

# L'impiego del poliuretano espanso nelle costruzioni. Opportunità e sicurezza antincendio

24 maggio 2016

ISA - Istituto Superiore Antincendi

**La valutazione del comportamento al fuoco  
delle facciate con l'isolamento a cappotto.  
Stato dell'arte in Europa**

**Arch. Sergio Schiaroli**

**Esperto Permanente per il Requisito sicurezza in caso d'incendio nel Comitato Permanente  
per le Costruzioni (CPD e CPR)**



# DEFINIZIONI

- **SISTEMI DI ISOLAMENTO A CAPPOTTO**
- **External Thermal Insulation Composite Systems (ETICS)**

Composti da

- un prodotto isolante prodotto in fabbrica incollato o fissato meccanicamente sulla parete.
- uno o più strati di rivestimento (intonaco) applicati in opera.

# DEFINIZIONI

## REGOLAMENTO (UE) N. 305/2011 Circolare del Ministero dell'Interno DCPREV 5043 del 15 aprile 2013

- **KIT**

un prodotto da costruzione immesso sul mercato da un singolo fabbricante come insieme di almeno due componenti distinti che devono essere assemblati per essere installati nelle opere di costruzione

# QUALIFICAZIONE

DM 26/06/1984

**OMOLOGAZIONE NON POSSIBILE**

**DIRETTIVA 89/106 CE  
REGOLAMENTO (UE) N. 305/2011**

