



# FISHWALL

**Fire and Seismic performances of Hybrid fire WALLs in case of single-storey industrial and commercial steel buildings**



## SESSION: Experimental campaign – Results and exploitation of fire tests

- **Extended fire resistance application rules for sandwich panels**
- **Tommy Gelders**
- **Joris Ide NV**



# Joris Ide group & Euroclad group

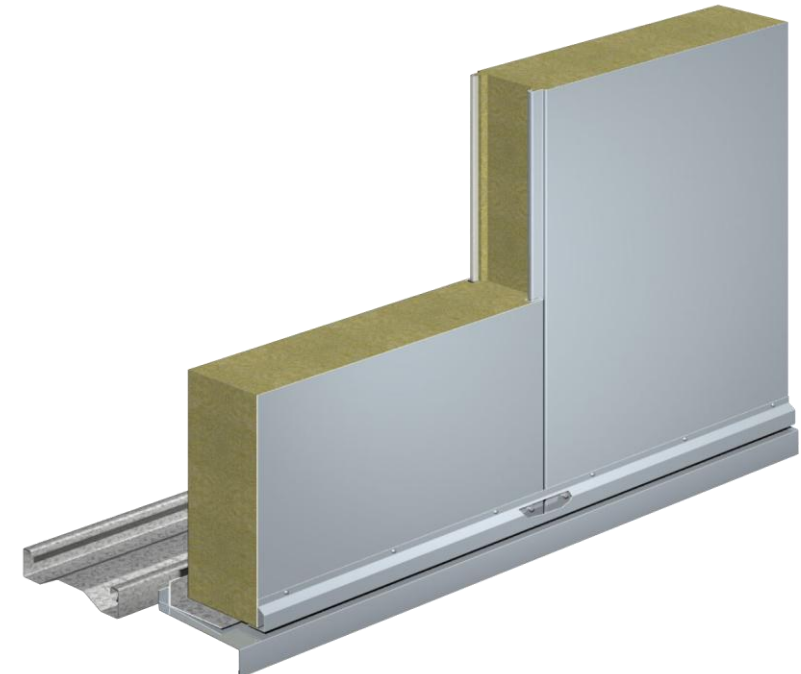
## ➤ Joris ide group

- ❖ 40 years of experience
- ❖ Represented in 15 countries
- ❖ 22 production sites across west-europe
- ❖ 1700+ employees



## ➤ Euroclad group

- ❖ 43 years of experience
- ❖ 345+ employees
- ❖ 3 production sites in the UK
- ❖ 3 divisions:
  - Euroclad systems
  - **Eurobond panels**
  - Euroclad architectural





# Objectives & goals

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- **Fire performance testing on large span panels**
- **Synthesis of existing extended application rules**
- **Propose standardisation amendments (if necessary)**



# Methodology – general

## ➤ Fire testing acc. EN 1364-1

- ❖ Targeted performance is fire integrity (E) and thermal insulation (I)
- ❖ Additionally: thermal radiation (W)
- ❖ Defined in minutes
- ❖ Specific direction (« inside-outside »)

