently by the Client. Contractor's drawings and samples shall be properly identified as specified or as the Client may require.

At the time of submission the Contractor shall inform the Project Manager in writing of any deviation in the Contractor's drawings or samples from the requirements of the sub-contract documents.

The drawings shall be submitted in a number of copies and along the channels directed by the Project Manager for approval.

By submitting drawings and samples, the Contractor represents that he has determined and verified all site measurements, site instruction criteria, materials, catalogue numbers and similar data, or will do so, and that he has checked and co-ordinated each Contractor's drawing and sample with the requirements of the Works and of the Contract documents.

SANSA will review and approve construction drawings and samples with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the sub-contract works and with the information given in the sub-contract documents. The approval of a separate item shall not indicate approval of an assembly in which the item functions.

The Contractor shall make any corrections required by the SANSA and shall re-submit the required number of corrected copies of Contractor's drawings or new samples until approved.

The Contractor shall direct specified attention in writing on re-submitted drawings to revisions other than the corrections required by SANSA on previous submissions.

No portion of the Contract works requiring a Contractor's drawing or sample submission shall be commenced until the submission has been approved.

1.5 Samples

Samples are any samples required by the Client. Samples shall be physical examples to illustrate materials, equipment or workmanship and to establish standards by which the works may be judged. Such samples, after approval, will be retained by the Client for a period sufficient to ascertain that the relevant component is actually provided as per such sample, but will then be returned to the Contractor for incorporation in the works.

1.6 Programming

The Contractor shall submit within two weeks of receipt of the Main Contractor's overall programme, a practicable work programme in reproducible form, based on the Main Contractor's programme in accordance with the relevant clauses of the Contract.

The section of the programme covering submission of equipment selection and the installation drawings, preparation of Operating and Maintenance Manuals, Testing, Balancing and Commissioning shall be presented in the form of a network analysis in accordance with procedures generally referred to as Programme Evaluation Review Technique (PERT) or Critical Path Method (CPM).

The network graphic representation must clearly depict the sequence of the activities planned by the Contractor, according to the Main Contractor's requirements, their interdependence, and time required to perform each activity. In developing the project network, the Contractor shall use arrow or precedence notation (on which available computer programmes are based).

The Contractor shall furnish with the initial programme, a tabular listing of all activities listed on the programme. For each activity there shall be listed the earliest and later finish times and the "float". Activities on the critical path shall be so indicated.

The Contractor shall regularly, throughout the progress of the works, amend and update the work schedule (both the network graphic representation and the tabular list of activities) to incorporate all variations, new drawings and site instructions, and all such amendments are to be subject to SANSA approval and shall not amend the completion date of the project unless extensions of time have been granted by the Client.

If in the opinion of SANSA, the Contractor falls behind the programme, the Contractor shall take such steps as may be necessary to improve his progress, and the Main Contractor may require him to increase the number of shifts and/or overtime operation, days of work and/or the amount of construction plant, and to submit for approval revised programmes in the form required above in order to demonstrate the manner in which the required rate of progress will be achieved, all without additional cost to SANSA.

Regular meetings to monitor progress will be held under the chairmanship of the Main Contractor. The meetings must be attended by as many of the representatives of the Contractor as the Main Contractor shall require and in addition the meetings may be attended other firms involved in the project and by representatives of the Quantity Surveyor and the Clerk of Works, at their opinion.

The purpose of such meeting will be to review progress against the programme, to investigate and establish actual or impending causes of delays, to instruct on such remedial action as may from time to time be necessary and generally to ensure that the progress of the work remains on programme at all times.

1.7 Contract Management

All activities, information required, approvals, etc. shall be managed by the officially appointed Contractor's Project Engineer/Manager to ensure completion of the Contract at specified completion date and specified quality.

- It shall be the duty and responsibility of this Project Manager to identify any item such as delays, activity time overrun, late information and/or approval at least fortnightly, and describe in his standard report proposed action to overcome the adverse conditions to maintain the planned construction schedule.
- It shall be the duty and responsibility of this Project Manager to prepare a detailed

tabulated construction activities breakdown with related earliest and latest dates for information required, approval, area availability and inspection.

