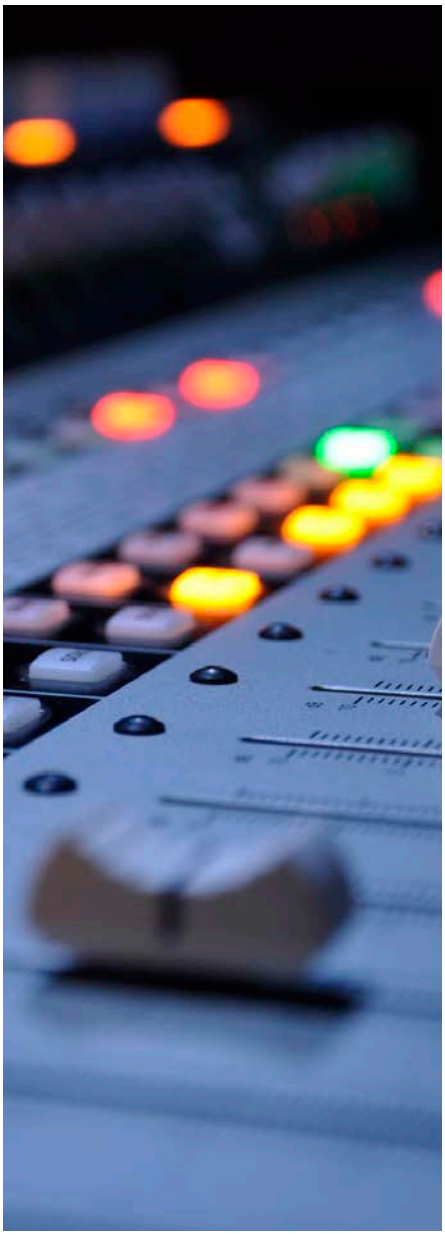
A New Safety Standard for High Tech Products

A New Approach to Safety for A/V and ICT Equipment — IEC 62368-1

A New Approach to Safety for A/V and ICT Equipment — IEC 62368-1

In January 2010, "IEC 62368-1 Ed 1.0: Audio/Video, Information and Communication Technology Equipment — Safety Requirements" was published as an international standard. The development was an outcome of almost eight years of planning, hard work and dedication by IEC TC108, the IEC technical committee responsible for standards for safety of electronic equipment within the field of audio/video, information technology, and communication technology.

This paper provides background on the new standard and looks ahead to the challenges and potential impact of its implementation.



The Origins of IEC 62368-1

In the final years of the 20th Century, an explosion of multimedia technology began to erase the distinctions between different types of products. Suddenly, computers, A/V equipment, and other new information and communications technology became interconnected and interchangeable. Products originally designed for business came home, and electronic equipment long used almost exclusively by adults was mastered and embraced by children.

The industry recognized that existing standards could not keep up with the convergence of technology, and that a new standard was needed to replace IEC 60065, which governed safety of A/V equipment, and IEC 60950-1 (IEC 950 at the time), which governed safety of IT equipment. Thus, the IEC TC108 committee was formed. The new technical committee's charge was to develop a safety standard for information technology equipment, office appliances, consumer electronics and telecommunication equipment as well as combinations of each.

The new standard would be based on Hazard-Based Safety Engineering (HBSE) principles, a process that integrates safety compliance early in the product design cycle, and supported by sound engineering principles, research and field data.

TC108 outlined the following objectives for the new Standard:

- A single standard for a broad range of products, leading to design and manufacture of safe products
- Technology neutral, facilitating innovation and commercialization of new technology
- Clear identification of any hazards
- Performance-based, rather than prescribed constructions, allowing proven prescriptive construction options, as warranted
- A (Type) test standard, but not a simple merger of IEC 60065 and IEC 60950-1
- Useful to designers, but suitable for suppliers, purchasers and certifiers to assess compliance
- Harmonization with allowance for warranted national/regional differences

Equally important was to attempt to meet all of the above in a user-friendly manner.

From the beginning, UL has played a significant role in the development of IEC 62368-1, directly within IEC TC108 and through leadership and participation in various national committees for IEC TC108.

