Technical Requirement Specification: Energy storage device and their security measures

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1. SCOPE

The scope of this specification is for Energy storage devices and security measures (new and retrofit) to limit theft and safe keeping of energy storage devices installed at various Broadband Infraco sites across South Africa.

Energy storage devices include traditional Valve Regulated Lead Acid (VRLA) technologies as well as newer lithium series technologies which are safe, efficient and effective.

The security measures describe the standards of the physical properties and safeguarding of Energy storage devices installed at Broadband Infraco sites.

These measures are to be implemented as follows:

- Retro-fitted to existing infrastructure; and
- Indoor and out-door installations.

2. REFERENCE DOCUMENTATION (LATEST VERSIONS)

a) SANS 1042-1 – Wiring of premises.
b) SABS IEC 60950- Safety of information technology equipment, including electrical business equipment (Alternative UL950).
c) SANS 529 Degrees of protection provided by enclosures.
d) SANS 62619 Secondary cells and batteries containing alkaline or other non-acid – Safety requirements for Secondary lithium cells and batteries for use in industrial applications
e) SANS 62620 Secondary cells and batteries containing alkaline or other non-acid – Secondary lithium cells and batteries for use in industrial applications
f) IEC 62133 specify requirements and tests for the safe operation of portable sealed secondary lithium cells and batteries containing non-acid electrolyte
g) EN61000-4-2 Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test.
h) EN61000-4-3 Electromagnetic compatibility (EMC)- Part 4-3: Testing and measurement techniques- Radiated, radio-frequency, electromagnetic field immunity test.
i) EN 55032 Electromagnetic compatibility of multimedia equipment - Emission requirements.
j) EN 55024 Information technology equipment - Immunity characteristics - Limits and methods of measurement.
k) SANS 949: 2005 Strong room and safe doors.

3. DEFINITIONS, ABBREVIATIONS AND ACRONYMS

3.1 Definitions

Word	Meaning

Word	Meaning
C2, C4, C10 rate	Capacity of the battery at the various discharge rates i.e. 2 hours, 4 hours or 10 hours respectively.
Float charge	Float voltage is the voltage at which the device is maintained after being fully charged to maintain that capacity by compensating for self-discharge of the device.
Shelf life	Shelf life is the life of the module (in years) from the date it is manufactured to the date it is first installed and commissioned.

3.2 Abbreviations

Abbreviation	Description
A	Ampere
AC	Alternating Current
Ah	Ampere-hour
DC	Direct Current
DoD	Depth of Discharge
e.g.	exempli gratiā, meaning “for example”
mm	millimetre
RMS	Root Mean square
V	Volt
W	Watts

3.3 Acronyms

Acronym	Description
ETS	European Telecommunication Standard
EMC	Electromagnetic compatibility
IEC	International Electro-technical Commission
LVD	Low Voltage Disconnect
MTBF	Mean time between failure
OHSACT	Occupational Health and Safety Act
PDF	Portable Document Format
QA	Quality Assurance
SABS	South African Bureau Standard
SANS	South African National Standard
SNMP	Simple Network Management Protocol
VRLA	Valve Regulated Lead Acid

4. ENERGY STORAGE DEVICE

Broadband Infraco intends to install existing installed technologies (VRLA) and newer Lithium technology storage devices with front terminal at Broadband Infraco sites.

The same Energy storage device shall be capable of being used in all different rectifiers systems deployed by Broadband Infraco in various configuration, by increasing parallel multiple devices where extra storage capacity is required.

In all cases, rectifier systems will be equipped with at least 2 x Energy storage devices as described in this specification, but in most cases, 4 devices will be put in parallel up to a maximum estimated 8 units.

5. VRLA BATTERIES

Although Broadband Infraco has got vast experience with this type of technology, Broadband Infraco may require test samples from the supplier to ensure the new proposed energy storage device/s are properly tested, can be correctly integrated and operated in the Broadband Infraco network.
Broadband Infraco will request demonstration of the proposed anti- theft feature/s to ensure it is working as per Broadband Infraco requirements and that it can be correctly integrated and operated in the Broadband Infraco network

5.1 Battery technology

The battery technology shall be thin Plate Pure Lead Technology to ensure long life, high energy density and superior shelf life.

5.2 Design Life

Each storage device shall have a design life of at least ≥12 Years at 20 degrees Celsius.

