TECHNOLOGY TOPIC

The Birth of a Safety Standard:

The IEC 62368-1 Ed 1.0 for Audio/Video, Information and Communication Technology Equipment

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After 10 years of work by the International Electrotechnical Commission's (IEC) Technical Committee 108 (TC-108), a new international safety standard was published in January of 2010. The IEC 62368-1 Ed 1.0: Audio/Video, Information and Communication Technology Equipment — Safety Requirements standard was developed to help engineers integrate safety compliance early in the product design cycle. Although it did not become mandatory until 2015, designers and manufacturers have already begun to look for appropriate and effective solutions that will meet the new industry standard.

It's no secret that there has been an incredible expansion of electronic and multimedia equipment in the last 20 years, including a convergence of multimedia and information technology products. For example, we now have personal computers with audio/video features, as well as other new communications technologies that are interconnected and interchangeable. A personal computer can now be used for business applications as well as playing music files and DVD videos and providing new communication options such as Wi-Fi.

These features are easily obtainable and available on one piece of electronic equipment, which in turn can be highly portable and offered in many popular formats. In addition, products originally designed for business can be found in the home or office. Moreover, electronic equipment which was previously used primarily by adults is now being employed by users of all ages.

The changes that have taken place in the marketplace suggested to TC-108 that an entirely new standard had to be developed, and not just a harmonization of existing standards as was done in the past (Figure 1).

In considering how today's multimedia equipment performs, TC-108 determined that a new approach to the standard's development was needed. It was decided that the new standard would be based on Hazard-Based Safety Engineering (HBSE) principles, a process that helps engineers integrate safety compliance early in the product design cycle, and is supported by sound engineering principles, research and field data.

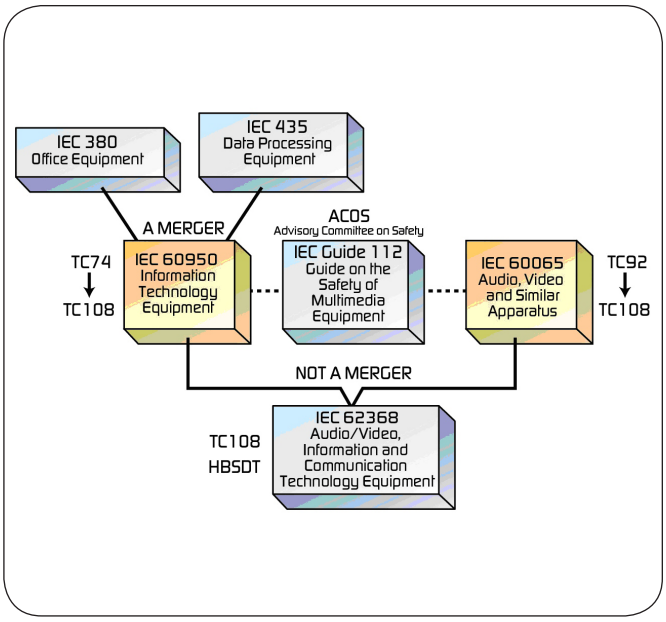

Figure 1. The progression of standards leading to the IEC 62368-1.

Upon review of the typical features and options of the latest electronic equipment, and what is expected in the near future, TC-108 determined that the new standard should:

- Consider and allow innovation, new technology, and features for a broad range of products and markets.
- Identify the types of hazards common in the equipment.
- Utilize performance-based criteria which allow proven prescriptive construction options.
- Utilize tests based on "Type" testing.
- Not be a simple merger of IEC 60065 and IEC 60950.
- Be useful and easy to understand by a variety of users, including suppliers, purchasers, and safety certification personnel.
- Be harmonized with national/regional differences.
- Be written in a user-friendly manner, as opposed to using complex technical jargon.

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Clause 0, Introduction to the Standard, summarizes the key principles of IEC 62368-1 and serves as an informative primer on HBSE. Because it allows one to quickly understand the fundamentals of the standard, it should be studied closely before using the standard.

IEC 62368-1 was developed using HBSE, which uses safeguards that are critical in preventing energy hazards. IEC 62368-1 uses a "three-block model" for safety and for pain and injury. It is based on the theory that if safeguards are adequate, there will be no hazard to the user for pain and injury (Figures 2 and 3). The first of the three-block HBSE model is the hazard condition itself. The second block of the model is the transfer mechanism or safeguard to the user. The third block is the user. If any one block is missing during the operation of the equipment, then there can be no hazard. So goes the thinking behind the HBSE model.

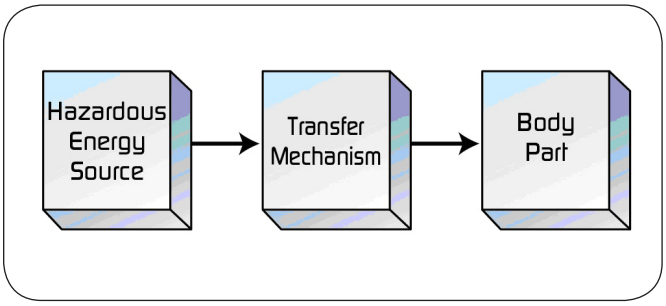

Figure 2. Three-block model for pain and injury.