With this amount of involvement, both at leadership and expert levels, UL's insight and influence is invaluable in preparing for the future implementation of IEC 62368-1.

Considering the Characteristics of IEC 62368-1

In preparing for this new safety standard for A/V, information and communication technology equipment, the objective is to consider how it differs from traditional standards that address safety of other forms of electronic equipment, including the standards it replaces. As indicated in the introduction to IEC 62368-1:

"*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. The prescribed safeguards are intended to reduce the likelihood of pain, injury and, in the case of fire, property damage.*"

This statement illustrates that new terminology is used in the standard, such as the word "safeguard." For those already familiar with IEC 60950-1 and other horizontal IEC standards, it is recommended to review the standard's Annex W, comparison of terms introduced in this standard. It provides a correlation between some of the common and new terms used in this standard and those used in other standards, like IEC 60950-1 and IEC 60664, among others.

On IEC TC108, UL holds the secretary (Al Brazauski) and assistant secretary (Margie Burke) roles. UL also maintains similar roles on the ANSI U.S. National Committee Technical Advisory Group (TAG) for IEC TC108.

UL also has a variety of staff participating in leadership and expert roles on several national committees associated with IEC TC108, including,

National Committees, TC108
- Denmark – Ole Nielsen (chair)
- Germany – Werner Haab (past chair)
- Japan – Ikuro Kinno
- Korea – J.K. Park

U.S. TAG
- Robert Backstrom (fire)
- Thomas Burke (information technology equipment)
- Thomas Lanzisero (electric shock)
- Craig Sato (audio-video/ consumer electronics)

Werner Haab of UL also had a leadership role on the team assigned to develop the new Test Report Form (TRF) for IEC 62368-1.

