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**PROPERTY INSURANCE COMMITTEE**
**Prevention Specifications**

# Specifications for the Protection of cold areas

*CEA 4050: October 2005 (en)*

(EFSAC endorsed)

## Contents

## FOREWORD

These CEA specifications have been drawn up by the GEI 15 - Fire Expert Group n° 15 - of the CEA Property Committee.
Insurers are responsible for adherence of regulations. However, national requirements shall be fulfilled.

## 1 - INTRODUCTION

Many large and expensive fires have occurred over the last decade within the food production sector, attributable to the high combustibility of both stored products and the old composite panels with a low quantity of fire retardant often used for construction and a very bad global conception (no fire engineering). In consequence, European insurers, through CEA (Comité Européen des Assurances) have drawn up guidance to reduce fire risk, for the benefit of designers, manufacturers and end-users, and to assist with the placing of insurance.

Statistics show:

- The majority of fires where fire spread has involved combustible sandwich panels have occurred in food processing factories.
- Few fires have occurred inside working local or above cold areas inside the internal building volume but these have caused major damage.

This document covers important measures that are designed to reduce the incidence of fire, and to minimise damage if fire does occur.

These measures include high standards of fire safety management, compartmentation, panel system specification and construction/assembly, fire detection and fire protection. The special risks and special requirements for protection in cold areas are shown in these specifications.

## 2 - SCOPE

These specifications only cover requirements for fire protection in cold areas (i.e. cold storage or production) additional to the usual standards for buildings, laid down in CEA documents and national documents.

Definition:

- Positive-temperature cold area = area with temperature at all times > 0 °C throughout. This is also referred to as a chilled store;
- Permanently negative-temperature cold area = area with temperature permanently ≤ 0 °C in the whole area, also called freeze area. [1]

Note: The design of the fire protection depends on the areas's temperature. It must be remembered even in a positive temperature area, there may be areas below freezing.

[1] Temperatures:

- - 40° C up to 0° C: Negative temperature cold areas (Freezers)
- + 1° C up to 10°C (approximately) : Positive temperature cold areas (chill areas)

## 3 COLD AREA CONSTRUCTION

### 3.1 Type of construction

For cold area construction, sandwich panels are often used as:

Insulated external envelopes;

and/or

Internal envelopes

#### 3.1.1 Insulated external envelopes

Sandwich panels used for external envelopes are assembled with the necessary supporting structure and fixings and are therefore less likely to become delaminated in a fire. Sandwich panels used externally have to withstand wind-loads and also be weather-tight. Purlins and mid-rails may also make some contribution in controlling flame spread across the surface.
The use of sandwich panels to form the external envelope (roof and walls) has quadrupled over the last 10 years.

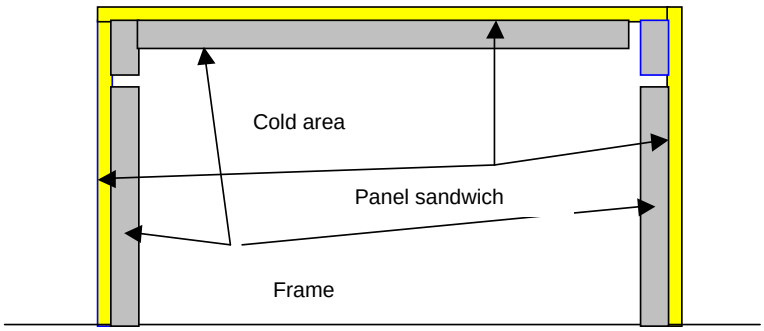


**Figure 1 : external sandwich panel systems**

#### 3.1.2 Insulated internal envelopes and partitions

Sandwich panels installed inside the buildings, in the form of partitions, ceilings and wall linings, are typically used in food factories, cold stores, pharmaceutical industries, other temperature controlled envelopes, and high tech clean areas. Usually for internal enclosures more penetrations (i.e. pipes, ductwork, conveyor openings and cables) have to be considered, compared to external envelopes.

