TECHNICAL SPECIFICATION

Uninterruptible Power System

RATED POWER: 1000 kVA/kW – Three-phase

X min autonomy at 1000 kW

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# TERMS and ABBREVIATIONS

For the purpose of this document, we have used the following terms and standard abbreviations:

UPS Uninterruptible Power System

UPS System UPS composed by one or multiple UPS unit(s)

UPS unit UPS composed by power bricks(s)

Power Brick Double conversion power converters

IGBT Insulated Gate Bipolar Transistor

DSP Digital Signal Processor

THDU [Total Harmonic Distortion Voltage](http://www.allacronyms.com/Total_Harmonic_Distortion_Voltage/abbreviated) (Phase/Phase)

THDI [Total Harmonic Distortion](http://www.allacronyms.com/Total_Harmonic_Distortion_Voltage/abbreviated) in Current

VFI Voltage and Frequency Independent (according IEC/EN 62040-3)

AC Alternative Current

DC Direct Current

N Neutral; Generic symbol used for neutral conductor

VRLA Valve Regulated Lead Acid

AGM Absorbent Glass Mat

EMC Electro Magnetic Compatibility

IEC International Electrotechnical Commission

EC European Conformity

EN European Norms

# USER GUIDE

Paragraphs shown in red are referring to options. These parts can be deleted if these options are not relevant to the current project.

Text in grey is to be completed, edited or selected according to the needs of the project.

*Text in purple gives you recommendations or highlight some facts, please read them carefully!*

# PURPOSE OF THE SPECIFICATION DOCUMENT

This specification document describes a double conversion Uninterruptible Power System (hereafter referred to as UPS). This solution is specified to provide high quality power, improve the overall availability and energy efficiency of power systems dedicated to protect sensitive and very critical loads.

The system will be composed of …N…. UPS Unit(s)

Each UPS unit shall be designed with internal power conversion bricks combined with a common static bypass rated for the full power. The power bricks will be associated with an appropriated mechanical and electrical segregation system, so that any abnormal event will be contained to the related brick and not propagated to the rest of the unit.

This UPS and installation shall allow a high grade of serviceability; such that all UPS maintenance can be carried out in a simple, fast and secured way.

The technical reference is SOCOMEC *Delphys XL* UPS or as a similar solution approved by us.

*If case of several UPS units connected in parallel, please make sure you clearly specify the number of Units included in each system.*

*If case of several parallel systems, please make sure you clearly specify the number of systems.*

DIRECTIVES AND STANDARDS CONFORMITY

The UPS covered by this specification must have the EU marking, in accordance with European directives and standards:

* Low voltage directive (LVD) : 2014/35/EU.
* Electromagnetic compatibility directive (EMC): 2014/30/EU.
* Restriction of the use of certain hazardous substances (RoHS): 2011/65/EU.
* WEEE - Electrical and electronic equipment waste (WEEE): 2012/19/EU.
* Safety UPS standard (LV): EN/IEC 62040-1.
* EMC Emissions UPS standard: EN/IEC 62040-2 class C3.
* EMC Immunity UPS standard: EN/IEC 62040-2 classes C2-C3.
* Test and performances UPS standard: EN/IEC 62040-3.
* Environmental aspects UPS standard: EN/IEC 62040-4.

Relevant documentation and certificates must be made available on request.

Compliance related to the Safety and EMC standards shall be certified by independent laboratory.

# ORIGIN

The system (including power bricks) shall be developed, manufactured and tested in a European country (France). The development and the production site must be certified according to ISO14001 (Environmental management system) and ISO 9001 (Quality management system).