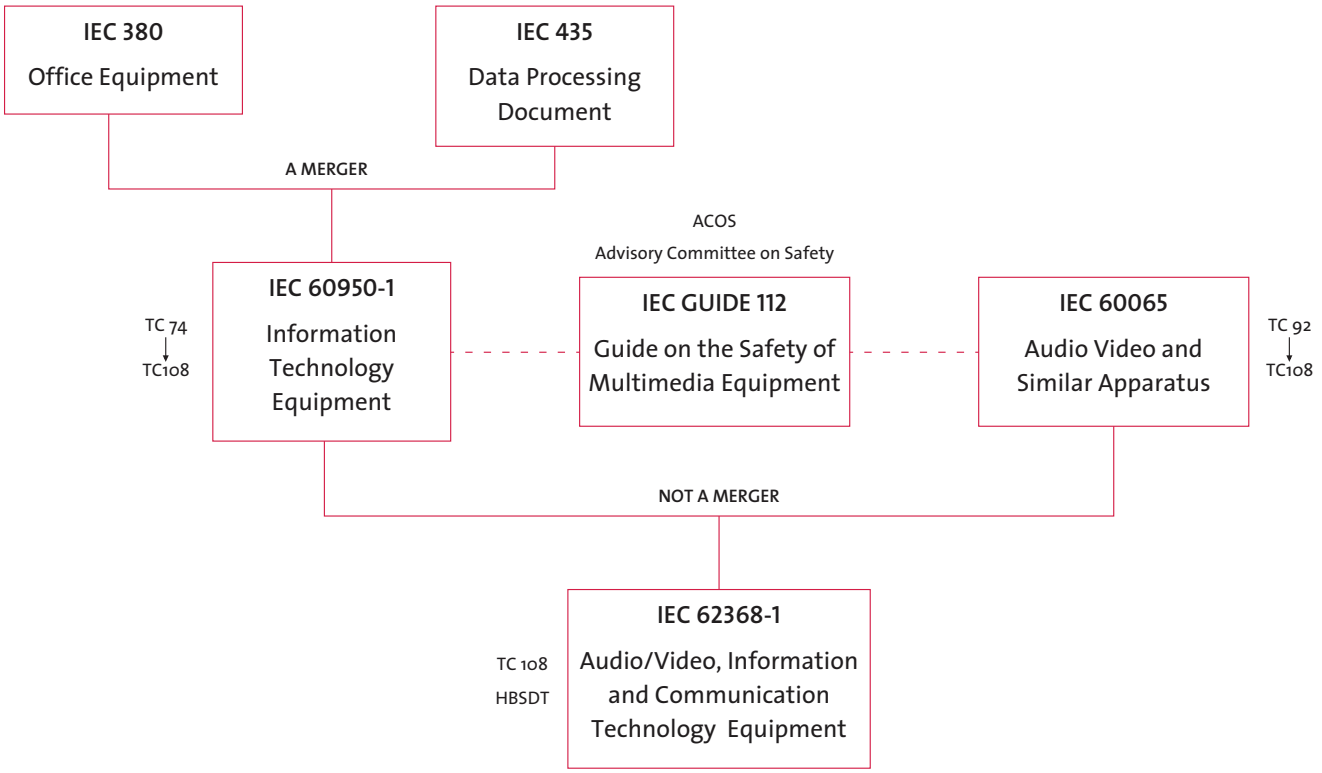


Figure 1: Progression of Standards

IEC 62368-1 was developed using hazard-based safety engineering, and those familiar with basic HBSE realize that safeguards are critical in preventing energy hazards from doing harm. In the three-block model for safety, if safeguards are adequate, there will be no harm. (See Figures 2 and 3)

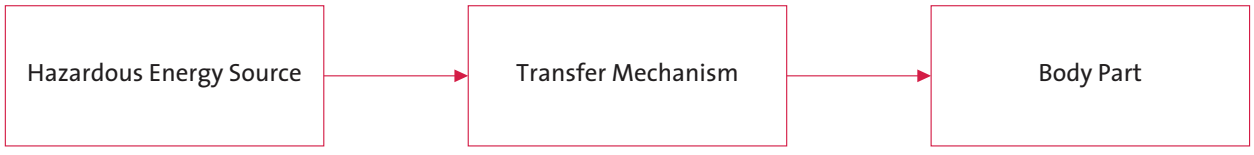


Figure 2: Three-Block Model for Pain and Injury

Figure 3: Three-Block Model for Safety

Another example of a new term used in the new standard is Electrical Energy Source Class 1 (ES1). The terms Safety Extra Low Voltage (SELV) and Limited Current Circuit (LCC), which are definitions and concepts in IEC 60950-1, are no longer used in IEC 62368-1. Instead, safe voltage and current limits have been combined in the definition of ES1.

Similarly, for those more familiar with IEC 60950-1 that identifies persons interfacing with the equipment as either "users" or "service persons," IEC 62368-1 uses the terms "ordinary person" and "skilled person," in addition to an "instructed person." Instructed person refers to someone instructed or supervised by a "skilled person" on energy sources who is expected to interact with the equipment safely with regard to those energy sources. The type of persons expected to interface with the equipment or parts of the equipment influences the types, number, and form of safeguards required.

Clause 0, Introduction to the Standard, summarizes all the key principles of IEC 62368-1 and serves as an informative primer on HBSE in the context of electronic equipment. Users should study the introduction carefully as it makes it possible to quickly understand the fundamentals of the standard.

The key new application processes associated with IEC 62368-1 include the identification and classification of energy sources, identification of safeguards, and evaluation of the suitability of these safeguards — through either performance-based criteria (requirements) or prescriptive construction criteria (requirements). In fact, in keeping with one of IEC TC108's key objectives, the standard attempts to provide a performance-based approach as the first option for demonstrating compliance, with proven prescriptive construction options as alternatives. Performance-based requirements are usually preferred in this context since they tend be technology neutral. Usually, any construction can be shown to be in compliance if it can comply with the performance criteria. This level of flexibility is not always possible with prescriptive construction criteria since prescriptive requirements may have been developed with a different form of construction in mind when the technical committee originally adopted them.

A common misconception held by some not familiar with the development of IEC 62368-1 is that engineers using the standard will perform free-form HBSE-based investigations on products without any prescriptive requirements. This is not the case. The standard and its requirements were developed using HBSE and the integral evaluation process is HBSE-based, but the standard does indeed have prescriptive requirements.

