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IEEE

A hazard-based standard (IEC 62368-1: HBSE 的實現及實務應用) – Part 1

Presented by: Jim Kao
Date: 2012-05-23

Outline

- Thermal burn injury
- Electrically-caused fire

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Thermal burn injury

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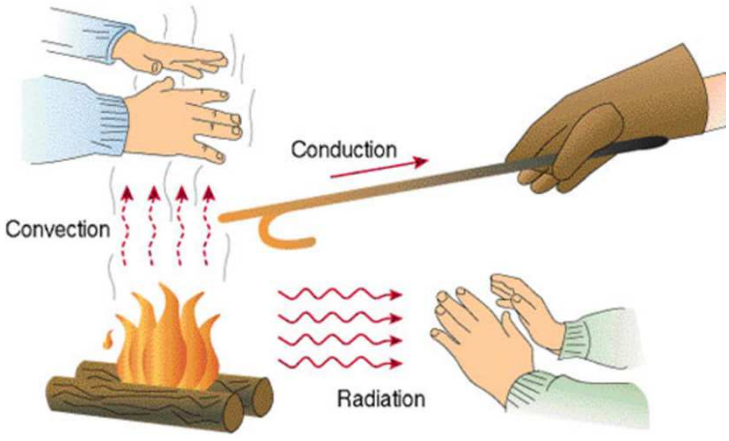
Thermal transfer



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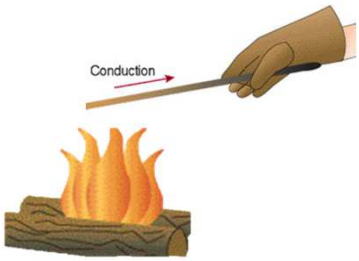
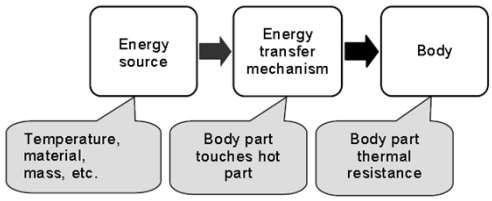
Parameters for thermal conduction

- temperature difference between the part and the body;
- the thermal conductivity (or thermal resistance) between the hot part and the body;
- the area of contact;
- the duration of contact.





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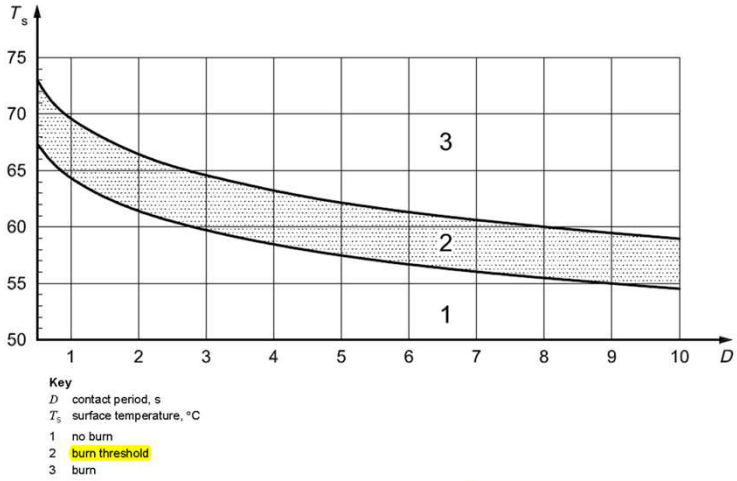
Thermal energy parameters



Key
D contact period, s
T_s surface temperature, °C
1 no burn
2 burn threshold
3 burn

Figure 2 — Burn threshold spread when the skin in contact with hot, smooth surface made of bare (uncoated) metal

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Definition of TS1

TS1 is a class1 thermal energy source with temperature levels

– not exceeding TS1 limits under

- **normal** operating conditions; and
- **single fault** conditions of a component, device or insulation **not** serving as a safeguard; and (proposed 2nd ed.)

– not exceeding TS2 limits under

- **abnormal** operating conditions; or
- **single fault** conditions of a basic safeguard. (proposed 2nd ed.)

Table 42 – Touch temperature limits

	Accessible parts [a]	Maximum temperature (T_{max}) °C			
		Metal	Glass, porcelain and vitreous material	Plastic and rubber [b]	Wood
TS1	Handles, knobs, grips, etc., and external surfaces held in normal use (>1 min) [c]	48	48	48	48

Definition of TS2

TS2 is a class 2 thermal energy source where:

– the temperature exceeds the TS1 limits; and

– under **normal** operating conditions, **abnormal** operating conditions or **single fault** conditions the temperature does not exceed the TS2 limits.

