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1 - UPS definition

1.1 - Purpose

The purpose of this specification is to define the design, manufacture and testing characteristics required in view of supplying and putting into operation an Uninterruptible Power Supply (referred to as a UPS in the rest of this document).

The UPS shall be designed to supply dependable electric power to:

1.2 - Brief description

The UPS shall be a single-UPS unit, operating in double-conversion mode (also called on-line mode), made up of the following components, described in detail in this specification:

- rectifier/charger;
- inverter;
- battery;
- static bypass (via a static switch);
- manual maintenance bypass.
- user and communications interface.
- battery management system.
- any and all other devices required for safe operation and maintenance, including circuit breakers, switches, etc.

The UPS shall ensure continuity of electric power to the load within the specified tolerances, without interruption upon failure or deterioration of the normal AC source (utility power) for a maximum protection time determined by the capacity of the backup batteries installed.

2 - Operating principle

The UPS shall operate in double-conversion mode (VFI) as defined below.

2.1 - Normal operation
(normal AC source available)

The rectifier supplies the inverter with DC current while the charger simultaneously float charges the battery. The load is continuously supplied with dependable electrical power by the inverter.

A current-loop system shall ensure automatic distribution of the total load between the various parallel-connected units.

2.2 - Operation on battery power
(normal AC source not available or outside tolerances)

Upon failure or excessive deterioration of the normal AC source, the inverter shall continue to supply the load from battery power without interruption or disturbance, within the limits imposed by the specified battery backup time.

2.3 - Battery recharge
(normal AC source restored)

When the normal AC source is restored, the rectifier shall again power the inverter, without interruption or disturbance to the load, while the charger automatically recharges the battery.

2.4 - Static-bypass operation (static switch)

In the event of an overload exceeding system capabilities (short-circuits, heavy inrush currents, etc.) or UPS shutdown (user-initiated for maintenance or automatic for internal faults), the static bypass switch shall instantaneously transfer the load to the bypass AC source without interruption, on the condition that bypass power is available and within tolerances.

To that end, synchronization of the inverter in phase and frequency with the bypass source shall be automatic. Transfer of the load back to the UPS-unit output, synchronized with the bypass AC source, shall be automatic or manual. During transfer, the load shall not suffer an outage or disturbance in the supply of power.
2.5 - Operation of the manual maintenance bypass

The UPS shall include a manually-operated mechanical bypass system for maintenance purposes. For personnel safety during servicing or testing, this system shall be designed to isolate the rectifier, charger, inverter and static switch while continuing to supply power to the load from the bypass AC source. Transfer to the manual maintenance bypass and back shall be possible without interruption to the load. The UPS shall also include a device making it possible to isolate the rectifier and the charger from the normal AC source.

2.6 - Operation without the battery

For safe maintenance on the battery, the system shall include a circuit breaker to isolate the battery from the rectifier, the charger and the inverter. When the battery is isolated from the system, the UPS shall continue to supply the load without interruption or disturbance, except in the event of a normal AC source outage.

2.7 - Cold start (AC power absent)

The battery shall be capable of ensuring UPS start-up even if normal AC power is not available and continuing operation within the specified back-up time.

3 - Sizing and general characteristics

3.1 - Technology

The UPS shall be based on SCR technology with 6 pulses or 12 pulses according to Power rating.

3.2 - Rating

The UPS shall be sized to continuously supply a load of \([10 / 120]\) kVA, at a power factor \((pf)\) of 0.8.

3.3 - Battery backup time

The battery backup time in the event of a normal AC source outage shall be \([8 / 10 / 15 / 30 / 60\ldots]\) minutes, for a load power factor of 0.8. Battery service life shall be equal to at least \([5 / 10\ldots]\) years. It shall be selected and sized correspondingly, for a load power factor of 0.8.