5.3 Cycle Life

The battery shall be designed, with a proven track record, to meet the challenging demands of unreliable grid, have an excellent cyclic performance.

Each storage device shall have a minimum cycle capability of at least 2500 cycles at 40%. Depth of Discharge (DoD) or 1000 cycles at 80%. Depth of Discharge (DoD).

Performances of different DoD rates should be supplied with submission.

5.4 Shelf Life

Each battery shall have a shelf life of at least 12 months at an uncontrolled temperature location without putting them on charge and still be able to utilise the energy storage device with no degradation of any performances after this period has lapsed and the device being installed the first time.

5.5 Rating and Nominal Voltage

Batteries should have a nominal voltage of 12V with 4 batteries of identical type and brand with same rating to be put in series to form a 48V string.

Each battery shall have the following capacity:

a) ≥ 190Ah.

5.6 Physical Size

Each battery shall be of a 19''/21'' front terminal type batteries and shall not exceed the following dimensions:

a) Height – 330mm (current standard battery shelf height deployed in Broadband Infraco);
b) Width – 125mm per battery (to be fitted in a standard 600mmx 600mm cabinet); and
c) Depth – 550mm (to be fitted in a standard 600mmx 600mm cabinet).

5.7 Weight

Each 12V battery shall not weigh more than 60kg.

5.8 Recharging

Each battery shall be able to be fully charged from 0 - 95% stage of charge in the following time period:

a) Over a period of 24 hours (default setting).
b) All batteries will be charged at the temperature compensated mentioned float voltage throughout the batteries' life. Batteries which require at regular intervals boost charge to maintain the capacity of the batteries shall not be accepted.

Recharge graphs at different recharge rates to be supplied with submission.

5.9 Float Charging

Each 48V string (with 4 x 12V batteries in series) shall be able to be charged/float at a continuous basis for the duration of its life at a DC voltage of 53.5V-54.5V at 25°C (positive earth).

5.10 Operating Voltage

During failing of AC powers to the rectifiers, DC voltage of the device is expected to decrease gradually. Each battery shall be able to be fully operational under a voltage range of between 54.5V-42V.

Discharge graphs at different discharge rates to be supplied with submission.

5.11 Parallel Operation

Each 48V string (with 4 x 12V batteries in series) shall be able to be connected in parallel with the same units up to a total of not less than 12 of the exact same devices.

5.12 Operating Temperature

a) The battery should be designed to operate in temperature range from 0°C up to 50°C.

Performance degradation may be applicable and the suppliers to provide the temperature response graphs.

5.13 Battery Performance

a) Batteries shall be tested to SANS IEC 60896-21/22 and the relevant test report/certificate shall be submitted with tender responds against Broadband Infraco requirements. Refer to appendix D

b) Preference will be given where test results for SANS IEC 60896-21/22 have been verified by an independent or accredited test house: Certification and such proof, where available, shall be submitted with the tender responds.

5.14 Battery age

The supplier shall guarantee that the date of manufacture, indicated on the cells, will not be more than one 180 days earlier than the date of the order.

5.15 Warrantee

In the event of any components becoming defective, the supplier shall replace such defective item, free of charge, up to 3 (three) years from the date of installation:

5.16 DC Power Connections

Each battery shall be able to be connected to a rectifier with at least 1 x 50mm² red cable to the positive terminal and 1 x 50mm² blue cable to the negative terminal.

5.17 Anti- Theft Feature with Tracking and Tracing

A hardware and digital solution for Anti-Theft Feature on the batteries should be provided with full specification of its operability and any required ancillary support systems.

a) If the battery has detected movement and/or tilting of the battery, it should immediately be alerted by means of a build-in accelerometer or a tilt sensor.
b) The battery should start tracking the movement of the battery by using the built-in GPS unit once the battery has been moved outside of the predetermined perimeter area.
c) The GPS locations are sent at regular intervals (user definable) via email/SMS and notification on an App (Android compatible).
d) The system should have low power consumption with a minimum 3 years autonomy
e) It is necessary to demonstrate the operation of the proposition above.

5.18 Maintenance

The battery should preferably not require any periodic maintenance. In the case of any maintenance are required, details of the maintenance tasks and the frequency shall be clearly indicated.

