UL 60950

Safety of Information Technology Equipment

December 1, 2000, Underwriters Laboratories, Inc. released their new standard UL 60950 3rd Edition. This standard fulfills the second and third parts of a 3 phase transition from UL 1950 to UL 60950 as the sole standard for approving Information Technology Equipment. The first of these phases has already expired. After April 1, 2000, new products are not permitted to be approved to UL 114, UL 478, UL 1459 or UL 1950 1st and 2nd edition.

2nd Phase

Currently, all new products submitted for approval may be approved to UL 1950 3rd edition or UL 60950 until April 1, 2003. After this time, new submissions must be evaluated for compliance to UL 60950, 3rd edition. Because both standards are available now, UL 60950 is being considered by UL as the default. If a manufacturer wants an approval to UL 1950 3rd edition, they must state this in a letter of intent to UL. Products certified to older standards do not have to be re-evaluated under UL 60950, 3rd edition and may be produced until April 1, 2005. However, any safety critical modifications must be evaluated against the criteria of UL 60950.

3rd Phase

All products submitted for approval after April 1, 2005, must comply with UL 60950, 3rd edition. UL 114, UL 478, UL 1459 and UL 1950 1st , 2nd and 3rd editions will then be withdrawn and no longer available for use in certifications. Equipment previously evaluated to these standards, that will continue to be manufactured and marked for certification after the April 1, 2005 deadline, must be reinvestigated to determine whether or not the product complies with the requirements of UL 60950, 3rd edition.

Numbering Changed

Some might wonder why the new standard did not become UL 1950 4th edition. The decision to use UL 60950 3rd edition was aimed at aligning with Europe, which uses a "60" numbering system. IEC safety standards, approximately a year and a half ago, were also renumbered to harmonize with European Union nomenclature. For example, the previously labeled IEC 825, "Safety of Lasers", is now referred to as IEC 60825. This numbering has also been carried out with the new UL 60950 as it refers to IEC 950 and other standards. For example, a reference to the old IEC 417 for safety symbols, now is a reference to IEC 60417.

Re-organization

The most apparent feature of UL 60950 is its re-organization of the old UL 1950 standard. Time was spent grouping parts all under the same topic instead of adding on extra sections. For example, clause 2.1, access to energized parts, deals with access to all types of circuitry. Accessibility of TNV circuitry, clauses 6.2.2.1 and 6.2.2.2 of UL 1950, have been moved into clause 2.1 for completeness. In fact, most of the constructional requirements of section 6 from UL 1950 has been distributed within the standard leaving the new section 6 solely for testing requirements of telecom circuitry.

Other sections of the standard have been improved to provide better explanation and necessary information in order to determine requirements. Clause 2.10, formerly 2.9 of UL 1950, discusses clearance, creepage and distance through insulation. Distances are based on pollution degree, working voltage, overvoltage category and insulation rating. Section 2.10 facilitates the determination of these categories by defining the types of pollution degree and methods of overvoltage category selection which were not as clear in the last standard. Additionally, TNV working voltages are defined for the different

classifications of TNV. Previously, voltage was determined by application, experience or worst case scenario.

Because a lot of material, whether changed or unchanged, has been moved, it will take time to find things. As a helpful guide, a short list of commonly performed tests are presented in Table 1 to illustrate some clause numbering changes.

New Topics

UL 60950 has done more than simply change the numbering and organization of the old standard. There are also topics which will directly affect new product submittals. The three that will be discussed are:

- Requirements for equipment connected to a DC centralized power system
- Ground impedance
- Alternate leakage current measurement method.

DC Centralized Power Systems

Clause 3.6 details special considerations for equipment connected to a centralized DC power system. This section provides new circuit classifications dependent on the level of voltage and defines test voltage tolerances.

Test Voltages

One of the confusions with UL 1950 was the issue of whether or not to apply the –10% or +6% tolerances, used for AC mains operated equipment, to DC powered units. Clause 3.6 now refers to annex NAB of UL 60950 which states that a - 48 VDC nominal system shall be tested between the range of - 40.0 to - 56.7 VDC and a - 60 VDC nominal system shall be tested in the range of - 48.0 to - 72.0 VDC or +/- 20%.

Circuit Classifications

Classifications are made based on the expected voltage. Power systems that never exceed 60 VDC are treated as a SELV circuit. SELV or Safety Extra Low Voltage is defined as a circuit that in normal and single fault condition never exceeds 42.4 V peak or 60 VDC. Voltages greater than 60 VDC to 80 VDC are classified as a TNV-2 circuit and voltages over 80 VDC are considered hazardous. Previously UL 1950 provided definitional language supporting classifications of SELV and hazardous secondary voltage. In order to determine what category applies, we must know the expected range of voltages from a nominal - 48 and - 60 VDC central office power system.