## ➤ Panel configurations

- ❖ Horizontal & vertical
- ❖ With and without additional supporting beam

## ➤ additionally

- ❖ Measurement of  $\Delta c$  and  $\Delta f$



# Relevant standards

## ➤ EN 1364-1

- ❖ Direct application
- ❖ Extension +1m possible

## ➤ EN 15254-5: 2018

- ❖ Extended application based on overrun of classification time

## ➤ EN15254-5: 2007/2009/2013

- ❖ Extended application based on  $\Delta c$  and  $\Delta d$

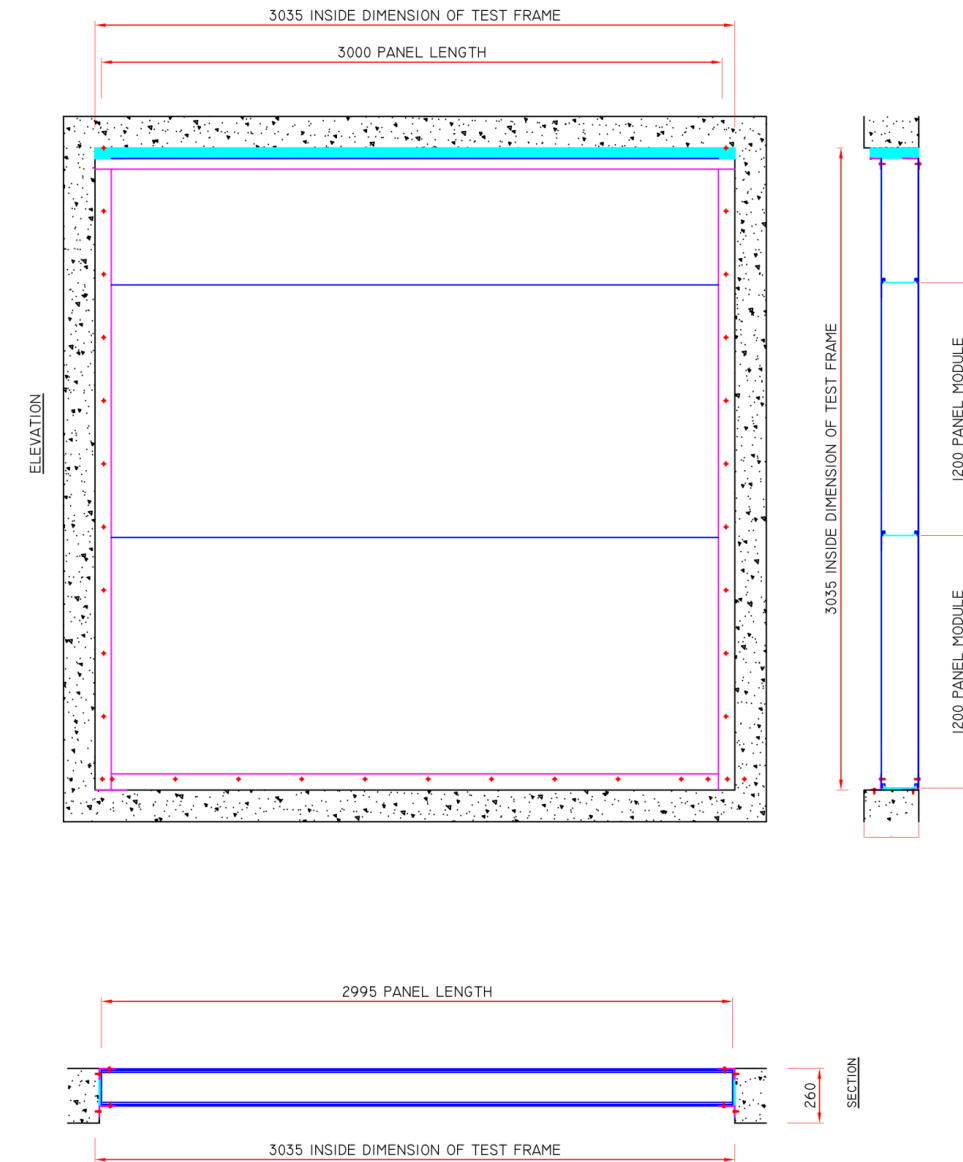
## ➤ New extended application rules proposed from the project IFBS/DIBT/PPA-Europe 2019

- ❖ Extended application based on overrun of classification time



# Extension rules acc. EN 1364-1 (direct application)

- Minimum tested height: 3m (unsupported) or 2,8m (supported)
- Maximum lateral deflection: 100mm
- Allowed extension = 1m
- Expansion allowances are increased pro-rata





# Extension rules acc. EN 15254-5:2018 (extended application)

➤ Testing still according to EN1364-1

➤ Extrapolation based on overrun time:

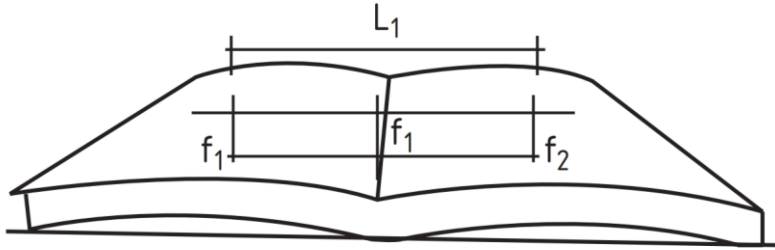
Tested span length	Extrapolation
3 m	Up to 6 m if 20 % overrun, minimum 10 min.
3 m	Up to 7,5 m if 35 % overrun, minimum 10 min.
> 4 m	Up to tested length + 2 m, if 20 % overrun, minimum 10 min.

➤ Extension length limited to 10m

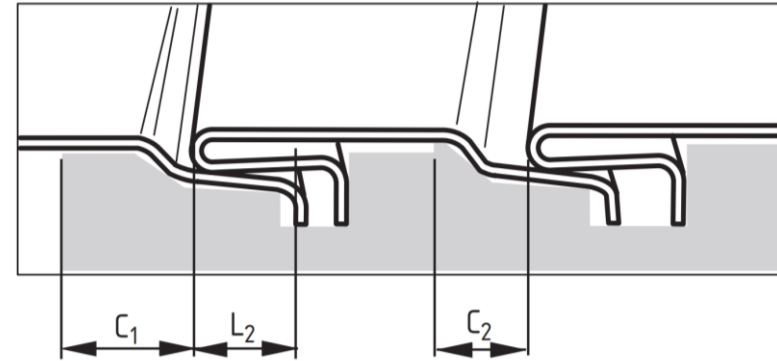


# Extension rules acc. EN 15254-5 – older versions (2007, 2009, 2013)

## ➤ Delta, f



## Delta, c



- « In order to extend the span above 4 m, there shall be an overrun of at least 20 % subject to a minimum 10 min compared to the classification. »
- Extension only allowed if  $\text{delta}, c \leq 0,5$
- Extension up to 12m if  $\text{delta}, f \leq 0,01$
- Extension up to 4m if  $\text{delta}, f > 0,06$
- Values in between: linear interpolation
- Values of  $\text{delta}, f$  and  $\text{delta}, c$  measured at the time of the foreseen fireclass should be used.
- Additional requirements:
  - ❖ stitching (every 3m)
  - ❖ only tested orientation
  - ❖ check of fasteners