5.19 System Failure Rate and other references

a) The battery design MTBF in operating hours should be stated.
b) References of other users/operators utilizing the same system/building blocks and field reports (of minimum 5 years) indicating the number of devices supplied, and the achieved failure rate shall be provided with the submission

5.20 Materials and Components

All materials and components shall be new and shall not have been in prior service except as required during factory testing and commissioning.

6. LITHIUM BATTERIES

As Broadband Infraco hasn't got experience with this type of technology, Broadband Infraco will require test samples from the supplier to ensure the new proposed energy storage device/s are properly tested, can be correctly integrated and operated in the Broadband Infraco network.

Broadband Infraco will request demonstration of the proposed controller, software and anti-theft feature/s to ensure it is working as per Broadband Infraco requirements and that it can be correctly integrated and operated in the Broadband Infraco network

6.1 Battery technology

The technology used for this requirement shall be Lithium Iron phosphate to ensure long-life, high-energy density and superior shelf life.

6.2 Design Life

Each storage device shall have a design life of at least 15 Years.

6.3 Cycle Life

Each storage device shall have a minimum cycle capability of at least 3 500 cycles at 95% Depth of Discharge (DoD) with end-of-life capacity of 80% of initial capacity.

Performances of different DoD rates should be supplied with submission.

6.4 Shelf Life

Each storage device shall have a shelf life of at least 1 year at an uncontrolled temperature location without putting them on charge and still be able to utilise the energy storage device with no degradation of any performances after this period has lapsed and the device being installed the first time.

6.5 Rating and Nominal Voltage

Energy storage devices should have a nominal voltage of 48V.

Each storage device shall have a capacity at 48V DC as follows:

a) ≥ 200Ah 10KWh.

6.6 Physical Size

The 48V Energy storage device should not exceed the following dimensions:

a) Height – 330mm (current standard battery shelf height deployed in Broadband Infraco);
b) Width – Standard 19-inch cabinet; and
c) Depth – 550mm (to be fitted in a standard 600mmx 600mm cabinet).

6.7 Weight

Each 48V storage device shall not weigh more than 100kg.

6.8 Recharging

Each storage device shall be able to be fully charged from 0 - 95% stage of charge in the following time periods and must be user definable.

a) In or in less than 2 hours (at a recharge current of 100A); and
b) Over a period of 24 hours (default setting).

Recharge graphs at different recharge rates to be supplied with submission.

6.9 Float Charging

These energy devices will be charged and maintained by the standard Telecommunication rectifiers, traditionally earmarked for VRLA batteries and these energy storage devices must be fully compatible with these rectifiers:

Each 48V storage device shall be able to be charged/float at a continuous basis for the duration of its life at a DC voltage of 53V-54.5V at 25°C (positive earth).

6.10 Charge and discharge current

Each 48V storage device shall have a minimum continuous charge and discharge current of at least 100A.

6.11 Operating Voltage

During failing of AC powers to the rectifiers, DC voltage of the device is expected to decrease gradually. Each storage device shall be able to be fully operational under a voltage range of between float voltage down to at least 42V.

Discharge graphs at different discharge rates to be supplied with submission.

6.12 Parallel Operation

Each storage device shall be able to be connected in parallel with the same units up to a total of not less than 12 of the exact same devices.

6.13 Protection

The device shall in all aspects be able to withstand the circumstances, without any damages, where the following fault condition for a duration of time has occurred. The device shall return to normal after the fault has cleared.

a) Over charge (voltage and current);
b) Over discharge;
c) Reverse polarity;
d) Over temperature; and
e) Cell imbalance (in the scenario of individual cells).

6.14 Operating Temperature

a) The device should be designed to operate in temperature range from 0°C up to 50°C.

Performance degradation may be applicable and the suppliers to provide the temperature response graphs.

6.15 Electromagnetic compatibility (EMC) and Safety and performance and endurance in cycles

The energy storage shall comply with EMC, safety requirements and endurance:

a) EMC compliance should be as per the following standards
    - EN 55032;
    - EN55024; and
    - IEC 61000
    - and carry the equivalent's CE mark.
b) Safety compliance should be as per one of the following standards
    - IEC60950
    - IEC 62133
    - IEC62619
    - IEC62620
b) Endurance in cycles should be as per one of the following standards
    - IEC62620
    - Or equivalent.

