

Power over Ethernet Safety Overview



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Agenda

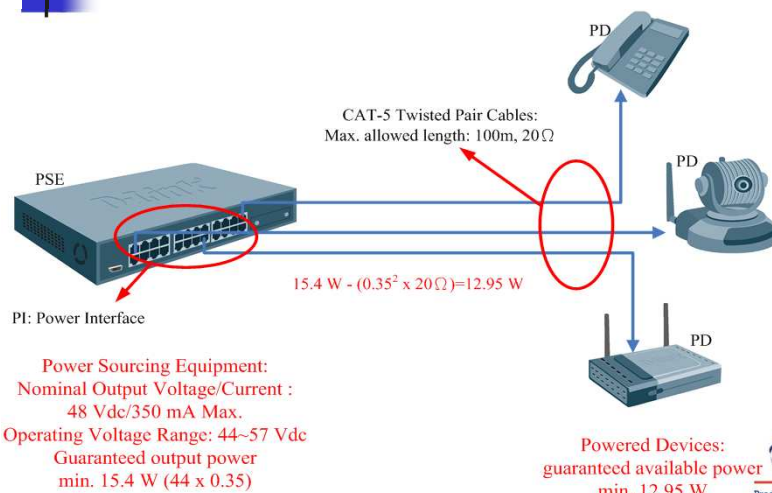
- General Ideas
 - PSE and PD, PoE Specification
 - Benefits
- Potential Hazards
 - Electric Shock Hazard
 - Touch Current limitations between
 - Fire Hazard
 - Fire Enclosure
 - Limited Power Source
 - Additional abnormal operation test
- Question
- Reference



Power over Ethernet

- CAT-5 twisted-pair cable can deliver data and power at the same time.
- Widely applications on Ethernet: VoIP, Entertaining equipments, WEB Camera, Wireless/Bluetooth AP...

General Ideas: Defined in IEEE 802.3af





Benefits of PoE technology

- Safe and Saving
- Convenient and Flexibility
- Remote Power Control/Management
- Reliability and Compatibility



Potential Hazards

- Electric Shock Hazard
- Fire hazard



Electric Shock Hazard-1

- Nominal output voltage <math><42.4\text{ Vpk}</math> or 60 Vdc.
- ECMA-287, Clause 3, classified as **ES1(Energy Source 1)**.
- IEC 60950-1:2001: **SELV**.



Electric Shock Hazard-2

“Electric shock hazard results from the current passing through the human body.” The definitions are identical in ECMA-287 and IEC 60950-1, except for the limitation of “Touch Current”.

Table 1

	Output/Input ≤ 60 Vdc (SELV)	
	ECMA-287 (Table 3.1)	IEC 60950-1: 2001 (Table 5A)
Limits for Touch Current	No limitation for All equipments	≤ 0.25 mA for all equipments' measured point which accessible parts and circuits not connected to protective earth ≤ 0.75 mA for “Handheld” Equipment measured point connected to main protective earthing terminal (if any) ≤ 3.5 mA for all Equipments' measured point connected to main protective earthing terminal (if any)



Why both are different?

- **IEC TR60479-1:** Effects of current on human beings and livestock.
- Annex C: Human body's resistance is 1500 ohm against to SELV (60 Vdc) and the frequency is ignored due to the DC voltage.
- Could it be supposed that is the reason for no limitation of Touch Current when the working voltage is DC in ECMA-287 (Table 3.1)?



Fire hazard-1

- IEC 60695-1-1:
 - Fire Hazard is “the potential for injury or loss of life and/or damage to property by a fire”.
 - Fire risk is “the probability of fire”.



Fire hazard-2

- ECMA-287, Clause 4.
 - “Electrically-caused fire is electrical heating followed by ignition. Such **risk of ignition** may result from excessive fuel temperature resulting from overload, component failure, loose connection, arcing, etc.”.
- IEC 60950-1: 2000, Clause 0.2.3.
 - “**Risk of fire** may result from excessive temperatures either under normal operating conditions or due to overload, component failure, insulation breakdown or loose connections.”.



Fire hazard-3

- Root cause of fire hazard for ITEs.
 - Lower the potentiality of electrical failure, minimize the possibility of fire hazard.
 - Reduce the likelihood of fire spreading from the equipment also minimizes the possibility of fire hazard.
- Solutions:
 - LPS (Limited Power Source) and
 - Fire enclosure.
 - Both are provided in IEC 60950-1: 2001 and ECMA-287 to reach the purpose of minimizing the fire risk.



Limited Power Source-1

- The output power of PSE is rated as **15.4 W**, which exceeds
 - IEC 60950-1: the Telecommunication networks' requirement 15 W;
 - ECMA-287, the PSE is classified as PS1 (Power Source Class 1).
- **Fire Risk has to be evaluated.**



Limited Power Source-2

- Most of these products employ only **HB** flammability plastic enclosure due to designed to supplied by LPS, either are IP Phones, Wireless AP or Web-Cam.
- The output of PSE shall be evaluated to be complied with LPS requirements in IEC 60950-1:2001 or ECMA-287's PS2 (Power Source Class 2) **under normal or abnormal condition.**
 - UL PAGOS (IEC/UL 60950-1 Practical Application Guidelines Online Service) can be a reference to conduct the relevant tests.



Additional abnormal operation

- For PSE which has to be considered per IEC 60950-1: 2001, Clause 5.3.6, 5.3.8 and ECMA-287, Clause 4.3.6.
- It states that relative components in PSE shall be short-circuit, disconnected or **overloading** and the output connectors which deliver power or signal outputs also has to be conducted the overloading test.
- To ensure the fire will not be ignited in the devices and the required **electrical insulation** will not be breakdown.



Questions

- When we conduct the LPS test on these PSE, that PoE IC is usually treated as an regulating network.
- The single fault condition is reached by short-circuit the PoE IC, for the most part it disables the function of regulating function of PoE IC.
- Is it proper to do that?
- **It seems like we are conducting the LPS test directly on the 48 Vdc output of power supply.**



Thank you !!