3.4 - Types of loads accepted

The UPS shall accept high crest factors (3:1) without derating. Linear and non-linear loads, the total harmonic voltage distortion at UPS output (THDU downstream) shall respect the following limits:

- THDU Linear \(ph/N \leq 3\ %\)
- THDU Non-linear \(ph/N \leq 5\ %\).

3.5 - Limitation of harmonics upstream of the UPS

The UPS system shall not draw a level of harmonic currents that could disturb the upstream AC system, i.e. it shall comply with the stipulations of guide IEC 61000-3-4 (formerly IEC 1000 3-4). To that end, it shall be possible to equip the rectifier/charger input with a filter of the type…[compensated LC / non-compensated LC / with contactor…]
3.6 - Efficiency

Overall efficiency shall be greater than or equal to:
- UPS 220Vdc up to 85%
- UPS 384Vdc up to 90%
  at 100 % of load without LC filter

3.7 - Noise level

The noise level, measured as per standard ISO 3746, shall be less than:
- 70 dBA

4 - AC sources

The UPS shall be designed to receive power from the sources listed below.

4.1 - Normal AC source
(rectifier/charger input)

The normal AC source supplying the UPS shall, under normal operating conditions, have the following characteristics:
- rated voltage: 380 - 400 volts rms at full rated load Pn;
- voltage: ___ volts, ±20%;
- number of phases: 3 + earth;
- frequency: ___ Hz ± 10%

4.2 - Bypass AC source
(static-bypass input, if separate from rectifier input)

The bypass power supplying the UPS in the event of an inverter shutdown (maintenance, failure) or an overload
(short-circuit, heavy inrush currents, etc.) shall have the following characteristics:
- voltage: 220/230 volts, ± 25%;
- number of phases: 1 + N + earth; (a non-distributed neutral is possible)
- frequency: ___ Hz ±10%

5 - Electrical characteristics

5.1 - Rectifier and charger

5.1.1 - Supply
The rectifier and charger module shall be supplied via the normal AC input (see section 4 "AC sources").

5.1.2 - Inrush current
A walk-in circuit shall eliminate overcurrents during starting by imposing a gradual increase of the rectifier/charger
input current until nominal conditions are reached.
This walk-in period shall last approximately 10 seconds.

5.1.3 - Battery-current limiting
For long battery life, an electronic device shall automatically limit the charging current to the maximum value specified
by the battery supplier (0.1 x C10 for a sealed lead-acid battery). A second device shall limit the total current drawn by
the rectifier/charger to avoid overloading the power supply line.
5.1.4 - Operating modes and DC-voltage levels

To substantially extend battery life without lowering its performance, the rectifier/charger shall provide four operating modes:

- **Float-charging mode**
  The battery-charger output voltage shall be set to the value specified by the battery supplier, i.e. 2.27 volts/cell.

- **Automatic charging mode**
  In the event of a normal AC source outage lasting longer than a user-defined time, a battery charging cycle shall be automatically initiated upon restoration of the normal source. For fast recharging without lowering battery performance, this cycle shall include two charging phases, the first at constant current and the second at constant voltage. The constant voltage for the second phase shall be that specified by the battery supplier, i.e. 2.33 volts/cell. Upon completion, the DC voltage shall return to the float charging value.

- **Manual-charging mode**
  The UPS shall also include a manually initiated 24-hour charge cycle. Upon completion, the DC voltage shall return to the float charging value.

- **Initial or equalising charge mode**
  For initial charging of a dry-fit battery or equalising of an installed battery showing a significant cell to cell voltage differential, the UPS shall allow charging at the voltage specified by the battery supplier, i.e. 2.33 volts/cell. This operation shall be carried out with the inverter turned off.

5.1.5 - Input power factor

The UPS shall present an input power factor greater than or equal to 0.9 for the normal AC source rated voltage and frequency and the inverter operating at full rated load.