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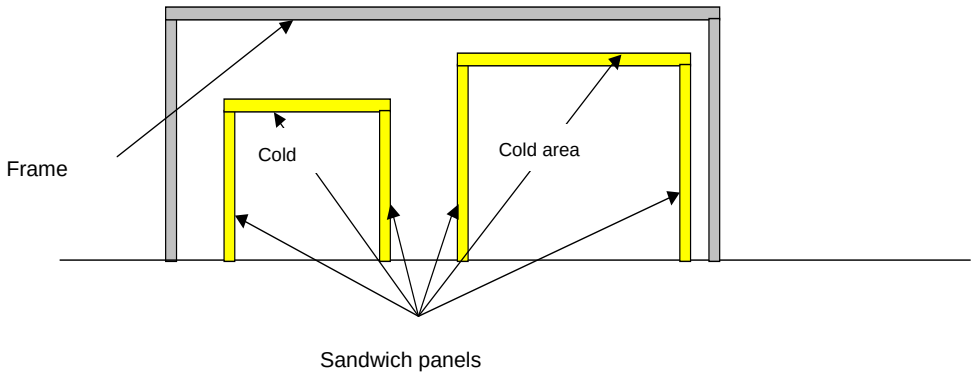



**Figure 2: internal sandwich panel systems**

N.B: Catwalks should be installed within the roof spaces for maintenance purposes;

The provision of fire protection for insulated external envelopes is generally far less complex than for the equivalent volume of internal enclosure.

### 3.2 Requirements

#### 3.2.1 Requirements regarding sandwich panels

The entire construction including structural support should be non-combustible.

The thermal insulation should ideally also be of non-combustible material, such as mineral wool (rock fibre or glass fibre). Such panels are recommended in terms of very limited combustibility and good fire behaviour, but they have the disadvantages of weight and thickness, relative to foam-cored panels. Some users have also had problems with condensation, although careful assembly, moisture sealing and maintenance will overcome this problem.

For these reasons, sandwich panels with combustible foam insulants, such as Polyurethane[2], Polyisocyanurate[1] or Expanded or Extruded polystyrene[3] are generally used for building construction. Because of the potential problems of combustibility, it is mandatory to use sandwich panels with enhanced fire behaviour. For that reason, the various national Insurers' Associations have developed test standards and programmes to identify and further classify suitable panels and panel systems.

If combustible material is used the following requirements should be fulfilled:

- Do not use PSE, PXE or PP sandwich panels;
- Use steel sheet;

[2] *Together PUR and PIR account for at least 90% of external applications*

[3] *For many years only FR (Flame Retardant) grades of EPS have been used. (Reaction to Fire Classification Euroclass E)*

- Absence of enclosed air layers; (good junction between two panels)
- Penetrations through the panels must be protected;
- No exposed insulated foam (i.e. covering of edges and joints) and
- Prevention of mechanical damage (i.e. crash barrier)

The sandwich panel's fire behaviour must have been evaluated in accordance with relevant specifications. At the moment, the following European evaluation methods are:

| | | Germany | France | United Kingdom |
|---|---|---|---|---|
| **Specifications** | Test specification | **DIN 4102 – 1**<br>Fire behaviour of building materials and components<br>Part 1 Building materials, terminology requirements and tests<br>Or<br>**DIN 18234**<br>structural fire protection in industrial buildings<br>definitions<br>requirements and tests for roofs<br>non-ventilated roofs with roofings exposed to fire from below<br>roof areas without openings | **APSAD T14-A**<br>(Technical rules / Fire behaviour / specifications and test methods, for walls, partitions ceilings and roofs) | **LPS 1181**<br>Reaction to fire test (various sub-test regimes exist)<br><br>**LPS 1208**<br>Fire resistance test for internal panels |
| | Specifications | | **APSAD D14-A** | |
| **Classification** | | **DIN 4102 – 1:**<br>minimum B1<br>and in accordance with DIN 4102 – 4 § 8.7 resistance against flying sparks and heat radiation<br>or<br>**DIN 18234:**<br>Approved<br>(Listed VDS 2097 – 3)<br>**Walls :**<br>Fire behaviour of the materials and components in accordance to the regulation given above | **Pa1**<br><br>**Pa2** | |

*Note: Much more work is necessary to establish a European set of equivalent standard or grading within existing standards, so that manufacturers, users and insurers are able to compare different panels tested to different regimes.*