Secondo specificazione tecnica armonizzata

**ETAG 004** Edition 2013 (emendamento entro 2018)

**GUIDELINE FOR EUROPEAN TECHNICAL APPROVAL**

of

**EXTERNAL THERMAL INSULATION**

**COMPOSITE SYSTEMS (ETICS) WITH RENDERING**

**MARCATURA CE VOLONTARIA**

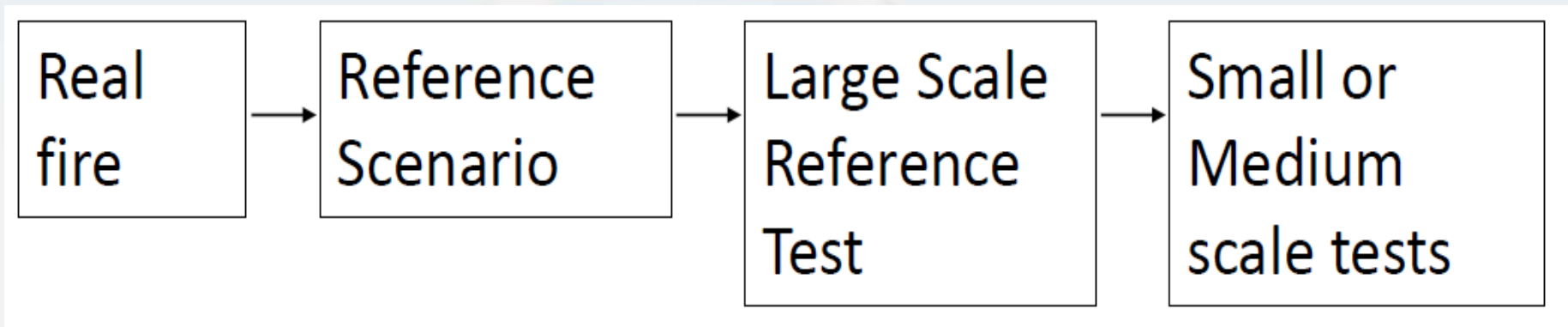


# ETAG 004 reaction to fire class

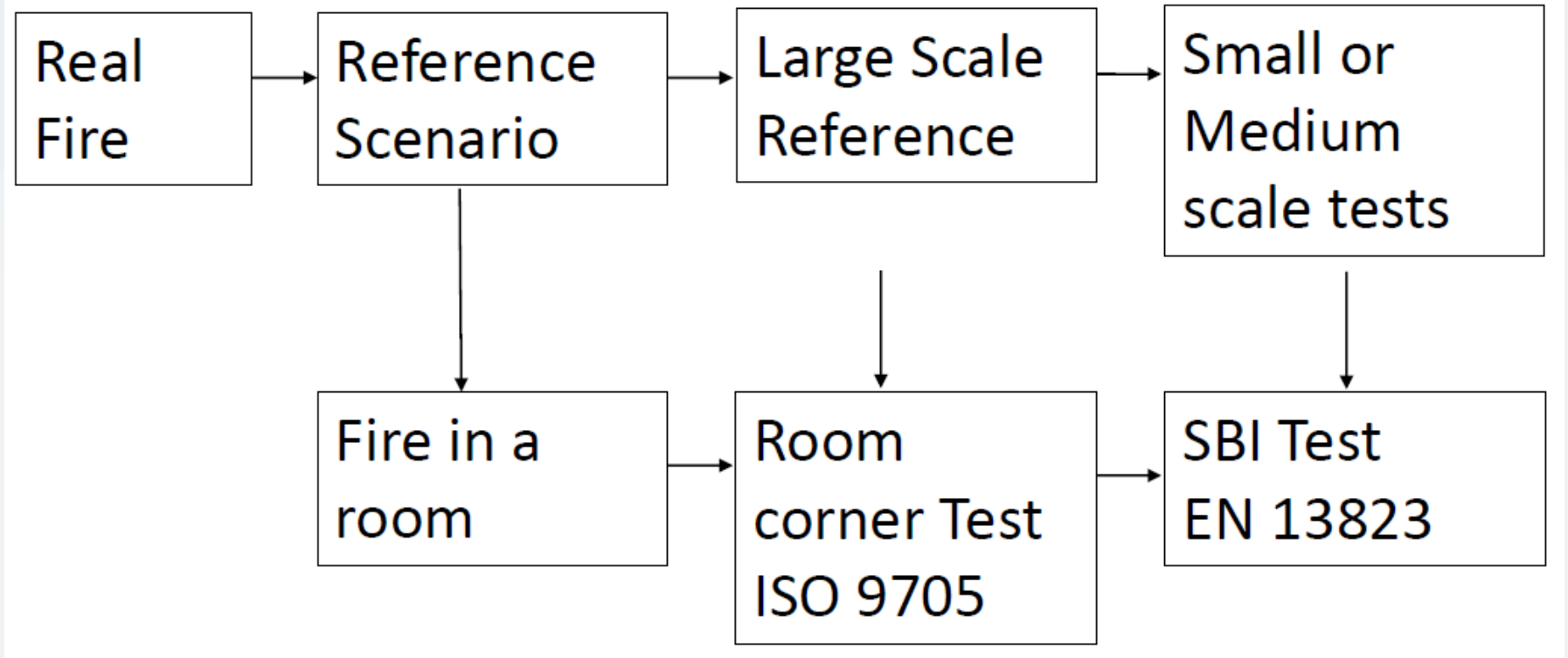
- Gli ETICS devono essere testati per essere classificati secondo **EN 13501-1**.
- Si determina la classe di reazione al fuoco dell'ETICS nel suo insieme (nella condizione più sfavorevole di montaggio e fissaggio) e quella del componente isolante.
- Se nessuna prestazione è determinata, il prodotto è in classe F.
- Nota: A European reference fire scenario has not been laid down for facades. In some Member States, the classification of ETICS according to EN 13501-1 might not be sufficient for the use in facades. An additional assessment of ETICS according to national provisions (e.g. on the basis of a large scale test) might be necessary to comply with Member State regulations, until the existing European classification system has been completed.



