PAM CPD

FIRE SAFETY & BUILDING CODES
FOR
EXTERNAL CLADDING SYSTEM

Ar Chong Lee Siong

18 January 2025

Built 1974

new façade cladding 2016

June 2017

Grenfell Tower, London

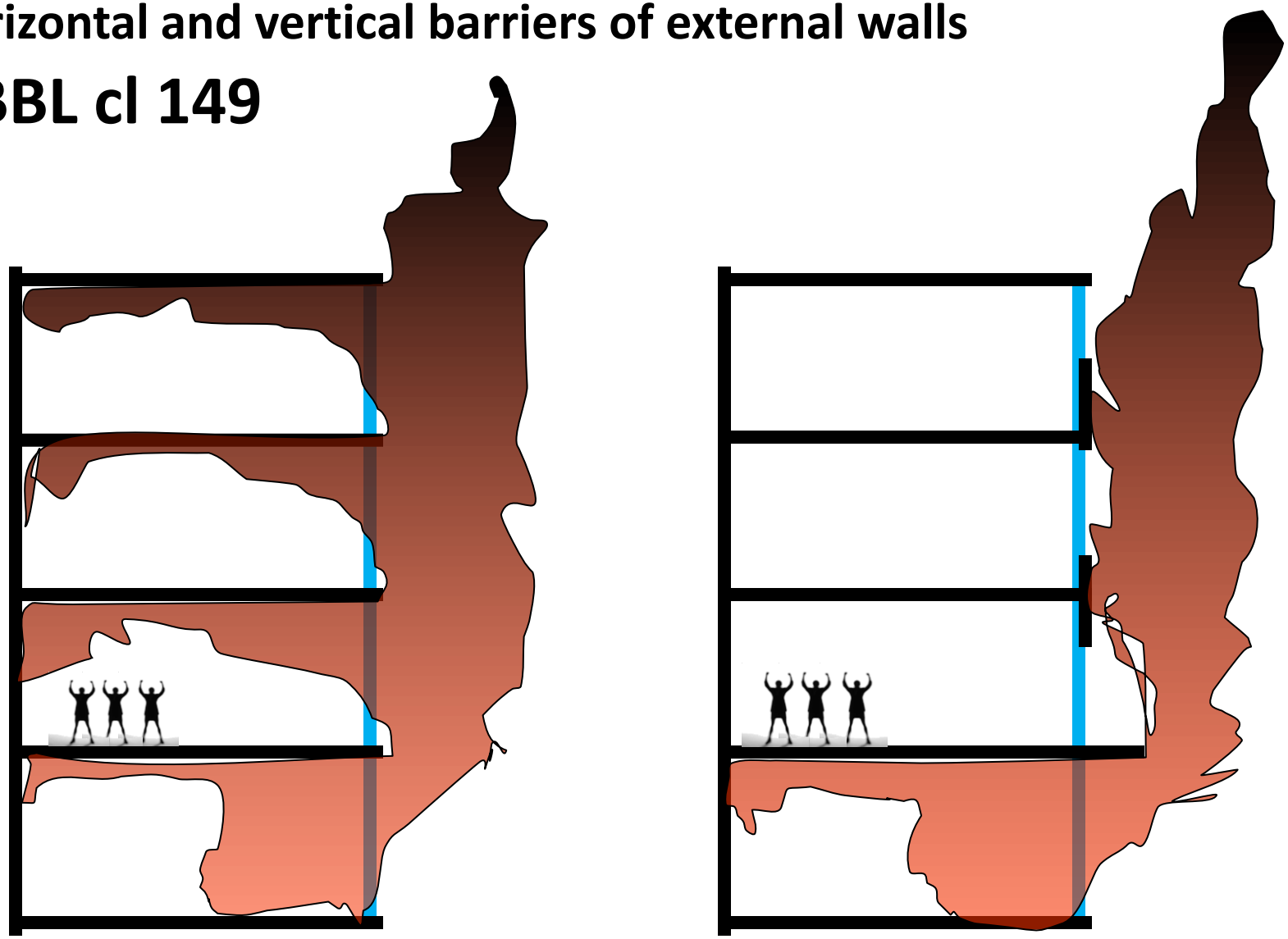
completed 2011 **Torre Dei Moro, Milan** August 2021