# GENERAL DESCRIPTION OF HIGH POWER UPS

The UPS architecture shall eliminate all single point of failure associated to traditional UPS to ensure best protection level under real operating conditions. An inherent feature of the UPS is the requirement of multiple self-sufficient power bricks to provide intrinsic N+1 redundant capability up to 75% of the rated power in double conversion mode

UPS architecture

Each UPS Unit will consist of the following parts:

* Input, output and DC energy storage connection area designed for high power connection - capable of accepting busbar flanges when required. DC connection capability shall be able to welcome up to 10 strings with 240mm² cables size per polarity.
* A unique and fully rated Static by-pass, designed to sustain high downstream fault current.
* Double conversion power bricks, having each of them their own control to master its rectifier, inverter, DC/DC converters.
* A units’ control, monitoring and indication incorporating a color touch screen HMI for local interface and some communication slots ready for plug-in remote communication interfaces.

## General UPS characteristics

* Storage temperature range : -20°C to + 70°C
* Operating temperature range: 0°C to + 50°C
* Operating relative humidity: Up to 95 % at room temperature, without condensation
* Altitude, without derating: ≤1000m,

|  |  |
| --- | --- |
| Apparent rated power of the UPS unit(s) | 1000 kVA |
| Active rated power of the UPS unit(s) | 1000 kW |
| Rated output power factor design | PF=1 |
| Type of network (input/output) | Three-phase / Three-phase |
| UPS classification according EN/IEC 62040-3 (Edition 3.0 - 2021) | VFI - SS - 11 |
| Rated input voltage | 380 / 400 / 415 V |
| Rated input frequency | 50 Hz |
| Rated output voltage | 380 / 400 / 415 V |
| Rated output frequency | 50 Hz |
| Power feeders for rectifier and bypass | Common input / Separate inputs |
| Input(s) and Output AC power connection | Bottom entry / Top entry cables / Flanges |
| Protection Index according to EN/IEC 60529-2 | IP 20 |

## UPS resiliency

The specified UPS will have a high resilient internal architecture, designed to maximise the normal mode service operation under abnormal event.

Compliance with the following requirements will be evaluated:

* The UPS will be designed to provide intrinsic double conversion mode redundancy in case a power brick is no longer available
* The system shall be designed to avoid fault propagation through mechanical segregation between each of the power conversion brick that compose the UPS unit.
* Each power conversion brick shall integrate all the hardware and software required for its rectifier, inverter and DC/DC converter self-sufficient operation.
* A selective disconnection system composed by contactors together with fast acting fuses at input and output stages of each power bricks, allowing its automatic isolation from the UPS unit - when required.
* The UPS unit shall be provided with a single static switch, sized for a permanent operation at 1000kVA and mechanically separated from the double conversion section.
* The UPS shall withstand a 50kA Icw short circuit - without additional fuses to maximise the level of selectivity
* Operating and protection parameters are to be firmware controlled with no requirement for manual adjustment.
* The user control panel does not embed any intelligence that may affect the system control upon failure and shall be replaceable without shutting down the unit

## Easy and risk-free UPS maintenance

The specified UPS will be engineered to ease maintenance activities with easy access to all components for maintenance or repair of each part of the system.

Compliance with the following requirements will be evaluated:

* Maintenance shall be done with a full front access only in order to reduce the MTTR
* All maintenance activities shall be done with the power brick outside of the system to avoid any risk and to ease the access to the consumables
* To ease and secure maintenance operation, the system will be provided with all means required to physically extract a power conversion brick
* Handling means such as rails or trolley required for the maintenance of a power brick will have to be provided with each unit and to remain physically on site to ensure their availability when required.
* If required, it shall be possible to swap a complete power conversion brick without any cabling action in less than 30 minutes. An automatic firmware alignment and parameters self-configuration are ensuring that the spare power brick will run with the customer firmware configuration. PCB replacement shall be possible with no requirement for recalibration.
* UPS heat run test - without the need of dummy load bench - shall be available in standard to certify the commissioning and advanced maintenance operations –.

The supplier shall be able to propose a spare power brick within a dedicated frame installed on site.

In this case - to guarantee its operation when required - the spare power brick will be permanently operating and the system shall include all the means to perform periodical test at the rated power of the power brick.

The above requirements shall allow a single person to ensure a short First Time Fix Rate, having the possibility to swap a power brick and to limit the time and operation on wrap-around bypass.

