

## **TECHNICAL SPECIFICATIONS**

### **Three-Phase Uninterruptible Power System**

#### **PURPOSE:-**

The UPS systems of suitable rating (True online double conversion VFI type as per IEC 62040-3) will be standalone/parallel mode. Battery backup has to be 2 Mins. With each UPS module for valve cooling system.

#### **Reference Standards**

The manufacturer must demonstrate that it makes use of quality management system in compliance with standard EN ISO 9001:2000 for the design, production, sale, installation, maintenance and support of the Uninterruptible Power Systems.

The Uninterruptible Power System must have CE marking in accordance with the directives on Safety and EMC 89/336, 2006/95 and 2004/108.

The Uninterruptible Power System shall be designed and produced in compliance with the following standards:

- EN62040-1: Uninterruptible Power Systems (UPS): General and safety requirements;
- EN52040-1-2: Uninterruptible Power Systems (UPS): General and safety requirements used in locations with restricted access;
- EN62040-3: Methods of specifying the performance and test requirements;
- EN50091-2 & IEC 62040-2: Electromagnetic compatibility;
- IEC60529: Degree of protection provided by enclosures;
- IEC60664: Insulation for equipment within low-voltage systems;
- IEC60755: General requirements for residual current operated protective devices;
- IEC60950: General safety requirements for Information Technology equipment;
- IEC61000-2-2: Electromagnetic compatibility immunity;
- IEC61000-4-1: Electromagnetic compatibility-overview of the IEC 61000-4 series;
- IEC61000-4-2: Electrostatic discharge immunity test;
- IEC61000-4-3: Radio-frequency, electromagnetic immunity test;
- IEC61000-4.4: Electrical fast transients/burst immunity test;
- IEC61000-4-.5: Surge immunity test;
- IEC61000-4-6: Test for immunity to conducted disturbances induced by radio frequency fields;

IEC61000-4-8: Power frequency magnetic field immunity test;

IEC 61000-4.11: Voltage clips, short interruptions and voltage variations immunity test

### **European Directives:**

LV 2006/95/EC replace LV 73/23/EC and 93/68/EC

Low voltage directive contains provisions relating to equipment safety and imposes the EC marking obligation from 1/1/97.

EMC 2004/108/EC

Electromagnetic compatibility directive: covers the immunity and emission aspects of the UPS in its installation environment and imposes the obligatory use of CE marking as from 1/1/96.

### **Description of the Required System**

The UPS must be of the On Line double conversion (VFI-SS-111 classification – as defined by standard IEC EN 6204003) type with a transformer on the output to the inverter; the load shall always be powered from the inverter, which shall supply a sinusoidal voltage that is stabilized in voltage and in frequency. The UPS must also be provided with input and output filters which, together with the transformer, significantly increase the immunity of the load against mains interference and lighting.

The input stage of the UPS must be IGBT (Isolated Gate Bipolar Transistor) with DSP microprocessor digital control.

The UPS must be compatible with the most critical installations and must, at the very least, anticipate the following blocks and peculiarities;

- Isolation transformer in output to the inverter;
- High short circuit current;
- Back-feed protection;
- Full and detailed diagnostics

The UPS must be able to power the load for prolonged periods (by means of optional battery modules) or for periods that are sufficient for the closure of the computer systems via supervision and shut-down software that must be provided as standard for the following operating systems: Windows 95, 98, 2000, Me, XP, NT 4.0, Linx, Mac, OS 9.x, OSX, Windows Vista.

## **1. COMPOSITION OF THE UPS**

### **1.1 RECTIFIER:**

The rectifier must be realized with an IGBT (Isolated Gate Bipolar Transistor) technology with DSP microprocessor digital control.

The rectifier must provide a “soft start’ with a time programmable from 1 to 30 seconds (during this interval of time, current absorption goes from zero to normal operating rate), so that the current

supplied by the mains or generator is gradually absorbed. In addition shall be possible test a power walk in delay timer programmable for 1 to 120 sec.

This must convert the alternating voltage of the power supply line into direct current voltage. The rectifier shall carry out the following functions:

- \*Power the inverter with direct current voltage;
- \*Ensure the battery is charged automatically.

The battery shall be charged in two stages: the first phase must provide 80% of the energy, with limited recharge current and increasing voltage; the second must provide the remaining 20% of capacity, with constant float voltage.

The recharge current must be automatically limited to 10% of the value of the capacity over 20h and must be adjustable. The maximum recharge current available may be greater at reduced load, in order to exploit the rectifier's potential in full with prolonged back up times.

