

SPECIFICATION FOR A UNINTERRUPTIBLE POWER SUPPLY



**THIS SPECIFICATION COVERS THE REQUIREMENTS FOR THE
UNINTERRUPTIBLE POWER SUPPLY.**

PL 720

REV 06

SPECIFICATION FOR A UNINTERRUPTIBLE POWER SUPPLY

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STAKEHOLDERS INVOLVEMENT

Function	Name	Designation	Approval Signature	Date	E-Mail	Contact Number
Compulsory Stakeholder Involvement						
Revised by	Dhani Singh (DS)	Electrical Specialist		12-11-2024	Dhanaswar.singh@transnet.net	0362712472
Approved by	Shanil Rugbeer (SR)	Principal Electrical Engineer		12-11-2024	Shanil.rugbeer@transnet.net	0119782886

SUMMARY OF VERSION CONTROL

Version Number	Effective Date	Summary of Changes
05	26 November 2019	Compiler (KN) added and updated the following: <ul style="list-style-type: none">• 60% of the specification content has been updated. Approver (BB) added and updated the following: <ul style="list-style-type: none">• Updated Stakeholder Engagement page with Revised by and approved by.• Clause 1.1.2 updated• Clause 2.1.7 updated• Clause 12.1 updated
06	13 November 2024	Compiler (DS) updated 5% of content: <ul style="list-style-type: none">• Clause 1.2 updated

1. GENERAL

1.1.1 This specification sets out the requirements for Transnet Pipelines (TPL) for the design and supply of an Uninterruptible Power Supply (UPS) system to be used for the powering of small, medium and large computerised control systems, variable speed drives, direct online motors, ICT equipment's such as servers and other relevant equipment's. The specification is based primarily on the requirements for a rectifier-battery charger, static inverter, battery and a manual/maintenance bypass mode.

1.2.1 The supplier must complete the technical data sheet to ensure that the correct UPS specification is adhered to and will be compliant to Transnet Pipelines requirements.

1.2 Standard specification

- 1.2.1 For any matter on which this specification is silent, tenderers must refer to the South African Bureau of Standards and IEC adopted specification Nos.

2. FACILITIES

2.1 Facilities required for overall system

- 2.1.1 The equipment shall be designed to form self-contained equipment UPS to be used as stated on clause 1.1.1.
- 2.1.2 The input for the UPS shall be:
- 400V $\pm 10\%$ tolerance with a frequency of 50Hz $\pm 5\%$ tolerance for a three-phase system.
 - 230V $\pm 10\%$ tolerance with a frequency of 50Hz $\pm 5\%$ tolerance for a single-phase system.
- 2.1.3 The output of the UPS is a 4 wire for a 3-phase system or a 3 wire for a single-phase system, ranging from 5 kVA to 100 kVA depending on the size stipulated on the tender document or requisition and the relevant UPS datasheet attached.
- 2.1.4 The output voltage shall be automatically regulated to within 1% of the desired value under steady state load conditions. Under dynamic conditions the output voltage shall not vary by more than 5% for step loads of the rated output. The recovery time shall be less than 30 milliseconds in this case. The output waveform shall remain within specification during recovery period.
- 2.1.5 The frequency of the output waveform shall be 50Hz $\pm 0.5\%$ tolerance.
- 2.1.6 The UPS shall incorporate three single phase bridges allowing total 100% unbalanced loads while still maintaining very close individual voltage regulation.
- 2.1.7 The stand-by period of the system in the case of mains failure and with a fully charged battery shall be 10 to 30 minutes minimum at the rated load as stipulated on the tender document or requisition and the relevant UPS datasheet attached.
- 2.1.8 It must be possible to switch the battery in and out at any time, even at full load, without any detriment to the power supply or load. The equipment shall be capable of operating continuously. The equipment shall be capable of operating continuously while the battery is disconnected.
- 2.1.9 It is the intention to the load to be supplied continuously from the mains power supply via the UPS. Should the power supply system fail, the UPS shall automatically transfer the load from the mains onto the battery.
- 2.1.10 The UPS is also to consist of static bypass switch which automatically bypasses the UPS in the event of rectifier faulty, inverter faulty and UPS overloading without dropping power to the load. This static bypass switch is also to be selectable manually to bypass the UPS and go into static bypass mode when selected.
- 2.1.11 A manual/maintenance bypass switch shall be provided to manually connected load to the bypass supply. It must be possible to totally isolate the UPS rectifier and

inverter sections for maintenance purposes with the UPS connected in manual/maintenance By-Pass mode.