5.1.6 - Voltage regulation

Rectifier/charger regulation shall ensure DC output voltage fluctuations of less than 2% irrespective of load and AC input voltage variations (within the limits specified in section 4.1 “Normal AC source”).

5.2 - Batteries

The battery shall be of the …[sealed lead-acid type, factory mounted and wired in a cabinet identical to that of the UPS, ...[sealed lead-acid type, mounted on shelves,]...[vented lead-acid type, mounted on a rack,]... with a service life of ...[5 / 10 ...] years.

The battery shall be sized to ensure continuity in the supply of power to the inverter for at least ...[8 / 10 / 15 / 30 / 60...] minutes, in the event of a normal AC source failure, with the inverter operating at full rated load, i.e., ...[10 /20/30/40/60/80/100/120]... kVA at a power factor pf = 0.8. Sizing calculations shall assume an ambient temperature between 15° C and 25° C.

The UPS shall include devices to ensure:
- effective battery protection (see section 8.4 "Protection - Battery");
- battery management (see section 9 "Battery management").

5.3 - Inverter

The inverter shall be sized to supply a rated load of ...[10/20/30/40/60/80/100/120]... kVA at a power factor (pf) of 0.8 and shall satisfy the specifications listed below.

5.3.1 - Output voltage

- Rated voltage
  ...[220 / 230 ...] volts rms, adjustable within a range of ± 3%.

- Number of phases
  3 phases + neutral + earth.

- Steady-state conditions
  The variation in the rated voltage shall be limited to ± 1% for a balanced load between 0 and 100% of the rated power, irrespective of normal AC input and DC voltage levels, within the limits specified in section 4.1 “Normal AC source” and 5.1.4 “Rectifier/charger - Operating modes and DC-voltage levels”.

- Voltage transients (transient conditions)
  Output voltage transients shall not exceed ± 5% of rated voltage for 0 to 100% or 100 to 0% step loads. In all cases, the voltage shall return to within steady-state tolerances in less than 20 milliseconds.
● **Unbalanced load conditions**
For a > 30% unbalanced load, the voltage unbalance shall be less than 2% for the phase-to-neutral amplitude and 3 degrees for the phase angle deviation.

● **Phase-to-phase harmonic distortion (voltage wave form)**
The UPS shall limit distortion of the phase-to-phase output voltages to less than:
- 1.5% for each harmonic;
- 3% overall;
irrespective of the type of load, as indicated in section 3.4 "Types of loads accepted".

5.3.2 - Output frequency
● **Rated frequency**
- 50/60* Hz.
*no frequency conversion

● **Variations**
- ± 1 Hz,
- adjustable from ± 5 Hz.

5.3.3 - Synchronization with bypass power
● **When bypass power is within tolerances**
To enable transfer to bypass power (see conditions below in section 5.4 "Static-bypass"), the inverter output voltage shall be synchronized with the bypass source voltage whenever possible. To that end, during normal operation, a synchronization system shall automatically limit the phase deviation between the voltages to 3 degrees, if the bypass source frequency is sufficiently stable (within ± 1% of its rated value).

● **Autonomous operation following loss of synchronization with bypass power**
When the bypass source frequency deviates beyond these limits, the inverter shall switch over to free-running mode with internal synchronization, regulating its own frequency to within ± 0.1%. When bypass power returns to within tolerances, the inverter shall automatically resynchronize.

5.3.4 - Overload capacity
The UPS shall be capable of supplying for at least:
● 10 minutes a load representing 125 % of the rated load;
● 1 minute a load representing 150% of the rated load.

