# SMOKE CONTROL

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# INDICE

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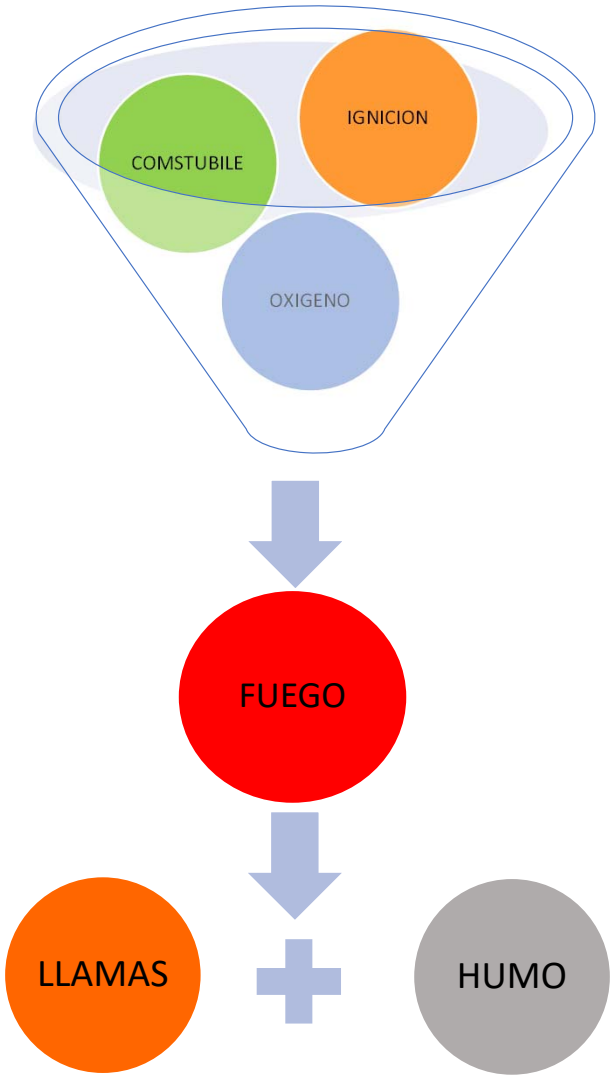
- Smoke control systems
    - Bouyancy based systems
    - Horizontal ventilation systems
    - Pressurissatio systems
    - Smoke extraction systems

Some people say: “There is not risk of a fire in our building”.

Although apparently flames are the most dangerous element, smoke causes most deaths.

80% of victims killed in fires die because of smoke



16 people died, including a child, and 60 people were injured because of smoke inhalation.

**GRENFELL TOWER**

"The staircase of Grenfell Tower should have allowed a safe evacuation instead of becoming a chimney full of toxic gases"

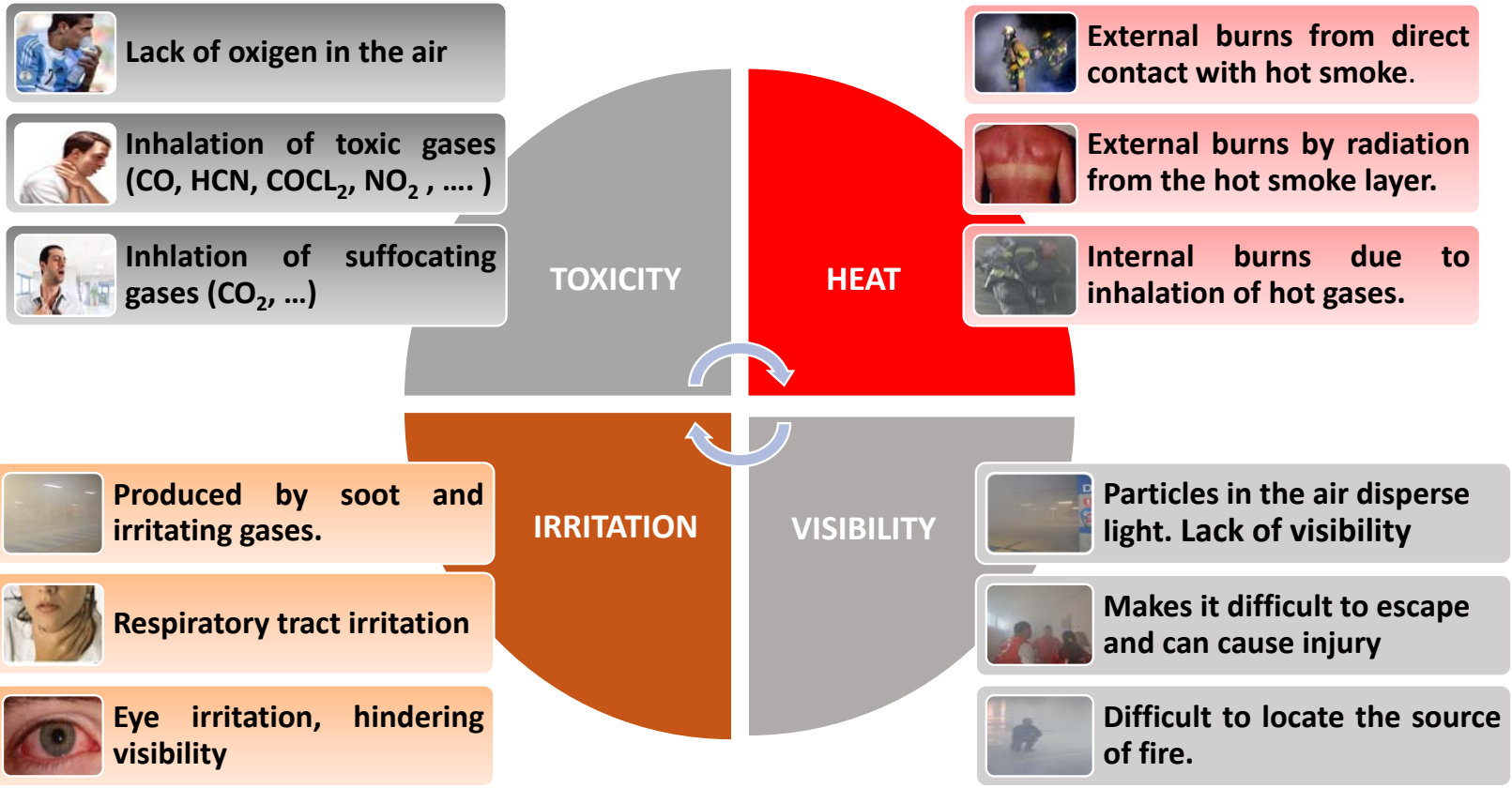
"It has been terrible, a fire fighter said. You can not see the hand in front of your face. The smoke was becoming more and more thick on each level we raise…. On the 9th floor we absolutely loss the visibility, and the heat continues increasing".