**Table 1: European evaluation methods**

### 3.2.2 Requirements regarding electrical equipment

- Electrical cables passing through sandwich panels should always be enclosed in a suitable metal conduit.
- Electrical equipment located near sandwich panels should be thermographically examined and tested at least annually,
- Electrical equipment should not be directly attached to sandwich panels. Where this is not possible, care should be taken to ensure that the core is not left exposed or damaged;
- Electrical cables for light equipment must made in an S to avoid water droplets going into the light

### 3.2.3 Other requirements linked to the realisation on the work site

Any penetration or gap between panels, the penetrations of smoke, flames and gases into cavities must be prevented – More details are given in the appendix n° 3.

As far as possible, services penetrations through sandwich panels should be avoided. If this is not possible, any gaps should be adequately fire stopped. To compensate the negative constructional fire protection the requirements in the following table should be fulfilled:

To compensate the negative constructional fire protection the requirements below should be fulfilled:

| | | | **Cold areas** | | | | |
|---|---|---|---|---|---|---|---|
| **Kind of sandwich panels** | | **Building and storage configuration** | **< 10 m²** | **< 100 m²** | **< 800 m²** | **< 3.000 m²** | **> 3.000 m²** |
| **Non-combustible** | | | Not specific for cold areas [4] | Not specific for cold areas | Not specific for cold areas | Not specific for cold areas | Individual assessment required |
| **Combustible** | Approved Sandwich panels | Storage height h < 7.5 m and building height h 7.6m < h< 11 m | Not specific | Fire detection inside and outside of the cold area | Fire detection inside and outside of the cold area | Automatic fire extinguishing inside and outside of the cold area | Automatic fire extinguishing inside and outside of the cold area + individual assessment required |
| | | Storage height 7.5 m < h < 11 m and building height h > 11 m | Automatic fire extinguishing inside and outside of the cold area | Automatic fire extinguishing inside and outside of the cold area | Automatic fire extinguishing inside and outside of the cold area | Automatic fire extinguishing inside and outside of the cold area | Automatic fire extinguishing inside and outside of the cold area + individual assessment required |
| | Non-approved Sandwich panels - only steel faced | building height h < 4.5 m | Fire detection outside of the cold area | Fire detection inside and Automatic fire extinguishing outside of the cold area | N/A | N/A | N/A |
| | Exposed insulation | building height h < 4.5 m | Fire detection inside and outside of the cold area | Automatic fire extinguishing inside and outside of the cold area | N/A | N/A | N/A |

**Table 2: Protection & Prevention measures in accordance with combustibility or non-combustibility of sandwich panels**

*Note: Per fire compartment only one cold area is acceptable*

Up to 6.000 m² a fire break wall is mandatory and also to split areas between different uses. Individual derogations could be given up to 7.000 m².

## 4 - FIRE PREVENTION

[4] To make reference to an assessment of consequence loss

### 4.1 General

The risk of fire may be significantly reduced by a good standard of fire safety management. A global fire engineering study is recommended:

- to establish where are the fire risks (storage of combustible element, electric cup board, electric light,.... etc)

- to avoid the risk of the development of the fire
  - install fire break walls (for the height of the building (cold area and internal building volume);
  - install prevention systems (fire detection,....);
  - install fire protection systems (sprinklers, fire hose,...)
  - consider smoke evacuation;

The following factors are of particular importance in controlling the hazard presented by combustible sandwich panels:

- Processes, which are a potential fire hazard, should be located well away from combustible sandwich panels;
- Forklift truck battery charging should be located well away from sandwich panels unless the sandwich panel system can be identified as having at least 60 minutes' fire resistance;
- Flues used to extract hot gases should not pass through sandwich panels unless adequately protected (and must be regularly cleaned to remove combustible deposits);
- The building should be sub-divided into a number of fire resisting compartments wherever practical;
- Unauthorised access to the external cladding or any external combustible storage should be prevented to reduce the possibility of an arson attack;
- Roof spaces must be ventilated;
- Flammable gas supply lines must not pass through cold areas, nor within the roof spaces above;
- Hot works must be controlled and documented in accordance with insurers' requirements;
- Smoking must be prohibited.

