Safety? Safe!!

1. Safety request:

European market: GS-mark (TUV, VDE, ERG, ETS, LGA, EGR,...).

North America market: UL mark, CSA mark (cUL mark), NOM.

2. Definition of primary/secondary:

	Electric standpoint	Safety standpoint
Primary	Source	*
Secondary	Load	**

* Primary circuit: An internal circuit which is directly connected to the external supply mains or other equivalent source (such as motor-generator set) which supplies the electric power. It includes the primary windings of transformers, motors, other loading devices and the means of connection to the supply mains.

** Secondary circuit: A circuit which has no direct connection to the primary power and derives its power from a transformer, convertor or equivalent isolation device situated within the equipment.

Safety extra-low voltage (SELV) circuits: it shall not exceed 42.4 Vpaek or 60Vdc.(EN60950)

Low-voltage, Limited-energy (LVLE) circuit: not exceed 30 Vrms, 42.4 Vpeak, or 60Vdc.(UL1778)

3. Temperature with components: (ΔT, operating at ambient 40^0 C max.)

3-1. Transformer and the coil of relay:

^{0}C (UL)	Class A (105)	Class E	Class B (130)	Class F (155)	Class H (180)	Class N (200)	Class R (220)
EN60950	50	65	70	90	115		
UL1778	50		70	95	110	125	140

3-2. Case (Enclosure):

^{0}C	Metal	Plastic*(Nonmetallic**)
EN60950	30	55
UL1778	30	55

* EN60950

** UL1778

External surface of equipment which may be touched (EN60950) or Surface subject to casual contact (UL1778). For each plastic material, account should be taken of data for that material to determine the appropriate maximum temperature rise.

3-3. Capacitor (105^0 C or 85^0 C max.), Wire (use code 1015, 105^0 C max.), Power Semiconductor (*), PCB/PWB (Printed Circuit Board/Printed Wiring Board, 130^0 C max.).

* For a power-switching semiconductor and the like, the temperature limit on the case is the maximum case temperature recommended by the semiconductor manufacturer.

3-4. Battery: (EN50091-1-1)

At 25^0 C*	Back-up mode	Other modes
Lead/Acid	30	15
NiCd	25	15

Temperature difference between separate blocks of the battery shall be less than 10^0 C.

* Compliance is checked by measurements under normal ambient temperature and full load conditions.

4. User replacement and Hot swappable.

Caution: Risk of electric shock. Battery circuit is not isolated from AC input. Hazardous voltage may exist between terminals and ground. Disconnect powercord from wall receptacle before servicing battery. → Battery replaceable, but not hot swappable.

5. Creepage* (Over surface**) and Clearance* (Through air**).

Between primary & secondary	Creepage	Clearance
EN60950 (Reinforced insulation)	5 mm	4 mm
UL1778	1.6 mm	1.6 mm

* Pollution Degree 2. (EN60950)

** Controlled environment: An environment that is a heated, indoor location such as a computer room, office, or a factory floor that is relatively free of conductive contaminants such as carbon dust and the like.(UL1778)

Slot (> 1mm) could be added, then the value for that clearance shall be applied as the value for the minimum creepage distance.

Please refer to Annex 1.

6. Performance:

6-1. (Earth) Leakage current:

	UPS	UPS + Load
EN60950		≦3.5 mA
UL1778	≦0.75 mA	

6-2. Hi-pot (Electric strength or Dielectric Voltage-Withstand test):

1 minute	L & N to Earth*	Primary to Secondary*
EN60950	1500 Vac	3000 Vac
UL1778**	1240 Vac	1240 Vac

* DC voltage is equal to the peak voltage of the prescribed a.c. test voltage.
** 1000 Vac plus twice rated voltage.

Insulation breakdown is considered to have occurred when the current which flows as a result of the application of the test voltage rapidly increases in an uncontrolled manner, i.e. the insulation does not restrict the flow of the current. Corona discharge or a single momentary flashover is not regarded as insulation breakdown.

6-3. Grounding impedance:
The resistance of the connection between the protective earth terminal or earthing contact and parts required to be earthed shall not exceed 0.1 Ω.