# POWER CONVERSION

Each UPS Unit is composed of several power conversion bricks.

Each power conversion bricks includes the following sub-assemblies:

* Rectifier
* DC/DC converter (battery management)
* Inverter
* Independent and brick dedicated control
* Input and output contactors together with fast acting fuses
* Cold plug-in system for minimum MTTR

## General characteristics

The UPS shall be designed to supply the latest generation of loads with unity output power factor (pf =1), without derating oroperating in ambient temperature. It must comply with the following key technical specifications:

|  |  |
| --- | --- |
| Rated power @ 30°C | 1000 kVA/kW |
| Type of network (input/output) | Three-phase / Three-phase |
| UPS classification according EN/IEC 62040-3 (Edition 3.0 - 2021) | VFI - SS – 11 |
| AC/AC efficiency in double conversion mode (VFI mode) | Up to 97 % |
| Rated input voltage / frequency | Aligned to the system specification |
| Rated output voltage / frequency | Aligned to the system specification |
| Protection Index according to EN/IEC 60529-2 | IP 20 |

## Rectifier

The rectifier will be protected by a current limitation and must operate with an incorrect input phase rotation.

The rectifier will comply with the following key technical specifications:

|  |  |
| --- | --- |
| Rectifier bridge technology and topology | DSP control - three level IGBT |
| Rated voltage | 3 x 380/400/415 V - 3 ph  (without required neutral) |
| Min - max voltage tolerance | 200 - 480V (depending on load rate) |
| Frequency range | 45 - 65 Hz |
| Input power factor at full load (without active or passive filters) | ≥ 0.99 |
| Input Harmonic distortion (THDi) at full load  (without active or passive filters) | ≤ 2.5 % |
| Rectifier power walk-in (current ramping) | configurable from instantaneous restart to 10 A/sec |
| Genset management | Smart power sharing for Genset support |

## DC/DC converter

The system must have a DC/DC converter that manages the battery according to the battery manufacturer’s recommendations. A sensor to measure the temperature of the battery room shall be provided and connected to the UPS.

To maximize the battery lifetime, its voltage must be independent from DC bus which is generated by the rectifier and must have the following performances:

|  |  |
| --- | --- |
| DC/DC rated power for battery discharge | 1000kW |
| Battery connection 2 Wires (+ / -) | 2 Wires (+ / -) |
| Battery voltage range | Up to 700V |
| Battery charger max current | 160A (Std) – 480A (optional) |
| Charging current in normal mode | Adjusted according to battery manufacturer recommendation |
| Charging current in GenSet mode | Settable according to customer request |
| Floating voltage (Lead acid batteries) | Possibility to adjust according to the temperature |

The UPS will be capable of charging the lead acid batteries in sustained floating mode and will automatically switch to intermittent charging mode if necessary. The temperature threshold for switching from one mode to the other will be configurable; this function can also be inhibited.

## Energy Storage

Energy accumulator will provide a backup time of … minutes at end of life at a load of … kW.

It will be a sealed lead-acid and maintenance-free battery (VRLA) / AGM technology / sealed lead-acid and maintenance-free battery (VRLA) gel technology / lead-acid unsealed battery / NiCd battery / Lithium-ion battery with a rated life of 10-12 years according to EUROBAT / > 12 years according to EUROBAT at 20°C

Batteries will be supplied and installed in a separate metallic cabinet / on shelves with an acid container / on shelves without an acid container / open steel racks. The battery calculation sheet will be attached to the offer, specifying the rated output power (kW), the inverter efficiency and the voltage at the end of discharge.

## Periodic battery discharge at configurable and stabilized power (optional)

A system with batteries should include the ability to perform battery discharge tests without the use of an external resistive load or any dedicated switchboard. Therefore, the unit will be able to inject the energy stored in the batteries upstream, to be consumed by other units or customer loads. The test will be performed at a constant power (full power or partial load, configurable through the manufacturer's maintenance software) to validate battery back-up time or availability.