**MGM Grand Hotel – Las Vegas**

75 deaths by smoke inhalation and toxicity due to carbone monoxide

## THE RISK IS THE SMOKE

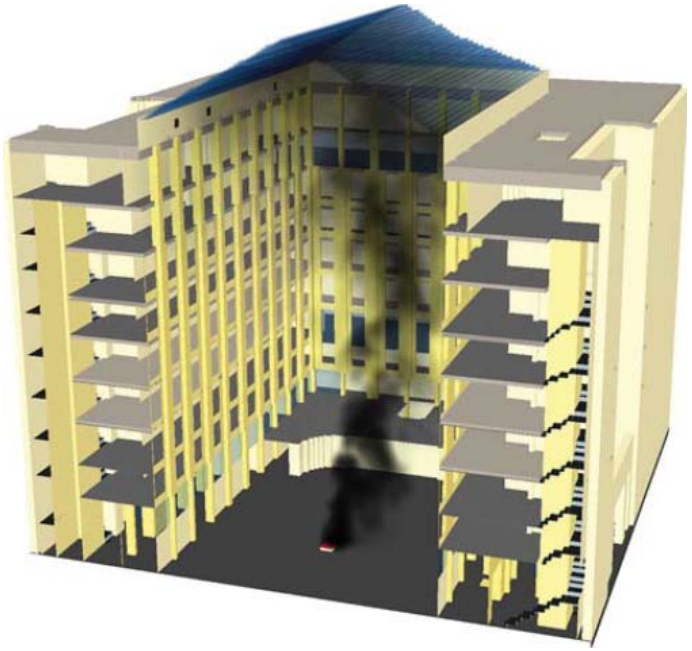
# The risks from smoke

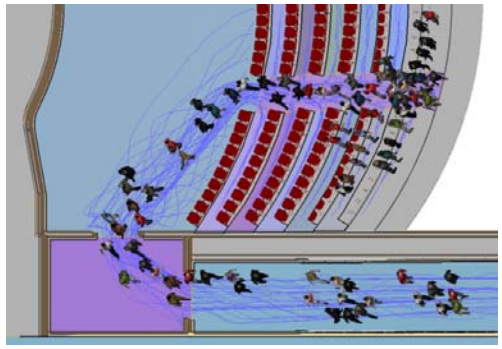


# GOALS OF SMOKE CONTROL SYSTEM

## Means of scape:

Public and comercial buildings. To keep the escape routes  free of smoke.





# GOALS OF SMOKE CONTROL SYSTEM

**Fire fighting**

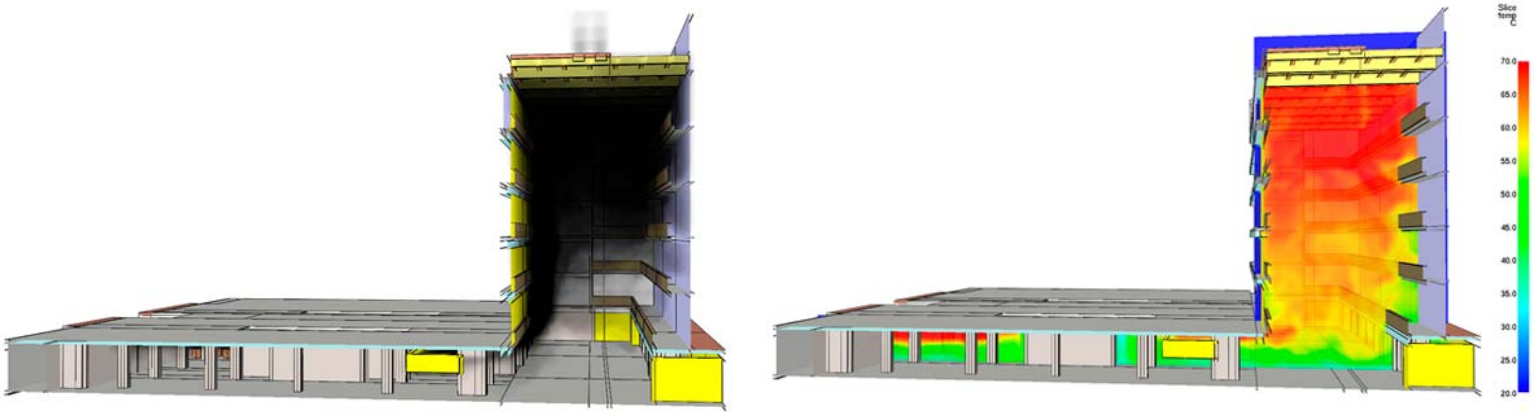
To allow the fire brigade to locate and fight the fire, and to locate possible victims.