Outside, combustible materials, like timber or plastic pallets should not be stacked near to the building. A 10 m separation distance is widely recommended.

### 4.2 Automatic fire detection and alarm systems

A smoke detection system should be provided.

The system must be installed and maintained in accordance with manufacturers' recommendations and generally in accordance with CEA 4040 - Planning and Installation for Automatic Fire Detection and Fire Alarm Systems – July 2003. Some of the important elements of these specifications are given below for the sake of convenience, but the full standard should be consulted.

Aspirating systems should be used, if standard detectors are unsuitable (i.e. because of low temperatures):

To avoid condensation freezing and blocking the detector pipe work, the following precautions must be fulfilled:

- Ensure airtight connections in aspirating network

- Use suitable low temperature pipe material
- Avoid subjecting sampled air to differing sub-freezing temperature inside freezer area
- Ensure freezer integrity is maintained at all pipe penetration points
- Return exhaust air back to the protected zones
- Provisions shall be made to avoid condensation in the aspirating detector, i.e. by heating equipment or water traps
- Keep sampling points distant from freezer openings
- Avoid sampling directly from chiller supply airflow
- Detectors must be situated outside sub-freezing areas. To protect the detector device from cold air, a heat exchanger, or a sufficient length of the pipe work installed in a heated area, is necessary
- Pipe work shall be installed concerning the avoidance of water entering the detector.
- Consider sampled air warming techniques when necessary

Sampling holes in aspirated smoke detection systems can be positioned where conventional detectors would normally be placed, according to local prescriptive standards. Alternatively, the configuration can be altered to meet performance requirements.

International codes and standards recommend spacing and/or the area of coverage per detector. The spacing requirements are modified by factors such as sloping ceilings, ceiling height, beams, air change rate in the protected environment, etc. The positioning of the actual sampling holes is usually determined by a simple grid layout.

***NOTE: It is advisable to locate the sampling pipes outside the direct supply airflow path of the chiller unit away from any entrance.***

Sampling pipes for aspirated smoke detection systems may also be located along the storage racking systems within the refrigerated storage areas.

To ensure fast response, excessive tube length shall be avoided.

Procedures following any alarm signal must be formalised, to ensure that staff take the correct action.

Conventional point detectors may be acceptable in chill areas (positive temperature), where there is little freezing risk, but careful system design is necessary to ensure that the time taken for the detectors to operate will give sufficient early warning of a problem.

### 4.3 Chiller / freezer plant / equipment

Freezer equipment shall be installed in separate enclosures with at least one external wall, with minimum fire resistance of 90 minutes or separated 10 m from the cold area outside the building also in a separate structure.

Separate dedicated drainage systems and containment shall be provided to control any leaking cooling fluids.

An Emergency Procedures Manual must be drawn up, including all necessary measures in case of fire, and all other relevant emergencies i.e.: switching off ventilation, drainage without (personnel) danger.

Over- and under-pressure cut-off devices must be fitted on the low-pressure side of the installations, as well as on the high-pressure side.

Where automatic fire detection or fire extinguishing systems are activated, ventilation and cooling plant should shut down and be electrically isolated automatically.

### 4.4 Door heating installations

Metal parts of the door shall be protected with an earth leakage circuit breaker (elcb). To protect the door heating the lowest possible rated fuse shall be installed to ensure quick response.

### 4.5 **Modified Atmosphere Packaging**

Consideration should be given to the special risk that may be associated with the supply of packaging gases. Although most of these are inert, there is a possibility of increased oxygen levels in some processes, which could present an increased fire inception and development hazard.

Arrangements should be made for automatic isolation of gas supplies, in the event of an emergency. Where oxygen is used, oxygen monitoring systems may be necessary.

## 5 - FIRE PROTECTION

### 5.1 Compartmentation / Segregation of high fire loads / High risks by using fire-resisting material

In such circumstances, improvements in fire risk should be achieved by measures such as separating the cold area from the food processing area by a **fire break wall (resistance not less than 90 minutes** (integrity and insulation) with all openings protected to the same standard and additional requirements for fire break walls, i.e. height over roof.

This relates to the sections of the roof, external walls and supporting frame of single-storey buildings adjacent to a compartment wall.