# FILOSOFIA DEL TESTING

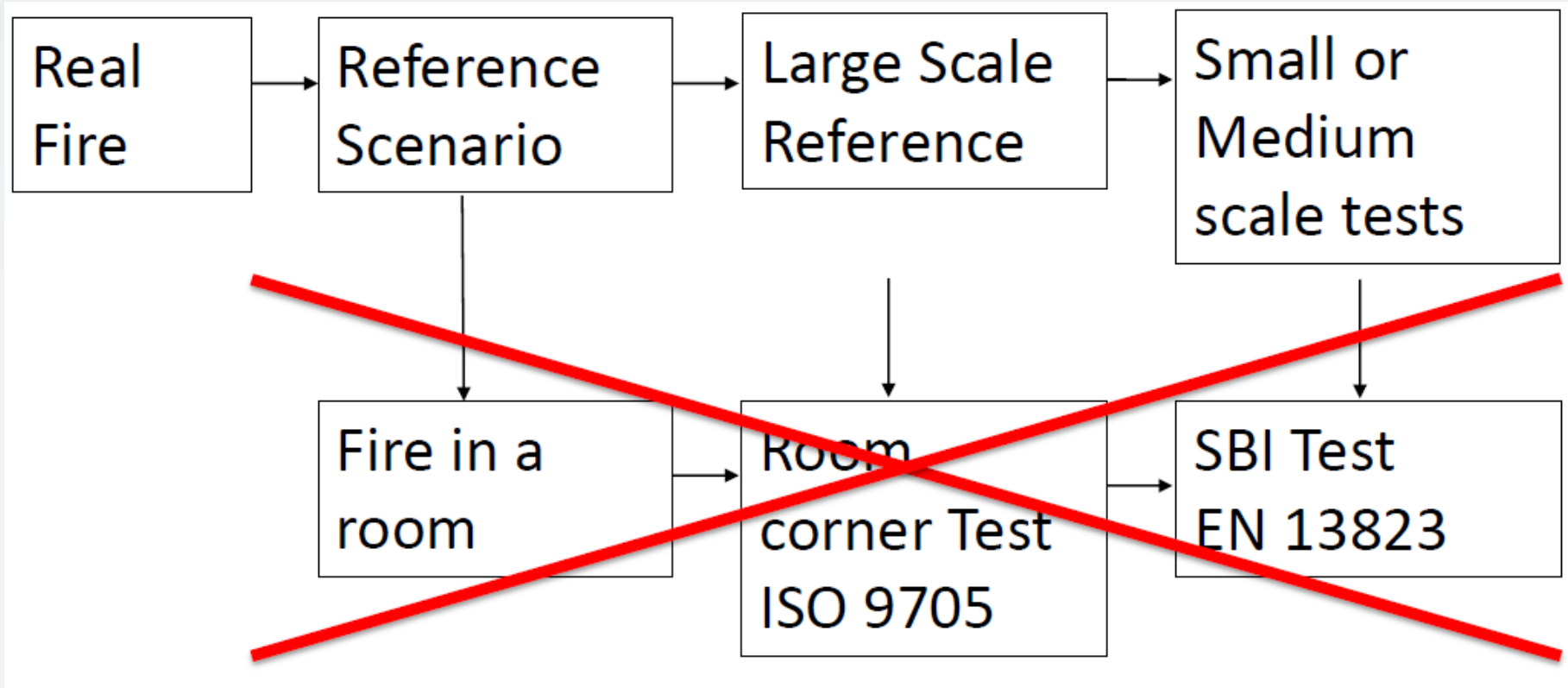


# LE EUROCLASSI





# LE EUROCLASSI e LE FACCIATE



# Metodi di prova europei

Standard	BS 8414-1	LEPIR II	MSZ 14800-6	SP FIRE 105	Önorm B 3800-5	PN-90/B-02867	DIN E 4102-20	ISO 13785-1
Country	UK	F	H	S, DK	A	PL	D	CZ, SK
Fire exposure	Wood crib, peak heat 3,5 MW, 4500 MJ	600 kg wood crib	650 kg wood crib, 3 MW approx. (controlled)	60 l heptane	25 kg wood / 320 kW propane	20 kg wood crib + wind towards the wall (2 m/s)	25 kg wood / 320 kW propane	100 kW propane
Max. heat flux on surface	70 kW/m <sup>2</sup> at 1 m height	Not specified	Not specified	15 or 80 kW/m <sup>2</sup>	Not specified	Not specified	70-95 kW/m <sup>2</sup> at 1 m height	Not specified
Max. temperature on surface	600° C / 20 min	Average 500° C, peak 800° C	600° C 0,5 m high / 50 min	450° C / 12 min	Not specified	800° C peak	Not specified	Max 150° C 0,5 m high
Test duration	30 min	60 min (30 min fire exposure)	60 min	Min. 12 min	30 min	30 min	21 min gas, 30 min wood	30 min
Test specimen	Corner 2,5 m x 8,0 m + 1,5 m x 8,0 m	Flat wall 5,3 m x 6,6 m	Flat wall 6,0 m x 7,0 m	Flat wall 4,0 m x 6,7 m	Corner 3,0 m x 6,0 m + 1,5 m x 6,0 m	Flat wall 2,3 m high	Corner 3,0 m x 5,2 m + 2,0 m x 5,2 m	Corner 1,2 m x 2,4 m + 0,6 m x 2,4 m
Substrate	Masonry or light frame	Any	Masonry	Aerated concrete	Aerated concrete	Masonry	Aerated concrete	12 mm Ca-Si board
Criteria	Temp. limits	Flame spread, temp. rise, falling parts	Temp. rise, fire spread, falling parts	Flames 2 floors above; Falling parts	Temp. rise, fire spread, falling parts	Temp. limits; Burning particles	Temp. rise, fire spread, falling parts	Not included

