INTER PLANT STANDARD – STEEL INDUSTRY		
IPSS	**SPECIFICATION FOR UN-INTERRUPTABLE POWER SUPPLY (UPS)**	**IPSS: 1-10-034-12**
	Corresponding IS does not exist	

0. FOREWORD

0.1 This Inter Plant Standard has been prepared by the Standards Committee on Electrical components and equipment, IPSS 1:10 with the active participation of the representatives of the steel plants, major consultancy organizations and established manufacturers of UPS, and was adopted in April 2012.

0.2 Inter Plant Standards for steel industry primarily aim at achieving rationalization and unification of parts and assemblies used in steel plant equipment and accessories, and provide guidance in indenting stores or equipment (or while placing orders for additional requirements) by individual steel plants. For exercising effective control on inventories, it is advisable to select a fewer number of sizes/types from among those mentioned in this standard, for the purpose of company standards of individual steel plants. It is not desirable to make deviations in technical requirements.

1. SCOPE

1.1 This Inter Plant Standard covers the requirements of UPS system used for process computers, programmable controllers and other sophisticated electrical appliances.

1.2 Individual devices and components used for the UPS shall conform to relevant IPSS, IS or IEC 60146-4(1986).

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions in IS 1885(Part 17):1979 “Electrotechnical vocabulary” shall apply.

3. SITE CONDITIONS

3.1 The following shall constitute the normal site conditions for the purpose of this standard as mentioned in IPSS:1-02-020-84 “Basic parameters for standardization of steel plant equipment” :

3.1.1 Ambient temperature - The reference ambient temperature shall be 50^{o}C.

3.1.2 *Altitude* - The altitude shall not exceed 1000m.

3.1.3 *Ambient air* - The ambient air in both indoor & outdoor installations may contain fair amount of conductive dust.

3.1.4 *Relative humidity* - The maximum relative humidity shall be 100%. However, the maximum ambient temperature and 100% relative humidity may not occur simultaneously. Equipment shall also withstand saline atmospheric condition.

4. POWER SUPPLY SYSTEM

4.1 The UPS systems shall be suitable for operation from the following power supply system :

a)	Rated voltage	:	415 V, 3 phase ac/240 V, 1 phase ac
b)	Voltage variation	:	+10%, -15%
c)	Rated frequency	:	50 Hz$\pm$ 6%

5. RATINGS

5.1 Preferred output ratings in kVA shall be as follows :

5, 7.5, 10, 15, 25, 40, 60, 80

5.2 When normal power source is off, UPS can operate on battery minimum for 30 minutes on rated kVA or as specified.

5.3 Derating factors above 50^{o}C ambient temperature should be applicable.

6. EQUIPMENT DETAILS

6.1 Salient technical features of the UPS system shall be as follows :

i)	Type	:	On line continuous duty
ii)	Output voltage	:	110 V/240 V single phase ac or 415 V three phase. Output voltage tolerance shall be $\pm$1%. The system shall be 2 wire for single phase and 4 wire for three phase.
iii)	Output frequency	:	Stand alone / free run mode 50 Hz $\pm$ 0.1%
iv)	Output voltage wave form	:	Sine wave
v)	Harmonic distortion	:	Less than 3% for individual harmonics Less than 5% for total Harmonics distortion

vi) Overload capacity : 125% rated load for 15 min
150% rated load for 60 sec

viii) Switching time from inverter mode to by-pass mode and vice-versa should be specified by the supplier.

ix) Phase displacement : $120^{o} \pm 1^{o}$ for balanced load
$120^{o} \pm 3^{o}$ for 50% unbalanced load

x) The UPS shall be capable of taking 100% non-linear load and 100% unbalanced load.

xi) **Transient recovery** – Return to steady state condition in less than 20 m sec after a disturbance.

xii) The efficiency values of UPS are minimum 92% under 100% loading.

xiii) Maximum accoustic noise level shall be less than 60 dB at 1 meter distance.

6.2 UPS system above 10 kVA capacity shall have provision for operating in

i) Parallel redundancy mode with identical UPS(same make/model), having separate/ common battery bank as specified by the indentor.

In this mode the two identical UPS systems shall be sharing the load equally under normal conditions. In case of failure of one UPS system, the entire load shall be bump- lessly transferred to the healthy UPS system, with alarm annunciation by the faulty UPS system.

Provision for programming for such operation, metering, protection & annunciation shall be inbuilt & selectable in each individual UPS

ii) In built provision for disabling parallel redundancy/Hot stand by mode so as to operate on stand alone mode and transfer entire load to a cold standby UPS of identical capacity(any make/Model) in the event of failure of operating UPS system, through

i) Necessary static bypass system of faulty UPS and subsequently ii) manually operated static switching system to put the cold standby UPS bumplessly in to service, shall be available.

6.2.1 The input power supply unit shall be isolation transformer or as per purchaser's requirement. The isolation transformer should be part of UPS supply.

6.2.2 The charger shall have the facility to charge the battery in the following modes :

- Float mode for keeping the battery under float charge
- Equalizing mode for compensating the charge lost by the battery after a discharge.
- Boost mode for initial charging of battery.
- Automatic Battery Testing facility

Automatic change-over from equalizing to float modes and vice-versa shall be provided.

6.2.3 The inverter power circuit shall comprise insulated gate bipolar transistor (IGBT) using PWM control technique.

6.2.4 The by-pass switch shall be of high speed static transfer device comprising all protective devices, trigger circuits and associated control circuits to provide un-interrupted transfer of load to an alternate source in case of failure of UPS system.