- 2.1.12 The power supply equipment must exhibit long term stability, and the manufacturer must ensure that the equipment will still conform to this specification after five years of continuous service.

3. DESIGN

3.1 Environmental conditions

- 3.1.1 The equipment must be suitable for continuous operation under the following conditions:

Ambient temperature	:	-10°C to 40°C
Relative humidity	:	0% to 95%
Altitude	:	0 to 2000 metres above sea level

- 3.1.2 Dust and vapours accumulate rapidly.

- 3.1.3 Lightning conditions : Severe

- 3.1.4 Air pollution : Heavily saline laden industrial fumes.

- 3.1.5 The equipment must be suitable for operation in remote areas, without attention or supervision.

3.2 Cubicle and metal work

- 3.2.1 The equipment must preferably be housed in a single cubicle of sheet steel or die cast metal. Cubicle having panels of expanded metal mesh or perforated sheet metal will also be considered.

- 3.2.2 The cubicle shall be designed for floor mounting, with adequate provision made for bottom entrance of cables.

- 3.2.3 The cubicle shall be fitted with a wide opening, removable hinged door to enable all units to be easily removed.

- 3.2.4 All equipment must preferably be mounted on removable subframes within the cubicle to facilitate easy removed.

- 3.2.5 All components and units within the cubicle shall be readily accessible for maintenance purposes.

- 3.2.6 All steel nuts, bolts, spacers, washers and similar hardware must be protected against corrosion by cadmium plating or similar means. All such hardware used on the front panel shall be chrome-plated or similar.

- 3.2.7 The cubicle shall be adequately ventilated. All apertures provided for ventilation and cable entry must be made vermin-proof.

- 3.2.8 One or two sides which may also include the most suitable front side (not blocking the display screen with the necessary warning signs) of the UPS cubicle. Is to

consist of a permanently, no removable, heat proof, waterproof, noncorrosive, permanently visible print label with the UPS start-up and shutdown procedure, how to switch the UPS from normal mode to manual/maintenance bypass mode procedure and vice versa.

3.3 Mounting of components

- 3.3.1 Electronic units shall all be of the plug-in type and must be mounted in such a position that they are protected from magnetic fields and extreme temperatures. All units must nevertheless be readily accessible for maintenance purposes.
- 3.3.2 Components such as transformers and inductors must be mounted and screened in such a way that the transmission of mechanical vibration and magnetic fields to other parts of the equipment is reduced to an absolute minimum.

3.4 Marking of components and terminals

- 3.4.1 All components shall be clearly marked in a manner approved by the Engineer and shall facilitate easy reference to the circuit diagrams and handbooks to be supplied with the equipment. Designations on labels shall be compatible in all respects to those used on the associated drawings.
- 3.4.2 All cable and wiring terminals shall be clearly marked in a manner approved by the Engineer and shall be compatible in all respects to the references made on the circuit diagrams. Any terminals which carry high voltages must be clearly identified to indicate this fact.

3.5 Labels

- 3.5.1 UPS equipment identification and all other key labels shall be traffolyte engraved type and fixed to the board by means of stainless-steel screws or epoxy glue.
- 3.5.2 Labels shall be in English, finish shall comprise of black letters against a white background, except in the case of cautionary labels where letters shall appear white on a red background.
- 3.5.3 Labels shall be affixed in such a way that they are easily legible and not obstructed by the wiring or by other components.
- 3.5.4 All lettering shall be in upper-case letters except where standard abbreviations of units are used, e.g. kWh, kVA, etc.
- 3.5.5 Labels prepared by embossing on adhesive tape will not be acceptable.