Standard	Country	Fire exposure	Max. heat flux on surface	Max. temperature on surface	Test duration	Test specimen	Substrate	Criteria <sup>a</sup>
BS 8414-1	UK	Wood crib, peak heat 3,5 MW, 4500 MJ	70 kW/m <sup>2</sup> at 1 m height	600°C / 20 min	30 min	Corner 2,5 m x 8,0 m + 1,5 m x 8,0 m	Masonry or light frame	Temp. limits
LEPIR II	F	600 kg wood crib	Not specified	Average 500°C, peak 800°C (read at 150 mm from the surface)	60 min, 30 min fire exposure	Flat wall 5,0 m x 6,6 m	Any	Flame spread, system Integrity, temp. rise, falling parts <sup>b</sup>
MSZ 14800-6	H	650 kg wood crib, 3 MW approx. (controlled)	Not specified	600°C 0,5 m high / 50 min	60 min	Flat wall 6,0 m x 7,0 m	Masonry	Temp. rise, fire spread, falling parts <sup>b</sup>
SP FIRE 105	S, DK	60 l heptane	15 or 80 kW/m <sup>2</sup>	450°C / 12 min	Min. 12 min	Flat wall 4,0 m x 6,7 m	Aerated concrete	Flames 2 floors above; Falling parts
Önorm B 3800-5	A	25 kg wood / 320 kW propane	Not specified	Not specified	30 min	Corner 3,0 m x 6,0 m + 1,5 m x 6,0 m	Aerated concrete	Temp. rise, fire spread, falling parts <sup>b</sup>
PN-90/B-02867	PL	20 kg wood crib + wind towards the wall (2 m/s)	Not specified	800°C peak	30 min	Flat wall 2,3 m high	Masonry	Temp. limits; Burning particles
DIN E 4102-20	D	25 kg wood / 320 kW propane	70-95 kW/m <sup>2</sup> at 1 m height	Not specified	21 min gas, 30 min wood	Corner 3,0 m x 5,2 m + 2,0 m x 5,2 m	Aerated concrete	Temp. rise, fire spread, falling parts <sup>b</sup>
DIBT procedure	D	200 kg wood crib	Not specified	Not specified	60 min, 25 min fire exposure	Corner 4 m x 9,8 m + 2 m x 9,8 m	Aerated concrete	Not Included
Procedure No. 281 – construction phase	I	30 kW propane burner	55-60 kW/m <sup>2</sup>	Not specified	15 min, 10 min fire exposure	3 m x 3 m insulation product uncovered	According to „end-use condition“	height of the damaged area < 250 cm and not extending to the edges; droplets not igniting the specimen
Procedure No. 281 – finished phase	I	300 kW propane burner	Not specified	Not specified	15 min, 10 min fire exposure	3 m x 3 m finished ET-ICS system	According to „end-use condition“	height of the damaged area < 250 cm and not extending to the edges
EOTA draft TR073, Exp. 1	EU	30 kg wood crib	Not specified	Not specified	60 min, 30 min fire exposure	Corner 2,8 m x 5,5 m + 1,5 m x 5,5 m	Any substrate	Temp. rise, fire spread, falling parts <sup>b</sup>