0.33 2.20 Flashover 3.46 5.20 Flameout

An apartment fire in Benidorm, Spain

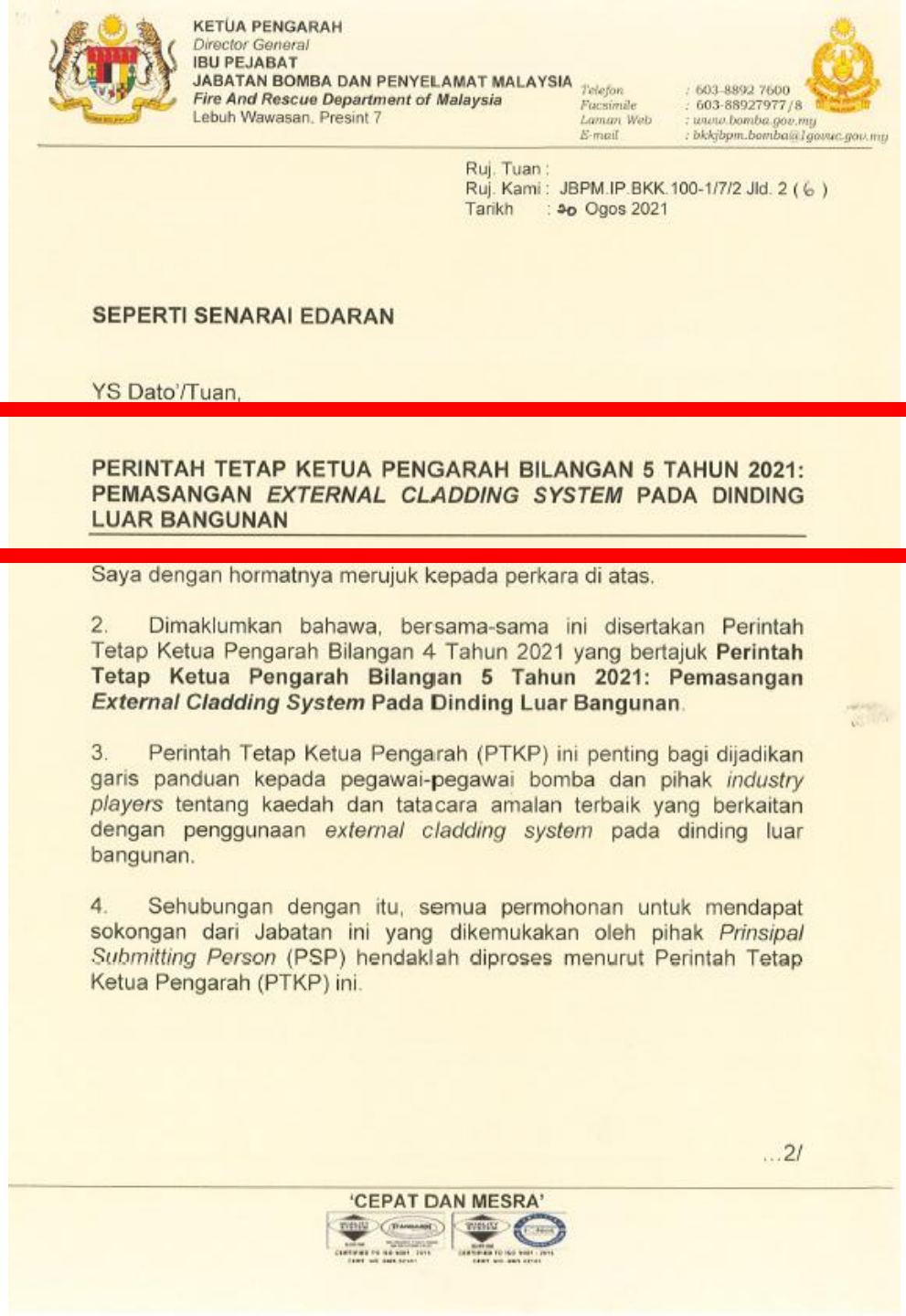
Horizontal and vertical barriers of external walls

UBBL cl 149



900mm vertical or
750mm horizontal barrier

External wall cladding system



KETUA PENGARAH
Director General
IBU PEJABAT
JABATAN BOMBA DAN PENYELAMAT MALAYSIA
Fire And Rescue Department of Malaysia
Lebuh Wawasan, Presint 7

Telefon : 603-8892 7600
Facsimile : 603-88927977/8
Laman Web : www.bomba.gov.my
E-mail : bkkjbpm.bomba@1govuc.gov.my

Ruj. Tuan :
Ruj. Kami : JBPM.IP.BKK.100-1/7/2 Jld. 2 (6)
Tarikh : 30 Ogos 2021

SEPERTI SENARAI EDARAN

YS Dato'/Tuan,

PERINTAH TETAP KETUA PENGARAH BILANGAN 5 TAHUN 2021: PEMASANGAN *EXTERNAL CLADDING SYSTEM* PADA DINDING LUAR BANGUNAN

Saya dengan hormatnya merujuk kepada perkara di atas.

2. Dimaklumkan bahawa, bersama-sama ini disertakan Perintah Tetap Ketua Pengarah Bilangan 4 Tahun 2021 yang bertajuk **Perintah Tetap Ketua Pengarah Bilangan 5 Tahun 2021: Pemasangan *External Cladding System* Pada Dinding Luar Bangunan**.

3. Perintah Tetap Ketua Pengarah (PTKP) ini penting bagi dijadikan garis panduan kepada pegawai-pegawai bomba dan pihak *industry players* tentang kaedah dan tatacara amalan terbaik yang berkaitan dengan penggunaan *external cladding system* pada dinding luar bangunan.

4. Sehubungan dengan itu, semua permohonan untuk mendapat sokongan dari Jabatan ini yang dikemukakan oleh pihak *Prinsipal Submitting Person* (PSP) hendaklah diproses menurut Perintah Tetap Ketua Pengarah (PTKP) ini.