A compliance certificate and test reports of proof shall be provided. Preference will be given where the compliance certificate and test results have been verified by an independent or accredited test house: Certification and such proof, where available, shall be submitted with the tender responds

6.16 DC Power Connections

Each energy storage device shall be able to be connected to a rectifier with at least 1 x 50mm² red cable to the positive terminal and 1 x 50mm² blue cable to the negative terminal.

6.17 Controller

Each storage device shall have a built-in controller for effective cell balancing, system control and charging algorithms.

6.17.1 **Controller Display and Interfaces and Alarms**

a) Each controller should have LCD with the following comprehensive current conditions including the following must be available on the display:
   i. DC Voltage;
   ii. DC Current;
   iii. Temperature.

b) The controller should provide indicative device conditions, simplifying fault diagnostics as far as possible, where the device behaves in a manner less than ideal. There should be at least the following indication on the controller self.
   i. Unit disconnected/faulty:
   ii. Reverse polarity;
   iii. Under/Over Voltage;
   iv. Over current charge/discharge; and
   v. Over temperature.

6.17.2 **Software**

The Energy storage devices must be supplied with a suitable client PC software for monitoring and managing the operation of the device. This section describes the operation of the software.

The software must also have a web base application, android compatible, to allow for remote reconfiguration.

6.17.2.1 **Communication**

The controller must have the following communication interfaces to facilitate system interrogation:

a) USB, 10BaseT Ethernet/serial Console and/or RS232 / RS485 for local and remote system configuration and management;
b) The controller module must be able to support Simple Network Management Protocol (SNMP).

6.17.2.2 **Password Protection**

Access to the device via the software should be password protected.

6.17.2.3 **Built-in Anti- Theft Feature**

a) During initial commissioning/connection to DC power, the energy storage device should be password protected and can only be operated by authorized personnel (and OEM in scenario that password is forgotten by operator) with a valid password. The password should be loaded to the device via the PC.
b) If the energy storage device is disconnected from the DC power source, an anti-theft feature must be standard and built in each device which requires the password to be loaded to restart the device. In the event of disconnection from the DC power source, to restart the device, a PC should be required to be connected to the energy storage device with the required password.
c) If the device disconnects due to a safety event (as indicated here below), it automatically reconnects once the safety event is over and should not activate an anti-theft feature.
    i. Over- and under voltage cut off;
    ii. Over-current cut off;
    iii. Over temperature cut off.

6.17.2.4 **Management and logging function**

a) The Energy Storage Device should have proper monitoring and algorithm built-in to ensure effective, efficient and smooth operation of the devices over the life of the device.
b) The controller shall log and store all events and data logs up to 5000 entries (i.e. including but not limited to alarms, general operating conditions, voltage and currents. All logs should include the time, date and condition of event and data. When the logs entry is full, the oldest log event will be deleted first to capture the latest log event
c) All logs shall be able to be retrieve and be exported to Excel via a PC.

6.18 Anti- Theft Feature with Tracking and Tracing

Over and above the physical Energy storage devices and protection mechanisms stipulated within this specification. a hardware and digital solution for Anti- Theft Feature on the Energy storage devices should be provided with full specification of its operability and any required ancillary support systems.

This feature must be built into/embedded into energy storage device

a) If the energy storage device has detected movement and/or tilting of the battery, it should immediately be alerted by means of a build-in accelerometer or a tilt sensor.
b) The device should start tracking the movement of the battery by using the built-in GPS unit once the battery has been moved outside of the predetermined perimeter area.
c) The GPS locations are sent at regular intervals (user definable) via email/SMS and notification on an App (Android compatible).
d) It is necessary to demonstrate the operation of the proposition above.

6.19 Warranty

In the event of any of the following items/components becoming defective, the supplier shall replace such defective item, free of charge, with a minimum of 7 (seven) years but preferably 10 (ten) years from the date of installation.

6.20 Maintenance

The device should preferably not require any periodic maintenance. In the case of any maintenance are required, details of the maintenance tasks and the frequency shall be clearly indicated.

6.21 System Failure Rate and other references

a) The energy storage system design MTBF in operating hours should be stated.
b) References of other users/operators utilizing the same system/building blocks and field reports (of minimum 5 years) indicating the number of devices supplied, and the achieved failure rate shall be provided with the submission

6.22 Materials and Components

All materials and components shall be new and shall not have been in prior service except as required during factory testing and commissioning.