5.4 - Static bypass

5.4.1 - Static-bypass function
Instantaneous transfer of the load from the inverter to bypass power and back shall take place without a break or disturbance in the supply of power to the load, on the condition that the bypass source voltage and frequency are within the tolerances specified in section 4.2 "Bypass AC source" and that the inverter is synchronized.
Transfer shall take place automatically in the event of a major overload or an internal inverter fault. Manually initiated transfer shall also be possible.
If the bypass power is outside the specified tolerances or is not synchronized with the inverter, automatic transfer of the load from the inverter to bypass power shall take place after a calibrated interruption of 500 to 800 milliseconds. Manual initiation of this transfer as well as transfer back to the inverter shall also be possible.
5.5 - Discrimination

If the bypass power is within the tolerances specified in section 4.1 "Bypass AC source", the presence of the static switch shall make it possible to use the short-circuit power of the bypass source to trip the downstream protection devices of the inverter.

To ensure tripping in a selective manner, the available power shall be sufficient to trip protection devices with high ratings (circuit breaker rated In/2 or UR fuses rated In/4, where In is the rated inverter current).

If the bypass source is outside the specified tolerances, the inverter on its own shall, for the same discrimination requirements, be capable of tripping circuit breakers rated In/2 or UR fuses rated In/4, irrespective of the type of short-circuit.

5.6 - System earthing arrangement

The UPS shall be compatible with the following system earthing arrangements:

- upstream source:
  - [TNS / TNC]
- downstream installation:
  - [TNS / TNC]

If the upstream and downstream earthing arrangements are different, galvanic isolation shall be provided.

TT & IT are available in option

6 - Mechanical characteristics

6.1 - Scalable design

The UPS shall be of scalable design so as to allow the installed power to be easily increased on site by connection of additional UPS units, either to meet new load requirements or to enhance system reliability by introducing redundancy. It shall be possible to adapt a single UPS unit for connection with parallel UPS units directly on site, without returning the equipment to the factory and without causing excessive system downtime.

Similarly, the UPS output frequency shall be readily adaptable on site from 50 to 60 Hz or vice-versa to meet possible changes in load requirements.

6.2 - Dimensions

The UPS shall require as little floorspace as possible.

To facilitate installation, UPS height shall not exceed 1 800 mm and passage through an 800 mm wide door shall be possible (with panels and/or doors removed, as necessary).

To save considerable space, it shall be possible to install the UPS with its back 600 mm from the wall.

6.3 - Mechanical structure

The mechanical structure of the UPS shall be sufficiently strong and rigid to withstand handling and installation operations without risk.

Access to UPS subassemblies shall be through front doors. The sheet-metal elements in the structure shall be protected against corrosion by a suitable treatment, such as zinc electroplating, bichromating, epoxy paint or an equivalent.
6.4 - Connections and busbars

Entry of downstream power cables, as well as any auxiliary cables, shall be possible at the bottom of the UPS or through the bottom for a false floor. Installation shall be facilitated by clear marking of connection terminals. Connections shall be made through the front of the UPS cabinets. All connections shall be directly accessible, without undoing any other connections.

The UPS shall be equipped with an earth-circuit connector, in compliance with the standards listed in section 12 "Standards and tests". Any busbars shall be made of rectangular cross-section electrolytic copper or aluminium bars and mounted in compliance with the stipulations in section 6.6 "Safety". The cables shall comply with the standards listed in section 12 "Standards and tests" and be mounted in compliance with the stipulations in section 6.6 "Safety". The neutral conductor shall be oversized for any third-order harmonic currents and their multiples (the size of the neutral shall be 1.5 times that of each phase).

6.5 - Ventilation

The UPS shall be provided with forced-air cooling. To avoid UPS shutdown in the event of a fan failure, redundant fans shall be provided on the UPS and fan failure shall initiate an alarm.

6.6 - Safety

For the safety of maintenance personnel, the cabinet shall be provided with a manually operated mechanical bypass designed to isolate the rectifier/charger, inverter and static switch while continuing to supply the load from the bypass AC source. Control circuits shall be galvanically isolated from power circuits. Live parts that could be touched during normal operation or maintenance shall be protected by insulated barriers. It shall also be possible to send to the UPS an external EPO order resulting in opening of the battery circuit breaker and the upstream circuit breaker.

