

**Information and Communication
Technology Equipment – Part 1: Safety Requirements,
UL 62368-1**

Section 0
Principles of Product Safety

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Safety Requirements, UL 62368-1

- **Background**
 - **IEC 62368-1/UL 62368-1**
 - New Safety Standard for
 - **Consumer Electronic** (Audio/Video) Apparatus,
 - **Information Technology Equipment**, and
 - **Communication Technology Equipment**
 - **NOT** a simple **merger** of IEC 60065 and IEC 60950-1

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- **Background**

- Is intended to ultimately **replace** IEC 60065 and IEC 60950-1;
- IEC Standard initially published in 2010 with a minimum five (5) year effective date that is being recommended by IEC TC108;
- Its Test Report Form (**TRF**) has been published;
- Publication of national standards based on IEC 62368-1 expected to follow after the publication of IEC 62368-1.
 - It is hoped that National/Regional Committees will adopt effective dates that will coincide with the effective date timing recommended by IEC TC108, but this cannot be guaranteed.
 - Since the five-year transition period is the **best case scenario**, there's no guarantee that one or more **regulators** will not adopt the standard sooner.
 - **Retailers** and other major **customers** may demand a product to be certified to IEC 62368-1 sooner than the transition period.

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- **Background**

- **IEC 62368-1**

- Its **scope** is broad and inclusive of the current IEC 60065 and IEC 60950-1.
 - Follows a different approach to safety using **HBSE** principles – but it is not a full HBSE or Risk Based standard – it relies on performance tests to demonstrate safety.
 - It's Hazard Based approach is different than that of the more prescriptive approach taken by the existing standards, i.e., IEC 60065 and IEC 60950-1.

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- **Workshop Format**
 - **Series of presentations**
 - **Each presentation will go thru the standard, Section by Section**
 - Section 0, Principles of Product Safety,
 - Section 1, Scope (skip)
 - Section 2, Normative References (skip)
 - Section 3, Terms and Definitions
 - Section 4, General Requirements
 - Section 5, Electrically Caused Injuries
 - Section 6,
 - **Open discussion**

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- **0 Principles of this product safety standard**
 - **0.1 Objective**
 - Classifies energy sources,
 - prescribes **safeguards against those energy sources,**
 - **and provides guidance on the application of, and Requirements** for those **safeguards.**
 - **0.2 Persons**
 - **0.2.1 General**
 - This standard describes **safeguards for the protection of three kinds of persons: the ordinary person, the instructed person, and the skilled person. This standard assumes that a person will not intentionally** create conditions or situations that could cause pain or injury.

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- **0.2.2 Ordinary person**

- **Ordinary person is the term applied to all persons other than instructed persons and skilled persons.**
 - **Ordinary persons include not only users of the equipment, but also all persons who may have access to the equipment or who may be in the vicinity of the equipment.**
 - **Under normal operating conditions or abnormal operating conditions,**
 - **ordinary persons should not be exposed to parts comprising energy** sources capable of causing pain or injury.
 - **Under a single fault condition,**
 - **ordinary persons should not** be exposed to parts comprising energy sources capable of causing injury.

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- **0.2.3 Instructed person**

- **Instructed person is a term applied to persons who have been instructed and trained by a skilled person,**
- **or who are supervised by a skilled person, to identify energy sources that may cause pain (see Table 1) and to take precautions to avoid unintentional contact with or exposure to those energy sources.**
 - **Under normal operating conditions, abnormal operating conditions or single fault conditions, instructed persons should not be exposed to parts comprising energy sources capable of causing injury.**

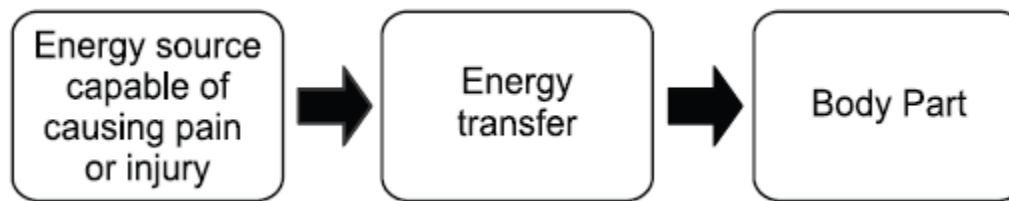
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- **0.2.4 Skilled person**