During the test phase, it shall be possible to keep the tested unit supplying the load in online double conversion mode.

The power to be fed back upstream through the rectifier will correspond to the difference between the discharged power and the load consumption.

To ensure safe site operation, the system will take into account the network status and automatically terminate the test in the absence of mains power.

The use of this function is conditioned by the capability to locally absorb the feedback energy fed back.

## Three Level IGBT Inverter

The inverter must use IGBT technology with DSP control and high switching frequency in order to support step changes in the output load. It must be equipped with its own current limiting algorithm, so that components will not be damaged in case of an output short-circuit. The Unit must provide a signal to trip the battery protection at the end of the discharge or in case of emergency stop activation.

The inverter must feature fast acting internal protection preventing transposition of DC current to the critical load in the event of an IGBT failure.

The inverter must comply with the following specifications:

|  |  |
| --- | --- |
| Inverter topology and technology | IGBT – Thee level |
| Rated output voltage | 3 x 380 / 400 / 415 V with neutral |
| Rated frequency and tolerance | 50 / 60 Hz ± 5Hz |
| Permanent rated power @ 30°C | 1000 kVA/kW |
| Load management without derating within the limits of the rated apparent and active power | Any load with a power factor from  inductive to 0.95 capacitive |
| Output voltage stability in dynamic conditions according to IEC/EN 62040-3 | Class 1 (VFI-SS-11) |
| Frequency stability (in battery mode or while auxiliary mains is absent) | ± 0.01 Hz |
| Line synchronisation range (auxiliary mains present) | ± 0.5 Hz to ± 5 Hz (configurable) |
| Output voltage stability in static mode between 0 to 100% load | ± 1 % Vn |
| Total output voltage distortion with a linear load at rated power | THDU ≤ 2 % |
| Minimum average peak short circuit current limitation (when the auxiliary mains or the bypass line is not available) | 3280 from 0 to 20ms  2600 from 20 to 100ms |
| Overload capacity for 1 hour | 1100 kW |
| Overload capacity for 10 minutes | 1250 kW |
| Overload capacity for 1 minute | 1500 kW |

# BYPASS

## Automatic bypass

The UPS shall be provided with an automatic static bypass ensuring the system switching between the power conversion side and the auxiliary source without any interruption of power. User initiated transfer from double conversion inverter operation to utility via the static bypass must be available through soft commands at the control HMI.

Each UPS Unit shall be designed with:

* A static bypass in the auxiliary source branch sized for a permanent operation at the rated power of the UPS unit - connected in parallel of the each power conversion brick’s integrated bypass circuit.
* No protections in series with the static bypass or, if present, fully coordinated with upstream and downstream plant protection in order not to compromise the coordination/selectivity design of the plant; the protection characteristics will need to be submitted for approval.
* Control logic ensuring a no break transfer to static bypass in case of overload, inverter failure or downstream short circuit.

The static bypass of each UPS Unit will comply with the following key technical specifications:

|  |  |
| --- | --- |
| Switching with inverter synchronized to the auxiliary source | No interruption |
| Static bypass overload capability:   * Permanent * 10 minutes * 1 minute * 10 sec | 110 %  125 %  150 %  200 % |
| Short circuit capability (without damaging the static switch) | ≤ 25 000 Apeak  ≤ 4 500 000 A²s |
| Short-circuit withstanding (ICW) | 50kA symmetrical / 100kA with fuses |
| Static bypass cooling | Forced with redundant fan |

## External Maintenance Manual Bypass

The UPS Unit(s) will be ready to monitor the position of an external manual maintenance bypass. This information will be managed by the UPS system for safe operation and maintenance activities. Transfer from the bypass static switch to the manual maintenance bypass switch will be without power interruption.

# OPERATING MODES

The UPS will be designed for permanent operation in online double conversion mode. It shall also be ready to operate in the following modes.