# Extension rules acc. IFBS/DIBT/PPA Europe project (2019)

## ➤ Rules based of overrun of classification time

### ❖ Horizontal application:

Tested span length	Extrapolation
From 3 m to 6m	-20 minutes by span meter
From 6 m to 7.5m	-35 minutes by span meter
From x meter to $x+2m \leq 10m$	-35 minutes by span meter

Table 5.1 — New extended application rule for horizontal application proposed in the project  
IFBS/DIBT/PPA Europe

### ❖ Vertical application:

Tested span length	Extrapolation
From 3 m to 6m	-35 minutes by span meter

Table 5.2 — New extended application rule for vertical application proposed in the project  
IFBS/DIBT/PPA Europe



# Test configurations

- **Sandwich panels type Eurobond Rockspan Extra**
  - ❖ Knauf Stonewool Lamellas (121kg/m<sup>2</sup>) core, 175mm thickness
  - ❖ 0,6mm thick powder coated steel facings
  - ❖ Visible fixation
  - ❖ Joint sealant applied between panel joints
  - ❖ Held in place by 2,0mm thick galvanised steel angle profiles
  - ❖ One edge unrestrained to incorporate a free edge (filled with mineral fibre-based insulation)
  - ❖ No stitching
  
- **Referentie tests 3mx3m**
  - ❖ Standard testing acc. EN1364-1
  
- **Testing for fishwall:**
  - ❖ Large scale testing: 5m (width of oven) x 6m (height of oven)
  - ❖ Horizontal & vertical
  - ❖ Tested with & without with additional support



# Vertical installation

- 6 m (height) x 5 m (width), panels of 6m length used
- With and without additional support (at 5,5m)
- Detailed measurement of delta,c- and delta,f-values during test





# Horizontal installation

- 6 m (height) x 5 m (width), panels of 5m length used
- With and without additional support (at 4,5m)
- Detailed measurement of  $\delta$ ,  $c$ - and  $\delta$ ,  $f$ -values during test





# Test results: overview

	Span tested	Integrity	Insulation	Radiation	Classification
Horizontal	3mx3m	216	216	216	EI210
	5mx6m	126	126	126	EI120
	5mx6m (with intermediate steel column)	163	122	163	EI120
Vertical	3mx3m	198	198	198	E180
	5mx6m	94	94	94	EI90
	5mx6m (with intermediate steel column)	141	104	141	EI90



# Results – conclusion & amendment proposal part 1

- Based on the new extended application rules proposed from IFBS/DIBT/PPA-Europe 2019 project
- **First amendment: span extrapolation rules for mineral wool sandwich panel spanning horizontally**
  - ❖ extension above 4 m for panel spanning horizontally is possible if:
    - The performance continues to decrease to the level of the possible lower classification of EN 13501-2 (60, 90, 120, 180) below the level obtained in the 3 m x 3 m tests after the reduction time rules defined below
    - A safety gap of a few minutes should be defined in connection with committee 15254-5 (same gap as EN 1364-1 or EN 1634-1)
    - The field of application of the extended rules is limited to 7.5 m maximum
    - The extension rules arrive in addition to the extensions which are already allowed in the EN 1364-1 standard
    - There is no beam or column on the reference test following EN 1364-1
    - If we lose the E level, we must be at the same level of E (Rules given by EN 1363-1 and EN 13501-2)
    - Minimum characteristics of the mineral wool panel have to be followed

Length of the tested span	Extrapolation
From 3 m to 6 m	-20 minutes per span meter
From 6 m to 7.5 m	-35 minutes per span meter



# Results – conclusion & amendment proposal part 2

- Based on the new extended application rules proposed from IFBS/DIBT/PPA-Europe 2019 project
- **Second amendment: span extrapolation rules for mineral wool sandwich panel spanning vertically**
  - ❖ extension above 4 m for panel spanning horizontally is possible if:
    - The performance continues to decrease to the level of the possible lower classification of EN 13501-2 (60, 90, 120, 180) below the level obtained in the 3 m x 3 m tests after the reduction time rules defined below
    - A safety gap of a few minutes should be defined in connection with committee 15254-5 (same gap as EN 1364-1 or EN 1634-1)
    - The field of application of the extended rules is limited to 7.5 m maximum
    - The extension rules arrive in addition to the extensions which are already allowed in the EN 1364-1 standard
    - There is no beam or column on the reference test following EN 1364-1
    - If we lose the E level, we must be at the same level of E (Rules given by EN 1363-1 and EN 13501-2)
    - Minimum characteristics of the mineral wool panel have to be followed

Length of the tested span	Extrapolation
From 3 m to 6 m	-35 minutes per span meter





# Thank you for your attention!

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