- **Skilled person is a term applied to persons who have training or experience in the equipment technology**, particularly in knowing the various energies and energy magnitudes employed in the equipment.
 - A **skilled person is expected to use their training and experience to recognize energy sources capable of causing** pain or injury and to take action for protection from injury from those energies.
 - **Skilled persons should** also be protected against unintentional contact or exposure to energy sources capable of causing injury.

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- **0.3 Model for pain and injury**



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- Three classes of energy sources
 - Defined by magnitudes and durations of source parameters relative to either the body or to **combustible material responses to those energy sources**.
 - Each energy class is a function of the body part or the **combustible material** susceptibility to that energy magnitude

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Table 1 – Response to energy class

Energy source	Effect on the body	Effect on combustible materials
Class 1	Not painful, but may be detectable	Ignition not likely
Class 2	Painful, but not an injury	Ignition possible, but limited growth and spread of fire
Class 3	Injury	Ignition likely, rapid growth and spread of fire

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- **0.4 Energy sources**

Table 2 – Examples of body response or property damage related to energy sources

Forms of energy	Examples of body response or property damage	Clause
Electrical energy (for example, energized conductive parts)	Pain, fibrillation, cardiac arrest, respiratory arrest, skin burn, or internal organ burn	5
Thermal energy (for example, electrical ignition and spread of fire)	Electrically-caused fire leading to burn-related pain or injury, or property damage	6
Chemical reaction (for example, electrolyte, poison)	Skin damage, lung and other organ damage, or poisoning	7
Kinetic energy (for example, moving parts of 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 (for example, hot accessible parts)	Skin burn	9
Radiated energy (for example, electromagnetic energy, optical energy, acoustic energy)	Loss of sight, skin burn, or loss of hearing	10

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- **0.5 Safeguards**

- The scheme that reduces the likelihood of energy transfer to a body part is a **safeguard**



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- **0.5 Safeguards**

- **A safeguard is a device or scheme or system that**
 - – is interposed between an energy source capable of causing pain or injury and a body part, and
 - – reduces the likelihood of transfer of energy capable of causing pain or injury to a body part.
- **Safeguard mechanisms against transfer of energy capable of causing pain or injury include**
 - – attenuating the energy (reduces the value of the energy), or
 - – impeding the energy (slows the rate of energy transfer), or
 - – diverting the energy (changes the energy direction), or
 - – disconnecting, interrupting, or disabling the energy source, or
 - – enveloping the energy source (reduces the likelihood of the energy from escaping), or
 - – interposing a barrier between a body part and the energy source.

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- **0.5 Safeguards**

- **A safeguard**

- can be applied to the equipment,
- to the local installation,
- to a person
- or can be a **learned or** directed behavior (for example, resulting from an **instructional safeguard**) **intended to reduce the** likelihood of transfer of energy capable of causing pain or injury.

- **A safeguard may be a single element** or may be a set of elements.

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- **0.5 Safeguards**

- Ideally, the order of preference for providing **safeguards** is:
 - – equipment safeguards;
 - – installation safeguards;
 - – instructional safeguards invoking personal protective equipment, or avoidance behavior.

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- **0.5 Safeguards**

- **0.5.2 Equipment safeguard**

- An equipment safeguard may be a basic safeguard, a supplementary safeguard, a double safeguard, or a reinforced safeguard.

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- **0.5 Safeguards**

- **0.5.4 Instructional safeguard**

- An **instructional safeguard** is a **visual indicator (symbols or words or both) or an audible message** describing the existence and location of an energy source capable of causing pain or injury and is intended to invoke a specific behavior on the part of a person to reduce the likelihood of transfer of energy to a body part.
 - An **instructional safeguard may be a basic safeguard, or a supplementary safeguard.**
 - Provision of an **instructional safeguard does not result in an ordinary person becoming an instructed person**

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- **0.5 Safeguards**

- **0.5.5 Personal safeguard**

- A personal safeguard may be a basic safeguard, a supplementary safeguard, or a reinforced **safeguard**.
 - Requirements for **personal safeguards (personal protective equipment)** are not addressed in this standard. However, this standard does assume that **personal safeguards are available for use as** specified by the manufacturer.

