

**TECHNICAL SPECIFICATIONS  
FOR**

**10/20/30 kVA  
Three phase in/out**

**UNINTERRUPTIBLE POWER SUPPLY  
SYSTEMS**

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## 1. General

- 1.1 This specification covers the design, supply, delivery, installation, testing and commissioning of a continuous duty, 50 Hz, \_\_\_kVA, 400V, three phase, (four-wire + earth) uninterruptible power supply system complete with maintenance-free sealed battery. The uninterruptible power supply system, hereafter referred to as the UPS system, shall operate in conjunction with the existing power distribution system. In the event of an emergency it shall be able to supply independently at least \_\_\_ minutes of clean and regulated uninterruptible power for computer equipment and other critical loads. Only "True-On-Line" technology, also called Voltage Frequency Independent Operation with By-pass (VFI according to IEC 62040-3 ), following the IEC-62040 standard, are accepted.
- 1.2 **OPTIONAL** : A redundant system can be created by connecting 2, 3 or 4 complete units of the same type in parallel. This parallel redundant configuration shall have redundant batteries and a decentralised bypass. The load is shared amongst the units connected in parallel. Units with a central control module and/or central static bypass are not accepted.
- 1.3 The UPS system and all associated equipment and components shall be manufactured in accordance with the IEC 62040 standards.
- 1.4 The UPS manufacturer shall be ISO 9001:2000 certified and shall have a minimum of 25 years experience in the design, manufacture, and testing of UPS systems.

## 2. Tender submission requirement

- 2.1 The tender submission shall be in sufficient details to show compliance to the specification and shall include a full set of descriptive and technical literature on the equipment and system proposed.
- 2.2 The following drawings and information are to be submitted with the proposal:
  - Functional description
  - Dimensions, weight and heat dissipation of units
  - Layout plan of front and rear panel.
  - Installation drawings

## 3. Environmental conditions

- 3.1 The UPS system shall be capable of withstanding any combination of the following environment conditions in which it must operate, without mechanical or electrical damage or degradation of operating characteristics:
    - Ambient temperature :0 to 40 degrees C (not recommended for batteries)
    - Relative Humidity :Up to 95% (non-condensing)
    - Interference :The UPS equipment shall be provided with EMI/RFI suppression following EN-50091-2
  - 3.2 Audible Noise - Noise generated by the UPS system under any condition of normal operation shall not exceed an allowable sound pressure level of 55 dBA @1 meter according to EN27779
  - 3.3 Backfeed protection – For safety purposes the UPS shall be equipped with a backfeed protection contactor in the bypass circuit, complying to IEC 62040-1. This backfeedprotection shall be installed standard inside the UPS cabinet.
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## 4. System description

4.1 The UPS system shall consist of the following major equipment:

- a) Rectifier
- b) Boost converter
- c) Battery charger
- d) Static inverter
- e) No-break static transfer switch
- f) Maintenance by-pass switch
- g) Battery bank
- h) Main control panel with LCD display

4.2 The UPS system shall be able to operate in any of the following modes:

4.2.1 On-line Mode - During on-line operation mode, the UPS system shall be used to provide precise regulated and transient-free power to the computer equipment loads. The mains supply provides power to the input converter. The input converter shall provide regulated DC power to support the inverter and simultaneously supply the battery charger to maintain the battery in a fully charged condition. The inverter shall convert the DC power into regulated AC power for the load.

4.2.2 ECO Mode - When the load does not require highest level of protection, the UPS shall be able to work in an energy saving mode. This mode shall be fully programmable to adapt it to the load and customer needs. When ECO mode is activated the UPS switches automatically to bypass as a function of the actual mains quality. In case of a mains imperfection (out of tolerances) the UPS seamlessly returns to 'On-line mode' without compromising the guarantee of total security for the critical load. **This mode will not be activated unless specifically requested by the client on site.**

4.2.3 Battery Mode - Upon failure of the mains supply, input power for the inverter shall automatically be supplied from the connected battery. When the mains is restored or the standby generator set supply is ready, input power for the inverter and for recharging the battery shall automatically be supplied from the rectifier.

If the input does not return, the UPS shall automatically shut itself down in an orderly manner when the discharge limit of the battery is reached.

4.2.4 By-pass Mode - Upon the failure of static inverter, the no-break static transfer switch shall be activated automatically to isolate the faulty inverter and at the same time maintain a continuous supply to the system load. The automatic transfer mode shall also operate in the event of system overloading or if irregular or undesirable output for the load is detected. In this case, the system shall automatically return to the original on-line mode operation if the disturbance is cleared.

4.2.5 Manual By-pass Mode - If the UPS system needs to be isolated for service or maintenance, the maintenance by-pass shall transfer the load from inverter to the mains without interruption and vice versa.