EOTA draft TR073, Exp. 2	EU	382,5 kg wood crib	Not specified	Not specified	60 min, 30 min fire exposure	Corner 2,8 m x 9,0 m + 1,5 m x 9,0 m	Any substrate	Temp. rise, fire spread, falling parts <sup>b</sup>
prEN 1364-6	EU	Standard temp./time curve	N/A	Defined by standard temp./time curve	Customer declaration	10x nominal width of cavity barrier, max 3 m	Aerated concrete	Integrity and insulation (180K max temp. rise)
ISO 13785-2	CZ, SK	Propane set by calibration	55 kW/m <sup>2</sup> at 0,6 m height	Min. 800°C	23-27 min	Corner 3,0 m x 5,7 m + 1,2 m x 5,7 m	Any	Not Included
ISO 13785-1	CZ, SK	Propane 100 kW	Not specified	Max. 150°C at 0,5 m height	30 min	Corner 1,2 m x 2,4 m + 0,6 m x 2,4 m	12 mm Ca-Si board	Not Included (CZ version: Internal temp.)
GOST 31251	AZ, AM, KG, KZ, MD, RU, TJ, UZ, UA	Soft wood 700 MJ/m <sup>2</sup>	12,5 kW/m <sup>2</sup> at 2 m height	750°C at Intel	35 min	Flat wall 3,0 m x 5,1 m	Masonry, concrete	Not Included
JIS A 1310	JP	Propane 600 kW or more	Not specified	Not specified	25 min, 20 min fire exposure	Flat wall 1,8 m x 4,1 m	Two layers of 12 mm Ca-Si board	Not Included
NFPA 285	USA	Gas burner	38-40 kW/m <sup>2</sup> at 0,6-1,2 m height	538°C at 3 m height or in cavities; 260°C on the 2nd storey	30+10 min	Flat wall 4,1 m x 5,3 m	150 mm th. concrete wall	Flame spread, cavity fire spread, temp. rise <sup>c</sup>
NFPA 268	USA	Radiant panel 12,5 kW/m <sup>2</sup>	12,5 kW/m <sup>2</sup>	Not specified	20 min	Flat wall 1,2 m x 2,4 m	Steel tube	Ignition
CAN/ULC-S134	CAN	Propane set by calibration	45 kW/m <sup>2</sup> at 0,5 m height	Approx. 415°C	25 min	Flat wall 10 m high	Concrete	Vertical flame spread, heat flux
CAN/ULC-S101 + CAN/ULC-S114	CAN	Defined time/temp curve	Not specified	Not specified	Min. 15 min	Flat wall min. 2,8 m x 2,8 m	None	Integrity of top layer <sup>d</sup>

a) Additional criteria may be contained in other standards or regulations. b) Temperature rise, vertical and/or horizontal flame spread, burning droplets and particles, falling parts of certain size or mass.

c) Temperature rise, vertical and horizontal flame spread on or within the wall. d) Protection of foam plastics on external facade – protective layer must remain in place, no openings developed, does not disintegrate. S114 is additional non-combustibility requirement.