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- **0.5 Safeguards**

- **0.5.6 Safeguards during ordinary or instructed person service conditions**

- During **ordinary person or instructed person service conditions**, **safeguards for such persons** may be necessary.
 - Such **safeguards** can be
 - **equipment safeguards,**
 - **personal safeguards,**
 - **or instructional safeguards.**
 - **Application of these safeguards is specified in the respective clauses.**

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- **0.5 Safeguards**

- **0.5.7 Equipment safeguards during skilled person service conditions**

- During **skilled person service conditions**, **equipment safeguards should be provided to protect against** the effects of a body's involuntary reaction (for example, startle) that might cause unintentional contact with a class 3 energy source located outside the view of the **skilled person**. **This safeguard typically applies in large equipment, where the skilled person may need to partially or wholly enter between** two or more class 3 energy source locations while servicing.

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- **0.5 Safeguards**

- **0.5.8 Precautionary safeguard**

- A precautionary safeguard is the training and experience or supervision of an instructed person by a skilled person to use precautions to protect the instructed person against class 2 energy sources.
 - Precautionary safeguards are not specifically prescribed in this standard but are assumed to be **effective** when the term **instructed person** is used.
 - During equipment servicing, an **instructed person** may need to remove or defeat an equipment safeguard. In this case, an instructed person must then apply precaution as a safeguard to avoid injury.

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- **0.5 Safeguards**

- **0.5.9 Skill safeguard**

- A **skill safeguard** is the education, training, knowledge and experience of the **skilled person** that is employed to protect the **skilled person against class 2 and class 3 energy sources**. **Skill safeguards** are not specifically prescribed in this standard but are assumed to be effective when the term **skilled person** is used.
 - During equipment servicing, a **skilled person may need to remove or defeat an equipment safeguard**. In this case, a **skilled person must then apply skill as a safeguard to avoid injury**.

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- **0.5 Safeguards**
 - **0.5.10 Examples of safeguard characteristics**

Safeguard	Basic safeguard	Supplementary safeguard	Reinforced safeguard
Equipment safeguard: a physical part of an equipment	Effective under normal operating conditions	Effective in the event of failure of the basic safeguard	Effective under normal operating conditions and in the event of a single fault condition elsewhere in the equipment
	Example: basic insulation	Example: supplementary insulation	Example: reinforced insulation
	Example: normal temperatures below ignition temperatures	Example: fire enclosure	Not applicable
Installation safeguard: a physical part of a man-made installation	Effective under normal operating conditions	Effective in the event of failure of an equipment basic safeguard	Effective under normal operating conditions and in the event of a single fault condition elsewhere in the equipment
	Example: wire size	Example: overcurrent protective device	Example: socket outlet

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- **0.5 Safeguards**
 - **0.5.10 Examples of safeguard characteristics**