Construction activities are:

1. Equipment Selection and Submission
 2. Construction Drawings
 3. Off Site Manufacturing
 4. Installation on Site
 5. Testing of completed work.
 6. Minimum of 40 Hours Training
 7. 12 months guarantee and free maintenance period, including all spares
 8. After guarantee expiry maintenance ass per BOQ
- The project manager shall monthly, throughout the progress of the Contract, amend and update the 'tabular list of activities' to incorporate all variations, delays and remedial action to ensure that the completion date will be met. He shall particularly note and report on unusual conditions encountered, which may (or has) delayed progress of the work related to the main contractor's programme.
 - The project manager shall report in writing only and shall personally not only sign each progress report, but also equipment submissions, drawings and inspection checklists and report.
 - The project manager shall be capable of using network diagrams to explain the sequence and actual dates used by him in his tabular form monthly report in order to prove that 'cut-off' dated are realistic and factual and not an attempt to formulate claims for delays.
 - On the request of SANSA and/or Main Contractor, the Contractor shall remove from the works a person acting as Project Manager who only records deviations from the original programme, reports mainly verbally and does not propose remedial action in writing, and replace him with a Project Manager who executes the above defined duties and responsibilities in a systematic, diligent manner.

1.8 Organisation and Staff of Contractor

In addition to the Site Supervisor/Foreman, the Contractor shall employ as many trustworthy and experienced engineers, programmers and administrators as may be necessary for the purpose of the Contract.

The duties and responsibilities of the Contractor engineering and management staff shall be as follows:

- Selection and/or engineering of equipment and components into working assemblies all in conformance with the design concept contained herein.
- Equipment and shop drawings submission for approval in accordance with the required procedure.
- Attendance on routing site progress meetings and programming monitoring meetings

organised by the Principal Contractor.

- Conducting of all tests required.
- Expediting of the work.
- Directing his employees to ensure efficient, timely and safe execution of the work, and co-operation with Principal Contractor and other trades to ensure such execution.
- Submission of progress claims
- Advising the Project Manager regarding occupation before substantial completion.
- Attendance in meetings from time to time with the Engineer in order to discuss any technical matters that need clarification.

1.9 One Year's Maintenance

The Contractor shall furnish as per BOQ all maintenance on the entire Contract works for a period of twelve months after handover. Maintenance shall include systematic examination and adjustment of equipment on not less than 2 x per year.

The Contractor shall in the course of such maintenance, or on call during the maintenance period, repair or replace defective parts if required, and shall use only genuine standard parts produced by the manufacturer of the original part. Renewals or repairs resulting from misuse or fair wear and tear, however, shall not be made at the expense of the Contractor.

Any specified spares shall not be used during this period.

1.10 Testing and Commissioning

Prior to the submission of shop drawings, the Contractor shall submit full testing and commissioning procedures for individual equipment and for the entire structured cabling system.

Procedures shall include the following:

- a) Checking of all safety features of equipment by simulation and abnormal conditions.
- b) Setting of protective devices to stop operation of equipment at overload or abnormal conditions.
- c) Checking of performance of equipment and systems by simulation through the range of maximum to minimum operating conditions.
- d) Method of adjustments to correlate operating point with chosen point of application on the performance curves of equipment.

After physical completion has been reported and all defects made good, "switch-on" shall take place and the above check-out procedures shall be carried out.

Prior to the carrying out of acceptance tests the Contractor shall operate the entire system for as long a period as may be required to provide satisfactory performance at all times in the occupied spaces served by that system for up to 24 hours a day continuously.

The Contractor shall provide all labour, supervision and equipment required for testing and operating. The Employer may assign operating personnel as observers but such observation time shall not be counted as instruction time.