The rectifiers must be able to power the inverter with a direct current voltage at nominal power, even if the input voltage is 25% lower than the specified nominal voltage, in this condition the batteries will not discharge.

The batteries must not cut in the for mains interruptions of less than 20msec. This means that the inverter shall continue to power the load following micro interruptions without needing to draw energy from the batteries.

The battery charging circuit must be able to compensate the buffer charging voltage according to the ambient temperature (correction factor: -0.11% per °C).

## 1.2 BATTERIES:

- A. A battery cells: Nickel-Cadmium type with minimum life of 20 years. (specification of Nickel-cadmium batteries as per Annexure –Revised)
- B. Reserve time: 2 minutes at each UPS fully load, 0.8 power factor, with ambient temperature between 20 and 30C. (Battery calculation should be attached)

## 1.3 INVERTER:

The inverter must convert the direct current voltage into stabilized sinusoidal alternating voltage for the power supply to the load. With the UPS in "on line" mode, the connected load must always be powered from the inverter.

The inverter must be IGBT (Isolated Gate Bipolar Transistor) with DSP microprocessor digital control. The three phase voltage output from the inverter shall be controlled individually on each phase.

The inverter shall be provided with its own current limiting circuit so that any short circuits do not damage the components. This circuit shall be sized so that the inverter can power a phase-phase short circuit with a current of 180% of the nominal current for a time of 1 second and power a

phase-neutral short circuit with a current of 300% of the nominal current for a time of 1 second; at the end of this time the inverter shall be automatically withdrawn from service.

The inverter shall also be able to manage overload conditions for variable periods of time according to its level and more specifically.

- 60 minutes for three phase overloads that are 110% of the nominal load;
- 10 minutes for three phase overload that are 125% of the nominal load;
- 1 minute for three phase of overloads that are 150% of the nominal load;
- 7 seconds for single phase overloads that is 200% of the nominal value.

After this time the load shall be transferred, without any interruption, onto the By-pass line.

#### 1.4 **AUTOMATIC BY-PASS:**

The BY-PASS device must allow the synchronized passage, either automatic or manual, in zero time (by means of SCR static technology) of the power supply to the load from a protected line (INVERTER Output) to an unprotected line (By-Pass line) or vice versa.

It may be provided with a back-up power supply that is separate from the main power supply.

The BY-PASS must also be provided with a protection device, commonly called Back-feed Protection, to prevent, in the event of a failure of the SCRs, a back feed of voltage on the main power supply. This device must comply with standards EN2040-1-1 and DK56000.

#### 1.5 **MANUAL BY-PASS**

The UPS must be provided with a non-automatic maintenance circuit breaker; by closing the manual by-pass and opening all the other circuit breakers, the UPS is excluded while keeping the load in output powered.

This operation is necessary in order to carry out maintenance operations inside the equipment.

The manual by-pass line must be sized for the nominal power of the UPS.

#### 1.6 **AUTOMATIC PHASE SEQUENCE REVERSAL CORRECTION:**

The system should be capable of supplying power to load from commercial mains without any break, in case of phase reversal at the input. The UPS should not draw power from batteries or it should not transfer into bypass in case of input phase reversal. In case the feature is not available in the standard design of UPS the bidder to provide an external back-to-back thyristor in conjunction with series and parallel contractors.

## 1.7 **STARTING UP FROM BATTERY (COLD START)**

This device makes it possible to switch on the UPS even in the event of a mains failure using only the battery energy.

## 1.8 **INTERFACE CARD:**

The UPS must contain, as standard, an interface card having the following minimum features:

- Be equipped with at least two RS232 serial ports;
- Have the availability of at least 12 potential free contacts for the remote signaling of the main reports.
- Have the possibility of acquiring four input signals from the field(settable) to enable the remote shutdown of the inverter and UPS, battery recharge inhibition with motor generator and other two programmable inputs;
- Be set to receive the (isolated) emergency shutdown command, commonly known as Emergency Power Off (E.P.O.).

## 1.9 **MINIC PANEL:**

This must provide the user with visual (by means of buzzer) reports on the status of the UPS. It shall also allow the control, diagnostics monitoring and personalization of the UPS through easy access to the display menus.

## 2.0 **DESCRIPTION OF OPERATION**

The uninterrupted Power System by means of DSP digital control may operate in accordance with the following types of operation:

- Double Conversion Operation
- Line Interactive Operation
- Smart economy Operation

It shall be possible to select the mode of operation from the mimic panel, by means of special codes.