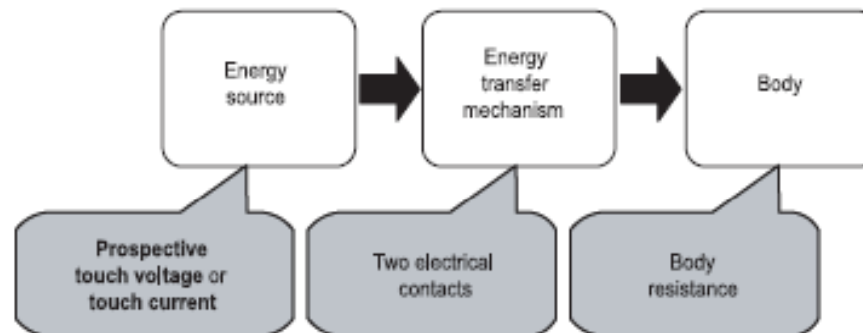
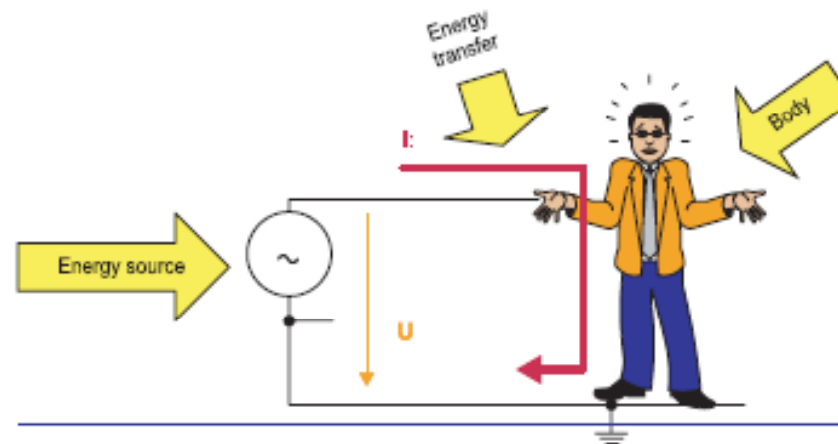
Personal safeguard: a physical device worn on the body	In the absence of any equipment safeguard , effective under normal operating conditions	Effective in the event of failure of an equipment basic safeguard	In the absence of any equipment safeguard , effective under normal operating conditions and in the event of a single fault condition elsewhere in the equipment
	Example: glove	Example: insulating floor mat	Example: electrically insulated glove for handling live conductors
Instructional safeguard: a voluntary or instructed behaviour intended to reduce the likelihood of transfer of energy to a body part	In the absence of any equipment safeguard , effective under normal operating conditions	Effective in the event of failure of an equipment basic safeguard	Only effective on an exceptional basis, when providing all appropriate safeguards would prevent the intended functioning of the equipment
	Example: instructional safeguard to disconnect telecommunication cable before opening the cover	Example: after opening a door, an instructional safeguard against hot parts	Example: instructional safeguard of hot parts in an office photocopier, or a continuous roll paper cutter on a commercial printer

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- **0.6 Electrically-caused pain or injury (electric shock)**
 - Electrically-caused pain or injury may occur when electrical energy capable of causing pain or injury is transferred to a body part
 - Electrical energy transfer occurs when there are two or more electrical contacts to the body:
 - – the first electrical contact is between a body part and a conductive part of the equipment;
 - – the second electrical contact is between another body part, and
 - • earth, or
 - • another conductive part of the equipment.