-More visibility

-Less temperature

# GOALS OF SMOKE CONTROL SYSTEM

## Temperature control:

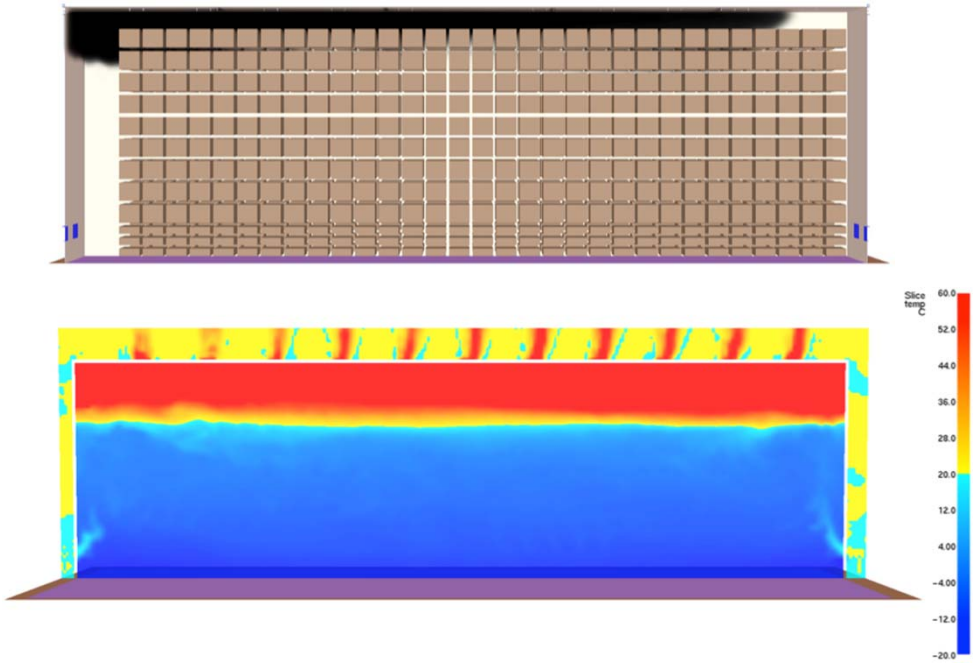


Depending on the strength of materials of the “smoke reservoir", the temperature of the smoke must be maintained below certain values.

# GOALS OF SMOKE CONTROL SYSTEM

## Protection of goods:

Depending on the value of the product stored, combustible nature, type of storage, etc., it can be expected that the smoke is above a certain height.



# European Documents 12101

| Part | Subject | Date | |
|---|---|---|---|
| 1 | Smoke curtains | 2006 | CE Adaption to CPR |
| 2 | Natural vents | 2003 | CE. |
| 3 | Fans | 2015 | CE. |
| 4 | Installation | 2009 | TR |
| 5 | Design, steady state | 2005 | TR |
| 6 | Pressurisation (products) | 2005 | CE. Not possible. |
| 6 | Pressurisation (products) | 2022 | CE. (Voluntary) |
| 7 | Smoke control ducts | 2013 | CE |
| 8 | Smoke dampers | 2013 | CE. |
| 10 | Power supply | 2005 | CE. |
| 11 | Car park ventilation | 2022 | TS |
| 12 | Design, time dependent fires | | Being developed |
| 13 | Pressurization, (design) | 2022 | |

PRODUCT

EN 12101-3. Specifications for mechanical ventilators

**CJTHT**

**CI**

**CJBDT**

# CE MARK FOR FANS

# PRODUCT CERTIFICATE

Certification Technological Center

Applus

**CERTIFICADO DE CONFORMIDAD**
***Certificate of conformity***

**0370-CPD-0394**

En virtud del Real Decreto 1630/1992, de 29 de diciembre, modificado por el Real Decreto 1328/1995, de 28 de julio, por el que se dictan disposiciones para la aplicación de la directiva 89/106/CEE del Consejo de las Comunidades Europeas de 21 de diciembre de 1988 relativa a la aproximación de las disposiciones legales, reglamentarias y administrativas de los Estados Miembros sobre los productos de construcción, se ha verificado que el producto:

*In application of the Royal Decree 1630/1992, of 29 December 1992, amended by the Royal Decree 1328/1995, of 28 July 1995, relative to the application of the Directive 89/106/CEE of the Council of European Communities od 21 December 1988 on the approximation of the laws, regulations and administrative provisions of the Member States relating to the construction products (Construction Products Directive-CPD), it has been stated that the product:*

Producto/Product: VENTILADORES – EXTRACTORES DE HUMO Y CALOR SERIE THT/IMP 200ºC
SMOKE AND HEAT EXHAUST POWERED VENTILATORS SERIE THT/IMP 200ºC

Fabricado por/ *produced by the manufacturer*: SODECA, S.A.
Ctra. De Berga, km. 0,7
08580-SANT QUIRZE DE BESORA (Barcelona)

Fabricado en/ *in its factory*: SODECA, S.A.
Ctra. De Berga, km. 0,7
08580- SANT QUIRZE DE BESORA (Barcelona)

Es sometido por el fabricante a un control de producción en fábrica y a ensayos posteriores de muestras tomadas en la fábrica según un plan establecido y que el LGAI ha realizado los ensayos de tipo iniciales del producto, la inspección inicial de la fábrica y el control de producción de la fábrica y realiza el seguimiento continuo, auditoría y aprobación del control de producción en fábrica.

El presente certificado indica que se han aplicado todos los requisitos relativos a la evaluación de la conformidad descritos en el Anexo ZA de la norma EN 12101-3 y que el producto cumple todos los requisitos mínimos.