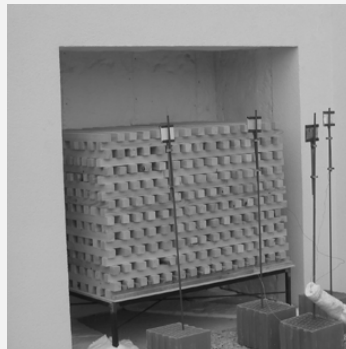
# UK – BS 8414-1

## A large scale façade test method

Corner 2,5 m x 8,0 m + 1,5 m x 8,0 m

The fire exposure conditions represent a fully-developed fire in a room, venting through an opening. The square opening of the combustion chamber has side length of 2 m and the fire source is a 382.5 kg wood crib with a nominal total heat output of 4500 MJ over 30 minutes at a peak rate of  $3\pm 0.5$  MW

Criteria: Temp. limits  
 $600^{\circ}$  C at 5 m  
above combustion  
chamber





# D - DIN E4102-20

Corner 3,0 m x 5,2 m + 2,0 m x 5,2 m

Fire source: 25 kg wood or 320 kW propane

Criteria: no fire spread 3,5 m above the lintel of fire chamber (window)

Temperature rise, vertical and/or horizontal flame spread, burning droplets and particles, falling parts of certain size or mass



# F - LEPIR II Arrêté du 24 mai 2010

Flat wall 5,3 m x 6,6 m

Two rooms on two levels, each with two windows

Spandrel representing level L+2

Fire source: two piles of wood (totalling 600 kg) = 9000 MJ to simulate the standard ISO fire curve

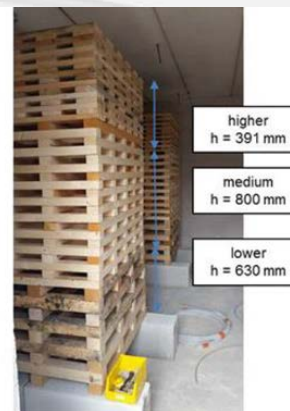
Criteria: For the first 30 minutes of the test

1 Ignition and vertical spread of fire

2 Lateral spread of fire

For ETICS

Integrity of external skin above 5.2 m





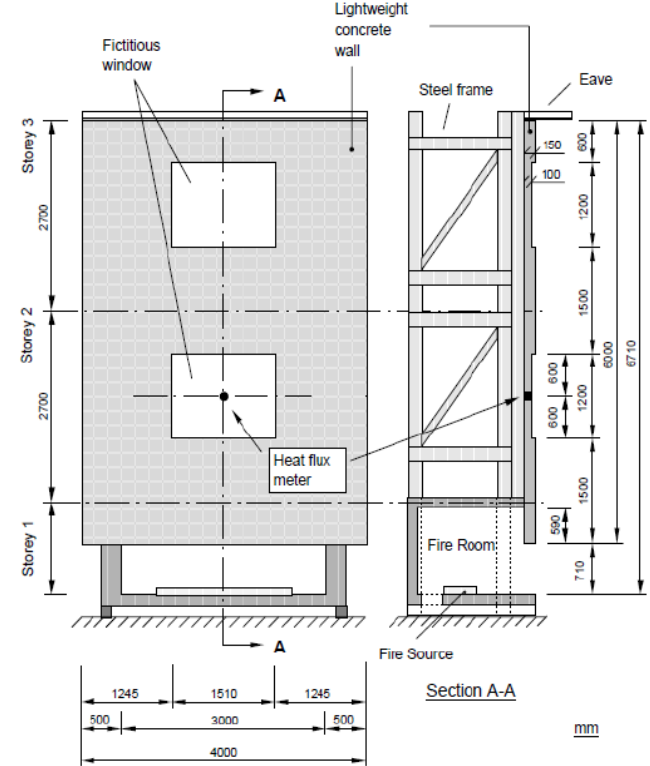
# S – DK SP FIRE 105

Flat wall 4,0 m x 6,7 m

Fire source: 60 l heptane

Criteria: Flames 2 floors above; Falling parts

surface temperature, measurements of gas temperature, velocity, and generation of gaseous species such as CO<sub>2</sub> and CO and depletion of O<sub>2</sub> were made





# CZ-SK ISO 13785-1

Corner 1,2 m x 2,4 m + 0,6 m x 2,4 m

Fire source: 100 kW propane

Criteria: Temperature rise, vertical and/or horizontal flame spread, burning droplets and particles, falling parts of certain size or mass  
Average of total heat flux and temperature



# EOTA N073 Technical Report

## Large Scale Fire Performance Testing of External Wall Cladding Systems

Una metodologia di prova per determinare:

- propagazione della fiamma,
- contributo all'incendio e
- prestazioni meccaniche

dei sistemi non portanti di chiusura delle facciate, con o senza isolamento.