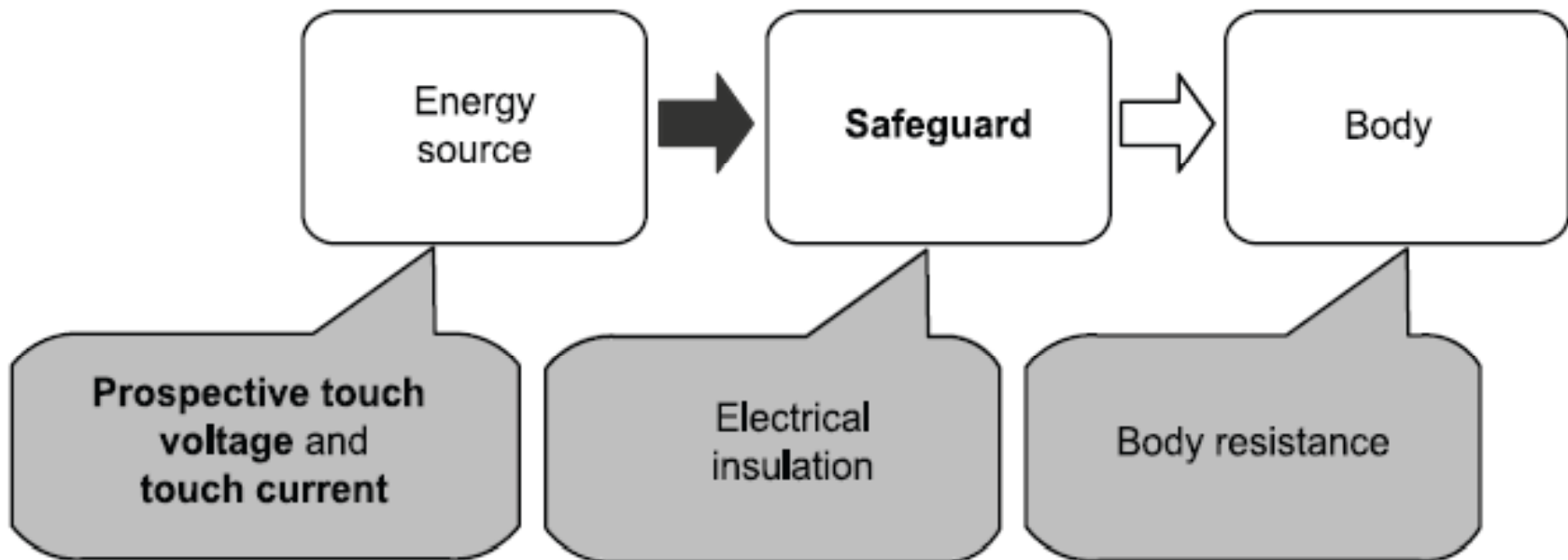
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- **0.6 Electrically-caused pain or injury**
 - **0.6.2 Models for electrically-caused pain or injury**



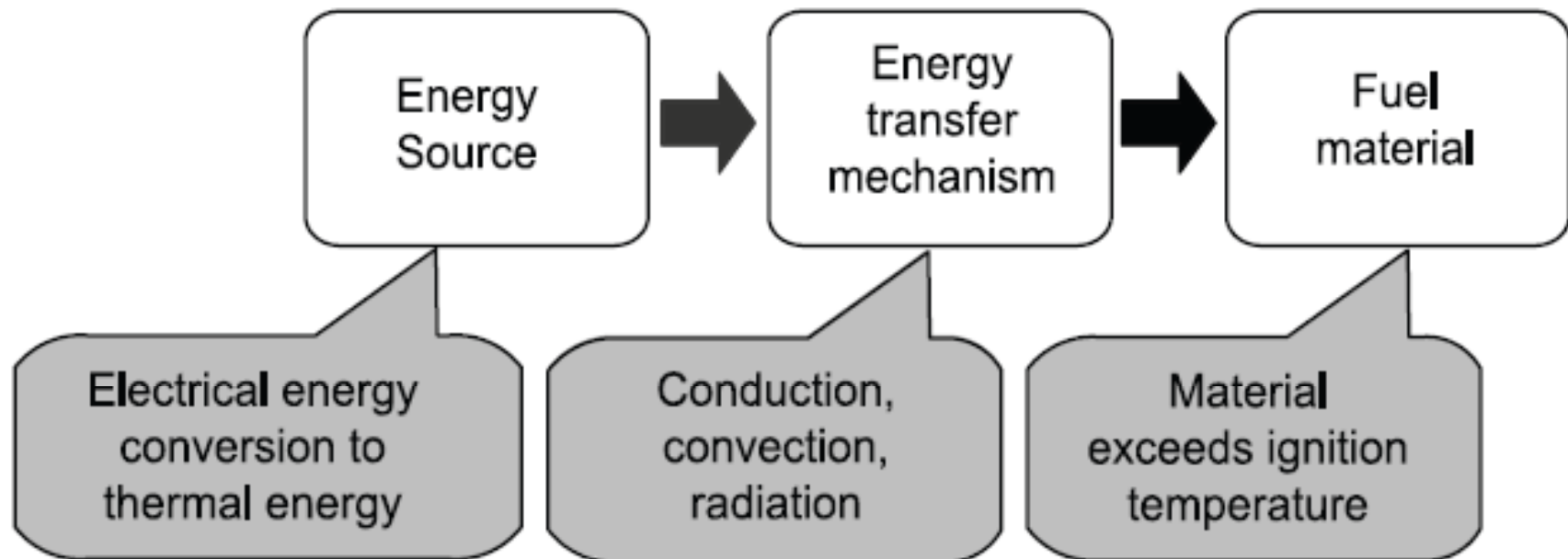
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- **0.6 Electrically-caused pain or injury**
 - **0.6.3 Models for protection against electrically-caused pain or injury**