1.11 Completion of Contract Works

Completion of the works will occur after the following procedure has been certified by SANSA

as having been carried out in accordance with the specification:-

1. Physical completion has been reported to SANSA by the Contractor, and all defects made good and SANSA has given approval for "switch-on".
2. "Switch-on" has taken place.
3. Commissioning and testing have taken place as specified and test results have been witnessed (where required), recorded and approved by the Project Manager.
4. One set of 'as built' drawings, as described in section 1.3.2 has been submitted. These shall comprise the "Shop Drawings" as specified, embodying all modifications and during construction, and further system diagrams indicating and intended functioning, capacity data and control functioning of all systems.
5. The contractor has completed at least 40 hours of comprehensive training of the client's nominated parties.
6. The number of copies specified below of indexed loose leaf manuals containing complete Operating and Maintenance Instructions have been furnished to the client for all cabling systems, equipment and controls, and for all other equipment or systems specified under this Contract.

1.12 Responsibility for Quality of Installation

- 1.12.1 Upon completion of the installation, the Contractor shall sign a Certificate of Compliance in respect of this work.
- 1.12.2 This Certificate of Compliance shall affirm that the following has been complied with:
 - a. All materials installed, cable routes and equipment settings are as set out on the construction drawings and in this specification.
 - b. All materials and workmanship comply fully with all of the requirements of this document.
- 1.12.3 The Contractor shall be responsible for the costs of repairs or any other costs resulting from any non-conformance with these requirements.

2. GENERAL DESCRIPTION OF PROJECT

- 2.1 This contract comprises the complete manufacture, supply, delivery, installation, testing, commissioning, certification for the two systems each consisting of an A+B UPS plant with each leg consisting of 1 x 200 kVA 180 kW on line double conversion transformer based parallel ready with paralleling equipment installed, UPS units and 1 x 150 amp 3 pole static transfer switch to supply loads that do not have dual feed input capability as described in this document.
- 2.2 Each parallel redundant 200 kVA installation shall consist of:
 - 1 x 200 kVA, on line double conversion UPS systems, capable of supporting a load of 180 kW/200 kVA at power factors between 0.8 lagging and 0.9 leading without any inverter derating.
 - 1 x 10 year valve regulated lead acid battery bank rated to supply full UPS inverter kilowatt load for 15 minutes at a room temperature of 20 degrees Celsius. The battery offered shall comply with Eurobat standards
 - The battery shall be sized to supply rated inverter kilowatt load after its ten years of life. Allowance must therefore be included for the 20% loss of capacity at end of life.
 - All DC cabling and cable support systems, between the UPS and the UPS DC circuit

breaker located in a wall mounted box, and between the DC circuit breaker and the individual string fused isolators and the battery bank

- All battery inter cell and inter row connectors shall be busbars
- Besides the internal static and manual bypass within the UPS the tenderer shall fabricate and install a wrap around system, which is electrically interlocked with the UPS, such that when put into operation the UPS can be disconnected and removed without interruption to the load

3. ENVIRONMENTAL CONDITIONS

- 3.1 The installation is at Hartebeesshoek and conditions of altitude; temperature and humidity should be allowed for accordingly.
- 3.2 Tenderers should visit the site in order to ascertain what rigging equipment, cranes etc. will be required in order to deliver and install equipment.

4. BUILDING CONSTRUCTION

The building work generally comprises of the following:

- The construction is generally a combination of concrete columns rising off reinforced concrete bases and strip foundations
- Reinforced concrete flat slab and beam structure
- The building externally is plastered with a specialist wall coating and purpose made glazed aluminium windows
- Reinforced concrete roofslab with a torched on type waterproofing system laid on screeds to falls
- The internal divisions are a combination of drywall partitioning with glazed panels and brickwork
- Floor finishes internally are a combination of carpet, ceramic tiles to patterns, access floors and powerfloated concrete
- Ceilings are a combination of acoustic panels and skim coated ceilings, all in a suspended ceiling grid system

The Contractor shall be responsible to study the Structural Engineer's drawings for details of the above before installing his equipment.