...2/

'CEPAT DAN MESRA'

CLADDING SYSTEM YANG DIPASANG PADA DINDING LUAR BANGUNAN

5. JBPM telah menetapkan bahawa mana-mana *cladding system* yang dipasang hendaklah berasaskan kepada keperluan berikut:

above 18m height
Full scale test
BS 8414

5.1 Bagi bangunan yang melebihi 18 meter tinggi diukur dari aras perkakas bomba hendaklah menggunakan bahan tidak mudah terbakar (non-combustible materials) dan telah diuji serta mematuhi *performance criteria* berdasarkan BS 8414.

below 18m height
Material test
Class 0
BS 476 part 6&7

5.2 Bagi bangunan yang ketinggiannya kurang 18 meter, *cladding* yang dipasang hendaklah dari jenis kelas 0 berdasarkan BS 476: Part 6 & 7.

5.3 Penentuan ujian *cladding system* dari bahan kelas 0 dan ujian *performance criteria* (full-scale test) adalah seperti di Lampiran A.

PERAKUAN BAHAN PEPASANGAN KESELAMATAN KEBAKARAN BAGI _CLADDING_

1984

UBBL 2021

144. Cladding on external wall.	**144. Cladding on external wall.**
(1) Any cladding on any external walls, if such cladding is situated less than nt on the relevant boundary lying with the requirements f	(1) Any cladding on any external wall situated less than 2 metres from any point on the relevant boundary or if the building is more than 18 metres in height, the cladding shall be constructed entirely of non-combustible materials and when tested, shall demonstrate compliance in accordance with BS 8414.
(2) Any cladding on any metres or more from the relev building is more than 18 m surfac complying with the in by-law 204 exc cladding below the height o ound may consist of timber of s finished thickness or of a material having a surface which, when tested in accordance with BS 476: Part 6: 1968, has an index of performance not exceeding twenty.	(1) Any cladding on any external wall, if such cladding is situated more than 2 metres from any point on the relevant boundary and the building is less than 18 metres in height, the cladding shall have a surface complying with the requirements for Class O when tested in accordance with ~~in~~ by-law 204

above 18m height
Full scale test
BS 8414

below 18m height
Material test
Class 0
BS 476 part 6&7

144 CLADDING ON EXTERNAL WALL

UBBL 144(1)

- *144. (1) Any cladding on any external wall situated less than 2 metres from any point on the relevant boundary or if the building is more than 18 metres in height, the cladding shall be constructed entirely of non-combustible materials and when tested, shall demonstrate the compliance*
- *in accordance with BS 8414.*

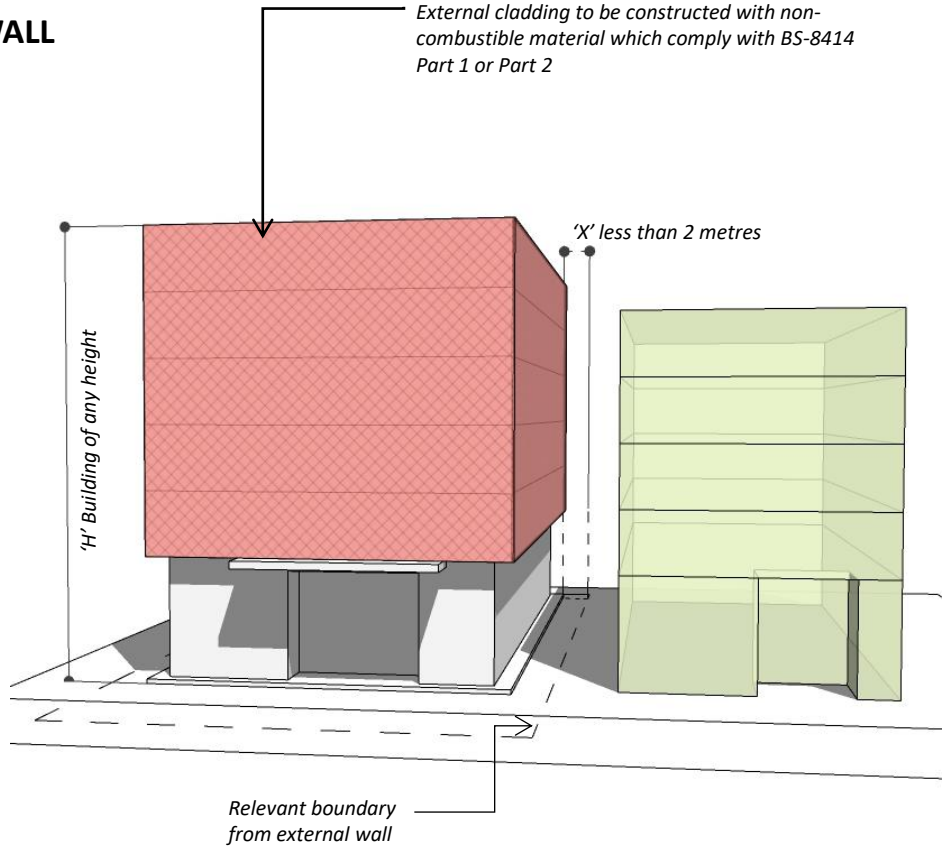


Diagram 4.5.8

Schematic of external cladding of building <18m height

< 2m from boundary OR

> 18m height, comply with BS8414

144 CLADDING ON EXTERNAL WALL

UBBL 144(1)