7 - Environment conditions

7.1 - UPS (not including battery)

7.1.1 - Operation

The UPS, not including the battery, shall be capable of operating under the following environmental conditions without loss of performance:

- ambient temperature range: 0° C to +45 ° C. (Working at 45°C derating to 85%), with linear load
- recommended temperature range: +15° C to + 25° C;
- maximum average temperature: 35° C for 24 hours
- maximum temperature: 45 ° C for 8 hours;
- maximum relative humidity: 95% at 25° C;
- maximum altitude: 1000 meters.

7.1.1 - Operation

The UPS, not including the battery, shall be designed for storage under the following conditions:

- ambient temperature range: -25° C to +55 ° C.

7.2 - Batteries

7.2.1 - Operation

The battery shall be capable of operating under the following environmental conditions without loss of performance:

- ambient temperature range: 0° C to +40° C.
- recommended temperature range: +15° C to + 25° C;
- maximum relative humidity: 95%;
- maximum altitude: 1000 meters.

7.2.2 - Storage

The battery shall be designed for storage under the following conditions:

- ambient temperature range: -10° C to +45° C.
8 - Protection

8.1 - UPS

The UPS shall include protection against AC-source overvoltages (as per standard IEC 60146), excessive external or internal temperature rise and vibrations and impacts during transport.

8.2 - Rectifier and charger

The rectifier/charger shall be equipped to receive an external order to automatically shut down under the following circumstances:

- emergency off; in this case, the shutdown will be accompanied by opening of the battery circuit breaker;
- battery room ventilation fault.

The rectifier and the charger shall automatically shut down if the DC voltage reaches the maximum value specified by the battery manufacturer.

8.3 - Inverter

The load shall be protected against any overvoltages that could result from voltage regulation failure at the inverter output.

The inverter (and the rectifier/charger module) shall automatically shut down if the DC voltage reaches the minimum value specified by the battery manufacturer.

The inverter shall be equipped with an automatic shutdown system to protect its power circuits against overloads exceeding its overload capacity when bypass power is not available. In particular, a short-circuit on the load shall initiate a static shutdown of the inverter, without blowing a fuse.

8.4 - Batteries

8.4.3 – Charge-current limiting

The UPS shall comprise a device to limit the charge current for the battery (0.05 C10 to 0.1 C10).

9 - Battery management

As the life of a battery is very sensitive to operating conditions, the battery shall be managed in an optimum manner. In addition to the devices indicated in "Protection - Battery" above, battery management features shall include the following:

9.1 - Self-test

The battery shall include a self-test system initiated in two manners:

- as necessary by a manual command;
- automatically at user-defined intervals.

This self-test system shall update the battery parameters and detect any abnormal deterioration to facilitate preventive maintenance.
10 - User interface and communication

10.1 - User interface

10.1.1 - Operating and start-up assistance
The UPS shall be equipped with an operating and start-up assistance, a system providing start-up and operating assistance including:
● display of installation parameters, configuration, operating status and alarms and indication of operator instructions for switching operations (e.g. bypass);
● time-stamped logging and automatic or manually initiated recall of all important status changes, faults and malfunctions, complete with an analysis and display of troubleshooting procedures.

10.1.2 - Controls
The UPS shall comprise the following controls:
● two ON and OFF buttons
Located on the front panel of the UPS, they shall control UPS-unit ON/OFF status. It shall be possible to turn OFF the UPS externally via an isolated dry contact.
● keypad
A keypad shall be provided to carry out the following operations:
- forced transfer or forced shutdown of inverter when the bypass AC source is outside specified load tolerances;
- equipment self-test and battery charge cycle.
● EPO terminal block
The UPS shall be equipped with an emergency power off terminal block for complete system shutdown following reception of an external control signal. The EPO command shall result in:
- shutdown of the UPS;
- opening of the static switch on the bypass line and of the battery circuit breaker;
● alarm reset button
This button shall turn off audio alarms (buzzer) (see section 10.1.3). If a new alarm is detected after clearing the first, the buzzer sounds again.
● self-test button

10.1.3 - Indications
The following status information shall be monitored by indicating lights on the UPS front panel:
● rectifier/charger on;
● load on UPS;
● load on bypass;
● general alarm.
A buzzer shall warn the user of faults, malfunctions or operation on battery power. This system shall be equipped with an alarm reset button (see section 10.1.2).