5. RELATED WORK BY OTHERS

5.1 Building contractor

The following work shall be provided by the building contractor:

- a) Making good of all wall chasings.
- b) Building in and cast in of conduits and other accessories (provided and positioned by the Contractor).
- c) All holes through structure and brick walls.
- e) All cable sleeves.
- f) All manholes.

5.2 Electrical Contractor

Main supply cable to the UPS panel

5.3 HVAC Contractor

Air-conditioning of UPS and battery rooms

5.4 Fire Protection Contractor

Fire detection and protection of UPS and battery rooms

5.5 Liaison

The contractor shall liaise with the all other disciplines on site regarding daily scheduling of the works, access routes, disposal of rubble/fill, cable trenching routes and existing underground services.

6. SCHEDULE OF DRAWINGS

The following drawings form part of this specification:

DWG NO	DESCRIPTION

7. TECHNICAL PERFORMANCE REQUIREMENTS**7.1 General**

All equipment shall be supplied to make up a complete and fully operational system as specified in this technical specification. All necessary accessories, major and minor parts and materials shall be included to ensure trouble free operation, whether or not these items are indicated on the drawings or in the specification. The following shall be included as a minimum:

7.1.1 UPS UNITS

- a) A CONTROLLED Rectifier/charger capable of normal operation under conditions of 400 volt supply varying by +20%, to -25% and the frequency varying by +/-5% without using battery power to feed the load.
- b) Separate bypass input with removable links shall be standard
- c) Back feed protection shall be standard
- d) An IGBT inverter using PWM control, keeping the load power supply at exactly 400 volts +/-1% when the supply voltage and frequency conditions of +/-20% and +/-10% respectively, are experienced without discharging the battery
- e) Inverter overload capability shall not be less than 110% for 60 min, 125% for 10 min and 150% for 1 minute
- f) An internal static bypass switch for transfer between inverter and mains and have a parallel contactor with the power electronics
- g) A manual bypass switch internally mounted within the UPS

- h) Each UPS shall be fitted with an input, output and static bypass mechanical isolator

BATTERY SYSTEM

- f) A 10 year, VRLA, AGM type battery, rated to supply the inverter load specified for 15 minutes at a room temperature of 20 degrees celcius at end of its 10 year life expectancy. Batteries offered that will only give 80% capacity after 10 years shall be sized such that the will achieve 100% capacity after 10 years. All batteries shall be Eurobatt compliant.
- g) A battery circuit breaker at the UPS in a wall mounted enclosure to protect the DC cabling and battery overdischarge
- h) The battery bank shall include a redundant string and be composed of 3 to 4 parallel strings thus preventing loss of overall backup if a string should be lost or out of service
- i) Each battery string shall be individually fused via its own wall mounted enclosure. The fused isolator shall be of the on load type and capable of breaking the full load current.
- j) DC cabling shall be of the PVC nitrile type with double insulation and rated for 100% of final discharge current on a continuous basis
- k) All inter cell and inter row connectors, as well as take off points to the cabling shall be insulated busbar or cable.
- l) All battery terminals shall be covered by insulating shrouds, there shall be no exposed live parts on the battery stand
- m) Battery is to be housed on a steel or wooden battery stand painted with acid resistant paint

OTHER

- n) All glands, cabling, labour etc necessary to complete the installation and put the system into good working order.

7.1.2 Initial assembly and factory acceptance testing of the complete system.

- Factory acceptance tests on imported equipment are to be included in the tendered total.
- Local testing and acceptance is to be included for in the total tendered price

7.1.3 Documentation, including manuals and drawings showing all boards to component level, with Fault diagnostic charts to assist with fault finding.

7.1.4 Test certificates, including battery discharge tests to be performed on site with a load bank to be supplied by the UPS supplier

7.1.5 Packing and crating, and transport to the nominated delivery point, off loading on site and rigging into position.

7.1.6 Pre-commissioning preparation and commissioning on site and 1 years full preventative maintenance.

7.1.7 Lists of recommended spares and consumables

- a) for commissioning and first years operation
- b) for ten years operation

7.1.8 Supply of spares as selected.

- 7.1.9 Maintenance training and a priced, pro forma preventative maintenance agreement for five years maintenance.
- 7.1.10 The termination inside the UPS and connecting of the mains cables for the rectifier input, the static and manual bypass input and the load output

The Contractor shall ensure that the equipment supplied is suitable for the duty detailed by this specification. The contractor shall provide a point-by-point statement of compliance to the technical and commercial specifications.