## Hot stand-by mode (double conversion)

The UPS unit(s) shall have an energy saving mode to improve the online double conversion efficiency under low load rate condition. Non-required power converters shall be able to automatically switch in hot stand-by while the load remains protected by the remaining power bricks protecting the load. The bricks operating in online mode or hot stand-by will be automatically defined by the system to ensure the battery charge and a homogenous lifetime of the different converters. The minimum number of online power bricks shall be settable according to the customer’s choice. In case of sudden load increase, all power bricks in hot stand-by will immediately come back into double conversion mode to provide the full double conversion capability.

## Smart Conversion mode (optional)

The UPS unit(s) will allow operating in a Smart Conversion mode to optimize efficiency without compromising the load protection. It will automatically select the most optimized working mode : double conversion or line interactive mode according to the input network conditions. Under line interactive operation, the UPS will work as an active filter, supplying the load through the bypass line together with the inverter – able to ensure the batteries charge while compensating the load harmonics and power factor.

The algorithm monitors in real time the network parameters related to the inputs network conditions (voltage, frequency, THDv tolerances to be configurable) in order to have the best power protection at any times with the highest level of efficiency. Transfer in case of network out of the tolerances shall respect the class 1 curve according to IEC 62040-3 standards.

When this option is required, it shall be possible to enable and configure this mode on the local HMI.

## Advanced Genset Management

The UPS unit(s) shall be able to support the upstream Genset in case of difficulties due to significant transient load steps when operating in double conversion, with the help of the DC/DC converter and the battery capacity. This mode will allow the generator to keep its frequency and voltage within an acceptable range in order to feed the UPS and critical loads .

This function shall be adjustable so that a load step from 0 to 100% of the rated power can be handled whatever the class of the Genset.

# CONSTRUCTION SPECIFICATION

The manufacturer will provide the UPS width, depth and height in accordance to here-in specified features and functionalities, including Input/output and DC connection cabinet when required.

The UPS must have no requirement for rear and side rear clearance, allowing installation against a wall or back to back, with no detrimental impact to installation, operating and servicing.

* The UPS unit shall not exceed a width of 2,625 meters for common or separated inputs with top or bottom cable entry.
* The unit shall be designed to be easily adaptable to bus bar flanges integration.
* The power and control cables must be accessible by the front.
* The cooling will be assured by forced ventilation: the air inlet will be on the front panel and the outlet will be at the top of the cabinet.
* Noise level will not exceed 75 dB(A), according to ISO 3746
* Maintenance operations will be carried out with front access only to ease and minimize the Mean Time To Repair.

# USER INTERFACE, CONTROLS AND ALARMS

The user interface on the UPS Unit must have a touchscreen colour graphic display of at least 7” and must provide the following controls/alerts:

* Synoptic with unit’s input/output state and energy flow representation;
* A USB port for updating language and downloading the event/alerts log;
* Display of the following parameters:

input and output voltages, currents and frequencies;

battery voltage;

battery charge / discharge current;

apparent and active power;

output load rate.

* Three-colour backlighted bar under the HMI giving the UPS status instantaneously

In the event of a parallel configuration, displays must support the configuration of the entire system and provide measurements, events and alarm data of the concerned Unit or for the entire system.

With its dedicated input terminal blocks, the system will be able to manage the following external devices/signals:

* External Emergency stop in order to activate following functions :
  + UPS stop and separation by opening the inverter downstream contactor
  + Static by-pass stop
  + Battery protection tripping (if equipped with a trigger device)
* Report the downstream / upstream / wrap around bypass protection devices positions
* Genset, with the option to inhibit battery recharge or to active the advanced genset management;
* Battery protection (open/closed), taking into account the status on the display;
* Battery temperature, to display on the screen and manage the battery charge;
* External maintenance bypass (open/closed), to secure manual and automatic operations ;
* Report the upstream backfeed isolation device position;
* Trigger the upstream backfeed isolation device if a fault is detected

The system will provide an alarm synthesis of any faults that could appear on the UPS unit (general alarm). The following interfaces could be supplied with the UPS or installed later:

* Ethernet connection card – compliant with the OWASP security recommendation / ISO27002:2013 standard - supporting the following communication protocols:

SNMP v1 / v3,

HTTP(s) (web page),

SMTP/TLS (secured email alerts),

* MODBUS over TCP-IDA / PROFIBUS / PROFINET / BACnet
* RS485 serial communication cards;
* In/Out programmable card, with at least 3 inputs and 4 outputs (VFC) by card;

Card programming must allow affecting to each output a state or an alarm available inside the system.