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## 5. Electrical characteristics

### 5.1 General

UPS Output Power Rating- \_\_\_\_ kVA, 4 wire plus earth, power factor 1

### 5.2 Input characteristics

- a. Input: - Voltage = 324 - 478 Vac (at full load)
- b. - Frequency = 45 - 66 Hz
- c. - Power Factor  $\geq 0.98$  lagging
- d. - THD-I  $< 8\%$

### 5.3 Output characteristics

- a. Output: - Voltage = 380/400/415 + N  
- Frequency = 50/60 Hz,  $\pm 0,1\%$  if free running  
=  $\pm 4\%$  with mains synch. (adjustable)
- b. Output power factor = 1.0
- c. Output voltage THD- Linear Load =  $< 2\%$   
- Non linear Load =  $< 3\%$
- d. Voltage Transients - at 100% load step =  $\pm 3\%$
- e. Recovery Time =  $< 20$  msec.
- f. Inverter Overload Capability = 125% for 10 min.  
= 150% for 1 min
- g. Crest Factor Acceptance  $> 3:1$  (according to EN-50091)

## 6. Input Converter

6.1 General - The input converter shall consist of a rectifier which converts the utility voltage into an unregulated DC voltage. This unregulated DC voltage is converted in a regulated, controlled DC voltage by a boost converter. The boost converter supplies power to the inverter and to the battery charger. The boost converter also provides a power factor corrected input to the UPS.

6.2 Capacity - The UPS shall have sufficient capacity to support a fully loaded inverter and at the same time maintain the battery in a fully charged condition.

## 7. Battery Charger

7.1 If the battery is fully discharged, with the standard current, the battery charger shall recharge the battery to 90% of its fully charged condition preferably within six to eight (6-8) hours and at the same time supplying full load current to the system. Otherwise the UPS supplier shall specify the charging time required

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- 7.2 Temperature Compensated Charging - The battery charger output voltage shall be automatically adjusted in proportion to the ambient temperature of the battery as per the battery supplier's recommendation to avoid over-charging.
- 7.3 Current and Voltage Limit - The rectifier/charger output current and voltage shall be limited to the battery supplier's recommendation.

## **8. Inverter**

- 8.1 General - The conversion of DC to AC must be accomplished by power transistors of the IGBT type. Failure of any components or power stage shall not interrupt the AC output. Instead it shall disconnect itself from the configuration while transferring the load to the static transfer switch and activate an alarm.
- 8.2 Output - The inverter output voltage shall be controlled by microprocessor-based software (software generated sine wave)
- 8.3 The waveform shall be fed through a filter circuit and protected by fast fuses. The inverter shall be able to handle short-circuit conditions without any damage.
- 8.4 Neutral - The neutral of the inverter output shall be electrically isolated from the UPS system chassis.
- 8.5 Frequency Control - The output frequency of the inverter shall be controlled by an oscillator, which can be operated as a free running unit or in synchronised operation with a separate AC source.
- 8.6 If the external synchronising source deviates from the pre-set frequency by  $\pm 4\%$  (adjustable), the oscillator shall automatically revert to free-running, and the microprocessor controlled accuracy shall be  $\pm 0.1\%$ .

## **9. Electronic by-pass switch**

- 9.1 The electronic by-pass shall consist of a static SCR-switch, used to provide an uninterruptible transfer of the load to the utility in case of remarkable variation of the output voltage.
- 9.2 The electronic by-pass switch shall return the load automatically to the UPS when the malfunction or overload is cleared.
- 9.3 The electronic by-pass switch shall consist of microprocessor controlled thyristors.
- 9.4 The electronic by-pass switch shall be able to be activated manually by a switch/push button to test bypass operation. The switching time from inverter to reserve (bypass) and vice-versa shall be of No-Break. If there is no synchronisation this test should be disabled automatically.

## **10. Maintenance by-pass**

- 10.1 The maintenance by-pass shall be based on a manually operated switch which allows the electrical isolation of the UPS from the load while still supplying the load with power directly from the utility.
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## 11. Battery / battery test

- 11.1 A battery shall provide the UPS system with a stored energy source. The battery shall be of a type designed for standby power service. The cells shall be completely sealed maintenance free.
- 11.2 The ampere-hour rating of the battery shall be sufficient to support the inverter for the protection time of \_\_\_ minutes with the inverter operating at full rated load at power factor \_\_\_\_.
- 11.3 Tenderer shall submit full technical data of the battery offered under the tender and shall provide calculation to show the number of cells required and their capabilities which shall match the load requirement and the charging characteristics of the UPS requirement being offered.
- 11.4 Tenderer shall specify the recommended voltage per cell for float charging and recharging, acceptable electrolyte specific gravity when fully charged at 25 degrees C.
- 11.5 The design life span of the battery shall not be less than \_\_\_ years and only battery with proven field applications of not less than \_\_\_ years shall be accepted.
- 11.6 The battery shall be mounted on/in shelves/cabinet with the following dimensions \_\_\_ x \_\_\_ x \_\_\_ mm.
- 11.7 The UPS must be provided with an automatic battery test system.
- 11.8 The end of discharge voltage of the batteries must be load dependent in order to prevent deep discharging of the batteries whilst utilizing maximum available capacity.