As Table 1 outlines in more detail, IEC 62368-1 addresses a variety of forms of energy, including electrical energy, thermal energy, chemical reaction, kinetic energy, thermal energy and radiated energy. Energy sources, regardless of form, are designated either Class 1, 2 or 3, depending on energy magnitude. As characterized in Table 2, classifying energy sources correctly and accurately is an important element of the implementation of this standard.

FORMS OF ENERGY	EXAMPLES OF BODY RESPONSE OR PROPERTY DAMAGE	CLAUSE
Electrical energy, e.g., energized conductive parts	Pain, fibrillation, cardiac arrest, respiratory arrest, skin burn or internal organ burn	5
Thermal energy, e.g., electrical ignition and spread of fire	Electrically caused fire leading to burn-related pain or injury or property damage	6
Chemical energy, e.g., electrolyte, poison	Skin damage, lung and other organ damage, or poisoning	7
Kinetic energy, e.g., moving parts of the equipment or a moving body part against an equipment part	Laceration, puncture, abrasion, contusion, crush, amputation, or loss of a limb, eye, ear, etc.	8
Thermal energy, e.g., hot accessible parts)	Skin burn	9
Radiated energy, e.g., electromagnetic, optical or acoustic energy	Loss of sight, skin burn or loss of hearing, etc.	10

Table 1: Forms of Energy

It is noted, in general, that ordinary persons are always allowed access to Class 1 energy sources, and are permitted access to Class 2 energy sources under single fault conditions. For example, for AC voltages below 1kHz, the ES1 voltage limit is 30 Vrms, 42.4 Vp, and 60 Vdc, and the ES2 voltage limit is 50 Vrms, 70.7 Vp, and 120 Vdc.

ENERGY SOURCE	EFFECT ON BODY	EFFECT ON COMBUSTIBLE MATERIALS
Class 1	Not painful, but may be detected	Ignition not likely
Class 2	May be painful, but not an injury	Ignition possible, but limited growth and spread of fire
Class 3	Injury	Ignition likely, with rapid growth and spread of fire