For a suitable distance on each side of the wall these will have to have fire resistance, to prevent the fire breaking through via the external cladding.

The following recommendations should be fulfilled:

- To install fire walls to split the risks;
- To compartment roof spaces, plenum and false floors to avoid propagation of the fire;
- In the absence of fire walls, the following should be separated by more than 15 m:
  - Main resources;
  - Boiler area;
  - Regulation and conditioning area;
  - Battery charging area;
  - Auxiliary premises (maintenance,…)
  - Any technical areas (electrical,……. );

Note 1:

Masonry is not the only solution for compartment walls. Some sandwich panel systems can be used very successfully in this application. High-density rock-fibre mineral wool is commonly used for this application as it can easily provide panels with 90 minutes and up to 240 minutes' fire resistance. The type of junction is equally important. It is important to ensure that the panel system provides adequate insulation to ensure that combustible materials in direct contact with the unexposed panel side will not ignite. (That is the purpose of the insulation requirement in the fire resistance test). It is also essential that the junction between the compartment wall and the building envelope be designed to prevent fire spread round the perimeter of the fire resisting compartment wall.

Note 2:

The thermal conductivity of the PU is better than the mineral wool. Consequently, for the same thickness of sandwich panel, the thermal resistance of these panels is very different. Consequently if two different panels are assembled (one in PU and one in mineral wool for example), there is a risk of moisture at the junction of these panels with all the consequences for the fire important in the cold building.

Plant and equipment (such as the conditioning system for temperature and humidity control) should be outside the refrigerated volume.

### 5.2 Sprinkler systems

The system must be designed, installed and maintained in accordance with insurers' requirements, with manufacturers' recommendations and generally in accordance with CEA 4001.

The provision of full sprinkler protection to the premises should be provided in accordance with Table 2.

Accepted unprotected areas should be in accordance with CEA 4001.

Some of the important elements of these specifications are given below for the sake of convenience, but the full standard should be consulted.

**Positive temperature cold area:**

Wet pipe system in accordance to CEA 4001 is applicable.

If temperature is beneath 4° C or where there is any risk of local freezing, a dry pipe system in accordance to CEA 4001 is applicable.

**Permanently negative temperature cold area:**

Due to consequences in case of false working of the sprinkler system (shock,…) special considerations shall be taken into account when designing system in permanent negative condition, especially for in rack sprinkler.

The following systems can be installed:

- Anti-freeze system
- Dry pipe system / Preaction system

The following recommendations have to be considered:

**Anti-freeze system:**

- The anti-freeze solution used shall be acceptable for extinguishing. This should be tested and accepted by a qualified company. For anti-freeze solutions which have less extinguishing performance than pure water, the maximum flooding time of the system must not exceed 2 mn. by 4 open sprinklers at the furthest point of the system.
  This has to be checked by hydraulic calculation. The calculation must be done by considering the physical characteristics of the anti-freeze solution at the average temperature in the cold area not exceeding 0 °C. The usual formula to be applied will depend on viscosity
- Only materials compatible with the anti-freeze solution shall be used.
- To protect the pipe work against pressure expansion above 12 bars, appropriate measures have to be considered. For example, a relief valve and a filling-pump should be installed above the control valve on the riser. The relief valve should be provided with a size not exceeding 6.4 mm to operate at pressures beneath 12 bar and not extending the dimension of the smallest sprinkler outlet to guarantee reliability of the alarm valve (false alarm?).
- An anti-freeze solution shall be prepared with freezing point below the expected minimum temperature for the locality.
- The specific gravity of the anti-freeze solution shall be verified by the manufacturer once a year
- A small part of the pipe work, which is filled with anti-freeze solution, should be outside the permanently negative temperature area. In case of damage to pipe or sprinkler, it is possible to limit the volume of water flooded pipe work by quick reaction of the user. Therefore, easy access to the shut valves is essential. Do not extend the 2 minutes of flooding.