* Remote display - touchscreen colour graphic display of at least 7”;

# CONNECTIVITY COMPLIANCE & SMART COMMUNICATION FUNCTIONALITY

The UPS shall be compliant with the following minimum connectivity requirements to enable smart communication functions and digital services as follows:

## EDGE connectivity for UPS local monitoring and orderly shutdown



**Connection compliance:** the following items shall be available:

* An Ethernet network card with an Ethernet port to connect to the LAN/WAN over TCP/IP (supporting also SNMP and Modbus TCP/IP protocols).
* A Modbus RTU RS485 multi-point interface for monitoring the UPS for example by BMS (Building Management System) and SCADA systems.

To avoid any loss of communication in any operating mode of the UPS, both interfaces shall be permanently powered by a secure supply such as from a UPS.

**SMART communication functionality:** the following shall be available:

* Web server function to Monitor the UPS via a web browser into LAN/WAN.
* NMS monitoring compatibility via Simple Network Management Protocol (SNMP) to monitor the UPS remotely through a standard MIB file
* Modbus RTU or Modbus TCP/IP communication protocol to monitor the UPS for alarms, status and metering data for integration into the SCADA system. (The Modbus registers communication table shall be made available and shall be provided for the SCADA system integration)
* Unattended Automatic Shutdown shall be provided to manage the graceful shutdown process for standalone workstations/servers, virtual machines and related hosts, via a Shutdown Agent software.

## Permanent Cloud IOT connectivity (for UPS remote monitoring & 24/7 service monitoring)

**Connectivity compliance**

An IoT Network Management card shall be provided as the gateway for Cloud provisioning via LAN/WAN. This shall enable the Internet connection for UPS data collection to the secure-proof manufacturer Cloud platform to provide the services listed below. *in the applicable countries and regions*

SMART communication functionality

End-user smartphone UPS monitoring app

The UPS manufacturer shall provide a smartphone app, downloadable from the major App Stores (such as Apple Store and Google Play).

As a minimum, the app shall display:

* The UPS model & serial number, to clearly identify the machine
* An overview of all UPSs installed,
* Real time UPS main information, including :
  + UPS status
  + Global UPS load rate
  + Battery capacity and autonomy
  + UPS internal temperature
* Push notifications in case of alarms and anomaly occurrence.

1. 24x7 proactive remote service monitoring

The UPS manufacturer shall be able to provide a UPS remote monitoring and diagnostics service 24/7/365 that includes a permanent and direct connection to the manufacturer’s expert technical service team.

When the operating parameters of the UPS fall outside the allowed range the system shall be able to automatically identify the anomaly and notify the local Service Center. The supervising service engineer of the manufacturer shall then carry out an immediate check of the alarms by accessing the UPS parameters and proactively inform the end-user.

1. Health Check reporting

The UPS manufacturer shall be able to provide the end-user with the following:

* Regular “health check reports” including technical notes, statistics on data and power quality trending of the UPS and recommendations from the manufacturers expert.
* UPS historical data access via an interactive WEB dashboard to consult graphs and performance trends including the possibility to download the data.

## On demand over Mobile Network connectivity

**Connectivity compliance**

A Bluetooth ® Low Energy (BLE) interface shall be available to allow on demand over mobile network service to enable a temporary and real time access for remote service purposes.

**SMART communication functions**

The manufacturer's expert service engineer shall be able to remotely connect direct-to- UPS at the customer's site for real-time diagnosis, an in-depth troubleshooting and perform a full root cause analysis. *in the applicable countries and regions.*

The connection shall be temporary and encrypted to guarantee safety operations (cybersecurity proof ).