*is submitted by the manufacturer to a factory production control and to further testing of samples taken at the factory in accordance with the prescribed test plan and that LGAI has performed the initial type-testing of the product, the initial surveillance, assessment and approval of the factory production control.*

*This certificate attests that all provisions concerning the attestation of conformity described in Annex ZA of the standard EN 12101-3 were applied and that the product fulfils all of the minimum prescribed requirements.*

Fecha/Date 04 de Abril de 2006

Firma/signature:

Applus Certification Technological Center

Xavier Ruiz Peña
Director Área de Certificación de Producto

Applus Certification Technological Center

Ramón Capellades i Font
Director General

**0370-CPD-0394**

Producto/*Product*: VENTILADORES – EXTRACTORES DE HUMO Y CALOR SERIE THT/IMP 200ºC
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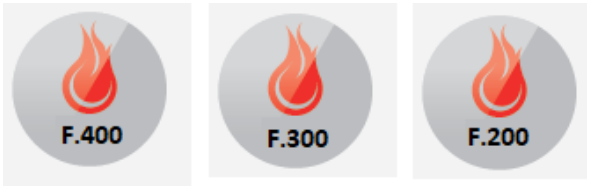
# TYPE OF FANS




## Inmerse

**TCR**

**CJTHT**

## Non inmerse

**TCR/R**

**CJBDT**

CLASSIFICATION FOR FANS

| CLASS | TEMPERATURE ºC | TTIME(MIN.) |
|---|---|---|
| F200 | 200 | 120 |
| F300 | 300 | 60 |
| F400 | 400 | 120 / 90 |
| F600 | 600 | 60 |
| F842 | 842 | 30 |

## TYPE OF BUILDINGS

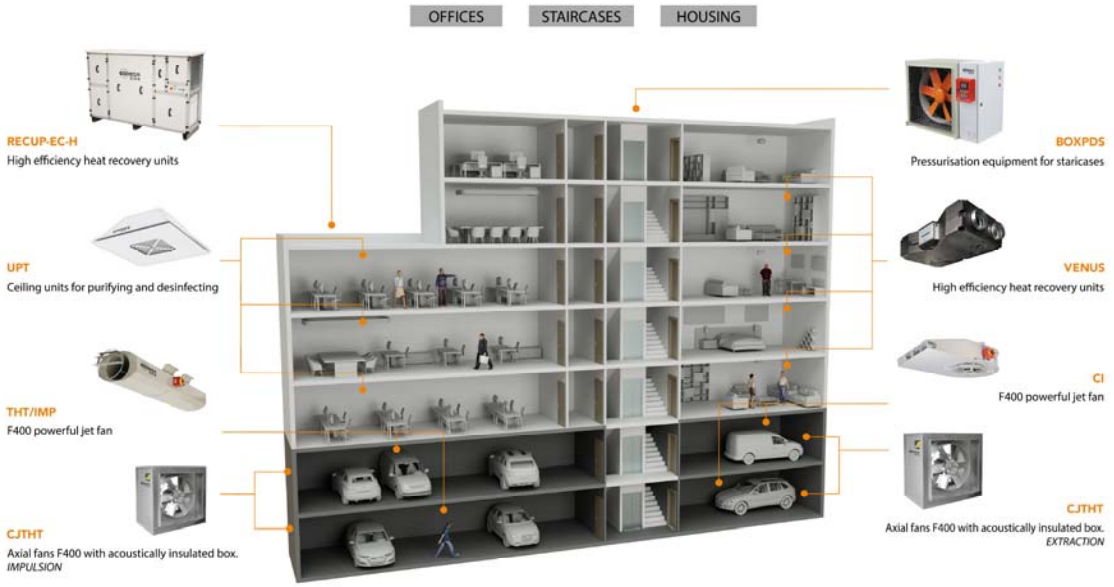
- Buoyancy of smoke (2 zones model)

  Single floor Industrial and Warehouse buildings.
  Multi floor buildings with atriums

- Smoke extraction
  Carparks

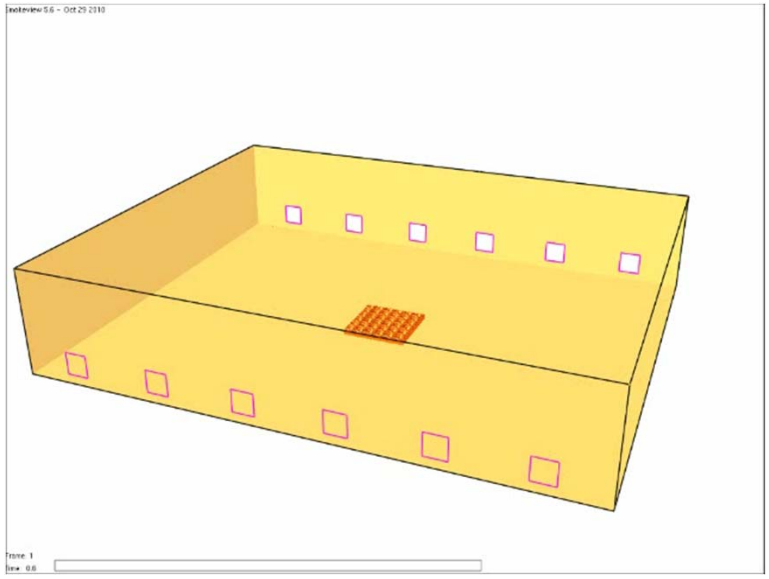
- Horizontal ventilation
  Tunnels ventilation
  Carpark ventilation