The input stage with IGBT technology shall guarantee a value lower than 3% of harmonic distortion current (THDI) rejected in the mains supply.

The IGBT inverter must be constantly synchronized with the stand-by mains in order to enable the transfer of the load from the inverter to the backup mains and vice versa without any interruption of the power supply to the load.

In any mode of operation, the battery charger must supply the energy needed to keep the accumulator battery at the maximum charge level.

In any mode of operation, the battery charger must supply the energy needed to keep the accumulator battery at the maximum charge level.

## **2.1 DOUBLE CONVERSION OPERATION (ON LINE)**

In this mode of operation, in normal conditions of service, the power supply to the applications shall always be provided from the inverter, guaranteeing the maximum protection to the load.

If the primary mains is not present or when it is outside the admitted range, the power supply to the applications shall be assured by the accumulator battery through the inverter. During this phase, the accumulator battery will be in discharging conditions. The user shall be notified of the operating status by both visual and audible reports. A diagnostic algorithm shall calculate the residual available back up time.

When the primary mains returns within the admitted limits, the uninterruptible power system shall automatically go back to operating in normal mode.

If the inverter should stop (voluntarily or due to the triggering of a protective device) or if there should be a temporary overload downstream of the UPS, the application shall be automatically transferred, without any interruption, onto the stand-by mains.

In the event of an overload with unsuitable mains, the Uninterruptible Power System shall not be transfer the load, but continue to power it through the inverter, for a period of time that depends on the extent of the overload and on the features of the UPS.

Appropriate reports shall inform the user of these abnormal operating states.

## **2.2 LINE INTERACTIVE OPERATION (STAND -BY ON)**

In this mode of operation, in normal conditions of service, the power supply to the applications shall always be provided by the stand-by line through the static switch. The quality of the direct line shall be constantly monitored by means of algorithms carried out in real time by the DSP control.

In the event of a stand-by line outside the allowed range, the load shall be automatically transferred, without any interruption, onto the inverter line.

If the primary mains is not present, the power supply to the applications shall be assured by the accumulator battery through the inverter. During this phase, the accumulator battery will be in discharging conditions. The user shall be notified of the operating status by both visual and audible reports. A diagnostic algorithm shall calculate the residual available back-up time.

When the quality and reliability of the direct line return within the allowed limits, the Uninterruptible Power System shall automatically go back to powering the load from this.

### 2.3 SMART ECONOMY OPERATION (SMART ACTIVE)

In this mode of operation, in normal conditions of service, the UPS may autonomously activate On Line or stand-by on operation according to the quality of the power supply.

When this mode is activated, the UPS power supply source shall be monitored for a few minutes, at the end of which, if the values have remained within the preset limits, the load shall be switched onto the By-pass line without any interruption. Otherwise, the load must remain powered by the inverter, while the monitoring must be repeated, for longer period this time, in order to check the quality of the by-pass line, before deciding whether or not to activate the transfer of the load onto the emergency line.

### 2.4 MODULAR POWER SUPPLY: PARALLEL CONNECTION:

In order to guarantee maximum reliability, the UPSs shall be connected in parallel to others of equal power. It must be possible to connect the units in parallel with others of the same type (upto a total of 8 units) at the installation site.

The UPSs may be connected in parallel either to increase the power of the uninterruptible system (power parallel) or to improved reliability (the stopping of one UPS must not cause loss of the power supply, thus providing a redundant configuration). The parallel connection must be of the "distributed" type (each UPS shall therefore have automatic by-pass)

Both the connection and the configuration of the parallel UPSs must be easy to execute and may also be carried out subsequent to the installation of the first unit, by means of a parallel kit for the connection between UPSs.

The operation shall not require manual calibration since the digital control must provide for the balance of currents between the UPSs and for the exchange of information needed for this type of configuration.

The information shall be exchanged between the UPSs via signal cabled; in order to guarantee redundancy in the interconnection cable, these connections shall be of the ring type so that the system will not fail, if the signal cable should break.

Communication shall be effected by means of an opto-isolated system, in order to keep the control systems of the individual UPSs electrically isolated from each other.

### 3.0 COMMUNICATION

3.1 The system must be provided with the related software that guarantee efficient and intuitive management of the UPS, displaying by means of bar graphs all the main information such as input voltage, applied load, battery capacity etc.

The software must be able to give detailed information even in the event of a failure of the UPS, in support of the failure diagnostics. It must be developed with a Client/Server

architecture that makes it flexible and easy to manage, and it must have multilingual support and on-line help.