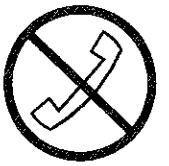
6-4. Flammability:
94V-0 > 94V-1 > 94V-2 (94-5VA / 94-5VB / 94HB / 94HBF / 94HF-1 / 94HF-2 / 94VTM-0 / 94VTM-1 / 94VTM-2).

6-5. Input test: (UL1778)
The input current shall not be more than 110 % of the rated value. The rated value shall not more than 80 % of the maximum current rating of plug.
Ex. NEMA 5-15P, max. current rating of plug is 15 A
Its max. rated input current on the marking of UPS is 15 x 0.8 = 12 (A)
The allowable max. current under recharging/Reserve/Bypass/Normal mode is 12 x 1.1 = 13.2 (A)

6-6. Battery terminal: (EN60950)
Test finger can't short the (+) terminal and (-) terminal of battery at the same time.

6-7. UL497A (TVSS) and backfeed protection: (UL1778)

Effected from November 17, 2000, the telecommunication type connectors and terminals are marked "Not for telecommunication Network" or with the symbol below, otherwise it should be approved by UL497A. And for preventing the additive load leakages to pass through the UPS to the input plug pins when the plug is removed from the wall, two-pole backfeed protection shall be provided.



6-8. Stability:

A unit shall not overbalance when tilted to an angle of 10^0 from its normal upright position.

6-9. Receptacle and plug: (UL1778)

If the plug rating is more than output receptacle rating, the outlet should be protected by branch type (UL489) of fuse/protector/breaker which rating is less or equal to outlet's rating.

Input protection is supplementary type (UL1077).

6-10. Input earth mark and fuse rating:

The wiring terminal intended for connection of the protective earthing conductor associated with the supply wiring shall be indicated by the symbol (IEC417 No. 5019). The indication shall not be placed on screws, or other parts which might be removed when conductors are being connected.

Marking shall be located on, or adjacent to, each fuseholder (or in another location provided that it is obvious to which fuseholder the marking applies) giving the fuse rated current and, where fuses of different rated voltage value could be fitted, the fuse rated voltage.

Where fuses with special fusing characteristics such as time delay are necessary, the type shall also be indicated.

A fuse and a fuseholder shall have voltage and current ratings acceptable for the circuit in which they are connected.

Fuses are not soldered directly to the PWB must be identified with their replacement rating.

6-11. Class of equipment and connection to the supply: (EN60950)
Class I and pluggable equipment type A.

6-12. Time constant:
Equipment is considered to comply if any capacitor having a marked or nominal capacitance exceeding 0.1uF and connected to the external mains circuit has a means of discharge resulting in a time-constant not exceeding 1 second for pluggable equipment type A. The relevant time-constant is the product of the effective capacitance in microfarads and the effective discharge resistance in megohms. Alternatively, during an internal equal to one time-constant the voltage will have decayed to 37% of it original value.

6-13. Operator accessible: (EN60950)
The operator (user) is permitted to have access to:
- Bare parts in SELV circuits.
- Bare parts in limited current circuits.
- Insulation of wiring in ELV circuits under the conditions specified in 2.1.3.

6-14. Equipment grounding:
There shall be provisions for grounding all dead metal parts of a unit that are exposed or that may be contacted by a person during intended operation or adjustment and that are likely to become energized as a result of electric malfunction.

The equipment-grounding conductor of a power-supply cord shall be connected to the grounding blade of a grounding attachment plug and shall be connected to dead metal parts within the frame or enclosure by means of a screw not likely to be removed during ordinary servicing not involving the power-supply cord. An external force applied to the power-supply cord shall not transmit stress to the equipment-grounding connection on the frame or enclosure before the line-voltage connections are broken.

6-15. Live heat sinks: (UL1778)
A current-carrying, aluminum heat sink shall be plated, conductive anodized, iridiated or the equivalent at surfaces contacting the solid state component.
Otherwise, there should be a marking on heat sink, "CAUTION-Risk of electric shock, Heat sinks are live. Disconnect UPS before servicing.", or the equivalent.
This requirement does not apply to live heat sink that is not used to conduct current.

6-17. Cautionary marking: (UL1778)

The words "CAUTION", "WARNING", or "DANGER" in a cautionary marking shall be in letters not less than 1/8 inch (3.2 mm) high. The remaining letters in a cautionary marking shall not be less than 1/16 inch (1.6 mm) high.