The European Telecommunication Standard, ETS 300 132-2, “Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc), state the voltage limits for normal and abnormal conditions for the supply that telecommunications equipment will be connected to. The normal service voltage range, for a - 48 Vdc nominal supply, is - 40.5 to - 57.0 Vdc. The abnormal service voltage under steady-state conditions is considered 0 to - 40.5 Vdc and - 57.0 to - 60.0 Vdc. In a nominal - 60 Vdc supply installation, the normal service voltage range is - 50.0 to - 72.0 Vdc. The abnormal service voltage under steady-state conditions 0 to - 50.0 Vdc and - 72.0 to - 75.0 Vdc.

These classifications of voltage are important in determining design requirements. The most obvious of these is the amount of insulation (creepage and clearance) provided between parts or circuitry within a piece of equipment.

- 48 Vdc power is still considered a SELV secondary circuit. Equipment powered at this voltage is mostly comprised of SELV circuitry and conductive parts. Using clause 2.9.5 of UL 60950, the insulation required between a SELV circuit and a conductive part or another SELV circuit is functional. The new standard has replaced the term operational with functional. This level of insulation is the least stringent of all the others because you have three methods to prove

compliance. It can be verified by either a given amount of creepage and clearance distance, successful application of the electric strength test or by short circuit analysis.

Power systems at - 60 Vdc can now be considered to be TNV-2 circuits instead of a hazardous secondary circuit. Using the same clause 2.9.5, the levels of insulation are stricter than those required for SELV circuits. From - 60 Vdc circuitry to a conductive part, functional insulation is required, but between - 60 Vdc circuitry and SELV circuitry, basic insulation is required. Without this TNV-2 allowance, the insulation requirements would be even higher.

Ground Impedance

This test is designed to induce a specified current for a certain length of time between the main protective earth ground conductor and any other accessible grounded parts. The application of the current will define the impedance between the path of test. This impedance is required to be less than 0.1 ohms.

UL 1950 defined the test current (AC or DC) to be 1.5 times the current capacity of the circuit but no more that 25 A. The test voltage must not exceed 12 V. The duration for this test is one minute. UL 60950 changes the test current to two times the current rating of the circuit under test. The voltage is

Test	UL 1950	UL 60950
Input Current	1.6.1	1.6.2
Durability of Marking	1.7.15	1.7.13
Accessibility	2.1.2	2.1.1.1
Energy Hazard Measurements	2.1.5	2.1.1.5
Enclosure Push	4.2.2, 4.2.3, 4.2.7	4.2.1, 4.2.3, 4.2.4
Capacitance Discharge	2.1.10	2.1.1.7
Humidity Conditioning	2.2.2, 2.2.3, 5.3	2.9.1, 2.9.2, 5.2.2
Earthing	2.5.11	2.6.3.3
Limited Power	2.11	2.5
Source Measurements Stability	4.1.1	4.1
Steel Ball/Impact	4.2.4, 4.2.7	4.2.1, 4.2.5
Lithium Battery Reverse	4.3.21	4.3.8
Current Measurement Heating	5.1	4.5.1
Leakage Current/Touch Current	5.2	5.1
Electric Strength	5.3.1	5.2.2
Transformer Abnormal Operation	5.4.3	5.3.3
Impulse (TNV)	6.4.2.1	6.2.2.1
Electric Strength (TNV)	6.4.2.2	6.2.2
Overvoltage	6.6	6.4

Table 1: Comparison of Tests.

still limited to 12 V, but that duration is increased to 2 minutes or more depending on current rating.

If the current rating of the circuit exceeds 16 A, the test current is still 2 times the rating of the circuit, but the test time is increased (see Table 2). The voltage drop across the test points, at the specified time, shall not exceed 2.5 V.

Earth Leakage Current vs Touch Current

Earth leakage current testing of UL 1950 clause 5.2 has been transformed into a touch current test of UL 60590 clause 5.1. Both tests utilized the measuring circuit in Annex D of the standard. The tolerances specified by Annex D of UL 1950 have been removed from the resistors and capacitors in the network. The calibration of the circuit per UL 60950 must be done in accordance with IEC 60990. This involves analyzing the frequency response of the circuit to the criteria in IEC 60990. For more details on this standard please refer to the March 2001 issue of *Conformity*, "*Leakage Currents – Safety Issues and Fixture Calibration*" by Isidor Straus.

UL 1950 measured the earth leakage current from each of the phase conductors on the supply side to the accessible earth connection on the equipment under test (EUT) with the ground disconnected. The new touch current method measures current in the earth conductor from the supply side to the EUT. Measurements are made in all combinations of the polarity of the AC mains and the open circuit and short circuit condition of the earth conductor. Limits of this current can be found in Table 5A of the standard.

Current Rating of Circuit (A)	Time (Minutes)
up to 30	2
> 30 to 60	4
> 60 to 100	6
> 100 to 200	8
more than 200	10

Table 2: Impedance Test Durations

UL 60950 contains some items that are new, but much that is familiar. It has been substantially reorganized so users of UL 1950 will have to read it carefully. The good news is that a generous transition time is allowed and it will align U.S. I.T.E. safety standards more closely with international practice. ■