- *144. (1) Any cladding on any external wall situated less than 2 metres from any point on the relevant boundary or if the building is more than 18 metres in height, the cladding shall be constructed entirely of non-combustible materials and when tested, shall demonstrate the compliance*
- *in accordance with BS 8414.*

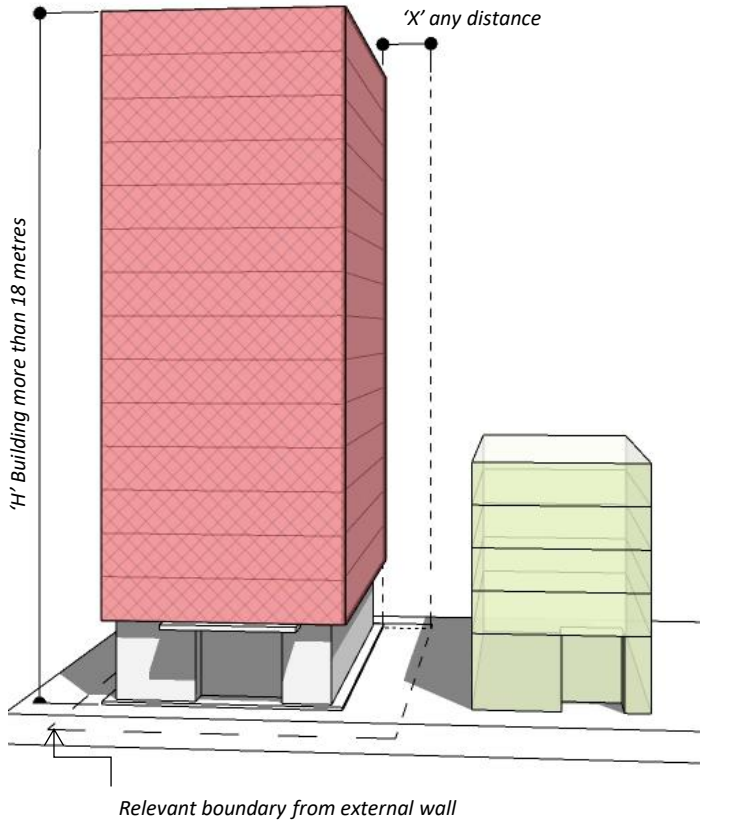


Diagram 4.5.9

Schematic of external wall of building >18m height

< 2m from boundary OR

> 18m height, comply with BS8414

144 CLADDING ON EXTERNAL WALL

UBBL 144(2)

- *Any cladding on any external wall, if such a cladding is situated more than 2 metres from any point on the relevant boundary and the building is less than 18 metres in height, the cladding shall have a surface complying with the requirements for Class O when tested and in accordance with by-law 204.*