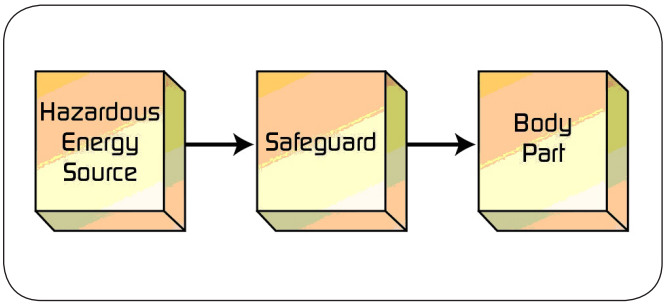

Figure 3. Three-block model for safety.

Another new concept worth noting is that users are now identified as an "ordinary person" or "skilled person," or an "instructed person." An "instructed person" refers to someone who has been instructed by a "skilled person" on energy sources and who is expected to interact with the equipment safely.

When preparing a test report for IEC 62368-1, the objective is to confirm the safe operating environment of the electronic equipment, with a focus on the hazard, rather than just a particular material or component used. As indicated in the Introduction to the Standard, "This International Standard is a product safety standard that classifies energy sources, prescribes safeguards against those energy sources, and provides guidance on the application of, and requirements for those safeguards."

IEC62368 includes Annex W, which is a comparison of terms introduced in this standard that differ from the previous standard used, IEC60950. One example is the Electrical Energy Source Class 1 (ES1). The terms Safety Extra Low Voltage (SELV) and Limited Current Circuit (LCC), which are definitions from IEC 60950-1, are no longer used in IEC 62368-1. Instead, voltage and current limits have been combined in the definition of ES1.

Product evaluations conducted to IEC 62368-1 require the identification and classification of energy sources, the identification of safeguards, and the evaluation of the suitability of the safeguards. These are to be identified as either prescriptive performance-based criteria (requirements) or prescriptive construction criteria (requirements). In keeping with one of IEC TC108's key objectives, the standard focuses on a performance-based option as the first option, with prescriptive construction options as alternatives.

Performance-based requirements are preferred in IEC 62368-1 since they tend be technology neutral. Different construction features can be shown to be in compliance if they comply with the performance criteria. This level of flexibility is not always possible with prescriptive construction criteria since the prescriptive requirements may have been developed with a different type of construction in mind at the time the technical committee originally adopted the requirements.

The new standard addresses a variety of forms of energy including electrical energy, thermal and kinetic energy, chemical reaction, and radiated energy. Energy sources are designated either Class 1, 2 or 3, depending on energy magnitude, regardless of type (Figure 3). Classifying energy sources correctly and accurately is an important element of IEC 62368-1.

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Energy Source	Effect on the Body	Effect on Combustible Materials
Class 1	Not painful, but may be detected	Ignition not likely
Class 2	Not painful, but not an injury	Ignition possible, but limited growth and spread fire
Class 3	Injury	Ignition likely, rapid growth and spread fire

Table 1. Response to energy class.

IEC 62368-1 allows exposure of an "ordinary person" to Class 1 energy sources, and also permits access to Class 2 energy sources under single-fault conditions. For example, for AC voltages below 1kHz, the ES1 voltage limit is 30 V_{RMS}, 42.4 Vp, and 60 V_{DC}. In comparison, an ES2 voltage is limited is 50 V_{RMS}, 70.7 Vp, and 120 V_{DC}.

When conducting an evaluation to IEC 62368-1, the form of energy needs to be classified and the existence and suitability of required safeguards will need to be evaluated. As indicated previously, performance-based criteria has been established as the first option, with known and proven prescriptive construction designs offered as suitable alternatives.

Some of the IEC 62368-1 safeguards are also identified in some existing standards as well, although they are not formally identified as "safeguards." For example, insulation material is one safeguard that can be used to reduce the risk of electric shock. Once the electrical energy source that the insulation protects against is classified, the insulation level required and the appropriateness of the insulation is evaluated, in accordance with sub-clause 5.4. A similar process is used for identifying safeguards that are required to prevent electrical fires based on the three-block model for safety.

In the case of electrically-caused fires, two safeguards are typically required:

(a) one basic safeguard that protects under normal operating conditions and abnormal operating conditions; typically using materials not exceeding 90 percent of the material's auto-ignition temperature, and

(b) one supplementary safeguard that protects against fire under single-fault conditions. As indicated in IEC 60950-1, the suitability of the supplementary safeguard can be demonstrated through either performance-based (single faults) or construction-based (fire enclosure) criteria.

The method for determining compliance with the main provisions of the standard is as follows:

- Begin with specific energy source/hazard.
- Identify and classify each type of energy source independently for each hazard clause, e.g., for electricallycaused injury each circuit must be characterized as ES1, ES2 or ES3 (per Clause 5).
- After energy sources are classified, identify the prescribed safeguards required, and qualify them per either the prescribed, performance test, or construction option (alternative to performance test, when known).
- Repeat steps 1 and 2 for every similar energy source (e.g., circuit) as applicable.
- Repeat cycle for each type of energy source/hazard (e.g., mechanical energy (MS), radiation energy (RS), etc.)

In terms of the First Edition of IEC 62368-1, it is important to acknowledge that the work of IEC TC-108 is not complete. TC-108 will continue to evaluate and develop the standard, and will make modifications as areas in need of further investigation and attention emerge.

In the meantime, component manufacturers are working toward identifying and addressing solutions that will meet the requirements of the new standard. Littelfuse currently offers a variety of devices which can be used for the proper protection of energy sources and fire hazards in OEM equipment, as required for compliance with IEC 62368-1.