The software must be supplied with the UPS, SNMP agent included for the following operating systems: Windows 95, 98, 2000, Me, XP, NT4.0 Noveli, Linux, MacOS, 9.x, OSX, windows Vista. The software must also allow weekly programming of UPS start up and shutdown in automatic mode.

### 3.2 **MIMIC PANEL**

The UPS shall be provided with a liquid crystal display (LCD) through which it shall be possible to get information, display status and/or alarm messages of insert commands.

### 4.0 **ENVIRONMENTAL CONDITION**

The UPS shall be able to withstand the following environmental conditions without damage or degradation of operating characteristics:

#### 4.1 **Operating Ambient Temperature**

UPS Module: 0°C to 55°C, if operating temperature is below than the required temperature then derating @ 1.5% per degree should be considered. (Supporting document should be attached)

Battery 25± 50°C

#### 4.2 Storage/Transport ambient temperature

-25°C to 70°C

#### 4.3 Relative humidity < 90% at 20°C

#### 4.4 Altitude operating to 100 meters above means Sea Level.

#### 4.5 **Audible Noise**

Noise generated by the UPS under any condition on normal operation shall not exceed 65 dba measured 1.0 meter from surface of the UPS.

### 5.0 **QUALITY ASSURANCE**

#### 5.1 **Manufacturer Qualifications:**

A minimum of ten years' experience in the design, manufacture, and testing of solid state UPS systems is acquired standards ISO 90001, CE certified. All these criteria must be full fill.

#### 5.2 **Factory Testing:**

Before shipment, the manufacturer shall fully and completely test the system to assure compliance with the specification.

5.3 **Cooling**

Cooling of the UPS shall be forced air through redundant fans.

6.0 **Field Engineering Support**

The UPS supplier shall directly employ a national field service network staffed by trained field service engineers to provide start up, maintenance and repair of the UPS equipment.

## UPS SYSTEM

### TECHNICAL PARAMETERS & COMPLIANCE STATEMENT

(To be filled up and enclosed along with the tender)

Sl. NO.	Parameter	Requirement as per Specification	Compliance or otherwise shall be confirmed against each item by the bidder
1.	UPS make offered	To be furnished	
2.	Technology	The UPS must be of the DSP controlled on line double conversion (VFI-SS-111 classification – as defined by standard IEC EN 62040-3) type with a transformer on the output to be inerter, “CE Marked”	
3.	System Rating	As per calculated requirement	
4.	System Configurations	Parallel Redundant configuration.	
5.	<b>Rectifier Section</b>		
5.1	Technology	The rectifier must be realized with a IGBT (Isolated Gate Bipolar Transistor) technology with DSP microprocessor digital control VFI based UPS Systems	
5.2	<b>Operating Parameters</b>		
5.2.1	Input Voltage rating	.....user selectable) 3 phase, 4 wire + ground	
5.2.2	Input voltage range	320VAC – 480VAC (400+/-20%	
5.2.3	Input frequency	50Hz+10%	
5.2.4	Power Walk in	The rectifier must provide a “soft start” with a time programmable from 1 to 30 seconds. In addition shall be possible test a power walk in delay timer programmable for 1 to 120 secs	
5.2.5	Power factor at nominal voltage (400V) and cattery charged from 25% to 100% of the load	99	
5.2.6	Current Harmonic distortion (THD) (with main distortion <2%)  <ul style="list-style-type: none"> <li>• Load 100%</li> <li>• Load75%</li> <li>• Load25 – 50%</li> </ul>	< 3% < 5% <8%	