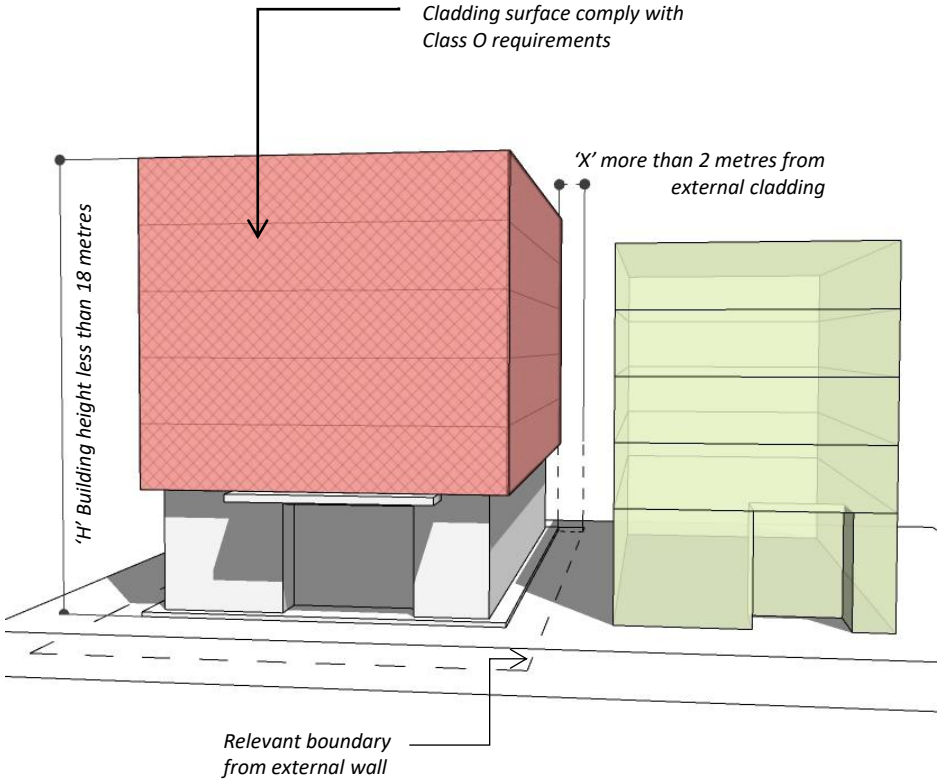


Diagram 4.5.10

Schematic of external cladding of building<18m height

> 2m from boundary AND

< 18m height, comply with Class O

Class 0

BS 476 part 6 Fire Propagation Test

BS 476 part 7 Surface Spread of Flame Test

UBBL 204 : Spread of flame classification

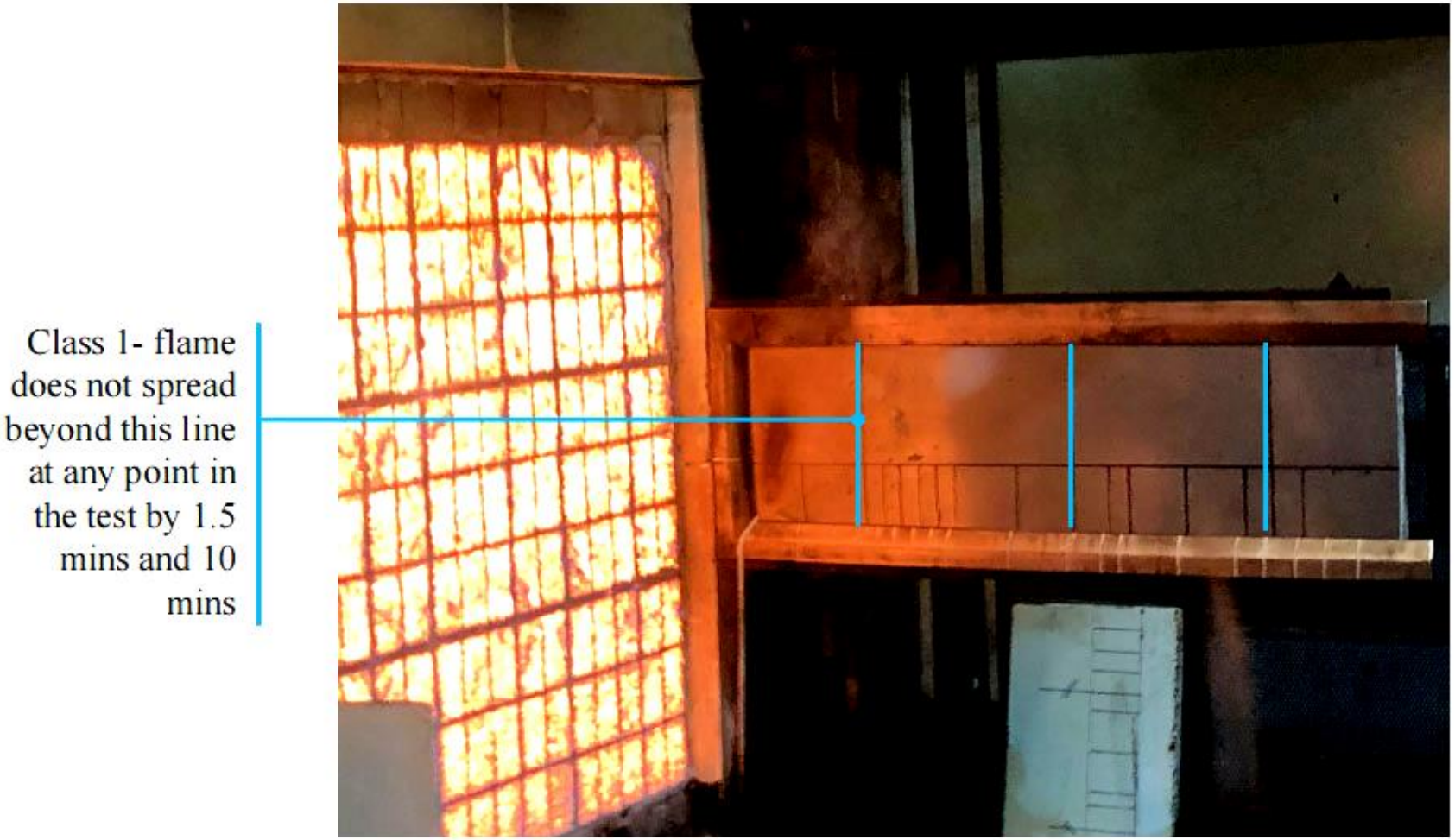


Image source: Arup's slides

UBBL 204 : Spread of flame classification

BS 476-7

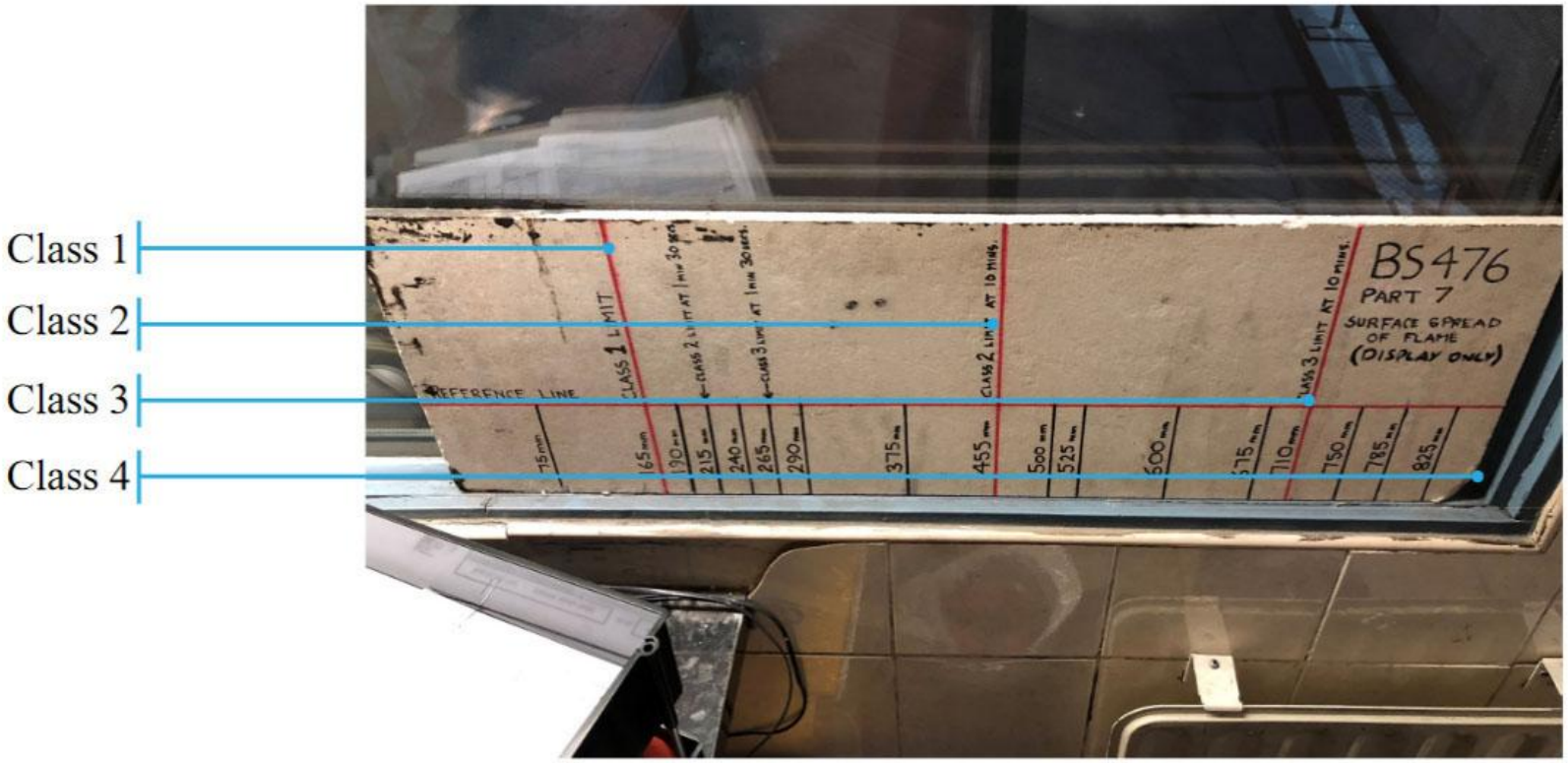


Image source: Arup's slide

UBBL

204. Classification of restriction of flame over surface wall and ceiling

(a) Any reference to a surface being **Class O** shall be construed as a requirement that

(i) The material of which the wall or ceiling is constructed shall be **non-combustible** throughout; **or**

(ii) the surface material, or if it is bonded throughout to a substrate, the surface material in conjunction with the substrate, shall when tested in accordance with **BS 476: Part 6** and **Part 7** have **an index of performance not exceeding 6.**

(b) Any reference to a surface being of a class other than Class O shall be construed as a requirement that the material of which the wall or ceiling is constructed shall comply with the relevant test criteria as to surface spread of flame specified in relation to that class in BS 476: Part 1: Clause 7.

(c) In relation to a requirement that a surface shall be of a class not lower than a specified class, Class 0 shall be regarded as the highest class followed in descending order by Class1, Class 2, Class 3 and Class 4.

UBBL 203 : Spread of flame classification

Classification of spread of flame				
Classification	**Spread of flame at 1.5 min**		**Final spread of flame**	
	Limit	**Limit for one specimen in sample**	**Limit**	**Limit for one specimen in sample**
	mm	mm	mm	mm
Class 1	165	165 + 25	165	165 + 25
Class 2	215	215 + 25	455	455 + 45
Class 3	265	265 + 25	710	710 + 75
Class 4	Exceeding the limits for class 3			

Image source: Arup's slide

So, what is “Class 0” ?

Class 0 is not a fire test classification, but is a definition in the UBBL.

For a material to be defined as “Class 0”, it has to:

1) achieve a Class 1 fire rating from BS476 Part 7 – Surface spread of flame

2) achieve an index of i1 = less than 6 from BS476 Part 6 Fire propagation.