7. Brochures

a) Broadband Infraco shall be provided with a full set of brochures of the energy storage devices, all performance- and datasheets, management and software indicating the detail specification of the various products offered.
b) Broadband Infraco shall be provided with a full set of operation, fault finding and installations manuals.

7.1 Installation Energy Storage Devices on behalf of Broadband Infraco

a) It shall be expected from the supplier of the Energy Storage Devices to supply, deliver and install the equipment in a relevant container and or datacentre on behalf of Broadband Infraco on request.
b) Installation of new Energy Storage Devices on site where existing batteries needs to be replaced, the supplier:
    i. Shall supply, transport and install the new energy storage devices on request;
    ii. The installer shall replace the old batteries with the new Energy Storage system during a “live” cut-over without disconnecting any circuit or power;
    iii. Shall recover the old equipment and safely dispose of the old batteries, complying with all the applicable legislation and OHSACT requirements;
    iv. Shall issue the relevant certificate of compliance and test report as per SANS 10142-1.

8. RECOVERY, REMOVAL AND DISPOSAL OF REDUNDANT BATTERIES

a) The supplier of the rectifiers and batteries shall be responsible for recovery and disposal of the redundant batteries being recovered from various sites after new batteries have been installed

b) The supplier shall indicate the relevant process which will be implemented for disposing of the redundant batteries, complying with all the applicable legislation and OHSACT requirements

c) The supplier shall forward a compliance certificate either from an accredited disposal / recycle facility or from their own facility that complies with the legal requirements governing the disposal of redundant batteries/lead/lithium.

d) The supplier shall issue Broadband Infraco with a certificate indicating the actual amount of batteries/weight have been disposed of by the relevant disposal/recycle facility

9. SECURITY MEASURES

a) Broadband Infraco will make use of security measures to safeguard energy storage devices at PoP sites where theft is prevalent.

b) A pilot test on selected sites is required where the installation of batteries, cabinets solution will be done.

c) The intention is to trial the solution on these selected pilot sites, with the objective of nationwide roll out if required.

d) All extra material for the solution should be fully stipulated and costed (including transportation, installation and labour costs).

e) The measures will be based on two approach methods:

   i. Retro fitted – This is where there is an existing site where security measures are implemented by fitting security measures on existing energy storage devices. The fitment process must not require service interruptions to achieve the required results for Option 1 as per paragraph 9.1.

   ii. Indoor and outdoor installations – This is where a new site is built or where energy storage devices are moved to an outside facility to house the energy storage devices.

f) The energy storage devices security measures must comply with the following standards indicated below:

   SANS 949:2005 - Strong room and safe doors

   - Category 2ADM that withstands break in with:
     - Hand tools for 1 hour
     - Drilling for 1 hour
     - Angle grinder for 1 hour
   - Category 3 that withstands break in with:
     - Hand tools for 1 hour
     - Drilling for 1 hour
     - Angle grinder for 1 hour
     - Oxy Acetylene cutting for 1 hour

9.1 Retrofitted battery security

The retrofitted security measures must comply to Category 2AMD of the SANS standard.

In addition to this, the properties of the security measures must comply to the following two options:

Option 1:

i. Must be implementable without any down time of the site,
ii. Replacement of Energy storage device must be possible e.g. no irreversible and permanent fixture of the Energy storage device or make replacement impossible or difficult.
iii. Replacement of individual Energy storage device must be possible,
iv. Must be compatible with any OEM manufacturer equipment,
v. Must be obtainable as an off the shelf item, at least for battery replacement and
vi. Must be approved by the OEM battery supplier.

Option 2: Epoxy Compound Specifications

i. The batteries to be stored in an anti-theft cabinet or vault and be fixed to the cabinet by means of Epoxy compound solution.
ii. The solution must be non-breakable once it has set.
iii. The solution must not be harmful to the environment and should not emit toxic gases.
iv. The solution must be safe for humans.
v. The solution must be non-flammable and non-explosive.
vi. The solution must be non-soluble if mixed with commonly existing chemicals.

9.2 Indoor and outdoor installations

As mentioned before in this document, this type of installation will be used in new sites.

9.2.1 New Indoor Installations

a) The security measures must comply to Category 2AMD of the SANS standard.
b) In addition to this, the properties of the security measures must comply with the requirements of retrofitted installations.