Where the malfunction of the equipment is evident, no limits apply.

TS2 may be accessible to an ordinary persons if an instructional safeguard is in place.

		Maximum temperature (T_{max}) °C			
		Metal	Glass, porcelain and vitreous material	Plastic and rubber [b]	Wood
TS2	External surfaces	100	100	100	150

Definition of TS3

TS3 is a class 3 thermal energy source where the temperature exceeds the TS2 limits in Table 42 under normal operating conditions or under abnormal operating conditions, or under single fault conditions.

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Table 42

Table 42 – Touch temperature limits

	Accessible parts [a]	Maximum temperature (T_{max}) °C			
		Metal	Glass, porcelain and vitreous material	Plastic and rubber [b]	Wood
TS1	Handles, knobs, grips, etc., and external surfaces held in normal use (>1 min) [c]	48	48	48	48

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Table 42

Table 42 – Touch temperature limits

	Accessible parts [a]	Maximum temperature (T_{max}) °C			
		Metal	Glass, porcelain and vitreous material	Plastic and rubber [b]	Wood
TS1	Handles, knobs, grips, etc., and external surfaces held for short periods of time or touched occasionally (>10 s and <1 min) [c]	51	56	60	60

Table 42

Table 42 – Touch temperature limits

	Accessible parts [a]	Maximum temperature (T_{max}) °C			
		Metal	Glass, porcelain and vitreous material	Plastic and rubber [b]	Wood
TS1	Handle, knobs, grips etc., and external surfaces touched occasionally for very short periods (>1 s and <10 s) [c]	60	71	77	107

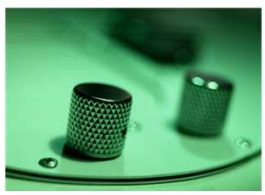

Table 42

Table 42 – Touch temperature limits

	Accessible parts [a]	Maximum temperature (T_{max}) °C			
		Metal	Glass, porcelain and vitreous material	Plastic and rubber [b]	Wood
TS1	External surfaces that need not be touched to operate the equipment (<1 s) [c]	70 [d]	80 [d]	94 [d]	140

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Questions?

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Electrically-caused fire

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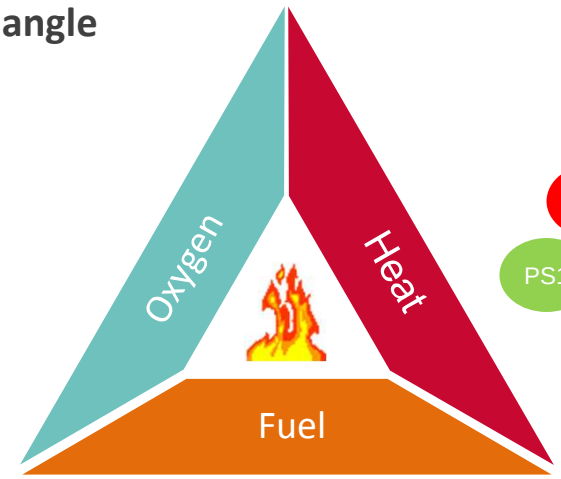
Fire triangle



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Power measurement for worst-case load fault (load fault)

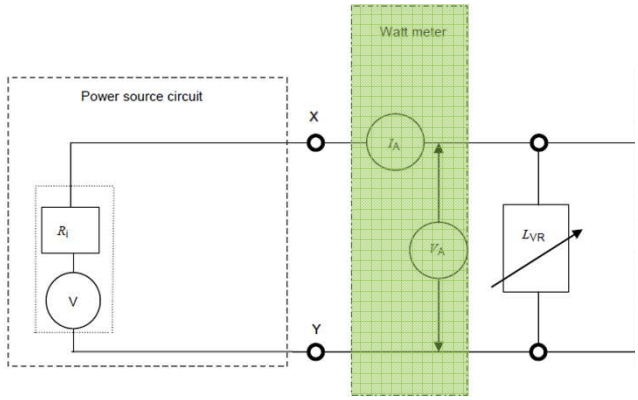

Figure 38 – Power measurement for worst-case load fault

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Power measurement for worst-case power source fault (source fault)