BS 8414

CLADDING ON EXTERNAL WALL

INTRODUCTION OF BS 8414 TEST METHOD

- The uncontrollable fire spread on the facade of high-rise buildings have illustrated the importance of adequately testing external wall systems on a realistic scale.
- The BS 8414 test methods were developed by the Building Research Establishment (BRE). They evaluate whether a cladding system subject to fire breaking out of an opening (such as a window) in an external wall, will result in excessive fire spread up the outside of the building and the potential for fire to re-enter at a higher level.
- This test method is used to evaluate the design of a cladding system installed on the external walls and it is different from BS 476 which only conduct fire test on building materials and structures separately.
- This test is carried out in specialist laboratories such as SIRIM QAS International, and are performed on full-scale systems rather than small-scale samples which are carried out by BS 476 tests.
- It documents the fire propagation response of a complete cladding system as well as the conditions of elements of the cladding system such as cladding sheets, fixings, joints, corner flashing, insulation, fire stop and cavities at the end of the test.
- It does not cover the performance of doors, windows, balconies, or ancillary penetrations installed on the external walls. It also does not cover the exposure to radiant heat from the fire developed on the cladding to adjacent building.

CLADDING ON EXTERNAL WALL

BS 8414 IS A TWO PART STANDARD:

- **1. BS 8414-1:2015+A1_2017**
- This test method is to document the fire performance characteristics of non-loadbearing external cladding systems, rain screen over cladding systems, and external wall insulation systems when fixed to, and supported by, a masonry substrate and exposed to an external fire under controlled conditions.
- The peak fire exposure is intended to be representative of an external fire source or a fully developed (post-flashover) fire in a room venting from an aperture that exposes the cladding to the effects of external flames.
- This part of BS 8414 is solely intended to give an indication of fire spread across or within an external cladding system.

- **2. BS 8414-2:2015+A1_2017**
- This test method is to document the fire performance characteristics of non-loadbearing external cladding systems when fixed to, and supported by, a structural steel frame and exposed to an external fire under controlled conditions.
- The peak fire exposure is intended to be representative of an external fire source or a fully developed (post-flashover) fire in a room venting from an aperture that exposes the cladding to the effects of external flames.
- This part of BS 8414 is solely intended to give an indication of fire spread across or within an external cladding system.

CLADDING ON EXTERNAL WALL

- BS 8414 is a large-scale system test that mimics a fire breaking out of a window and exposing a cladding system to a severe fire.
- The cladding system must be tested to the full test duration of 60 minutes without any early termination of the test. The 60 minute test measures and evaluates fire spread and mechanical performance, including a 30 minute observation to evaluate propagation behaviour post exposure.
- Performance criteria for assessing cladding systems tested using BS 8414 are as follows:
- **1. External Fire Spread**
- Failure due to external fire spread is deemed to have occurred if the temperature rise above start temperature, *Ts* of any of the external thermocouples at level 2 exceeds 600°C for a period of at least 30 seconds, within 15 minutes of the start time, *ts*.

- **2. Internal fire spread**
- Failure due to internal fire spread is deemed to have occurred if the temperature rise above start temperature, *Ts* of any of the internal thermocouples at level 2 exceeds 600°C, for a period of at least 30 seconds, within 15 minutes of the start time *ts*.

- **3. Visible flaming**
- Failure of the system is deemed to have occurred if visible flaming, which exceeds the confines of the test rig either vertically or laterally during the full 60 minute test period, is observed. For the purposes of this clause, visible flaming is defined as a continuous flame which is observed for more than 60 seconds duration (i.e. not intermittent or glowing**)**