**Dry pipe systems**

- Pre-action is recommended to prevent false activation (i.e. compressor failed);
- Generally upright sprinklers located on the top of the branch line are used;
- In permanently negative temperature areas the forming of ice has to be considered. Usually, the use of air dryers is not sufficient. Due to residual condensate in minimum percentage in “dry” air, ice growing over months and years cannot be avoided;
- Therefore dry pipe installations should be charged with dry inert gas under pressure downstream of the dry alarm valve;
- A permanent inert gas supply to maintain the pressure in the pipe network shall be installed;
- Precautions must be taken to allow the installation’s draining.

Dry sprinklers must be installed in accordance with manufacturers' requirements.

**Special installations**

For small areas, a wet pipe installation in the heated area with pendant dry pipe sprinkler inside the permanent negative temperate areas is acceptable if:

- the heating of the wet pipe and distance to the cold area is appropriate,
- the penetrations are sealed as described in § 3.2 This is also necessary to prevent ice growing on the sprinkler. Due to penetrating condensate, ice growing must be prevented.

### 5.3 Inert gas systems

Inert gas total flooding systems ($CO_2$, Argon, Nitrogen, mixtures of these gases) can in principle be used for cold areas. The design of such a system must take into account the low area temperature (higher amount of gas necessary), tightness of the area (also in case of fire) and pressure relief openings. All precautions regarding personnel safety must be taken into account (national regulations have to be followed). Therefore, inert gas systems are not a typical protection system used in cold areas (except if a special study is carried out regarding personnel safety and pressure relief……)
The systems must be installed and maintained in accordance with manufacturers' recommendations and generally in accordance with CEA 4007 and CEA 4008.

Systems providing permanently reduced oxygen levels are maybe applicable in cold areas with automatic storage process (no people in the cold area), but personnel safety aspects must be taken into account (national regulations must be followed). As there are no regulations for such systems at the moment, individual judgement at the planning phase (including insurance approval of the system) is necessary.

### 5.4 Fire hose systems

Conventional wet hose reels cannot be installed within cold-areas, as they will freeze, but they can be installed in the ambient temperature area immediately adjacent to the doorways.

Dry hose reels can be installed within the negative temperature area or hose reels systems “wet/dry” with filling and draining devices operated by remote control can be used.

Conventional wet hose reels can be installed in positive temperature areas.

### 5.5 Fire extinguishers

Fire extinguishers shall be installed within the immediate vicinity of the cold area, in accordance with national regulations, and shall be provided within positive temperature areas.

### 5.6 Smoke and heat exhaust vent(ilator)s

The removal of smoke and heat will greatly improve the chance of successful fire fighting. There are no approved insulated roof ventilators currently available, therefore arrangements should be made for sections of the walls at high level to be openable or removable by the fire brigade.

If fire extinguishing systems are installed, smoke and heat vents should be manually controlled. Approximately 0.5 % of an aerodynamic free area is considered adequate. In any other case, smoke and heat vents should be installed in accordance with CEA 4020 to improve the efficiency of manual fire fighting.

**Appendix n° 1**

**Informative**

**SPECIFIC RISKS**

## 1 – COLD AREAS

Sandwich panels do not spontaneously combust, but the use of the lower grades of combustible core (sandwich panel D or E or F s3 d0 – Euroclasses[5] ) which can ignite easily and with a very bad global fire conception of the building (internal building volume without sprinkler, no fire wall brake or fire wall brake with holes not treated, no smoke evacuation, bad realisation of the building, no respect of the disposition concerning the electrical equipment etc), will result in very rapid fire spread.

This type of sandwich panel and a bad global fire conception of the building (no fire engineering study) can significantly increase the fire load and the spread of the fire, in some cases within the panel itself.

By opposition, there is no risk of fire spread when the building has a global conception of the fire protection, with sandwiches panels that are B s3 d0 ( Euro class), and that are correctly assembled on the work site (see § 3.2 requirement) and with strict respect for the electrical dispositions.

Note: Flammability classification is not the only aspect of constructional fire protection! It may initially decrease the risk of fire, but not provide fire protection!

*Stand-alone Cold Stores*

Relative to cold areas attached to a food processing plant, stand-alone cold stores are considered to have a lower fire inception risk. However, their fire record is still of concern, as fire spread will generally result in total effective loss of the structure and its contents. Most of the fires involving stand-alone cold areas have been shown to originate outside the cold area itself, in plant areas or in external storage.