- Pressurization
  Pressurization of stairs in buildings multi floor



# BUOYANCY OF THE SMOKE

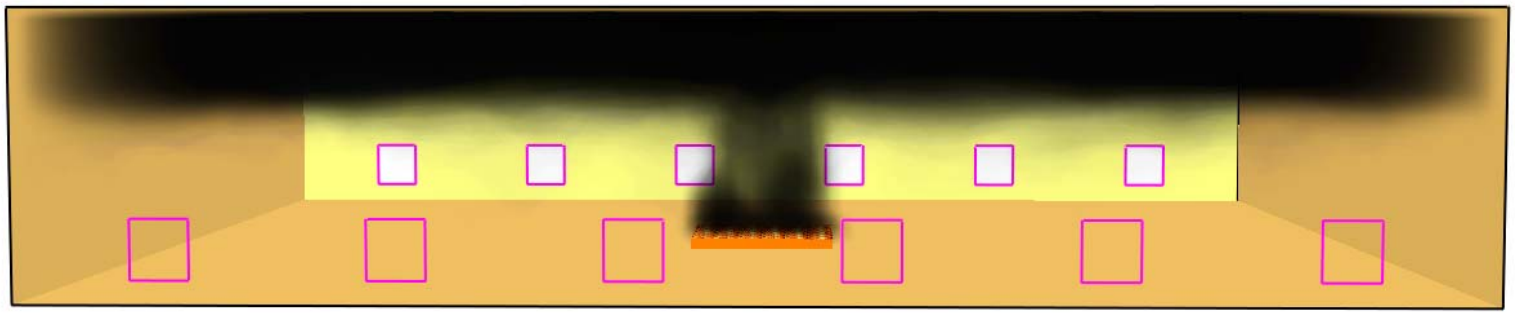
The goal is to have two zones (or layers) in the vertical plane. One zone with smoke below the ceiling (we call this the smoke zone), and a second zone without smoke (below the smoke zone) (we call this the  smoke free zone)



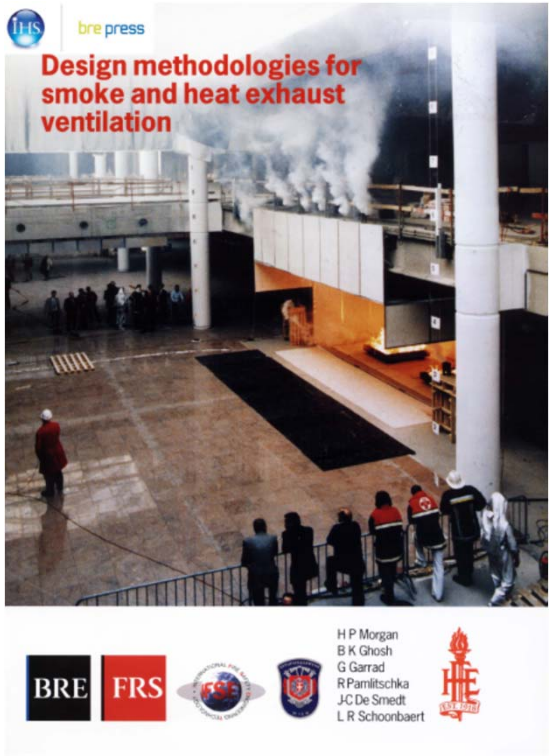
## BUOYANCY OF THE SMOKE

The existence of the smoke free zone allows the evacuation of people and access for the fire brigade.

The height and the temperature of this smoke free zone has to be controlled.



# BUOYANCY OF THE SMOKE. DESIGN STANDARDS




TECHNICAL REPORT
RAPPORT TECHNIQUE
TECHNISCHER BERICHT

**FINAL DRAFT**
**prCEN/TR 12101-5**

May 2005

ICS 13.220.99; 23.120 — Will supersede CR 12101-5:2000

English version

Smoke and heat control systems - Part 5: Guidelines on functional recommendations and calculation methods for smoke and heat exhaust ventilation systems

Systèmes de contrôle de fumées et de chaleur - Partie 5 : Guide de recommandations fonctionnelles et de calcul pour les systèmes d'exutoires de fumées et de chaleur

Rauch- und Wärmefreihaltung - Teil 5: Anleitung zu funktionellen Empfehlungen und Rechenverfahren für Anlagen zur Rauch- und Wärmefreihaltung

This draft Technical Report is submitted to CEN members for Technical Committee Approval. It has been drawn up by the Technical Committee CEN/TC 191.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

**Management Centre: rue de Stassart, 36 B-1050 Brussels**

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Ref. No. prCEN/TR 12101-5:2005: E

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FOR CIB – Activation and start of DIS

**ISO/TC 21/SC 11**
Date: 2016-11-17
**ISO/DIS 21927-5:2016(E)**
ISO/TC 21/SC 11/WG -
Secretariat: DIN

**Smoke and heat control systems — Part 5: Powered smoke exhaust systems; requirements and design**

*Installations pour l'extraction de fumée et de chaleur — Partie 5: Systèmes d'extraction de fumée mécaniques: exigences et planification*

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Document type: International Standard
Document subtype:
Document stage: (40) Enquiry
Document language: E

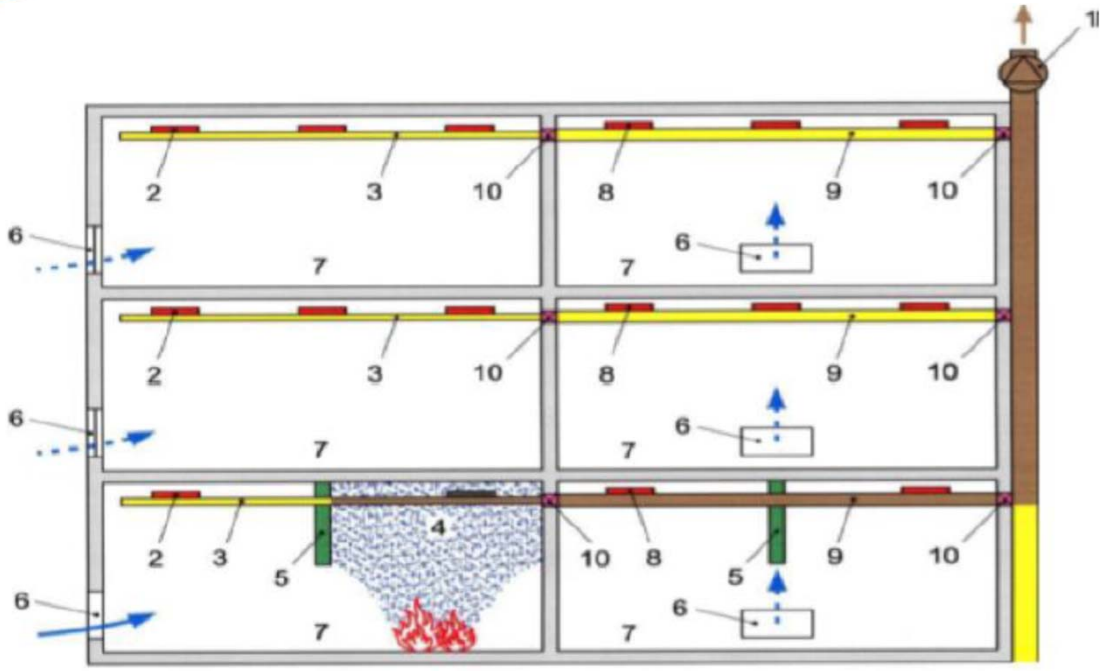
X:\TA2\TG2-1\NABAU\003_Neue_Struktur_Gremien_und_Normen\ISO\TC21\SC 11\Normen\21927-5\ISO_21927-5_(E).docx STD Version 2.8f

