IEC 62368-1 Technical Brief

HBSE's Three Block Models

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This technical brief is one in an ongoing series of briefs that are intended to provide an introduction to key concepts and requirements covered in the new safety standard for audio/video, information and communication technology equipment, IEC 62368-1.

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One of the underlying principles of hazard-based safety engineering (HBSE) in general, and IEC 62368-1 in particular, is the Three Block Model. Understanding the fundamentals of the three block model is important in order to better understand the approach IEC 62368-1 takes towards product safety.

First, let's first look at the three block model in the context of pain and injury.

Generally, an energy source capable of causing pain or injury will only cause actual pain or injury if there is transfer of the energy to a body part. An engineering-based model, also as known as the Three Block Model, is used to represent the relationship between a potentially hazardous energy source and pain and injury, as illustrated below.

Note that in order for there to be actual pain or energy, there needs to be both an energy source able of causing pain or injury, and actual energy transfer to a body part.

In IEC 62368-1 there are several types of energy sources that can be represented by this three block model, including electrical energy, thermal energy, kinetic energy and radiated energy. The energy sources themselves are further broken into three classes (e.g., ES1, ES2 & ES3) based on the magnitudes and duration of the energy source. Energy source levels will be discussed more in a later brief.

To prevent pain or injury, either the energy source can be designed to levels not capable of causing pain or injury (e.g., SELV in the IEC 60950-1 context), or a safeguard(s) can be designed into the product to prevent the energy transfer to the body part (e.g., insulation). This brings us to a derivation of the basic three block model, the Three Block Model for Safety.

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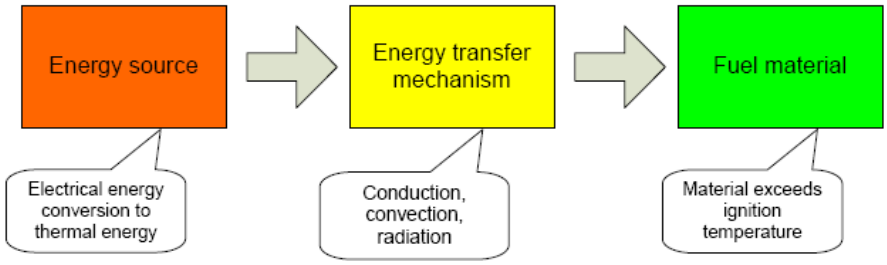
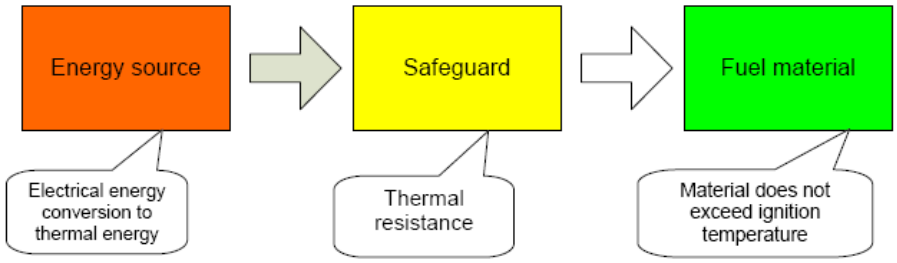
As illustrated above, if a suitable safeguard is inserted in between the energy source capable of causing pain/injury and the actual body part itself, there will be no injury. Safeguards also will be discussed in greater detail in a later brief.

Traditionally, the three block model has been viewed in the context of pain and injury, but IEC 62368-1 also uses it in the context of electrically caused fire.

Electrically-caused fire is due to conversion of electrical energy to thermal energy, with the thermal energy heating a fuel material to the point of ignition. However, parallel to the previous model, in order for there to be actual ignition of fuel material there needs to be an actual transfer of energy from the energy source (having sufficient energy to cause ignition) to the fuel material itself, as illustrated below.



Similar to the use of safeguards in the model for protection against pain/injury, safeguards, such as thermal resistance, as illustrated below, or a fire enclosure to enclose the fire, can be designed into the equipment (system) to reduce the risk of fire. If adequate safeguards are in place, as defined in the Standard in its prescriptive requirements for the safeguards (Clause 6, Electrically-caused fire), the risk of fire will be reduced to acceptable levels.



The discussion of the three block model in this brief is only intended to be an introduction to the topic. A more comprehensive introduction to the subject is contained in IEC 62368-1's **Introduction** (Clause 0), which discusses all the key principles of IEC 62368-1. Additionally, the UL University ***Hazard-Based Safety Engineering Workshop*** reviews the general subject in much greater detail.

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In this continuing series of technical briefs, additional key topics associated with the new IEC 62368-1 standard will be reviewed similarly.

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