*Food Processing Risks*

Cold areas attached to a food processing plant have a much poorer record, due to the greater ignition risk; fire statistics clearly show that it is the specification of unsuitable sandwich panel with untreated foam (panel D or E or F s3 d0) systems in food factories and bad global conception of the fire behaviour of the building that are the principal reasons for rapid fire spread. The very highest standards of management are necessary to control the fire inception risk, but in practice, standards are often found to be deficient.

There are many different reasons for a fire starting, but if allowed to develop, these fires will almost always come to involve the panel cores with no or with a low quantity of ignifugeant, leading to major loss.

Some reported causes of ignition in "*Food Processing plants"* are listed below:

- Bad fire conception of the building
- No smoke evacuation
- No effective fire brake wall
- No sprinkler in the internal building volume
- Large gallery or large gallery without brake fire
- Bad realisation

[5] Euroclasses will be considered by each country when officially applied by their government

- Bad realisation of the electrical equipment (short-circuit of unprotected cabling passing through panel,...)

• Arson (both internal and external);
• Uncontrolled Hot Work
•
• Debris at the base of an oven
• Oil heated to above its flash point
• Discarded-smoking material in a packaging store
• Ignition of deposits in flue leading from smoke box
• Oil deposits on filters ignited by a spark from an oven
• Badly maintained deep fat fryer
• Oil ignited in a reservoir surrounding an oil holding tank
• Sparks from a smoke box containing burning sawdust igniting tarry residue on pipe work
• Inappropriate specification for conveyor belting
• Badly maintained or used radio frequency defrosting ovens
• Spanner dropped on live electrical connection in electrical intake area

……..

Some reported causes of ignition in "*Stand-alone stores*" are listed below:

- Electrical equipment within the cold area (Area lighting, Cables, Charger for Battery lift trucks)
- Electrical power distribution boards
- Electrically heated doors (anti-freezing systems)
- Heating devices within the "evaporator" system
- Cabling in the roof spaces (44 % of fires due to electrical origin)
- Arson
- Hot works (16 % of fire due to hot work)

.

The speed of development and the spread of fire are mainly influenced by:

- High fire load of combustible insulation
- Large uncompartmented volumes
- Delay in detecting fire
- Lack of smoke vents (no means of releasing hot, toxic and corrosive combustion gases)
- Attendance time of fire brigade
- Insufficient water resources
- Chemical risks relating to cooling systems
- Combustibility of stored goods and packaging
- Lack of automatic extinguishing systems (sprinklers,…)
- Presence of flammable liquid or gas

Many of the issues above can be directly related to inadequate levels of fire safety management.

Good standards of fire safety management, both internally and externally, will substantially reduce the fire risk.

National building regulations (building codes) are generally designed only to provide an adequate level of Life Safety for the occupants, and do not necessarily provide sufficient fire protection for insurance purposes. For example, unlimited floor areas are a major contribution to losses because of the lack of fire resisting compartment walls.

## 2 - FOOD FACTORY APPLICATIONS-EXISTING BUILDING PROTECTION

Due to the potentially higher risks associated with food processing at elevated temperatures, some replacement of sandwich panels in designated high risk areas may be considered necessary, although the same options given for external claddings may be appropriate in certain circumstances (see Section 4.3.).

Such a decision will depend on, for example:
• Presence of an automatic extinguishing system in cooking and other high-risk areas such as packaging/storage or if the facility is fully sprinkler protected
• Standard of fire safety management, with particular reference to maintenance of equipment that presents an inception risk
• Presence of fire resisting compartmentation
• Attitude of building operator to fire risk management
• Presence of unprotected conveyors.