3.6 Rectifier – battery charger

- 3.6.1 The rectifier shall be designed to supply the necessary direct current to the inverter for the maximum rated load and be able to simultaneously charge/recharge the

storage battery to at least 80% of its capacity in 10 hours and to 95% of the battery capacity in 15 hours.

- 3.6.2 The rectifier shall have a constant voltage characteristic with current limiting adjustable between 105% and 120% of the rated full load current.
- 3.6.3 Any adjustments which are necessary for the setting up to the equipment shall be stable over the entire operating temperature range of the equipment.
- 3.6.4 The output of the rectifier shall not be connected to frame or earth on either positive or negative legs,
- 3.6.5 Input filters shall be provided to minimise the interference and "ringing" effect caused by thyristor or transistor operations and to prevent interference generated within the equipment from being fed back into the mains supply.
- 3.6.6 In order to eliminate high inrush current on start-up, the input current to the rectifier shall be "ramped" for approximately 10 seconds after start-up.
- 3.6.7 The output voltage of the rectifier shall be smoothed according to the battery and inverter manufacturer's requirements. The ripple voltage must not exceed 1% of the battery voltage.
- 3.6.8 The DC output voltage of the rectifier shall be stabilised to $\pm 1\%$ with mains input variation of $\pm 10\%$ under conditions varying from no-load to full load over the specified temperature range.
- 3.6.9 The rectifier shall be designed to operate in conjunction with the battery offered and shall conform to the requirements of the battery manufacturer.

3.7 Static inverter

- 3.7.1 The static inverter shall be designed to supply 400V three phase and or 230V single phase alternating current from a standard type of storage battery at a power factor ranging from 0.7 IND to unity within the kVA rating.
- 3.7.2 The static inverter must be guaranteed to satisfactorily operate the following type of equipment:
 - a) variable speed drives
 - b) And all the other equipment listed on clause 1.1.1
- 3.7.3 The static inverter must be protected against out-of-limit variations in the battery voltage. Under conditions of high battery voltage, the load shall be automatically transferred to the mains bypass and an alarm generated.

- 3.7.4 The static inverter must be protected against voltage surges and spikes across the battery terminals, between the output terminals and chassis and between battery terminals chassis. Similarly, protection is required against surges caused by lightning and by power mains switching.
- 3.7.5 The output of the inverter shall not vary by more than $\pm 1\%$ for variation of $\pm 10\%$ of the normal battery voltage. The DC ripple on the battery, caused by inverter operation shall not be more than 1% of the nominal battery voltage.
- 3.7.6 The inverter shall be designed for continuous operation but in certain applications the equipment will be operated intermittently for short periods at a time. The equipment offered must be able to withstand both the continuous and the intermittent operation.
- 3.7.7 The waveform of the output shall be substantially sinusoidal and symmetric. The total harmonic content of the output shall not exceed 5% for input voltage variation of $\pm 10\%$ of the nominal input voltage and with output load variation from no-load to full load. The harmonic content of the output of any single harmonic shall not exceed 3% under these conditions/
- 3.7.8 Inverters which utilise synthesising techniques to generate the output waveform will be given preference over equipment which merely relies on filtering of a square wave to achieve the desired output.
- 3.7.9 The long-term frequency stability under static load conditions shall be better than 0.5% and the short term (1 hour) stability shall be better than 0.1% and should be independent of the temperature of the equipment and surroundings.
- 3.7.10 The equipment must exhibit the following overload characteristics:
- a) The equipment must be capable of supplying a load of 110% of the rated output for 30 minutes without damage to the equipment.
 - b) The maximum output short-circuit must be limited to 150% of the rated output should a short circuit be applied. The inverter must be capable of delivering this overload current for a period of 10 seconds without damage to the equipment.
 - c) The equipment shall be capable of supplying short-term inrush current typically demanded by variable speed drives, without activating the protection or causing damage to the inverter equipment. Typically, 300% for 100 milliseconds.