7.2 Drawings

A single line diagram shall be included in the tender showing the configuration of the system. Within two weeks of order placement the appointed contractor shall supply SANSA with full installation drawings, to include but not be limited to all single line diagrams, connection schedules and cable schedules

7.3 Technical specifications

Complete technical specifications of the UPS and associated items shall be submitted with the tender.

7.4 Compliance with this specification:

The Contractor shall submit a clause-by-clause statement to indicate the degree of compliance with this specification. If the Contractor complies fully with a clause, the Contractor shall confirm compliance. In the event that the Contractor does not comply with the clause in any way, this shall be indicated, together with a statement providing details of the non-compliance.

7.5 Regulations and Standards

The equipment offered and work performed, shall comply with the requirements of the governing occupational Health and Safety act, at time of tender.

The Uninterrupted power system shall comply with the requirements of IEC for static UPS systems, and shall be produced in a factory with ISO9000 rating and the applicable quality assurance standards

7.6 Operating Conditions

The equipment offered shall be robust and capable of continuous operation in the following environments and conditions:

- a) Ambient temperature of 0°C to 40°C @ 2000 metres, without derating
- b) Humidity 0% to 95%, non condensing
- c) Degree of mechanical protection IP 20
- d) Radio frequency suppression and immunity; the equipment shall be immune to 5W two way VHF and UHF radios transmitting within a distance of 0.5m.
- e) Input Power supply voltage variations of +20% to -25% and frequency variations of $\pm 5\%$ without using battery.
- f) Immunity to spikes and surges on the power supply, whether due to lightning or other causes.

7.7 System Requirements

- 7.7.1 **Each UPS offered shall consist of:** A CONTROLLED thyristor rectifier / charger, 10 year VRLA battery, inverter, static-bypass switch, manual bypass switch and system wrap around panel. The UPS shall be of the on line double conversion type and totally automatic in operation except for manual bypass implementation. The rectifier shall operate normally without the use of the battery power during supply conditions of 400 Volts +/- 20%.