## Appendix n° 2

## Insulation (For information)

Main characteristics are the following

| Insulation | Density without claddings | Thermal conductivity | Upper calorimetric value |
|---|---|---|---|
| Mineral wool | 100 to 170 kg / $m^3$ | 0,040 W / m · K. | 2,5 MJ / kg |
| Cellular glass | 115 to 125 kg / $m^3$ | 0,040 W / m · K. | 2 MJ/kg |
| PUR | 35 to 45 kg / $m^3$ | 0,025 W / m · K | 24 to 31 MJ / kg |
| EPS | 15 to 35 kg / $m^3$ | 0,038 W / m · K | 32 to 41 MJ / kg |

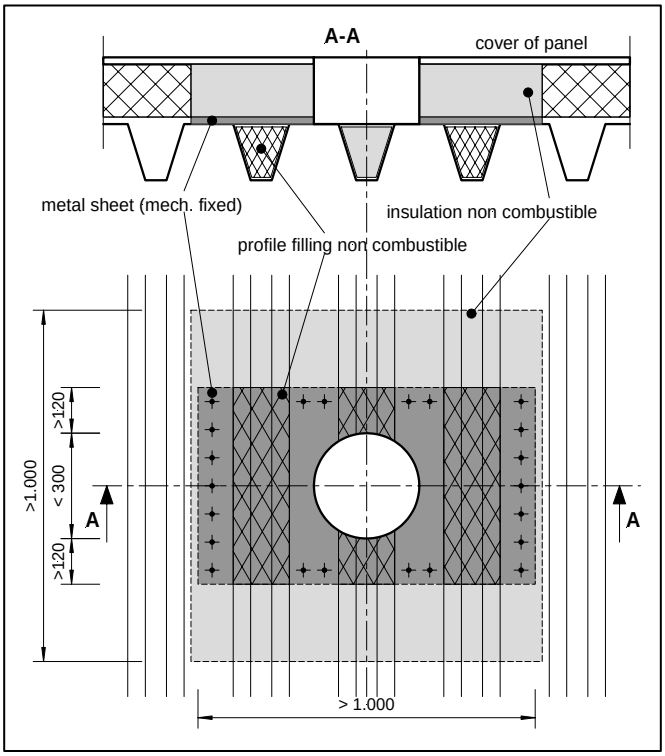
Sandwich panel classification may be better than the insulation's classification.

## Appendix n° 3

## Penetrations and openings

Structural measures at penetrations and edges to delay the spread of fire:

- As far as possible, services penetrations through sandwich panels should be avoided. If this is not possible, any gaps should be adequately fire stopped.
- Electrical cables passing through sandwich panels should always be enclosed in a suitable metal conduit.
- Electrical equipment located near sandwich panels should be thermographically examined and tested at least annually.
- Equipment should not be directly attached to sandwich panels. Where this is not possible, care should be taken to ensure that the core is not left exposed or damaged.




profile filling (see above), mechanical fixed

**General:** At any penetration or gap between panels, the penetration of smoke, flames and gases into cavities must be prevented.

**Small penetrations**: Openings or penetrations, i.e. pipes, cables and cabinets measuring less than 300 mm x 300 mm.

Exemplary measures for penetration by non-thermoplastic (non-combustible) components:

- Cavities of profiled panels must be filled with non-combustible insulation / components
  - Minimum 0.12 m in direction parallel to profile
  - Minimum 1.00 m in direction vertical to profile
- Non-combustible insulation minimum 1.00 m x 1.00 m in the surrounding of the penetration or full enclosure of combustible insulation, i.e. closed rim (metal / canted) around the opening
- Cover of metal sheet minimum area as for

Exemplary measures for penetration by thermoplastic (combustible) components:

- Additional to non-thermoplastic (non-combustible) there must be a fire resisting closure (self-closing).

**Large penetrations**: Openings, penetrations, i.e. smoke and heat vents, light domes, doors... measuring over above 300 mm x 300 mm.

Exemplary measures:
- Closed Rim (made of metal sheet / canted minimum 2 mm thick) around the penetration / opening.
- Non-combustible insulation minimum 0.5 m in the surrounding of the penetration / opening

**Gaps** (i.e. between panels):

All form of connection (vertical, parallel, panel to panel, panel to other components) must be tested (e.g. in accordance to DIN 18234-3).
As a minimum requirement for non-approved gaps between panels, they should be covered by metal sheets with a minimum area of 0.12 m in any direction to the gap. The metal sheet should be mechanically fixed.
Cavities of profiled panels must be filled with non-combustible insulation minimum 0.12 m in direction parallel to profile and minimum 1.00 m vertical to profile. Metal sheets shall cover filling insulation.