9.2.2 Outdoor installations

a) The security measures must comply to Category 3 of the SANS standard.
b) In addition to this the security measure must comply with the following:
    i. The security measure must be a cabinet/vault type enclosure;
    ii. The cabinet/vault must be able to house a rectifier system with up to 4 x 48V energy storage device strings in parallel.
    iii. The cabinet/vault type enclosure must be constructed of steel.
    iv. The cabinet/vault must have ventilation system to extract the heat from the enclosure, by means of a fan cooling but should also be capable to house an optional air conditioning system when required.
    v. The door must be lockable with a standard Broadband Infraco padlock or lock barrel.
    vi. A remote (via NOC) locking system is also preferred but must have a fail-safe function in case of a power failure so that access is always possible.
    vii. The cabinet/vault must be mountable on a concrete plinth so that it cannot be lifted to gain access to the cabinet/safe.
    viii. The cable access to the equipment container must be underground in a 110mm duct.
    ix. The duct must be protected with concrete encasement of at least 250mm deep.
    x. In addition to the above requirements as an extra safety measure, the option must be available for batteries to be fixed to the cabinet by means of Epoxy compound solution compliant to paragraph 5.1 Option 2.

9.3 Brochures

Broadband Infraco shall be provided with brochures, datasheets, pictures of the proposed security measure of all the various products offered for retrofit as well as indoor and outdoor products

10. APPENDICES

Selected schedule(s) are found in the appendices and forms part of this specification.

10.1 Appendix A: Maintenance Processes

Suppliers are required to respond to all questions in this schedule.

Broadband Infraco will make use of the information provided during its price evaluation process to assess the complete lifecycle cost of the proposed systems, as well as the potential impact on the total cost of ownership of the equipment over a period of 10 years and 30 years

10.2 Appendix B: Support Processes

Suppliers are required to respond to all questions in this schedule.

Broadband Infraco will make use of the information provided during its technical evaluation process to assess whether a supplier's support processes will be able to effectively support Broadband Infraco's requirements.

10.3 Appendix C: Schedule of Compliance / Non-compliance / Information

Suppliers are required to complete this schedule and must take note of the following:

1. A detailed statement of compliance or non-compliance, accompanied by reasons (if any) for every requirement called for in the specification, must be submitted. The detailed statements must be in the format as provided in Schedule A. Where needed, further notes may also be appended to the schedule.

2. It must be clearly stated whether the equipment offered, for each of the specified requirements, is:
    - **Fully Compliant**, or
    - **Non-compliant**

3. Phrases such as "**noted**" must only be used against paragraphs that are for information only and carry no contractual commitment.
4. Phrases such as "**noting**", "**will comply**" and "**comply, except**", in a paragraph that requires a compliance or non-compliance statement will be read as non-compliance.

END

APPENDIX A: MAINTENANCE PROCESSES

1. What routine maintenance procedures are required for the energy storage device (if any) components of the proposed system solutions:
    a) How often is routine maintenance required (if any)?
    b) Explain what tasks should typically be performed during routine maintenance and what tools and or training will be expected of such personnel?
2. Provide a life cycle costing model/analysis taking into account all factors/relevant assumptions predicting the life expectancy of the supplied solution for energy storage device individually operating under normal circumstance. Normal circumstance is regarded as 1 cycle per month with a depth of discharge of 80% at average ambient temperature of 22 degrees Celsius. A predicted total cost to company including all aspects over a 10 and 30 year life cycle is to be calculated and supplied.
3. The supplied shall give a technology life cycle positioning of the equipment offered which shall include but not limited to the following:
    a) When was the offered equipment first introduced into the commercial market,
    b) When was the last upgrade and when is the next planned upgrade.
    c) What is the life expectancy of the offered equipment before equipment will become
    d) Obsolescent and
    e) Obsolete

APPENDIX B: SUPPORT PROCESSES

1. Support services
    a) Do you offer support services beyond the sale of equipment?
    b) If so, how are such support services provided inside and outside the equipment warrantee period?
    c) If support services are offered, are there additional cost implications?
    d) If there are additional cost implications, kindly provide a detailed breakdown of these costs?
2. How will Level 2 and Level 3 support queries be handled? Please describe the process that would be followed for each support level. As part of the process descriptions, kindly make reference to the following aspects:
    a) Who will be responsible for handling Level 2 and Level 3 support queries
    b) Access to Level 3 support engineers
    c) Availability of local subject-matter experts
        xi.
3. Repair of faulty equipment
    a) How will in-warranty and out-of-warranty repairs be handled? What is the process to be followed for each and what turnaround times can be expected?
    b) Will spares be kept inside the country?
    c) Will repairs be done inside the country?
    d) Will modules / equipment / energy storage devices be readily available for swop-out during failures?
4. Training
    a) What training is offered on purchase, and what is offered on an ongoing basis?
    b) Will training be conducted inside the country or outside of the country?
    c) What training is offered / required in terms of continuous certification of staff and contractors?
    d) Is an online help / training facility available?
    e) Is a “train the trainer” concept supported whereby experts are created locally?