- 7.7.2 **It shall have two separate sources of mains input:** A normal supply to the rectifier and a reserve supply connection for the static bypass.
- 7.7.3 **Modes of start up and shutdown:** It shall be possible to manually start up and shut down the UPS under the following conditions
- 1) Switch off the inverter during a mains fail condition
 - 2) Switch on the inverter during a mains fail condition, with the battery circuit breaker initially open, i.e. black start
- It shall also be possible to:
- 1) Close the manual bypass or wrap around bypass, while the inverter is on line without damaging the UPS
- 7.7.4 **All loads:** Shall be permanently connected to the common output, via an appropriately rated circuit breaker, and shall be normally supplied through the rectifier to inverter chain, with automatic changeover through the static-bypass switch to the reserve supply and back again, in a no-break manner with frequency synchronization to the bypass supply. Similarly, the manual bypass shall also connect the loads onto the reserve supply.
- 7.7.5 **The UPS:** Shall be equipped with an output isolation transformer to provide galvanic isolation of the load from the inverter. All UPS magnetics to include, input transformer, output transformer and all chokes, shall be rated such that they will supply the full rated load for their application at an ambient of 40 degrees Celsius without any need for forced air cooling. Fan cooling of magnetics is unacceptable and will render the tender disqualified.
- 7.7.6 **Apart from the manual system bypass switch:** Manual isolation of other parts of the system shall be possible for easy maintenance access. Each UPS unit shall have separate input isolators for the rectifier and the static bypass. An output isolator shall be provided for the inverter and the battery bank shall be protected by a DC circuit breaker, with undervoltage trip, which the UPS will activate when final discharge voltage is reached and thus prevent the electronics from further draining the battery.
- 8.7.7 **A display and metering panel:** Shall show the status of the UPS at all the main nodes in the system. Metering,, shall show input voltages and currents, battery voltage and current, inverter output voltages, currents and frequency, and load current and voltage. The display indicators (showing at least the conditions in this document) shall be distributed on a mimic diagram. All parameter adjustments shall be done from this front display
- 8.7.8 **Alarm signal contact outputs:** Two sets of programmable potential free contacts, shall be provided for remote status indication of (at least) 12 different alarms. Contacts shall be either changeover or have fail-safe action, i.e. normally open in the de-energized and alarm state
- 8.7.9 **Remote control and Emergency power off:** The UPS shall be equipped with a remote inverter off input, which shall shut down the inverter. It shall also be possible to switch off the entire unit in the case of a fire
- 8.7.10 **UPS parameter adjustments:** All important operating parameter adjustments shall be readily accessible from the front display.
- 8.7.11 **Battery:** A battery with a minimum life expectancy of 10 years shall be supplied with the UPS unit. The battery shall be of the Valve regulated lead acid type, employing AGM technology. The battery shall be rated to provide the full UPS rated load via the inverter, for the minimum period specified in the data sheets, to a final voltage of 1,7 volts per cell at a room temperature of 20 degrees Celsius at the end of its ten year life.
- 8.7.12 **Battery charging:** The battery shall be charged by the UPS rectifier at upto C20 and limiting the ripple it is exposed to and hence increasing the battery life expectancy to less than 1%. On return of mains supply after a mains failure the battery shall automatically receive a boost charge but the charging current shall be limited to a value, according to the battery manufacturers specifications upto C20. A programmable automatic battery test facility shall be

included and it shall operate without switching off the rectifier or discharging the battery.

8.7.13 Battery charging current and voltage: The UPS rectifier shall be rated such that it is capable of supplying the following:

- 1 Full inverter DC load requirements, when the inverter is supplying rated kVA load at 0,8 lagging power factor.
- 2 All relevant losses
- 3 An additional 20 % of the inverter DC load requirement, to ensure sufficient current to charge any battery, which may replace the battery offered in the future. This additional 20% shall be controlled by means of an adjustable current limit, and shall be available while the UPS is supplying full rated load
- 4 The rectifier shall also be capable of automatic and manual boost charging of up to 2,4 volts per cell, while still supplying full inverter load
- 5 The rectifier shall also be capable of an initial charge of up to 2,5 volts per cell. This will be done with the UPS off line.
- 6 The UPS shall be fitted with a 28 days auto boost facility which is programmable in hourly steps

Boost and initial charge operation of the rectifier shall be adjustable in 1 hour steps up to a maximum of 12 hours. After the selected period has ceased, then the rectifier will automatically revert to float charging.

8.7.14 The batteries: Shall be housed on a wooden or steel stand, painted with acid resistant paint. Each battery shall be individually numbered. The UPS supplier shall include in his price for the assembly of this stand on site and connection of the batteries and the DC cabling between the Battery and the UPS. Each UPS battery shall consist of no less than three and no more than four parallel strings of batteries with a redundant string with any individual string being no more than 240 cells in series. For battery strings in excess of 200 cells the tenderer shall supply manufacturers proof that the DC cable and DC circuit breaker to be used are rated for such a high DC voltage. The DC circuit breaker shall be housed in a wall mountable, glass front closure into which all DC cables are to be glanded and terminated onto the DC circuit breaker. Each battery string shall be individually fused. There shall be adequate access to the terminals of all batteries within the rows for ease and safety of working on all connections. All cables to, from and between batteries shall be included with the supply of the unit

8.7.15 The UPS cubicle: Shall have front access only for all maintenance and repair work, and these cubicles shall be capable of operation when mounted up against a wall. For units exhausting air out of the top of the panel, a drip tray shall be allowed for to prevent any liquids from dripping down into the UPS's internal section. Dust filters shall be fitted to the air inlets on the panel sides

8.7.16 Comprehensive documentation: Is required to cover the equipment specification and for installation, commissioning, operation and maintenance. The literature and drawings shall be the contractor's originals in English.