6.2.5 In addition to the static by-pass switch, a manual change-over arrangement shall be provided to supply the load directly from the mains instead of through the UPS system.

6.2.6 The battery bank shall act as stored power source for the UPS system and shall be of heavy duty industrial service. The battery shall be of lead-acid, Sealed maintenance free (SMF) or Nickel-Cadmium type.

6.2.7 The battery bank shall be mounted on a free standing acid resistant self supporting battery rack. The battery shall have sufficient ampere-hour capacity to supply the rated current to the inverter for a minimum period of 30 minutes. Up to and cell voltage of 1.85 for lead acid / 1.1 for Ni-Cd.

6.3 Indicating meters – For display of following parameters :

- ac input voltage
- ac input current
- dc voltage
- Charging/discharging current of the battery
- ac output voltage
- ac output current
- Input & output frequency measurement
- ac voltage for by-pass circuit.
- ac current for by-pass circuit.
- Frequency for bypass circuit.

6.4 Indicating lamps – LED type indicating lamps shall be provided on the mimic diagram to indicate the status of UPS power circuit, breakers and

contactos. There should be indication/tripping provision to protect the battery from complete discharge (100%).

6.5 Annunciation – Alarm annunciation shall be provided using LED indicators for depiction of major fault conditions in the UPS system along with audible alarm. The system shall have “accept”, “reset”, and “test” facility over separate push buttons.

6.6 Remote Audio Alarm indicating transfer of input from mains to battery shall be provided.

6.7 Potential free contacts for giving the status of failure of UPS will be provided for remote annunciation.

6.8 Suitable earthing provision to be provided

7. STANDARD PROTECTION

7.1 ac input side protection

i) Line filters to eliminate the mains generated spikes
ii) Input side single phasing and phase unbalance in case of 3 phase input
iii) Moulded case circuit breaker shall be with positive isolation feature as per IEC having built-in over current and short circuit releases
iv) Under voltage protection
v) Isolation for control and annunciation circuits.
vi) Protection against lightning surges

7.2 Converter Output

i) Battery charging current limit to restrict the current drawn by the battery in each mode within permissible limits.
ii) Overall current limit to restrict the total current supplied by the converter-cum-charger.
iii) L-C filters as required to keep the ripple value within the permissible limits. The filter capacitors shall have longer life with fire proof protection features.
iv) Snubber circuits for the semi-conductor devices for dv/dt protection.
v) Suitable protection of individual power devices.
vi) Earth fault protection to be provided on output side.

7.3 Inverter Unit

i) Output over voltage and under voltage protection.
ii) Output current limit.
iii) Output overload and short circuit.
iv) Fast acting HRC fuses for inverter circuit.
v) HRC fuses for control circuits.

vi) Over temperature alarm for power devices.
vii) Reverse power protection for parallel inverters are required.

7.4 **Battery side**

i) Moulded case circuit breaker having built-in over current and short circuit releases.
ii) Pre-tripping alarm for battery low voltage condition with remote alarm & annunciation.
iii) Tripping for battery low voltage for over discharge protection.
iv) Battery earth fault.

7.5 **Static by-pass switch**

i) By-pass over voltage and under voltage.
ii) By-pass frequency out of limits.
iii) Inhibit retransfer to the inverter if the inverter is not in synchronous mode with the by-pass
iv) By-pass isolation transformer has to be provided.

8. CONSTRUCTION DETAILS

8.1 The UPS system shall be housed in enclosed, vermin proof, floor mounting type CRCA sheet steel cubicles with various sections arranged logically inside the panel. Sheet steel used for fabrication of metal cabinet for control panel shall be of cold rolled type and of thickness not less than 2 mm. Non-load bearing side may be of 1.6 mm thick sheet.

The cabinet shall be of base mounting design and shall be provided with removable hinged door with good latching system operated by a front handle. A base channel/frame of minimum 50 mm height and 3 mm thickness shall be provided.

8.2 A mimic diagram of the UPS system shall be provided on the front door of the cubicle along with instruments, alarms and indication LEDs showing the operation of individual unit of the UPS.

8.3 All devices provided on various control cubicles shall have identification labels fixed in a readily visible position but not on the device itself.

8.4 Durable gaskets shall be provided for all doors and covers and for all partitions between adjacent units. The gasket shall be of synthetic rubber and shall be adequately secured.

8.5 Removable cable gland plate shall be provided at the bottom. The plate shall be undrilled unless specified otherwise.

8.6 All ventilating and forced draft openings shall be provided with suitable screen protection.

8.7 All bolts, nuts and other hardware materials used shall be of Chromium / Zinc coated finish.

8.8 Anti-vibration pads to be provided for UPS system on mobile equipment or where vibration is likely to be encountered during operation.

9. TESTS

9.1 All equipment shall be fully tested in accordance with the relevant clauses of applicable standards. All components and devices shall be checked for correct operation before despatch.

9.2 Type test certificates shall be submitted for all equipment as stipulated in the relevant standards.

9.3 Routine tests as per relevant standards shall be carried out on all equipment. The test certificates shall be submitted.

9.4 Where test procedures are not specifically mentioned in the applicable standards, procedure described in IEC shall generally be followed.

9.5 Back-up time verification test at site.

9.6 A list of diagnostic parameters with their recommended value should be provided.