10.1.4 - Display of parameters
A display unit shall indicate at least the following parameters in the [Simplified Chinese/English] language:

● internal fan fault;
● low battery warning;
● position of switching devices;
10.1.5 - Display of measurements
The display unit shall also indicate the following measurements:

- inverter output phase-to-phase voltages;
- inverter output currents;
- inverter output frequency,
- voltage across battery terminals;
- rectifier/charger input phase-to-phase voltages;
- rectifier/charger input currents;
- active and apparent power;

10.2 - Communication

10.2.1 - Standard communication
- a remote control and indication unit, for which the UPS shall be provided as standard with dry contacts for incoming and outgoing signals;
- an RS485 serial-link communication card capable of implementing the JBus/ModBus protocol for connection to a building management system (BMS);
- an RS232 serial-link communication card for communication with a modem and a remote-maintenance system;

10.2.2 - Communications options
The UPS shall be designed to enable the extension of communications, without system shutdown, to the following types of cards:
- an SNMP communication card for connection to an Ethernet network, for connection to a computer-network management system;

11. - Maintainability

- All power subassemblies shall be accessible from the front.
- UPS design shall provide maximum mean time between failure (MTBF) and minimum mean time to repair (MTTR).

11.1 - Local and remote diagnostics and monitoring - E. Services
12 - Standards and tests

12.1 - Standards

All equipment shall be designed and built in accordance with accepted engineering practice and applicable international standards, in particular the standards listed below.
- IEC 61000-4-5 Surge protection
- IEC 60146-4: UPS - Performance.
- IEC 62040-1 and EN 62040-1: UPS - Safety.
- IEC 60950 / EN 60950: Safety of IT equipment, including electrical business equipment.
- IEC 61000-2-2: Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems.
- IEC 61000-3-4: Limits for harmonic current emissions (equipment input current > 16 A/phase).
- IEC 61000-4: EMC - Electrical fast transient/burst immunity.
- EN 55011 and EN 55022: Limits and methods of measurement of radio interference characteristics of industrial, scientific and medical (ISM) radio-frequency equipment - Level B conducted and radiated emissions.
- IEC 439: Low-voltage switchgear and controlgear assemblies.
- IEC 60529: Degrees of protection provided by enclosures (IP Code).
- ISO 3746: Sound power levels.
- CE marking.

What is more, the equipment must comply with environmental-protection standards, with production taking place on premises certified ISO 14001.

12.2 - Certification of conformity

The manufacturer shall provide, on request, a complete qualification file demonstrating compliance with the above standards.

13 - Test procedures and quality system

13.1 - Test procedures

The UPS manufacturer shall provide proof of a stringent Quality Assurance programme. In particular, the main equipment manufacturing stages shall be sanctioned by appropriate tests such as:
- incoming components inspection, discrete subassembly testing;
- complete functional checks on the final product.
Equipment shall undergo on-load burn-in before leaving the factory.
Final inspection and adjustments shall be documented in a report drawn up by the supplier’s Quality Inspection department.
ISO 9001 or 9002 certification of the production site is compulsory.

13.2 - Quality system

The UPS design procedure shall be covered by an ISO 9001 quality system as well as a dependability study to ensure maximum reliability.
14 - Services

14.1 - Maintenance
The supplier shall propose contracts covering four levels of maintenance.