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- **0.7 Electrically-caused fire**
 - **0.7.2 Models for electrically-caused fire**

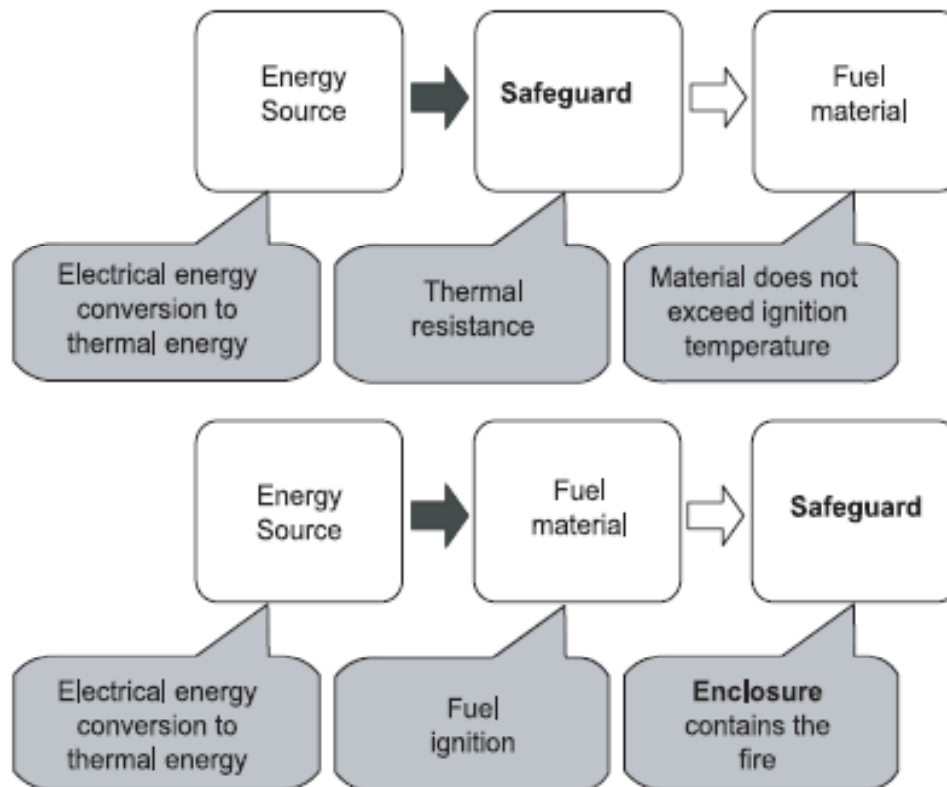


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- **0.7 Electrically-caused fire**
 - **0.7.3 Models for protection against electrically-caused fire**
 - The **basic safeguard against electrically-caused fire is that the temperature of a material, under normal operating conditions and abnormal operating conditions, does not cause the material to ignite.**
 - The **supplementary safeguard against electrically-caused fire reduces the likelihood of ignition or, in the case of ignition, reduces the likelihood of spread of fire.**

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- **0.7 Electrically-caused fire**
 - **0.7.3 Models for protection against electrically-caused fire**



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- **0.8 Chemically-caused injury**
 - The **basic safeguard against chemically-caused injury is containment of the material.**
 - **Supplementary safeguards against chemically-caused injury may include:**
 - – a second container or a spill-resistant container;
 - – containment trays;
 - – tamper-proof screws to prevent unauthorized access;

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- **0.9 Mechanically-caused injury**

- Examples of kinetic energy sources are:

- – body motion relative to sharp edges and corners;
- – part motion due to rotating or other moving parts, including pinch points;
- – part motion due to loosening, exploding, or imploding parts;
- – equipment motion due to instability;
- – equipment motion due to wall, ceiling, or rack mounting means failure;
- – equipment motion due to handle failure;
- – part motion due to an exploding battery;
- – equipment motion due to cart or stand instability or failure.