La resistenza al fuoco non è presa in considerazione

L'esposizione al fuoco è rappresentativa:

- di un incendio in una stanza, (attraverso un'apertura)
- o una sorgente fuoco esterno

che espone il rivestimento agli effetti delle fiamme e dei fumi. Al fine di prendere in considerazione diversi requisiti normativi la metodologia si compone di due scenari differenti.

# EOTA N073 Technical Report

## Large Scale Fire Performance Testing of External Wall Cladding Systems

	EOTA draft TR073 Exp. 1	EOTA draft TR073 Exp. 2
Fire exposure	30 kg wood crib	382,5 kg wood crib
Max. heat flux on surface	Not specified	Not specified
Max. temperature on surface	Not specified	Not specified
Test duration	60 min (30 min fire exposure)	60 min (30 min fire exposure)
Test specimen	Corner 2,8 m x 5,5 m + 1,5 m x 5,5 m	Corner 2,8 m x 9,0 m + 1,5 m x 9,0 m
Substrate	Any substrate	Any substrate
Criteria	Temp. rise, fire spread, falling parts	Temp. rise, fire spread, falling parts

Una combinazione di 2 metodi di valutazione



# LA COMMISSIONE EUROPEA propone

- **Option A:**

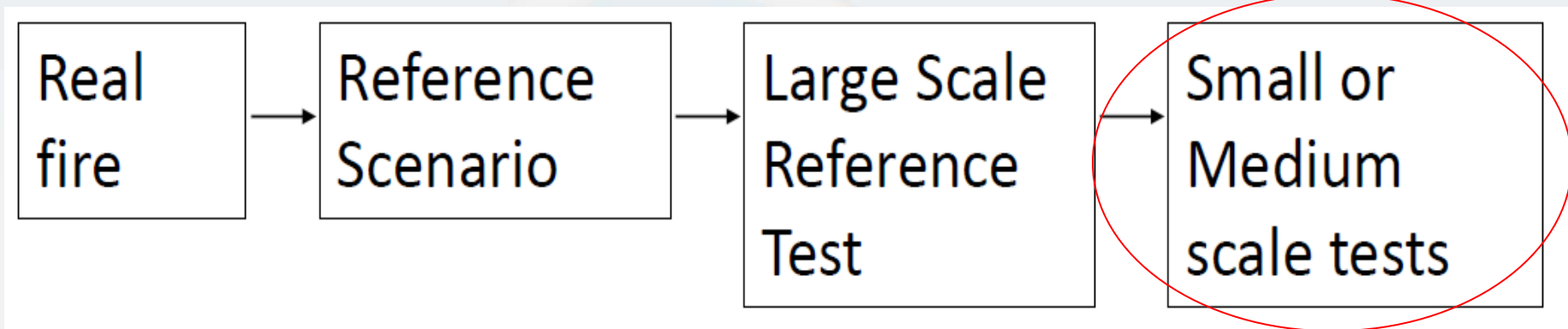
Utilizzare il BS 8414-1 (completato da SP Fire 105) come il metodo europeo di valutazione su larga scala per le facciate e mantenere il metodo DIN E 4102-20 come il metodo europeo di valutazione su piccola scala.

# LA COMMISSIONE EUROPEA propone

- **Option B:**

Continuare il lavoro basato sul TR073 di EOTA al fine di sviluppare il metodo europeo di valutazione su larga scala per facciate (BS 8414-1 + SP Fire 105) e (come secondo metodo) mettere a punto il metodo di DIN come il metodo europeo di valutazione su piccola scala.

# FILOSOFIA DEL TESTING



# IL PUNTO DI VISTA ITALIANO

Sviluppare mediante la ricerca prenormativa  
un unico metodo armonizzato,  
possibilmente su piccola o media scala



# Grazie per l'attenzione