**THT-HATCH**

**THT-WALL**

**HTMF**

**THT ROOF**

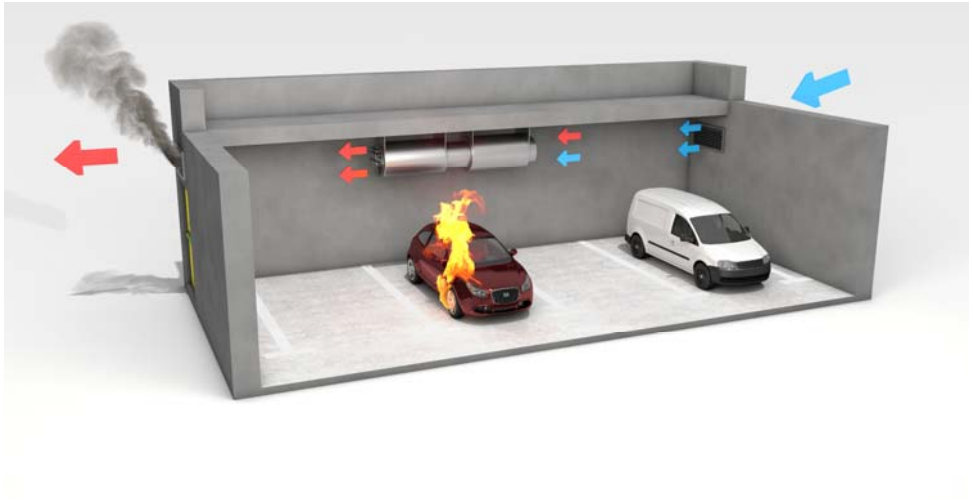


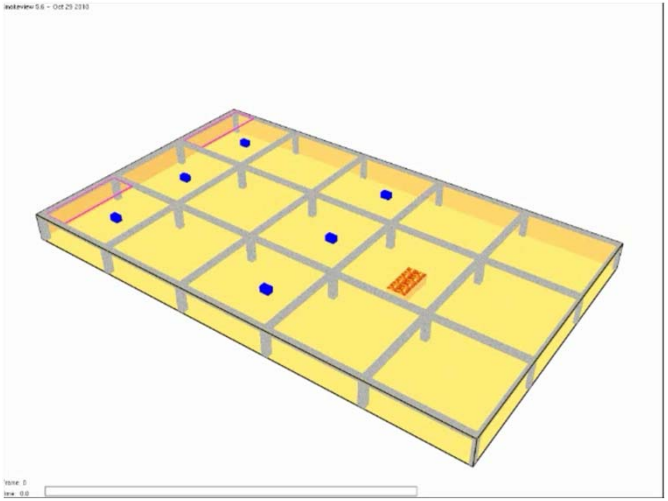
1. Smoke extract fan EN 12101-3
2. Smoke control damper, single compartment EN1366-10
3. Smoke control duct, single compartment EN12101-7 & 1366-9
4. Smoke
5. Smoke Barrier EN 12101-1
6. Supply air
7. Fire compartment
8. Smoke control damper, multi compartment EN1366-10
9. Smoke control duct, multi
10. Compartment EN12101-7 & 1366-8
11. Smoke control damper, multi compartment EN1366-10

## HORIZONTAL VENTILATION

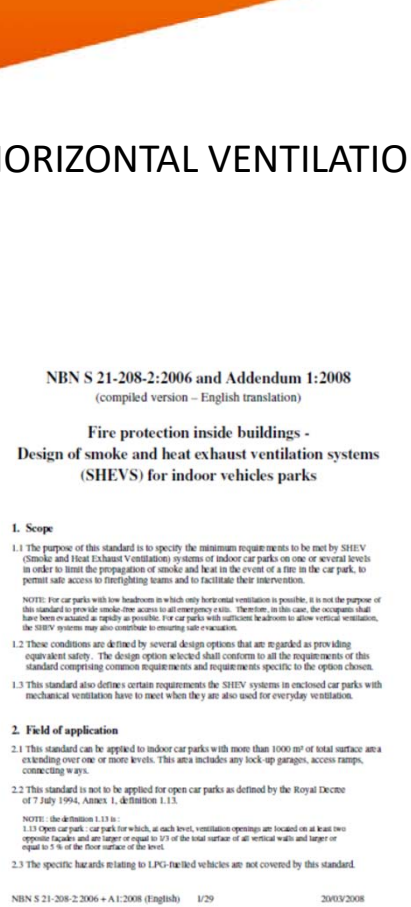
This system is used in areas that do not have high enough ceilings to use a smoke buoyancy based system, and which might have one or two of its other dimensions (width and length) bigger than the ceiling height. (e.g. tunnels, and some types of carparks, …)

As it is not possible to create two vertical zones, the goal is to create two horizontal zones, so that there are parts of the building free of smoke.