- Level one: simple checks and settings, procedures accessible without any dismounting and involving no risk.
- Level two: preventive maintenance, checks not inhibiting continuous operation of the system and preparing operators for Manufacturer services.
- Level three: trouble-shooting. Repairs by standard exchange of subassemblies and functional power and control components. Preventive-maintenance operations, both systematic and when indicated by qualified diagnosis.
- Level four: major preventive and corrective maintenance operations or technical upgrades during start-up, operation or renovation of the UPS installation and recycling of equipment or components representing a risk. These operations require the use of devices and means that have been calibrated by certified organisations.

14.2 - Technical competency

- Customer operators: the supplier shall offer a level 2 training program.
- Service personnel: the supplier shall ensure that service personnel are qualified for level 4.

14.3 - Functional components - organisation of supplier services

- Sufficient geographical proximity of the supplier or an authorized agent shall ensure reasonable access times to the customer site in view of reducing the mean time to repair (MTTR). The supplier shall be in a position to offer a contract limiting the response time to four hours.
- The supplier's logistics system and the availability 24 hours a day of original replacement parts shall similarly contribute to reducing to the greatest extent possible the mean time to repair (MTTR).

14.4 - System start-up

- The system and equipment shall be started up on site by the supplier or its authorized agent. The procedure shall include checks on the characteristics of the upstream and downstream protection devices and on the UPS installation parameters.

14.5 - Replacement parts

- The supplier shall undertake to provide certified original replacement parts for at least ten years following the date of delivery.

14.6 - Recycling and renovation/substitution

- At the end of the UPS service life, the supplier shall guarantee the continuity of service of the customer's installations if necessary, including dismantling of equipment and replacement of equipment, in compliance with applicable standards on environmental protection.

15 - Warranty

The rectifier/charger and inverter subassemblies shall be guaranteed (parts and labour on site) for one year following the start-up date. The sealed lead-acid battery shall be covered by the same warranty as the UPS.
16 - Installation services

Required services include:
- supply of the UPS and any accessory parts or elements;
- carriage-paid UPS transportation and delivery to the site.

Options:
- UPS handling and installation on the site;
- connections between the battery and the UPS;
- connection of the normal AC source to the rectifier/charger;
- connection of the bypass AC source to the input transformer or bypass input;
- connection of the load circuits to the UPS output.

17 - Electrical diagram

Fig. UPS electrical diagram.
# Appendix. Check list

## Type of UPS

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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<tbody>
<tr>
<td>Total rated power (kVA) at PF 0.8</td>
<td>kVA</td>
</tr>
<tr>
<td>Manufacturer</td>
<td></td>
</tr>
<tr>
<td>Range of products</td>
<td></td>
</tr>
<tr>
<td>Operating mode (IEC 62040-2)</td>
<td>double conversion</td>
</tr>
</tbody>
</table>

## Rectifiers

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three-phase input voltage at Pn</td>
<td>380 or 400 V ±20%</td>
</tr>
<tr>
<td>Input frequency</td>
<td>50 or 60 Hz ± 10%</td>
</tr>
<tr>
<td>Input-current distortion</td>
<td>THDI upstream ≤ 15% with LC filter</td>
</tr>
<tr>
<td>Input power factor</td>
<td>PF &gt; 0.9</td>
</tr>
</tbody>
</table>

## Battery

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>standard sealed lead acid in a cabinet</td>
</tr>
<tr>
<td>other</td>
<td></td>
</tr>
<tr>
<td>Service life</td>
<td>years</td>
</tr>
<tr>
<td>Backup time</td>
<td>minutes</td>
</tr>
</tbody>
</table>

## Battery management and protection

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold start on battery power</td>
<td>yes</td>
</tr>
<tr>
<td>Charge-current limiting</td>
<td>0.05 C10 to 0.1 C10 (depending on the battery)</td>
</tr>
</tbody>
</table>
### Inverter