7.8 Backup Services

The Contractor shall offer full technical backup on the systems offered, and guarantee spares availability for a minimum period of ten years. The Contractor shall offer an emergency spares exchange service whereby it can be guaranteed that any item can be replaced within 12 hours in the event of breakdown of an operational system. The contractor shall supply written proof of his emergency spares holding for the units offered.

7.9 Documentation

Three copies, in English, of manuals covering all the following topics for each assembly and the system shall be supplied:

System QA manual as per the QA section requirements
 Installation procedure showing full installation point layouts
 Point by point commissioning procedure

Operation procedure
UPS dimensional drawings showing all major components
Detailed descriptions of all power components and sections
Printed circuit board descriptions giving full analysis of all boards to include test points, LED indication points and board logic descriptions and operation
Mechanical schematic diagrams of all assemblies and sub assemblies
Fault analysis records and fault flow charts showing waveforms and expected readings with action lists to enable any electrical technician or engineer to repair the unit effectively by simply following the flow charts

7.10 Spares List

A list of recommended spares shall be provided to the Engineer. This shall be broken down into lists of commissioning spares, and maintenance spares based on one years operation.

7.11 Training

A suitable on site training course of at least 40 hours shall be provided. The course shall cover maintenance of the equipment, system operation and fault tracing and diagnostics

7.12 Commissioning

Commissioning and performance testing shall comprise:-

- a) Checking of physical installation on site of the equipment.
- b) Re-mounting all items separately demounted and packed for delivery, the making of all internal connections and the preparation for commissioning.
- c) Provision of resources to obtain the operation of the system according to the conditions described in this specification.

8. QUALITY ASSURANCE PROVISIONS

8.1 Quality management system

The requirements of SABS ISO 9000 shall apply. All volitional requirements in SABS ISO 9000 shall be mandatory for material supplied against this specification.

8.2 Quality plan

The Contractor shall compile and submit a quality plan or checklist which shall be approved prior to commencement of manufacture. The quality plan shall include, but shall not necessarily be limited to, all major operations, specifications, verifications, tests, methods of test and equipment to be used, and acceptance and rejection criteria.

As a minimum the quality plan documents shall consist of the following:

- Supplier document index
- Project plan – supplied in MS project or similar program
- Inspection and test plan
- Bought out items list
- GA drawings of the system proposed
- Single line diagram
- Cable schedules
- Connection schedules
- Wiring diagrams
- Packing and shipping list
- UPS I & O manual
- Battery I& O manual
- Relevant brochures
- Design statement of compliance

8.3 Test facilities

The Contractor shall provide qualified Labour and approved testing equipment for tests.

If facilities are not available at the Contractor's premises they shall arrange for tests to be conducted by approved test authorities. The cost of all tests shall be borne by the Contractor.

8.4 Access

The Client shall have access at all reasonable times to those parts of the manufacturing facilities engaged in the manufacture of articles to this specification. SANSA is authorized to witness any stage of manufacture, tests and to inspect documentation; SANSA is authorized to reject any items not complying with the requirements of this specification. In the event of a dispute arising regarding the interpretation of test results the decision of SANSA shall be final.

9.0 TESTING AND INSPECTION

The testing and inspection procedures shall be approved prior to the commencement of manufacture.

The Contractor shall assemble the complete UPS for inspection and factory testing, and present the system to SANSA, to whom it shall be demonstrated that the equipment meets the requirements of the specification.

The Contractor shall provide suitably qualified personnel and all necessary equipment to carry out the tests to demonstrate conformance with the specification and simulate the operation of the system in its final operating state.

The Contractor shall prepare a set of completed test and inspection certificates for approval.

10.0 PACKING AND MARKING

10.1 Packing

The Contractor shall protect the equipment against scratching and damage by suitable application of wrapping, packing and crating of the equipment items.