# HORIZONTAL VENTILATION. DESIGN STANDARDS



NBN S 21-208-2:2006 and Addendum 1:2008
(compiled version – English translation)

Fire protection inside buildings -
Design of smoke and heat exhaust ventilation systems
(SHEVS) for indoor vehicles parks

1. Scope

1.1 The purpose of this standard is to specify the minimum requirements to be met by SHEV (Smoke and Heat Exhaust Ventilation) systems of indoor car parks on one or several levels in order to limit the propagation of smoke and heat in the event of a fire in the car park, to permit safe access to firefighting teams and to facilitate their intervention.

NOTE: For car parks with low headroom in which only horizontal ventilation is possible, it is not the purpose of this standard to provide smoke-free access to all emergency exits. Therefore, in this case, the occupants shall have been evacuated as rapidly as possible. For car parks with sufficient headroom to allow vertical ventilation, the SHEV systems may also contribute to ensuring safe evacuation.

1.2 These conditions are defined by several design options that are regarded as providing equivalent safety. The design option selected shall conform to all the requirements of this standard comprising common requirements and requirements specific to the option chosen.

1.3 This standard also defines certain requirements the SHEV systems in enclosed car parks with mechanical ventilation have to meet when they are also used for everyday ventilation.

2. Field of application

2.1 This standard can be applied to indoor car parks with more than 1000 m² of total surface area extending over one or more levels. This area includes any lock-up garages, access ramps, connecting ways.

2.2 This standard is not to be applied for open car parks as defined by the Royal Decree of 7 July 1994, Annex 1, definition 1.13.

NOTE : the definition 1.13 is :
1.13 Open car park : car park for which, at each level, ventilation openings are located on at least two opposite façades and are larger or equal to 1/3 of the total surface of all vertical walls and larger or equal to 5 % of the floor surface of the level.

2.3 The specific hazards relating to LPG-fuelled vehicles are not covered by this standard.

NBN S 21-208-2:2006 + A1:2008 (English) 1/29 20/03/2008

BS 7346-7:2013

BSI Standards Publication

Components for smoke and heat control systems –
Part 7: Code of practice on functional recommendations and calculation methods for smoke and heat control systems for covered car parks

bsi.

UNE

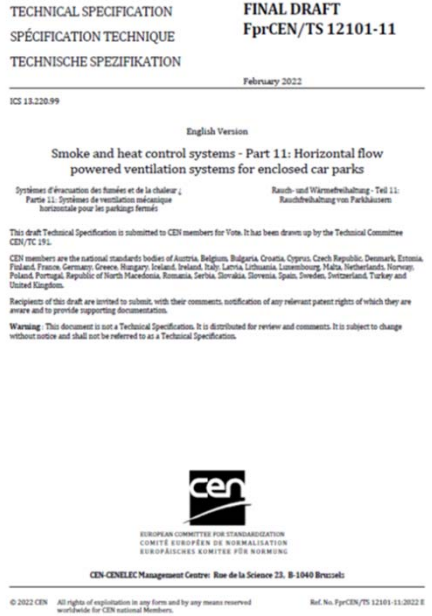
Norma Española
UNE 100166
Julio 2019

Climatización
Ventilación de aparcamientos

Esta norma ha sido elaborada por el comité técnico CTN 100 *Climatización*, cuya secretaría desempeña AFEC.

AFEC

UNE Asociación Española de Normalización Génova, 6 - 28004 Madrid 915 294 900 info@une.org www.une.org



TECHNICAL SPECIFICATION
SPÉCIFICATION TECHNIQUE
TECHNISCHE SPEZIFIKATION

FINAL DRAFT
FprCEN/TS 12101-11

February 2022

ICS 13.220.99

English Version

Smoke and heat control systems - Part 11: Horizontal flow powered ventilation systems for enclosed car parks

Systèmes d'évacuation des fumées et de la chaleur - Partie 11: Systèmes de ventilation mécanique horizontale pour les parkings fermés

Rauch- und Wärmefreihaltung - Teil 11: Rauchfreihaltung von Parkhäusern

This draft Technical Specification is submitted to CEN members for Vote. It has been drawn up by the Technical Committee CEN/TC 191.

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COMITÉ EUROPÉEN DE NORMALISATION
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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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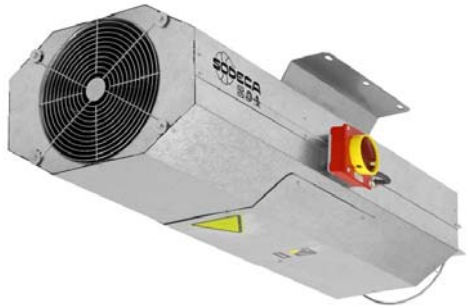
Ref. No. FprCEN/TS 12101-11:2022 E