3.8 Communication system

- 3.8.1 The UPS management software and communication module must allow the user to configure: IP address, monitor from a central location and perform multi shutdown on different operating systems.
- 3.8.2 The basic functionality must:
- a) Support TCP/IP, UDP, SNMP, Telnet, HTTP, SMTP protocol.
 - b) Provide SNMP MIB to monitor and control the UPS.
 - c) Manage and configure via Telnet web browser or network managements system.
 - d) Consists of a shutdown agent.
 - e) Consists of a Log and alarm management.
- 3.8.3 The UPS shall be equipped with voltage free common alarm and indications contacts in order to interface with a remote PLC.

4. QUALITY AND RATING OF COMPONENTS AND MATERIALS

4.1 General

- 4.1.1 All components must be suitably rated for the function they have to perform without interference to neighbouring components or materials. Components must preferably not be operated at more than 60% of their rating and must be protected against surges where necessary.
- 4.1.2 Heavy components may not be mounted on printed circuit boards unless it can be guaranteed that the board will stand up to severe handling without fracturing or warping with the components so mounted.
- 4.1.3 Fuses and circuit breakers shall be rated to give adequate protection to the circuit concerned while not rupturing or tripping prematurely. Wherever possible, fuses must be protected with indicators which reflect the state of the fuse.
- 4.1.4 Heavy power components such as thyristors, transistors and diodes must be protected against thermal overload by shutting the system down when any component reaches excessive temperatures.
- 4.1.5 Where heat sinks are used for mounting components, steps must be taken to protect the heat sinks from corrosion and oxidation so that the heat transfer is not impaired during the life of the equipment.
- 4.1.6 Contacts of relays and contactors must be adequately rated and protected against sparking. Where possible, twin contacts must be provided.

- 4.1.7 Components must not rise in temperature such that mountings, printed circuit boards, markings or adjacent components are burnt or discolored.
- 4.1.8 The number of component types must be kept to a minimum consistent with good design of the equipment. Tenderers must furnish details of the expected life span of components or suitable information from which the reliability may be deduced.
- 4.1.9 Electromechanical relays must be provided on plug-in basis so that, when necessary, they can be readily removed and replaced. Relays which are permanently mounted on printed circuit cards will not be accepted.
- 4.1.10 All materials used must be of the best quality and of the class most suitable for the purpose for which they are required. Unless otherwise specified or approved by TPL, all materials shall be to the most recent SANS, IEC, DIN or British Standards specification where applicable or to such published standards applicable in the country of origin.
- 4.1.11 Plastic or other materials which may under the influence of heat, light or pressure, decompose or liberate elements or compounds which are likely to corrode or otherwise affect metals or other materials in contact with them may not be used in the construction of the equipment offered by tenderers
- 4.1.12 All components used in the manufacture of the equipment must be readily available in the Republic of South Africa from at least two independent sources
- 4.1.13 Multi-turn potentiometers must be provided for all adjustment points. In order to eliminate difficulty in adjusting voltage, current and frequency settings, the design of the circuitry must be such that the sensitivity of the potentiometers must allow for fine adjustment yet have adequate range.
- 4.1.14 Only new components may be used in the construction of the equipment.
- 4.1.15 Circuitry must be designed in such a way that it will not be necessary to specially select components from a batch in order for the equipment to function correctly. The components must also be operated well within the specifications of the manufacturer.

4.2 Capacitors

- 4.2.1 Any commutation capacitors used shall be of a high grade so as to withstand continuous operation of the equipment at adverse temperature conditions.
- 4.2.2 Electrolytic capacitors may not be used in any critical timing or frequency control circuits.
- 4.2.3 Capacitors used in filter circuits shall be of a high grade, long-life type with proven reliability.
- 4.2.4 Any capacitors or capacitor bank which store high voltages shall be fitted with bleeder resistors in order to reduce these voltages to a safe limit within one minute of removal from the source.