10.2 Marking

Each separately packed and transported piece of equipment shall be clearly marked

11.0 UPS TECHNICAL REQUIREMENTS

Manufacturer	:	
Model No.	:	
Actual full load rating	:	200 Kva 180 kW 0.9 lag power factor
Required full load rating	:	200 kVA 200 kW 0.9 lag power factor
required battery back-up (at required full load rating)	:	15 minutes per 200 kVA UPS
Battery type	:	10 year VRLA, to achieve time specified at end of its 10 year life
No. of cells	:	Min of 3 and maximum of 4 parallel strings with redundancy of 1 string to prevent loss of capacity should one string fail. Upto 200 cells
Input : Voltage	:	Three-phase four wire 400 V +/- 20% without discharging battery
: Frequency	:	50 Hertz ±10% without discharging battery
: Power walk in	:	The rectifier shall power up from 0 to 100% over a period of 120 seconds to prevent inrush currents overloading

the UPS supply circuit. Furthermore the power walk in of the 4 units to be installed shall be adjustable such that on return of mains, UPS 1 Rectifier shall first reach 25% of capacity before UPS 2 rectifier switches on, when UPS 2 achieves 25% the 3 shall turn on and the same for UPS 4.

Output : Voltage	:	Three-phase four wire 400 V
: Frequency	:	Synchronized to mains, or ± 0.1 % when internally generated
: Power factor	:	The inverter shall be rated to supply its rated capacity between 0.8 lagging and 0.9 leading power factors without de rating.
Unbalanced load	:	100% unbalanced load capability, with a phase voltage dissymmetry of no more than 3% and a phase shift of no more than 2 degrees electrical.
Load step	:	The UPS shall withstand a 100% load step, with a voltage stability of $\pm 5\%$, and a recovery to within 1% of nominal voltage within 10 milliseconds
Crest factor	:	3 : 1
Waveform	:	Sinewave output
Total Harmonic distortion (With 3:1 crest factor) Non linear loads:	:	Linear loads <2% maximum <5% maximum
Overload capability	:	110 % for 60 minutes 125% for 10 minutes 150% for 60 seconds
Regulation	:	$\pm 3\%$ for 100% load change
Overall efficiency at rated load	:	Better than 90%
Acoustic noise level	:	Less than 70 dBa at 1 metre
Cooling	:	Power components and electronics may be forced air cooled Magnetics must be naturally cooled
Metering panel	:	Required
Mimic panel	:	Required

Mimic panel:

The following LED status information must be available from the front mimic panel

Rectifier input power status
Inverter output power status
Bypass power status
Battery status

Audible alarm:

An alarm shall sound for all conditions which occur which are not part of normal operation status

Alarm messages:

- Bypass supply abnormalities – Alarm for voltage peaks or high harmonic content in mains supply
- Manual bypass operation
- Parallel system - control cable defect
- Bypass fault – fuse failure or mains out of limits
- Mains supply out of limits – mains low/failed or frequency out of limits
- Battery low voltage
- Battery in bad condition – as a result of automatic battery test
- Inverter overload – including storage of overload percentage and time
- Internal fault – Self analysis with sub menus
- Over temperature or fan failure
- Supply phase rotation incorrect
- Output CB status

LCD display measurements:

- Inverter VA load
- Battery status in terms of % of full charge
- Battery backup time available at running inverter load
- Input, battery, bypass and inverter voltage
- Input, bypass and output frequency
- Input, DC link, battery and inverter currents
- System cabinet temperature
- Rectifier and inverter power module temperature
- Hours of operation on inverter
- Hours of operation on bypass
- Hours of operation on battery
- Number of times the battery was discharged
- Number of times the battery was discharged to shutoff voltage
- Date unit was put into operation
- Battery self test data
- LDC display contrast adjustment

Customizing and adjustments via LCD display:

- Bypass voltage and frequency limits adjustment
- Rated output voltage
- RS232
- Modem interface
- Battery settings
- Pre alarms

Event history:

- All events including voltages and currents shall be recorded for pre fault analysis