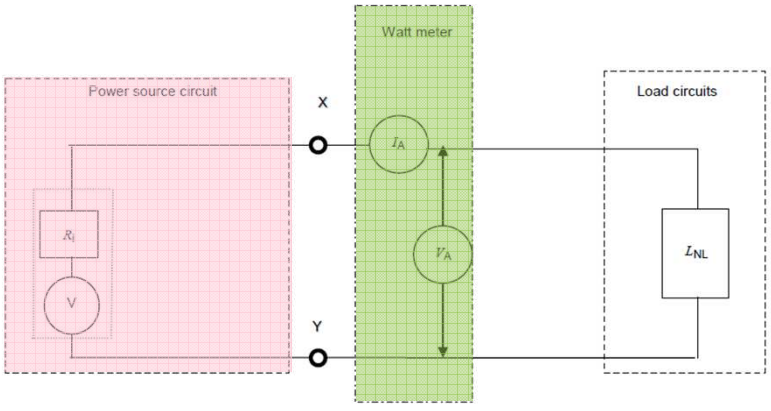

Figure 39 – Power measurement for worst-case power source fault

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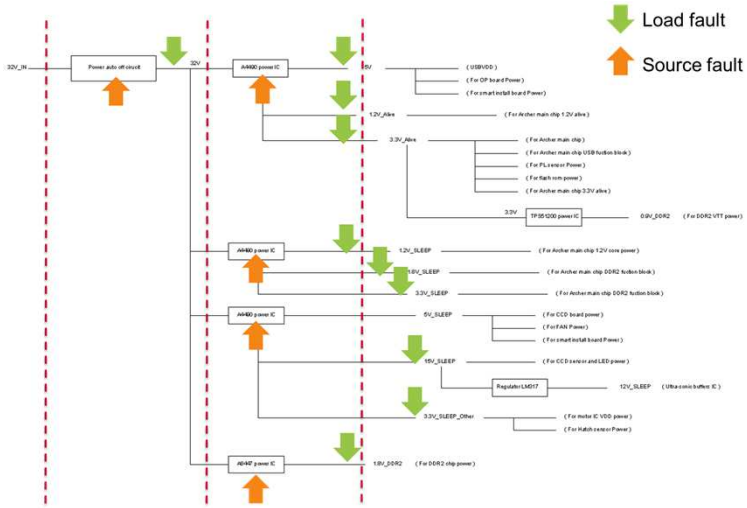
Power source classification



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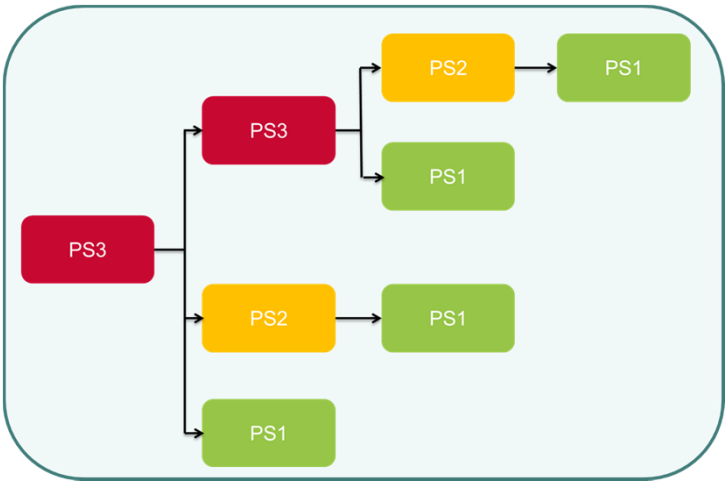
Power source classification



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Definition of PS1

PS1 is a circuit where the power source, measured according to 6.2.2, does not exceed:

- **500 W** measured during the **first 3 s**; and
- **15 W** measured **after 3 s**.

For the purpose of this standard, the power available from external circuits described in Table 16, ID numbers 11, 12, 13 and 14, are considered to be PS1.

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Definition of PS2 and PS3

PS2 is a circuit where the power source, measured according to 6.2.2:

- exceeds PS1 limits; and
- does not exceed **100 W** measured **after 5 s**.

Circuits that meet the requirements of Annex Q are considered to be PS2 circuits. (108/479/CDV)

PS3 is a circuit whose power source exceeds PS2 limits, or any circuit whose power source has not been classified.

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Illustration of power source classification

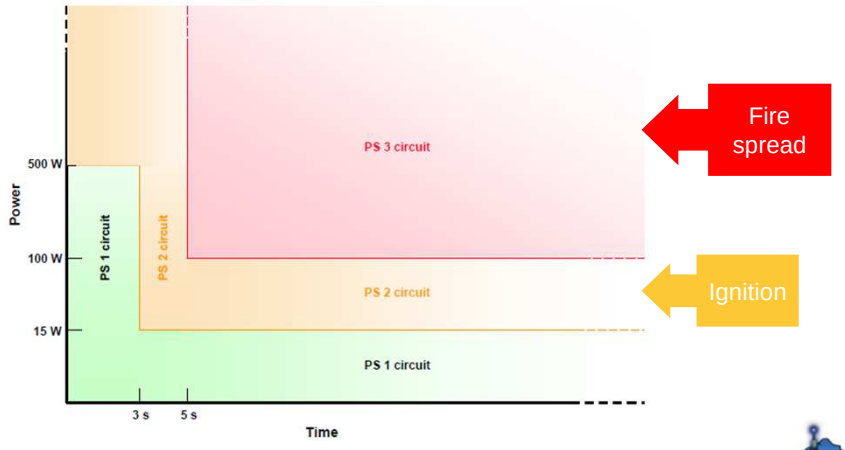

Figure 40 – Illustration of power source classification

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Definition of Arcing PIS

Determination of an arcing PIS is performed under **normal operating conditions** unless otherwise specified.