6.	<b>Inverter Section</b>		
	Technology	Microprocessor based PWM-IGBT based technology	
6.1	UPS output Power factor	0.8 lagging (Between load power factor 0.8 lag to 0.9 lead without derating.	
6.2	Output voltage rating	380/400/415 V user selectable 3 phase 4 wire + ground	
6.3	Output voltage regulation	$\pm 1\%$ steady state for a static 100% unbalanced load.	
6.4		$\pm 5\%$ steady state for a dynamic 100% unbalanced load	
6.5	Voltage distortion with linear load	.....typical), 2% (max)	
6.6	Voltage distortion with non-linear load (EN 62040-3)	.....	
6.7	Out frequency	$\pm 0.05\%$ free running	
6.8	Output harmonic distortion (Ph/N)	3%THD maximum and 1% any single harmonic for a 100% Linear load 5% THD maximum for a 100% non leaner load	
6.9	Crest Factor:	3:1 minimum	
6.10	Voltage Transient Response	$\pm 3\%$ for a 50% load step. $\pm 5\%$ for a 100% load step.	
6.11	Voltage Transient Recover Time within +/-1%	20 mili seconds	
6.12	Phase displacement	120 degrees $\pm$ 1 degree for balanced load	
		120 degrees $\pm$ 1 degree for 50% unbalanced load	
		120 degrees $\pm$ 3 degree for 100% unbalanced load	
7.0	Overload Capability (Three phase):	125% for 10 minutes in normal operation	
		150% for 60 seconds in normal operation	
		120% for 60 min.in normal operation	
8.0	AC to AC efficiency	Min. 93% at 100% load in double conversion mode at nominal input voltage with battery fully charged.	
9.0	Backfeed protection	.....as standard feature	
10.	Input Phase sequence correction circuit	To be provided as standard or with external panels to avoid UPS transferring to Battery mode in case of phase sequence change at Input. UPS should continue to work on mains mode	
11.	Starting of UPS system from battery (Cold start)	The device makes it possible to switch on the UPS even in the	

		event of a mains failure using only battery energy.	
12.	Hot Insertion/Disconnection	The UPS should work in parallel redundant load sharing mode. There should be redundant communication cable & control (Redundant signal cable between individual units). It allows hot insertion and the hot disconnection of UPS modules without affecting loads.	
13.	Acoustical Noise	<65 dB (A) of noise typical, measured at 1 meter from the operator surface	
14.	Output wave form	Pure sine wave	
15.	Transient recovery time	Within 2 ..... seconds to $\pm 1\%$	
16.	Heat losses	To be furnished	
17.	MTBF of the system	Minimm .....,000hour for standalone system with static bypass and batteries	
18.	Automatic integral bypass	The integral bypass shall perform an automatic transfer of the critical load from the inverter to be bypass, in the events of overload, over temperature, or inverter failure conditions with zero transfer time	
19.	Automatic restart	Upon restoration of mains AC power, after a mains AC power outage and complete battery discharge, the UPS shall automatically restart and resume supplying power to the critical load and the battery charger shall automatically recharge the battery.	
20.	Output Galvanic Isolation Transformer	To be provided as standard at inverter output within the UPS cabinet to provide separate Neutral in Delta Star configuration.	
21.	Display and Control		
21.1	Metered parameters	Input AC voltage (Line to line, three phase simultaneously)	
		Input AC Current Voltage	
		Output AC Voltage, voltage (line to line, three phase simultaneously)	
		Output AC current	
		Battery temperature	
		Output peak current	
		Battery voltage	
		Battery current (charge/discharge)	
21.2	Event log	Display a log of status and alarm	

		events to be provided for upto 120 events on the front panel display.	
22.	Internal Manual maintenance	To be provided	
23.	Charger Temp. compensator	To be provided	
24	Remote UPS monitoring kits	Be able to connect to a LAN network, using the main network communication products (TCP/IP/HTTP and SNMP):	
25.	Prosecution	Output fully isolated from Input (export if disabled)	
		Built in overload	
		Built in short circuit	
		MCB protection at input	
		Over temperature sensing circuit	
26.	Alarms	Mains fall	
		Low battery	
		Over load	
		UPS on bypass	
		UPS or battery	
27.	Software capability	The UPS shall be capable to communicate with network operating system and shall be capable of doing safe shutdown of critical load by means of a auto shutdown software	
28.	SNMP/WEB management	To be provided	
29.	Operating ambient temperature	0°C to 55°C, if operating temperature is below than the required temperature then derating @1.5% per degree should be considered. (Supporting document should be attached)	
30.	Reactive humidity	< 90% at 20°C	
31.	Altitude operating	To 1000 meters above mean Sea Level	
32.	Degree of protection	IP20	
33.	Battery parameters		
33.1	Type	Valve regulated lead acid (VRLA) SMF	
33.2	Make	Sonnet schien/ Sonnen/ Hoppecke/ Aamarraja make Mul Ripple Gel Type battery having design life 10 year or higher	
33.3	Battery charger	Current limiting max voltage 2.33 volts per cell.	
33.4	Battery backup	Battery backup has to be 2 mins with each UPS module individually for valve cooling system	
33.5	Max. Charging current	10% of AH rating	

3.6.	Battery rating for each UPS in VAH	To be furnished	
34	Overall weight and dimensions		
34.1	Over all dimensions of battery bank	To be furnished	
34.2	Over all weight UPS system	To be furnished	