<table>
<thead>
<tr>
<th>Specification</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single phase output voltage with neutral adjustable to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>± 1 %</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Steady-state conditions</td>
<td>± 1%</td>
<td>yes</td>
</tr>
<tr>
<td>Voltage transients</td>
<td>± 5 % (load from 0 to 100 or 100 to 0 %)</td>
<td></td>
</tr>
<tr>
<td>Output voltage distortion at Pn</td>
<td>THDU ph-N &lt; 5% linear load</td>
<td>yes</td>
</tr>
<tr>
<td>Output frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>± 1 Hz</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>adjustable from</td>
<td>± 5 Hz</td>
<td>yes</td>
</tr>
<tr>
<td>Overload capacity</td>
<td>125 % In for 10 minutes</td>
<td>yes</td>
</tr>
<tr>
<td></td>
<td>150 % In for 1 minute</td>
<td>yes</td>
</tr>
<tr>
<td>Crest factor</td>
<td>up to 3:1</td>
<td>yes</td>
</tr>
</tbody>
</table>

### Static bypass

<table>
<thead>
<tr>
<th>Specification</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard function</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-circuit withstand of static bypass</td>
<td>5 In – 20 milliseconds</td>
<td>yes</td>
</tr>
<tr>
<td>Maintenance bypass</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Efficiency

<table>
<thead>
<tr>
<th>Specification</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal mode</td>
<td>&lt; 90 % at Pn</td>
<td>yes</td>
</tr>
</tbody>
</table>

### User interface

<table>
<thead>
<tr>
<th>Specification</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>measurements, status, events</td>
<td>yes</td>
</tr>
<tr>
<td>Controls</td>
<td>ON, OFF, EPO terminal block</td>
<td>yes</td>
</tr>
<tr>
<td>Status indications</td>
<td>Audio alarm, LEDs</td>
<td>yes</td>
</tr>
</tbody>
</table>

### Communication

<table>
<thead>
<tr>
<th>Specification</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programmable relay card</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPO terminal block</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 slots for communication cards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Options</td>
<td>Ethernet SNMP card</td>
<td>yes</td>
</tr>
<tr>
<td>Standard</td>
<td>RS485 JBus/Modbus card</td>
<td>yes</td>
</tr>
<tr>
<td></td>
<td>RS232 U-Talk card</td>
<td>yes</td>
</tr>
<tr>
<td>Administration software with shutdown management</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Certification</td>
<td>see list in section 12.1</td>
<td>yes</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>--------------------------</td>
<td>-----</td>
</tr>
<tr>
<td>Quality certification</td>
<td>ISO 9001 / 9002</td>
<td>yes</td>
</tr>
<tr>
<td>Eco-design and manufacturing</td>
<td>ISO 14001 site</td>
<td>yes</td>
</tr>
<tr>
<td>Services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical competency of supplier</td>
<td>Level 4 NFX 060-010</td>
<td>yes</td>
</tr>
<tr>
<td>Diagnostics and monitoring</td>
<td>On site</td>
<td>yes</td>
</tr>
<tr>
<td>Technical support</td>
<td>Great China</td>
<td>yes</td>
</tr>
<tr>
<td>Operation, Maintainability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to power components through front</td>
<td></td>
<td>yes</td>
</tr>
<tr>
<td>Back-to-wall installation for units &gt; 600 mm</td>
<td></td>
<td>yes</td>
</tr>
<tr>
<td>Availability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of original replacement parts</td>
<td>Great China</td>
<td>yes</td>
</tr>
<tr>
<td>Response time of Service teams</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance programmes</td>
<td>Preventive</td>
<td>yes</td>
</tr>
<tr>
<td></td>
<td>Predictive</td>
<td>yes</td>
</tr>
<tr>
<td>Emergency services</td>
<td></td>
<td>yes</td>
</tr>
<tr>
<td>Renovation / substitution programmes</td>
<td></td>
<td>yes</td>
</tr>
</tbody>
</table>