The established connection with the Service Center shall be further secured by using an OTP code (One Time Password) between the remote service engineer and the end-user.

In order to ensure maximum data protection during communication, all remote operations shall be based on a telecom mobile connection that is completely independent of the customer’s local area network LAN/WAN.

# EXECUTION

## FACTORY TESTING AND INSPECTION

The supplier of the equipment must be able to offer factory acceptance tests which may be witnessed by the customer.

All tests will be carried out with appropriate measuring instruments, their accuracy demonstrated by a certificate of calibration.

Following the positive outcome of the test procedure, the manufacturer shall prepare a certificate listing the tests performed and the results obtained.

## COMMISSIONING

After installing the equipment (the complete system and the power modules required at the beginning) and its power supply, commissioning will be carried out by technicians trained and certified by the UPS manufacturer.

The following steps must be performed on the supplied equipment:

* Visual inspection of the equipment,
* Check electrical and mechanical connections,
* Functional and operational tests,
* Full Load-testing using heat-run test functionality, avoiding the use of a dummy load test bench,
* Install and verify the transfer of data to the supervision station
* Basic training for system users: \* General description of how to use the system

\* Instructions on use and maintenance

At the end of the commissioning procedure, the technician will create a full report on the undertaken work.

## FIELD MAINTENANCE AND REMOTE SERVICES

The UPS manufacturer shall ensure a local or remote service organisation available 24 hours a day, 7 days a week, 365 days a year, in order to perform the maintenance services necessary to preserve the UPS in the best operating conditions during its lifecycle.

All maintenance operations (onsite or remote) shall be performed by service engineers that are qualified by the manufacturer or by authorised partners that have been trained and certified by the UPS manufacturer.

The UPS manufacturer shall ensure the proper asset management maintenance program of the installed UPS equipment, by means of a service contract agreed between the manufacturer and the end-user including a defined SLA (Service Level Agreement).

The service program shall list details of what is included such as the following:

* **preventive maintenance program,** that will ensure the maximum availability of the UPS
* **on field and digital remote services**, to:
  + meet the UPS life expectation as declared
  + minimize the MTTR in case of anomalies
* **List of Replacement Parts** to be readily available for shipment within four (4) working hours from the order confirmation
* **24x7 proactive remote monitoring service**:

The UPS manufacturer shall be able to provide a UPS remote monitoring and diagnostics service 24/7/365 by means of a permanent and direct connection to the manufacturer’s expert remote service engineering team, in the applicable countries and regions.

The system shall be able to automatically identify an anomaly and notify the remote Service Center whenever the UPS’s operating parameters fall outside the predetermined range. In this case the supervising service engineer shall immediately carry out an alarm verification by accessing the UPS parameters and proactively informing and advising the end-user.

The remote diagnostics system shall as a minimum offer the following features:

* Continuous monitoring of the performance of the UPS,
* Ensure communication between the UPS, the authorized Service Centre and the authorized service engineers,
* Automatic call out of service engineers in the event of an abnormal operation of the UPS (24/7/365),

The system shall provide the end-user with the following:

* Regular health check report by Email including technical notes from the expert service engineer, statistical data on power quality and trending of the UPS,
* Access to a WEB interactive dashboard to consult the UPS time-stamped historical data, interactive graphs and key parameters with the possibility to download all available data.
* **Remote real-time diagnostics**:

The manufacturer shall have the possibility to connect the remote service engineer to the UPS at customer site to perform real-time diagnostics, a full root cause analysis and with the possibility to troubleshoot and clear a fault remotely.

To ensure a maximum of data protection during communication, all remote operations shall be based on a connection that is completely independent from the customer local area network LAN/WAN.

The UPS manufacturer shall be able to deliver a maintenance slot with a spare power brick as an option, allowing fast and secured First Fix Time Rate.

This maintenance slot shall allow testing the spare brick at full power through a heat-run test mode, without the need of a load test bench.