An arcing PIS is a location with the following characteristics:

- an open circuit voltage (measured after 3 s) across an open conductor or opening electrical contact **exceeding 50 V (peak) a.c. or d.c.**; and
- the product of the peak of the open circuit voltage (*V*p) and the measured r.m.s. current (*I*rms) exceeds 15 (that is, ***V*p × *I*rms >15**) for any of the following:
  - a contact;
  - a termination;
  - opening of a conductor.

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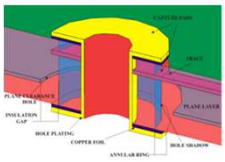
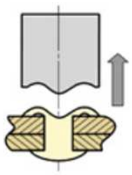
Definition of Arcing PIS

Reliable or **redundant** connections are not considered to be an arcing PIS.

Examples of connections that could be considered reliable are:

- holes of solder pads on a printed board that are through-metallized;
- tubular rivets/eyelets that are additionally soldered;
- machine-made or tool-made crimp or wire-wrap connections.





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Definition of Resistive PIS

A resistive PIS is any part in a PS2 or PS3 circuit that:

- has a power capability to dissipate more than 15 W measured after 30 s of **normal operation**; or
- has an available power exceeding 15 W measured 30 s after the **introduction of the fault**.

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Basic Safeguard

– **ignition** shall not occur; and

– no part of the equipment shall attain a temperature value greater than **90 % of the autoignition temperature limit**, in Celsius, of the part as defined by ISO 871. When the autoignition temperature of the material is not known, the temperature shall be limited to **300 °C**; and

– combustible materials for components and other parts outside fire enclosures, shall have a material flammability class of at least:

• HB75 if the thinnest significant thickness of this material is <3 mm, or

• HB40 if the thinnest significant thickness of this material is ≥3 mm, or

• HBF.

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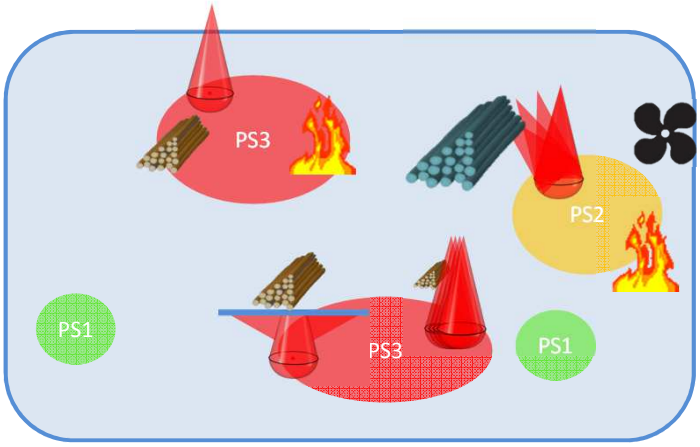
Supplementary safeguard – Reduce the likelihood of ignition



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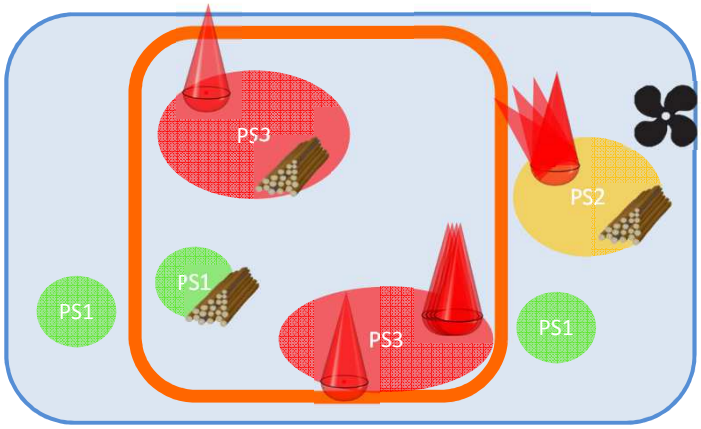
Supplementary safeguard – Control of fire spread



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謝謝大家的時間！

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