**THT-IMP-C**

**CI**

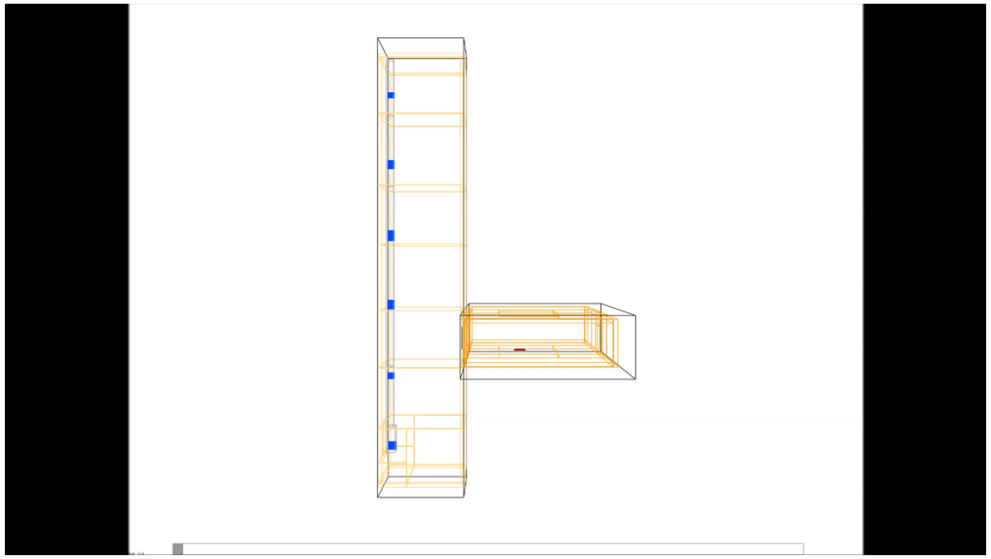


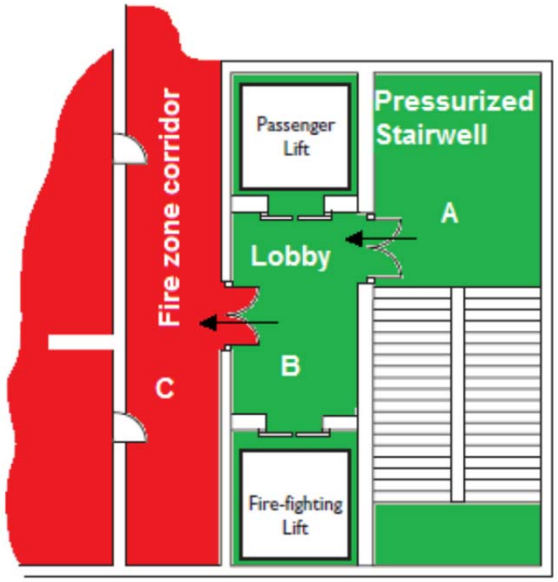
**THT-IMP-L-LS**

## PRESSURISATION SYSTEM OBJECTIVE

- The objective of a pressurisation system is to create a smoke-free protected space, either for the safe evacuation of people, for firefighting or for property protection.

- To achieve this objective, the pressurisation system must create a positive pressure between the safe area (escape route) and the adjacent accommodation area, so that smoke from fire does not leak through doors gaps into the protected area.

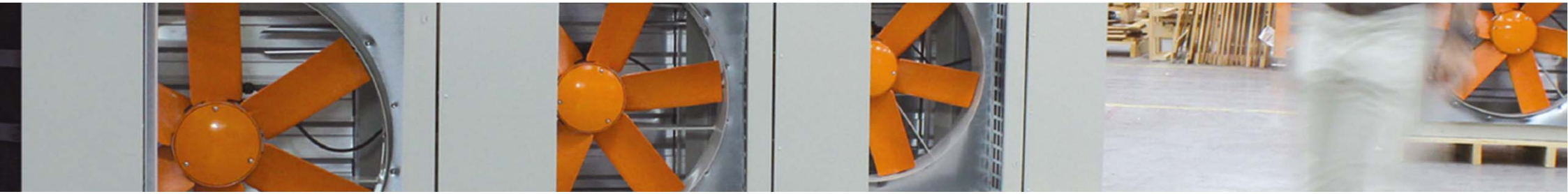




**Closed door**: When doors are closed, a **high enough overpressure level** in the staircase with respect to the unprotected area will prevent the infiltration of smoke into the staircase. This overpressure must be maintained in zones “A” and “B” so that the air flow always goes from the protected zone to the unprotected zone.

**Warning**: The overpressure level must not be so high as to impede the opening of doors connecting the unprotected zone with the protected zone, so it is necessary to maintain an appropriate balance between the minimum pressure to prevent the smoke infiltration, and the maximum pressure to allow the opening of doors.

**Open door**: When doors between the protected and unprotected zone are opened during evacuation, the gaps are much larger and the pressure tends to equalize between both zones. The pressurisation system must quickly increase the airflow supplied into the protected zone to provide a minimum air velocity through the open door.



# PRESSURISATION CONTROL SYSTEMS

FOR STAIRCASES, FIRE-FIGHTING LOBBIES AND ESCAPE ROUTES

# STAIRCASE
# NATURAL VENTILATION

SODECA

SODECA

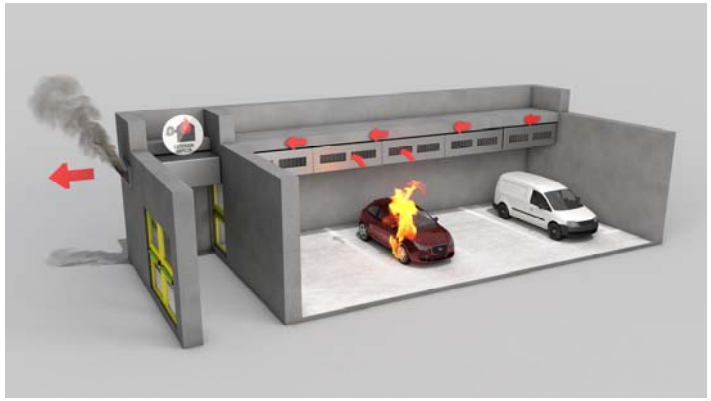
# SMOKE EXTRACTION

The goal is to have a system able to extract smoke generated during  a fire. The system has to work during and after a fire in order to clear smoke from the building.

It is mainly designed to achieve a set number of air changes per hour or an extraction rate related to other parameters (i.e. an airflow rate per car in carparks).

It can be also be used for smoke extraction after the fire, where a supression system is also installed (ESFR sprinklers, water mist system , inert gas system…)

**CJTHT**



**CJBD**

**THT**

**CJTCR - R**

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