## 12. Instrumentation

- 12.1 A back-lit 4 x 20 alpha-numeric characters Liquid Crystal Display (LCD), controlled by push buttons shall be provided.
  - 12.2 The UPS system main control panel with LCD back-lit display shall include the following measurements indications:
    - Mains voltage and mains frequency, and the current delivered by the mains
    - Output voltage and output frequency, and the current delivered by the UPS
    - Battery voltage and DC link voltage
    - Remaining runtime (during mains failure)
    - The total operating time of the UPS and inverter
  - 12.3 The UPS system main control panel with LCD back-lit display shall include the following indications or controls:
    - Start of a battery test
    - Forced (manual) transfer to bypass
    - Enable/disable ECO mode
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12.4 The UPS system main control panel with LCD back-lit display shall include the following settings:

- Setting of the system operating frequency
- Setting of the system output voltage
- Setting of the installed battery capacity
- Bypass enable/disable
- Language on display (English/German/French/Spanish/Italian/Finnish)

12.5 On the system alarm panel, a common audible alarm and indicating LED's shall be initiated when any of the following conditions are present:

- UPS is on battery operation
- UPS is on bypass operation
- UPS is on manual bypass operation
- Output is not synchronized to input
- Bypass input is out of limits
- High temperature
- Overload
- Batteries need to be replaced
- Batteries have low voltage (battery low)

12.6 The UPS must be able to store up to 255 alarms or events

Tenderer shall provide detailed information for the above-mentioned together with their tender submission.

## **13. Mechanical Design**

13.1 Enclosure - The UPS system shall be housed in free standing steel cabinet.

13.2 Colour - The UPS cabinet colour shall be RAL 9010

13.3 Ventilation - Forced air-cooling shall be provided to ensure that all components are operated within specifications with air entry on the side and exit in the top.

13.4 Cable Entry - Input to the system and outgoing cables shall be from the rear or the side of the cabinet.

13.5 Modular Construction - The UPS system shall be modular in construction for ease of maintenance and to minimise downtime.

13.6 Power Connections - Adequate space for termination shall be provided for incoming and outgoing cables. The cables for interconnecting the UPS and battery cubicles shall be supplied for side by side installation.

13.7 Protection - The equipment shall meet the requirements of protection class IP 20.

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## **14. Acceptance**

- 14.1 The tenderer shall submit detailed acceptance procedures and checklist which shall be designed to verify the full compliance of the installed system with this specification.
- 14.2 The acceptance test shall be carried out by the contractor's engineer and witnessed by the end-user's Project Engineer.
- 14.3 \_\_\_\_\_ copies of the test report and commissioning certificate stating that the system has been installed and commissioned to the requirement of the specification shall be submitted to the end-user on handing over the commissioned system.

## **15. Documentation**

- 15.1 All documentation shall be written in good, simple and concise English using accepted technical terms, symbols and nomenclatures. For submission, all documentation shall be bounded with hard covers.
- 15.2 The document shall be updated regularly as the installation progresses. All changes in the installation layout, wiring, cabling and design shall be incorporated in its final edition. \_\_\_\_\_ copies of this final edition shall be handed over to end-user upon commissioning of the system.
- 15.3 The final edition of the hand-over documents shall cover design, installation, commissioning, operation and maintenance aspects of the system.
- 15.4 One set of basic consumable spare parts shall be supplied under the contract.

## **16. Maintenance**

- 16.1 The tenderer shall be responsible for the maintenance of the system after the expiring of the warranty period. In the tender submission, the tenderer shall include a maintenance agreement for the subsequent maintenance of the system for consideration by the end-user.
  - 16.2 The agreement shall include a fixed sum proposed for five years to perform regular testing and up-keeping of the system.
  - 16.3 The tenderer shall submit a checklist on the activities to be carried out for the system regular maintenance.
  - 16.4 The tenderer shall provide evidence and undertake that round the clock on-call service is available to attend to system failure.
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## 17. Options for Interfacing and Communications

- 17.1 Potential Free Contacts must be available on the UPS to indicate at least 6 alarms. The alarm to be indicated should be free programmable from a list of alarms and working condition presents in the UPS software which should contain at least: general alarm; bypass active; battery low; utility failure ; Stop Operation.
  - 17.2 Input Connections for customer provided signals must be available "emergency power off" (to shutdown UPS and load in the event of an emergency).
  - 17.3 SNMP adapter It shall be possible to connect the UPS to a TCP/IP network using SNMP (simple network management protocol) using the international standard UPS MIB. The SNMP adapter can be a plug-in card, an external SNMP box or a PC with a proxy agent.
  - 17.4 UPS Data Protection Software The UPS shall have available data protection software compatible with Windows/95, Windows/98, Windows/NT, UNIX, Novell, OS/2 and other common operating systems.
  - 17.5 Internet Information and Alarm transmitting The UPS shall be able to communicate relevant data and alarms via the Internet to multiple addresses as E-mail, FAX and SMS. The remote access to the UPS shall be protected.
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