5. If applicable, please describe how firmware / software upgrades are handled, including licensing issues, etc.
6. Supplier to provide an end of life management, which include the disposal process

APPENDIX D: BATTERY REQUIREMENTS AS PER SANS IEC 60896 21/22

User statement of requirements

1) Application description information						
Application summary	Telecommunication					
Load (in A or W) and autonomy time profile (s)						
Minimum and maximum system float voltage	Max voltage: 57V and min Voltage: 42					
Maximum of boost charge system voltage available Y/N If yes what value?	N/A					
Expected minimum and maximum operating temperatures and their duration per year	Min temp of 10 degrees with maximum degrees of 40 degrees					
Any other relevant information or operational requirements such as duration and frequency of power outages, of diagnostic discharges and of energy cost saving actions						
2) Product specification information						
Product safe operation in service	**Compliance information mandatory**					
6.1 Gas emission (at the float voltage and at 2,40 VPC)	Maximum allowed gassing are as follows: Ge at Float: 0.043ml/cell/h/Ah and Ge at 2.4VPC: 0.43ml/cell/h/Ah					
6.2 High current tolerance	Pass					
6.3 Short circuit and DC internal resistance	Maximum allowed short circuit current: 5000A					
6.4 Internal ignition from external spark sources	Pass					
6.5 Protection against ground short propensity	Pass					
6.6 Content and durability of required markings	Pass					
6.7 Material identification	Pass					
6.8 Valve operation	Pass					
6.9 Flammability rating of materials	VO - rating					
6.10 Intercell connector performance	Maximum allowed temperature is 70°C					
Product performance in service	**Compliance information mandatory**					
6.11 Discharge capacity	Data for	C_{10}	C_8	C_3	C	$C_{0.25}$
6.12 Charge retention during storage	Pass					

6.13 Float service with daily discharges	Requirement: Very unreliable mains failure)
6.14 Recharge behaviour	Pass
Product durability in service	**Compliance information** **mandatory**
6.16 Impact of stress temperature of 55 ^{0}C or 60 ^{0}C	Requirement: Very long duration exposure time)
6.17 Abusive over-discharge	Poor mains supply with E.o.d voltage control
6.18 Thermal runaway sensitivity	Pass
6.20 Dimensional stability at elevated internal pressure and temperature	Pass
6.21 Stability against mechanical abuse of units during installation	Pass

Supplier statement of test results

1) General product type information		
Product manufacturer		
Manufacturing site of tested product		
Product name		
Product model range		
Product comprising the above model range		
Product tested		
2) Product test performance information		
Product performance in service	**SANS IEC 60896-21 test clause result**	
6.1 Gas emission (at the float voltage and at 2,40 Vpc)		
6.2 High current tolerance		
6.3 Short circuit and d.c. internal resistance		
6.4 Internal ignition from external spark sources		
6.5 Protection against ground short propensity		
6.6 Content and durability of required markings		
6.7 Material identification	Case	Cover
6.8 Valve operation	Before	After
6.9 Flammability rating of materials	Case	Cover

6.10 Intercell connector performance					
Product performance in service	**SANS IEC 60896-21 test clause result**				
6.11 Discharge capacity	C_{10}	C_8	C_3	C	$C_{0.25}$
6.12 Charge retention during storage					
6.13 Float service with daily discharges	Cycles	C_{af}	C_{ab}		
6.14 Recharge behaviour	24 h	168 h			
Product durability in service	**SANS IEC 60896-21 test clause result**				
6.15 Float service life at 40 ^{0}C	Days with C_3 rate test at 40 ^{0}C				
6.16 Impact of stress temperature of 55 ^{0}C or 60 ^{0}C	Days with C_3 rate test at 55 ^{0}C or 60 ^{0}C Days with $C_{0.25}$ rate test at 55 ^{0}C or 60 ^{0}C				
6.17 Abusive over-discharge					
6.18 Thermal runaway sensitivity					
6.20 Dimensional stability at elevated internal pressure and temperature					
6.21 Stability against mechanical abuse of units during installation					