A cautionary marking shall be:

1) Located on a part that cannot be removed without impairing the operation of the UPS; and
2) Visible and legible to the operator during normal operation of the unit.

7. Component selection:

Generally, if the components are connected or used in primary circuitry/isolation purpose, they should be approved by related agencies.

Ex. Y-capacitor (L-E, N-E), X-capacitor (L-N), MOV, fuse, protector, breaker, power cord, wire, relay, photocoupler, transformer, plastic case, (common, differential) choke, inlet, fuse holder, outlet, NTC, TCO, fan, switch, connector and so on.

EN60960: VDE, TUV, or other European agencies.

UL1778: UL, CSA, or cUL.

8. Power rating:

EN50091-1-1: rated input/output voltage or voltage range, rated input/output frequency, rated input/output current, number of input/output phase, output rated active/apparent power.

UL1778: input/output voltage, input/output frequency, input/output current, output volt-amperes and watts (or power factor)

9. CE requirement:

Please refer to Annex 2.

Annex 1

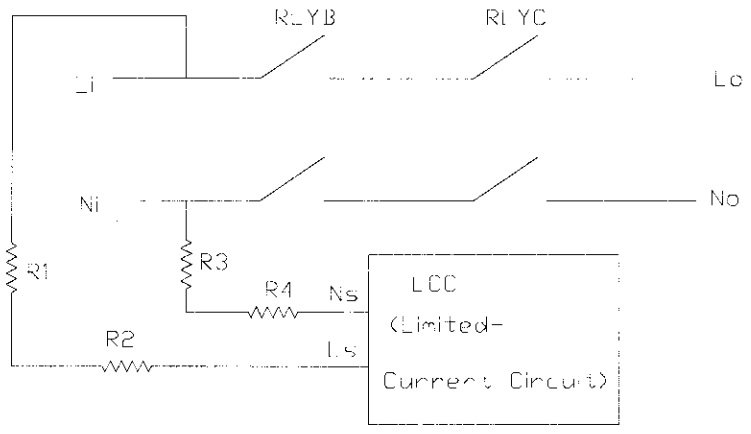
Air gap*:

	TUV	Nemko
Li to Lo	1.9 mm	2.8 mm
Ni to No	1.9 mm	2.8 mm

Creepage:

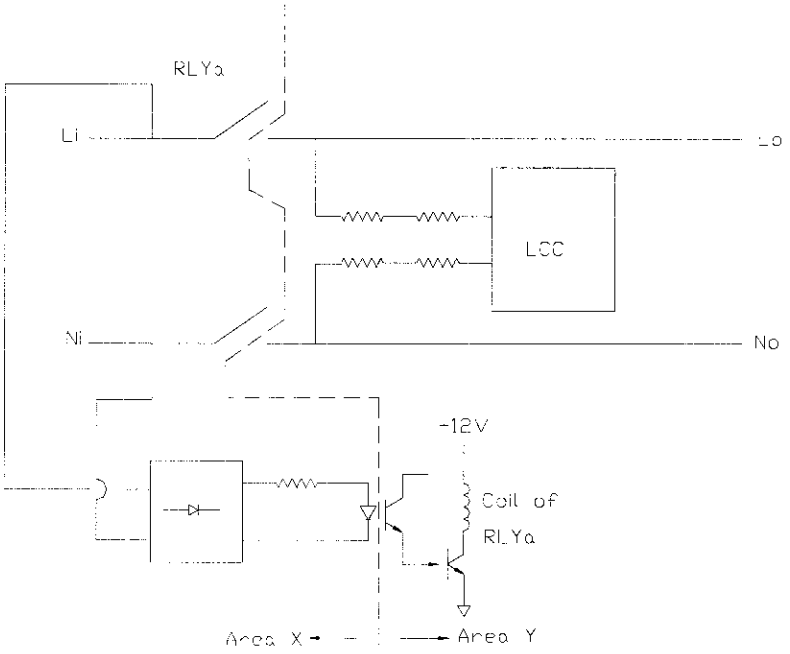
PCB	TUV	Nemko
Li to Lo, Ni to No	2.5 mm	5 mm
Li to Ni, Lo to No	2.5 mm	2.5 mm
Li to No, Ni to Lo	2.5 mm	5 mm
Li to Ls, Li to Ns	5 mm	5 mm
Ni to Ls, Ni to Ns	5 mm	5 mm
Ls to Ns	N/A	N/A
Area A to Area B	2.5 mm	5 mm