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- **0.9 Mechanically-caused injury**
 - The **basic safeguard against mechanically-caused injury is a function of the specific energy source.**
 - **Basic safeguards may include:**
 - – rounded edges and corners;
 - – an **enclosure to prevent a moving part from being accessible;**
 - – an **enclosure to prevent expelling a moving part;**
 - – a **safety interlock to control access to an otherwise moving part;**
 - – means to stop the motion of a moving part;
 - – means to stabilize the equipment;
 - – handles;
 - – mounting means;
 - – means to contain parts expelled during **explosion or implosion.**

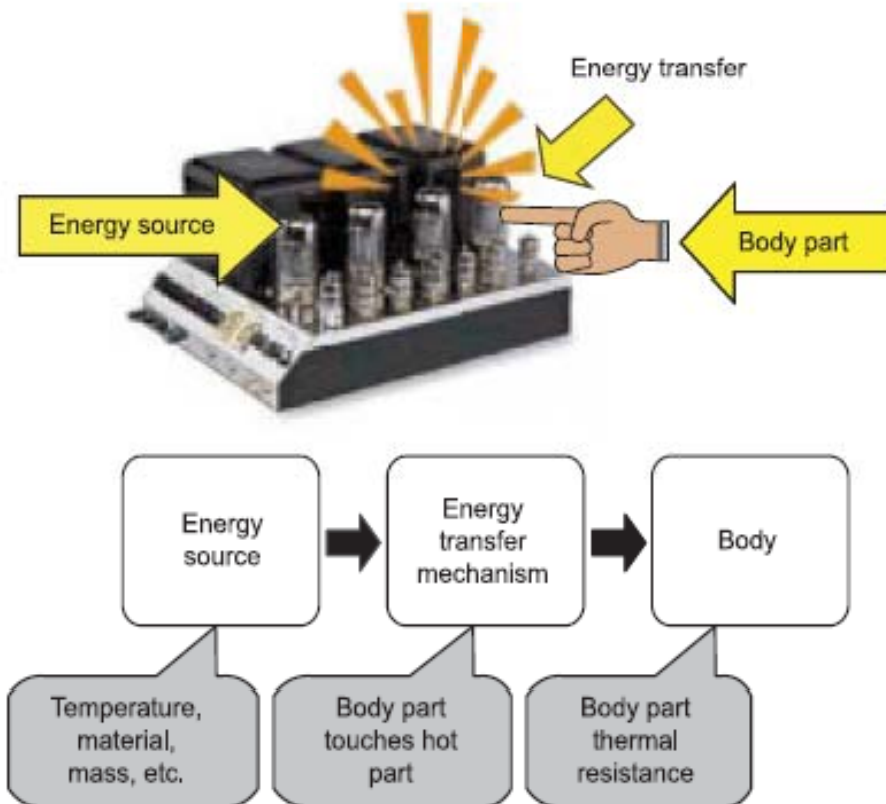
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- **0.9 Mechanically-caused injury**

- The **supplementary safeguard against mechanically-caused injury is a function of the specific energy source. Supplementary safeguards may include:**
 - – **instructional safeguards;**
 - – instructions and training;
 - – additional **enclosures or barriers;**
 - – **safety interlocks.**
- The **reinforced safeguard against mechanically-caused injury is a function of the specific energy source. Reinforced safeguards may include:**
 - – extra thick glass on the front of a CRT;
 - – rack slide-rails and means of support;
 - – **safety interlock.**