Company name:

Company officer:

Address/phone/fax/e-mail:

Signature/date/place:

Document established as reply of RFI:

APPENDIX C: SCHEDULE OF COMPLIANCE / NON-COMPLIANCE / INFORMATION

Specification		
Specification	**Fully Compliant / Non-compliant / Noted**	**Comments (if applicable)**
4 Energy Storage device		
5. VRLA batteries		
Sample and demonstration		
5.1 Battery Technology		
5.2 Design life		
5.3 Cycle Life		
5.4 Shelf life		
5.5 Rating and nominal voltage		
5.5.a		
5.6 Physical Sizes		
a		
b		
c		
5.7 Weight		

5.8 Recharging		
a		
b		
5.9 Float charging		
5.10 Operating Voltage		
5.11 Parallel Operation		
5.12 Operating temperature		
5.13 Battery Performance		
a		
b		
5.14 Battery Age		
5.15 Warrantee		
5.16 DC Power connections		
5.17 Built-in Anti- theft feature		
5.17a		
5.17b		
5.17c		
5.17d		
5.17e		
4.18 Maintenance		
4.19 System Failure Rate		

and other references		
4.19.a		
4.19.b		
4.20 Materials and components		
6. Lithium batteries		
Sample and demonstration		
6.1 Battery Technology		
6.2 Design life		
6.3 Cycle Life		
6.4 Shelf life		
5.5 Rating and nominal voltage		
6.5.a		
6.6 Physical Sizes		
a		
b		
c		
6.7 Weight		

6.8 Recharging		
a		
b		
6.9 Float charging		
6.10 Charge and discharge current		
6.11 Operating Voltage		
6.12 Parallel Operation		
6.13 Protection		
6.13.a		
6.13.b		
6.13.c		
6.13.d		
6.13.e		
6.14 Operating temperature		
6.15 Electromagnetic compatibility (EMC) and Safety and performance and endurance in cycles		
6.15.a		
6.15.b		
6.15.c		
6.16 DC Power		

connections		
6.17 Controller		
5.15.1 Controller display and interfaces and alarms		
a		
a.i		
a.ii		
a.iii		
b.i		
b.ii		
b.iii		
b.iv		
b.v		
c		
6.17.2 Software		
6.17.2.1 Communicatio n		
6.17.2.1.a		
6.17.2.1.b		
6.17.2.2Passw ord Protection		
6.17.2.3 Built- in Anti- theft feature		
6.17.2.3a		
6.17.2.3b		
6.17.2.3.c.i		
6.172.3.c.ii		
6.17.2.3.c.iii		

6.17.2.4 Management and logging function		
6.17.2.4.a		
6.17.2.4.b		
6.17.2.4.c		
6.18 Tracking and Tracing of Energy storage devices		
6.18 a		
6.18 b		
6.18 c		
6.18 d		
6.18 e		
6.19 Warrantee		
6.20 Maintenance		
6.21 System Failure Rate and other references		
6.21.a		
6.21.b		
7 Brochures		
7.a		
7.b		
7.1 Installation Energy Storage Devices on behalf of Broadband Infraco		
7.1.a		

7.1.b		
7.1.b.i		
7.1.b.ii		
7.1.b.iii		
7.1.b.iv		
8. RECOVERY, REMOVAL AND DISPOSAL OF REDUNDANT BATTERIES		
8.a		
8.b		
8.c		
8.d		
9 Securities measures		
a		
b		
c		
d		
e		
e.i		
e.ii		
f		
5.1 Retrofitted energy storage devices security		
Option 1		
i		
ii		

iii		
iv		
v		
vi		
Option 2		
i		
ii		
iii		
iv		
v		
vi		
9.2 Indoor and outdoor installations		
9.2.1 New Indoor Installations		
a		
b		
9.2.2 Outdoor installations		
a		
b		
b.i		
b.ii		
b.ii		
b.iv		
b.v		
b.vi		
b.vii		
b.viii		
b.ix		

b.x		
9.3 Brochure		

Appendix A: Maintenance Processes

Appendix B: Support Processes