Table 2: Response to Energy Class

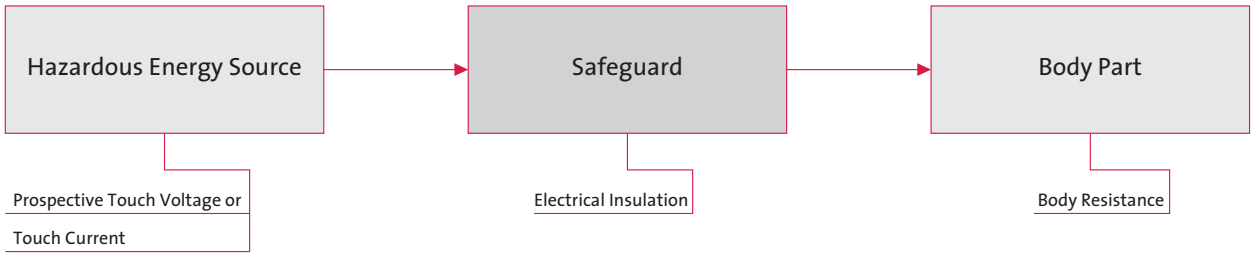


Figure 4: Model for Protection against Electrically Caused Pain or Injury

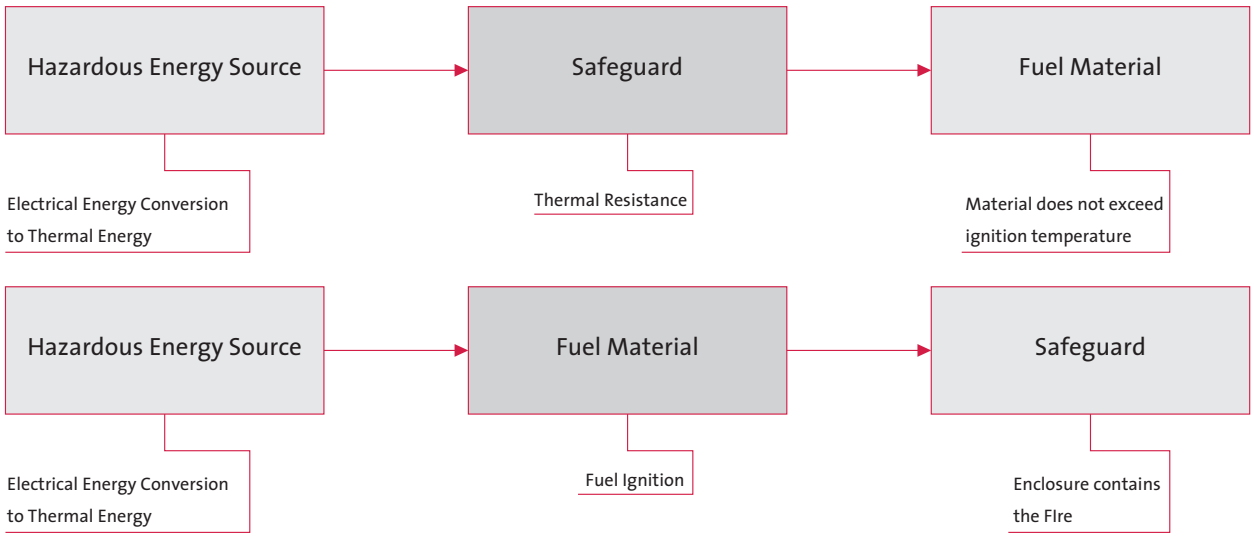


Figure 5: Models for Protection against Fire
Basic Safeguard Under Normal and Abnormal Operating Conditions (Top)
Supplementary Safeguard Under Single Fault Conditions (Bottom)

Once the form of energy is classified, the existence and suitability of required safeguards needs to be evaluated. As indicated previously, performance-based criteria have been established as the first option, with known and proven prescriptive construction designs offered as suitable alternatives. Table 3 provides examples of safeguard characteristics.

Many of these safeguards are required in existing standards as well, although they are not formally identified as "safeguards" in the way they are in this new standard. For example, electrical insulation is one form of a safeguard that can be used to prevent risk of electric shock. Once the electrical energy source is classified, the level and appropriateness of the insulation is evaluated, in accordance with sub-clause 5.4. The actual requirements for insulation are very similar to the requirements that are part of IEC 60065 and IEC 60950-1 today, e.g., prescriptive requirements for clearances, creepage distances and solid insulation. Figure 4 illustrates a model for protection against electrically caused pain or injury.

As indicated in Figure 5, a similar process is used for identifying safeguards required to prevent electrically caused fire. Again, this is based on the three block model for safety depicted in Figure 3.

In the case of electrically caused fire, as described in Figure 5, two safeguards typically are required:

- One (basic safeguard) in place under both normal and abnormal operating conditions, and typically proven by using materials not exceeding 90 percent of the material auto-ignition temperature and
- One (supplementary safeguard) in place against fire under single fault conditions. As 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

A high-level process for determining compliance with the main provisions of IEC 62368-1 follows a two-step process described below.

Begin with specific energy source (hazard clause) and:

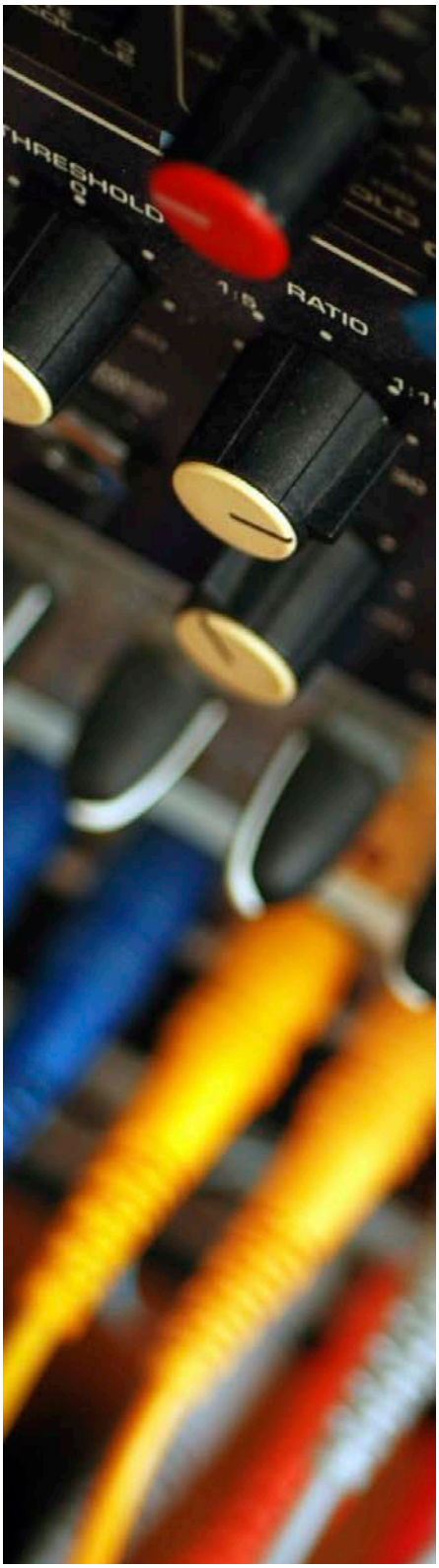
Step 1: Identify and classify each type of energy source independently for the hazard clause, e.g., for electrically caused injury, characterize each circuit as ES1, ES2 or ES3 (per Clause 5).

Step 2: After energy sources are classified, identify the safeguards required and qualify them per either the 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 the step 1 and step 2 cycle for each different type of energy source (hazard clause), e.g., Clause 8 - mechanical energy (MS), Clause 10 - radiation energy (RS), etc.

UL expects that as IEC 62368-1 is put into use and users become more familiar with it and its approach to investigating electronic equipment, best practices will be identified that help increase efficient and effective use of the standard.



In terms of the first edition of IEC 62368-1, it is also important to acknowledge that even with its initial publication, the work of IEC TC108 is not complete. Because IEC 62368-1 is a new standard — and because its scope covers a very wide variety of technologies, constructions and industry segments — additional work is required to resolve any lingering deficiencies discovered as it is introduced and implemented. In fact, the first edition of IEC 62368-1 will likely only be used by a relatively small segment of the industry, and more widespread use of the standard will not occur until publication of the second edition, when areas needing further attention are addressed. IEC TC108 is actively working on the second edition of IEC 62368-1 and is targeting publication in 2013.

As mentioned, UL has been deeply involved in the development process for the new standard and will remain engaged with its continuing development and implementation. We are already in the process of applying the standard in product evaluations to provide more effective input into the next editions of the standard, develop tools to facilitate its use and develop education programs for those interested in learning more about the standard.

SAFEGUARD	**BASIC SAFEGUARD** *Effective under normal operating conditions*	**SUPPLEMENTARY SAFEGUARD** *Effective in the event of the failure of the basic safeguard*	**REINFORCED SAFEGUARD** *Effective under normal conditions and in the event of a single fault*
Equipment safeguard A physical part of the equipment	Basic insulation Normal temperature below auto-ignition temperature	Supplementary insulation Fire enclosure	Reinforced insulation Not applicable
Installation safeguard A physical part of a manmade installation	Wire size	Overcurrent protection device	Socket outlet
Personal safeguard (in the absence of equipment safeguard) A physical device worn on the body	Glove	Insulating floor mat	Electrically insulated glove for handling live conductors
Instructional safeguard (in the absence of equipment safeguard) A voluntary or instructed behavior intended to reduce the likelihood of transfer or energy to a body part	Instructional safeguard to disconnect telecommunication cable before opening the cover	After opening a door, instructional safeguard instructing to avoid touching hot parts	Instruction for avoiding hot parts in an office photocopier, or a continuous roll paper cutter on a commercial printer

Table 3: Examples of Safeguard Characteristics