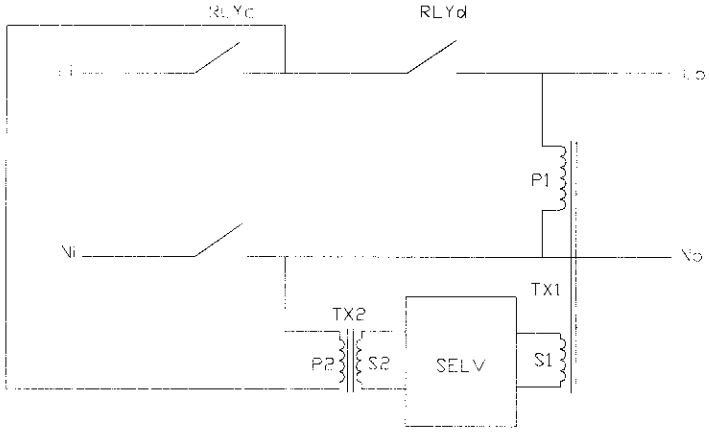
R1, R2, R3, and R4: Through-hole type, each one meets basic insulation (≧1/4 W, > 2.5 mm). Generally, for meeting LCC, R1 ~ R4's resistance should be more than 1 MΩ. 1500 Vac of high-pot is implemented to the resistor for 1 minute, no smoke or fire occurs during the test.



* The air gap or sum of the air gap in each pole shall in accordance with Table 5 – Minimum clearance in secondary circuits and using the column headed "circuit not subject to transient overvoltage" for reinforced insulation at the working voltage that is backfed.

Bridging resistors: It is permitted to bridge double or reinforced insulation by two resistors in series. They shall each comply with the requirement of clearance and creepage between their terminations for the total working voltage across the pair and shall have the same nominal resistance value.





Annex 2

Subject: **CE marking**

Reference: EN50091, Uninterruptible Power Systems (UPS)
Part 1: General and safety requirements, Part 2: EMC Requirements.

EMI:

1. Paragraph 2.4.1 (Conducted emissions) Limits of mains terminal interference voltage.

a) UPS for unrestricted sales distribution.

Table 1 (Rated Output Current Is Less Than 25A).

- Class A or B is based on customer requirement.

2. Paragraph 2.5.1 (Radiated emissions) E field.

a) UPS for unrestricted sales distribution.

Table 3 (Rated Output Current Is Less Than 25A).

- Class A or B is based on customer requirement.

EMS:

3. Paragraph 3.2 Immunity to electrostatic discharges (IEC801-2 or IEC1000-4-2, ESD).

- Minimum requirement : Level 3
- Performance criterion : B

4. Paragraph 3.3 Immunity to radiated electromagnetic filed (IEC801-3 or IEC1000-4-3, RS).

- Minimum requirement : Level 2
- Performance criterion : A

5. Paragraph 3.4 Immunity to fast transients (IEC801-4 or IEC1000-4-4, EFT).

- Minimum requirement : Level 2
- Performance criterion : A

6. Paragraph 3.5 Immunity to surge (IEC801-5 or IEC1000-4-5, Surge).

Under consideration.

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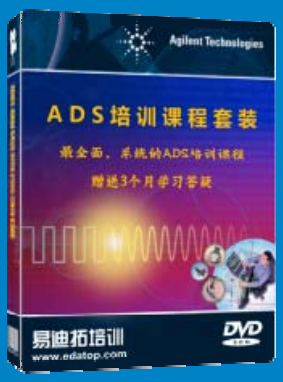

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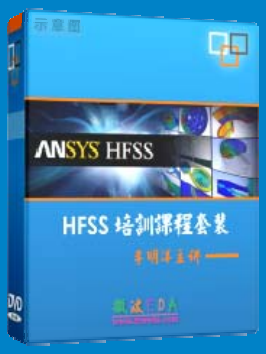

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