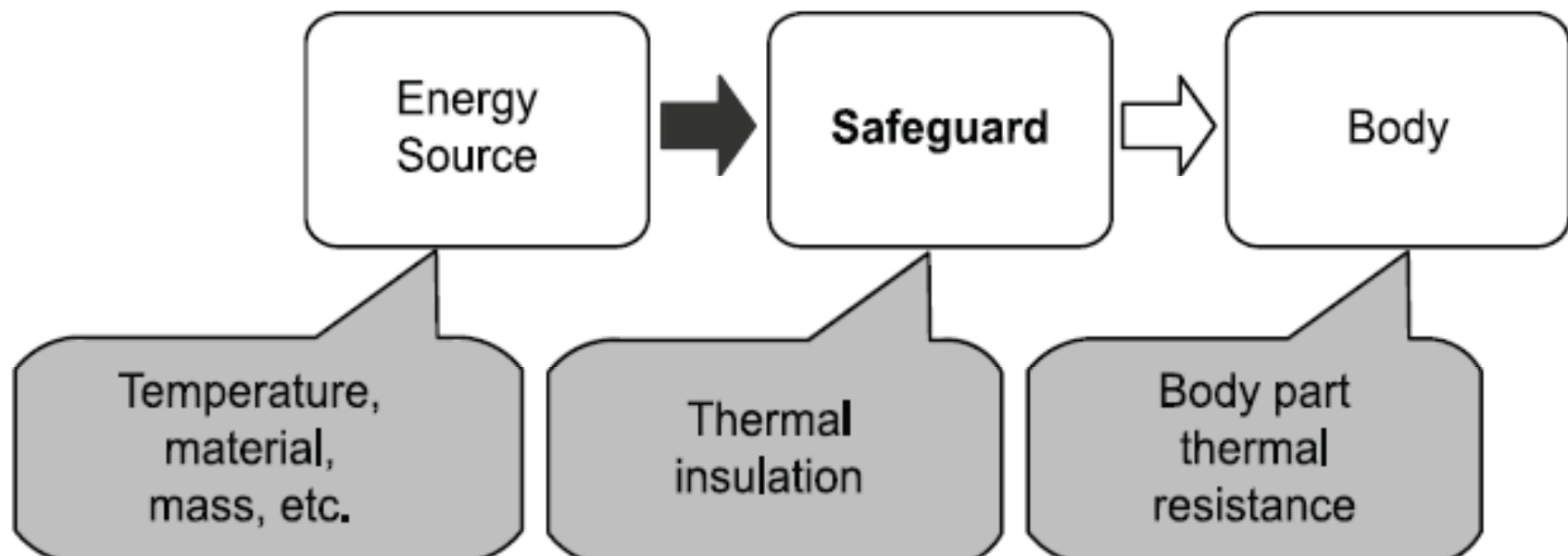
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- **0.10 Thermally-caused injury (skin burn)**
 - **0.10.2 Models for thermally-caused injury**



Safety Requirements, UL 62368-1

- **0.10 Thermally-caused injury (skin burn)**
 - **0.10.2 Models for thermally-caused injury**



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- **0.11 Radiation-caused injury**

- Radiation-caused injury within the scope of this standard is generally attributed to one of the following energy transfer mechanisms:
 - – heating of a body organ caused by exposure to non-ionizing radiation, such as the highly localized energy of a laser impinging on the retina, or heating a larger volume such as the energy from a high frequency wireless, electromagnetic fields, or high frequency transmitter, or
 - – auditory injury caused by over stimulation of the ear by excessive peaks or sustained loud sound, leading to physical or nerve damage.

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- **0.11 Radiation-caused injury**
 - The **basic safeguard against radiation-caused injury is containment of the energy within an enclosure** that is opaque to the radiated energy.
 - The **basic safeguard against auditory injury is the provision of warnings and information advising the user how to use the equipment correctly.**
 - Examples of **basic safeguards against auditory pain and injury are the provision of warnings and** information advising the user how to use the equipment correctly.
 - Examples of **supplementary safeguards against auditory injury are the provision of a safety interlock or a soundproof enclosure.**
 - There are several **supplementary safeguards against radiation-caused injury. The supplementary safeguards may include safety interlocks to disconnect power to the generator, tamper-proof screws to prevent unauthorized access, etc.**