4.3 Transformers and inductors

- 4.3.1 All transformer and inductors shall be design for continuous operation.
- 4.3.2 All connections between inductors, transformers and the rest of the equipment shall be via approved terminals and lugs only.
- 4.3.3 C-core construction of transformers and inductors will be permitted provided that the strapping of the cores is such that no relative movement can take place between sections of these cores and no excessive noise or heat is generated by the transformers or inductors.
- 4.3.4 Power transformers must incorporate an electrostatic screen between primary and secondary windings. It must be possible to easily connect this screen to earth when necessary.
- 4.3.5 All heavy current magnetic components shall be earthed.
- 4.3.6 All magnetic components shall be vacuum impregnated.
- 4.3.7 The input transformer shall be of the double-wound type.

5. INDICATIONS AND CONTROLS

5.1 Instrumentation and indications

- 5.1.1 Provision shall be made on the control panel for the display of the following:

Measurements

- a) Battery voltage
- b) Battery current (both charging and discharging)
- c) Battery runtime at the given current load
- d) Inverter/UPS output voltage(s), current(s), frequency(ies), active power, apparent power and power factor
- e) Mains/UPS Input voltage(s), current(s), frequency(ies), active power, apparent power and power factor
- f) UPS bypass voltage(s), current(s), frequency(ies), active power, apparent power and power factor
- g) UPS current load percentage

Indications

- a) UPS input supply available
- b) Both Bypass supply available
- c) Rectifier on
- d) Inverter on

- e) Battery on
- f) Load on inverter
- g) Load on static by-pass
- h) Load on manual/maintenance by-pass
- i) Load on battery
- j) Load on normal mode
- k) Inverter / by-pass synchronized
- l) UPS over temperature
- m) UPS battery charged percentage
- n) UPS current load percentage

Alarms

- a) Incoming supply failed
- b) Rectifier fault
- c) Inverter fault
- d) Battery low
- e) Battery isolator tripped
- f) UPS on static bypass
- g) UPS on maintenance bypass
- h) UPS on battery

5.1.2 A summarised system alarm indication shall be fitted to the exterior of the cubicle to indicate a failure of the equipment.

5.1.3 The UPS shall be equipped with voltage free common alarm and indications contacts in order to interface with a remote PLC.

5.2 Controls

5.2.1 The following controls shall be provided in the equipment:

- a) Load on static bypass
- b) Load on inverter/normal mode
- c) Load on mains
- d) Load on battery backup

6. PROTECTION OF UNITS

6.1 Rectifier protection

- 6.1.1 The rectifier input shall be protected by means of suitable magnetic circuit breakers of fuses.
- 6.1.2 The output shall be protected by:
- a) The inherent current limiting characteristics of the equipment.
 - b) Fuses in both positive and negative legs. These shall be removable for isolation purposes.
- 6.1.3 The rectifier shall be protected against emission of radio and television interference and must comply with the current requirements of the Department of Post and Telecommunications in this respect.
- 6.1.4 The equipment will be required to operate in areas with a high lightning incidence, transients and harmonics normal to an industrial electricity supply are to be expected on the incoming mains supply. Suitable protection shall therefore be included and connected to the mains supply.

6.2 Static inverter protection

- 6.2.1 The inverter shall be protected against excessive variations of the input battery voltage and must be capable of automatically shutting down and transferring the load to the mains by-pass when certain pre-set limits are encountered.
- 6.2.2 Current overload protection for the input and output of the inverter shall be provided by means of suitable fuses or circuit breakers as well as electronic protection. Overvoltage protection for the output shall be provided as well as protection for variation of the battery voltage outside of the specified limits.

6.3 Battery protection

- 6.3.1 The battery shall be adequately protected by means of a double pole fused isolator or a circuit breaker.

6.4 Input and output protection of the UPS

- 6.4.1 The input and output of the UPS shall be adequately protected by means of a two-pole circuit breaker for a single-phase UPS system or four pole circuit breaker a three phase UPS system. An earth leakage protection at the input and output of the UPS is also to be included.
- 6.4.2 The input power to the overall UPS system shall also be protected from unwanted power surges by means of a suitable Dehngaard or similar surge arrestor which consist of its operational indicators.

7. NAME PLATE

7.1 Each unit of equipment shall bear an anodised nameplate on which the following particulars shall be shown:

- a) Name of manufacturer
- b) Type and model of equipment
- c) Serial number
- d) Rated input voltage(s), current(s), power, frequency(ies) and phase(s)
- e) Rated output voltage(s), current(s), power, frequency(ies) and phase(s)
- f) Bypass input voltage(s), current(s), power, frequency(ies) and phase(s)
- g) Battery type of current, voltage, charging current, discharging current, maximum battery voltage, battery make, battery type number, battery manufacture and manufactures contact number
- h) Rated power factor, apparent power and output active power
- i) Maximum ambient temperature at which equipment will operate to specification
- j) Efficiency at full load

8. NOISE LEVELS

8.1 Special precautions must be taken to keep noise levels to a minimum. The equipment offered shall be suitable for operation in a normal office environment without causing a disturbance or annoyance to personnel working in close proximity to the equipment. The acoustic noise generated by the complete system operating at the rated load shall not exceed 55 dB (A) at 1 metre.

9. SPECIAL TOOLS

9.1 Any special tools such as those required for removal of fuses, etc. and any special instruments required for the maintenance, adjustment or repair of the equipment must be supplied as part of the equipment. Full details of all tools and test equipment to be supplied must be submitted with the tender and separate unit prices given for all items.

10. A MANUAL/MAINTENANCE BYPASS SWITCHING

10.1 A manually controlled change-over switch shall be provided to connect the load either to the uninterruptible supply or directly to the incoming mains supply in order to facilitate servicing of the equipment. It will be preferred if this switch is located on the control panel of the equipment.

11. EXTERNAL BYPASS SWITCHING

- 11.1** Upon request by TPL representative(s), an external manually controlled changeover make-before-break rotary switch shall be provided to connect the load either to the uninterruptible supply or directly to the incoming mains supply in order to facilitate servicing of the equipment. It will be preferred if this switch is located on the control panel of the equipment.

12. STORAGE BATTERY FOR UNINTERRUPTIBLE POWER SUPPLY

- 12.1** A storage battery is required to deliver stored electrical energy to drive the inverter during period of failure or non-availability of electricity mains supply or battery charger. The stand-by period shall be 10 to 30 minutes minimum at the rated load as stipulated on the tender document or requisition and the relevant UPS datasheet attached.
- 12.2** The battery shall be made up of the correct number of cells, each with the same ampere-hour capacity to suit the limits of the inverter input voltage under all conditions of charge and discharge.
- 12.3** The ampere-hour capacity of the battery shall be sufficient to provide the specified reserve period for the uninterruptible power supply and to maintain correct inverter operation under specified temperature conditions for the whole of this period. In addition, an ageing factor for a period of five years must be taken into account when calculating battery capacity.
- 12.4** The battery offered shall be suitable for operation within computer rooms and normal office environment without emission of harmful, irritating or dangerous gas or fumes. Details of the batteries offered shall be provided with the tender submission.
- 12.5** Battery cubicle shall be adequately ventilated and facilitate easy access to all maintenance purposes.
- 12.6** A suitable chart or description detailing the maintenance procedure for the batteries shall be fitted in the battery cubicle for easy reference.
- 12.7** Unless otherwise stated in the Schedule of Requirements, tenderers may offer either or both of cell type described below, provided that the battery charger offered is suitably matched.
- Tenderers are requested to quote separately for different battery options.
- a) Nickel-cadmium cells of the long-life, low maintenance type, with a large electrolyte reserve. The cells must be capable of withstanding float charging for prolong periods, without any discharge cycle and without any undue deterioration in performance.

- b) Sealed, rechargeable lead-acid cells of the maintenance free type, with a minimum life of five years under the continuous float and operating conditions which are likely to exist over the full temperature range specified.

12.8 The positive terminal posts of cells shall be clearly and indelibly marked "P", "POS" or "+".

12.9 Cell connectors must be lead alloy, lead plated copper or other approved materials.

12.10 Connector bolts and nuts must be of cadmium plated steel or similar protection against corrosion with nuts of the self-locking type.

12.11 Instruction

12.11.1 The successful contractor/manufacture shall be required to supply two sets of instructions in English for the assembly, installation and maintenance of the cells.

13. SYSTEM TESTS

13.1 Factory acceptance tests shall be conducted under the supervision of the TPL engineer(s) or TPL appointed representative(s) as per the attached TPL UPS FAT sheet which includes a 24-hour uninterrupted type-test and other four routine tests. The 24-hour type test is only conducted on a single unit of each UPS range, its runs under full load on the completely assembled system giving the following information, preferably by means of recording instruments over the whole period of the test:

13.1.1 Input voltage(s), current(s) and frequency(ies)

13.1.2 Input power

13.1.3 Output voltage(s), current(s) and frequency(ies)

13.1.4 Output power

13.1.5 Output voltage ripple

13.2 Static Bypass Switch tests shall be conducted, and measurements of the voltage waveforms shall be recorded during simulation of all transfer and re-transfer conditions.

13.3 TPL reserve the right to carry out any operational functionality tests on the equipment offered as may be considered necessary. The contractor shall render all assistance necessary for the execution of the acceptance tests.

13.4 Upon request by TPL representative(s), the contractor/ manufacturer's will also perform site acceptance tests under the present of TPL engineer(s) or TPL appointed representative(s) in order not to invalidate guarantees, tests will be conducted with the UPS connected to a load bank sized for the rated output current as per the attached TPL UPS SAT SHEET, the following measurements will also be recorded:

13.4.1 Battery voltage after the specified discharge time.

13.4.2 Battery discharge duration at the instant the rectifier is shut down by the low voltage monitor in the DC circuit.

13.4.3 The factory acceptance test results need to be forwarded to the TPL Engineer within 48 hours of completion of all tests.

14. WARRANTIES AND GUARANTIES

14.1 The UPS equipment shall have a 1 or more years' product warranty to cover for any unexpected equipment failures or faults with the inception state of UPS equipment operation.

14.2 The UPS equipment shall have a minimum of a 5-year guarantee on all components used in the design, assembling, construction and operation of this equipment inclusive of all boards used.

14.3 Both conditions on the above clauses (14.1 and 14.2) must be inclusive of all callout costs, labour costs and transportation costs which may arise should the conditions stated on the above clauses (14.1 and 14.2) occur.

15. DOCUMENTATION

15.1 Final documentations (user manual, all relevant software disks with it configuration setup, equipment specification, all relevant drawings (including SLD's, As-built GA's and etc.), battery datasheet (with all relevant battery characteristics e.g. battery life per number of discharge cycle, battery life per percentage of discharge and etc.), testing equipment's, testing meter's calibration sticker with stamps and certificates (when required), testing results, warranties, guaranties, etc.) per UPS per site must be provided by the Manufacture/Contractor during UPS system testing and on final hand over.

15.2 All final documentations should be in the manner approved by the relevant TPL drawing office standards (PL100, PL101, PL102, PL103).

ANNEXURE 1: TPL UPS FAT SHEET

See attached annexure 1: TPL UPS FAT Sheet for Three Phase UPS and/or Single UPS depending on which UPS is purchased

ANNEXURE 2: TPL UPS SAT SHEET

See attached annexure 2: TPL UPS SAT Sheet for Three Phase and/or Single UPS depending on which UPS is purchased

--- End of Specification ---