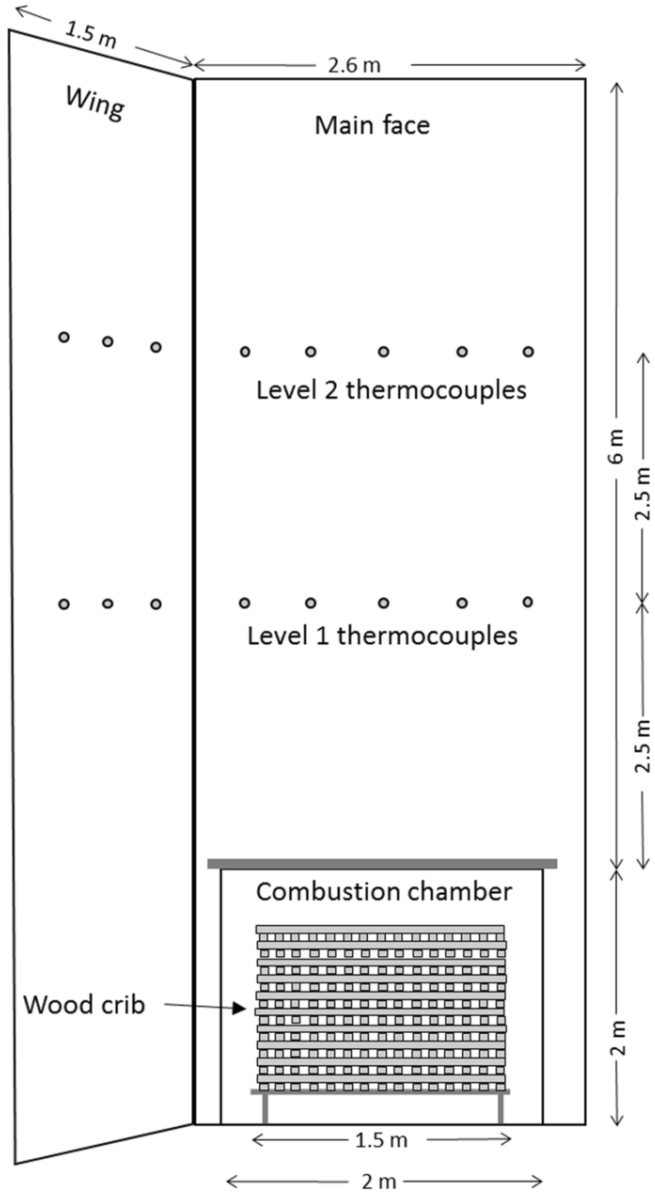


Image source: BS 8414

Diagram 4.5.11

Schematic of standard requirement for Test Apparatus

BS 8414 TEST FOR EXTERNAL CLADDING

- **4. Mechanical performance**
- Failure will be deemed to have occurred if there is collapse of the system or part thereof, flaming or not, onto the floor of the test facility outside the designated crib collapse zone, see note 1, within the duration of the full 60 minute test period.

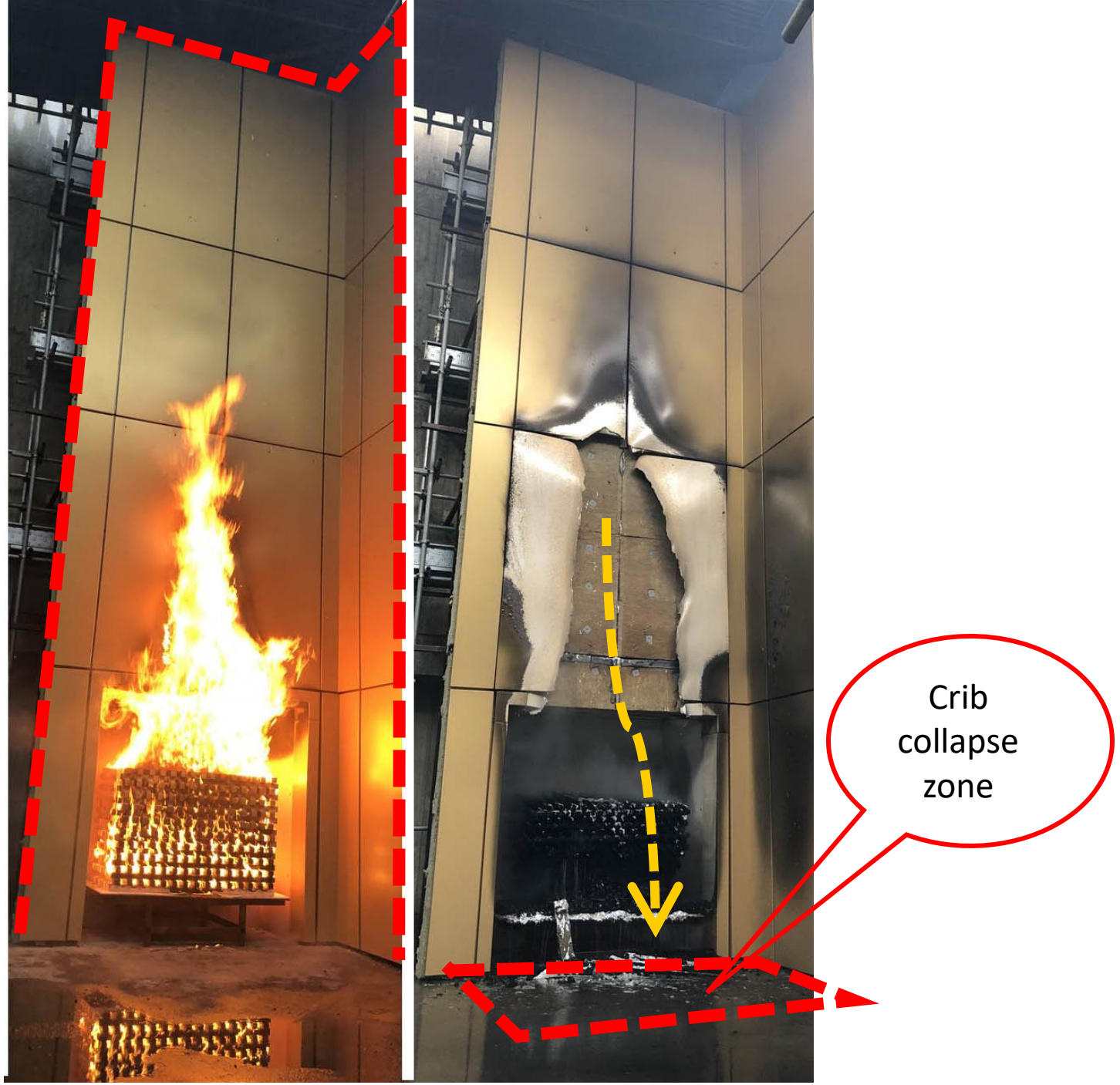
- **5. Burning debris and pool fires**
- Failure is deemed to occur if burning debris or a pool fire develops on the floor of the test facility, outside the designated crib collapse zone, see note 1.
- Burning debris is defined as visible flaming for more than 60 seconds duration (i.e. not intermittent or glowing) within the duration of the full 60 minute test period.
- *Note 1: The crib collapse zone is defined as a 2.4m x 1.2m positioned centrally on the centre line of the hearth opening (2.4m length parallel to the face of the hearth).*

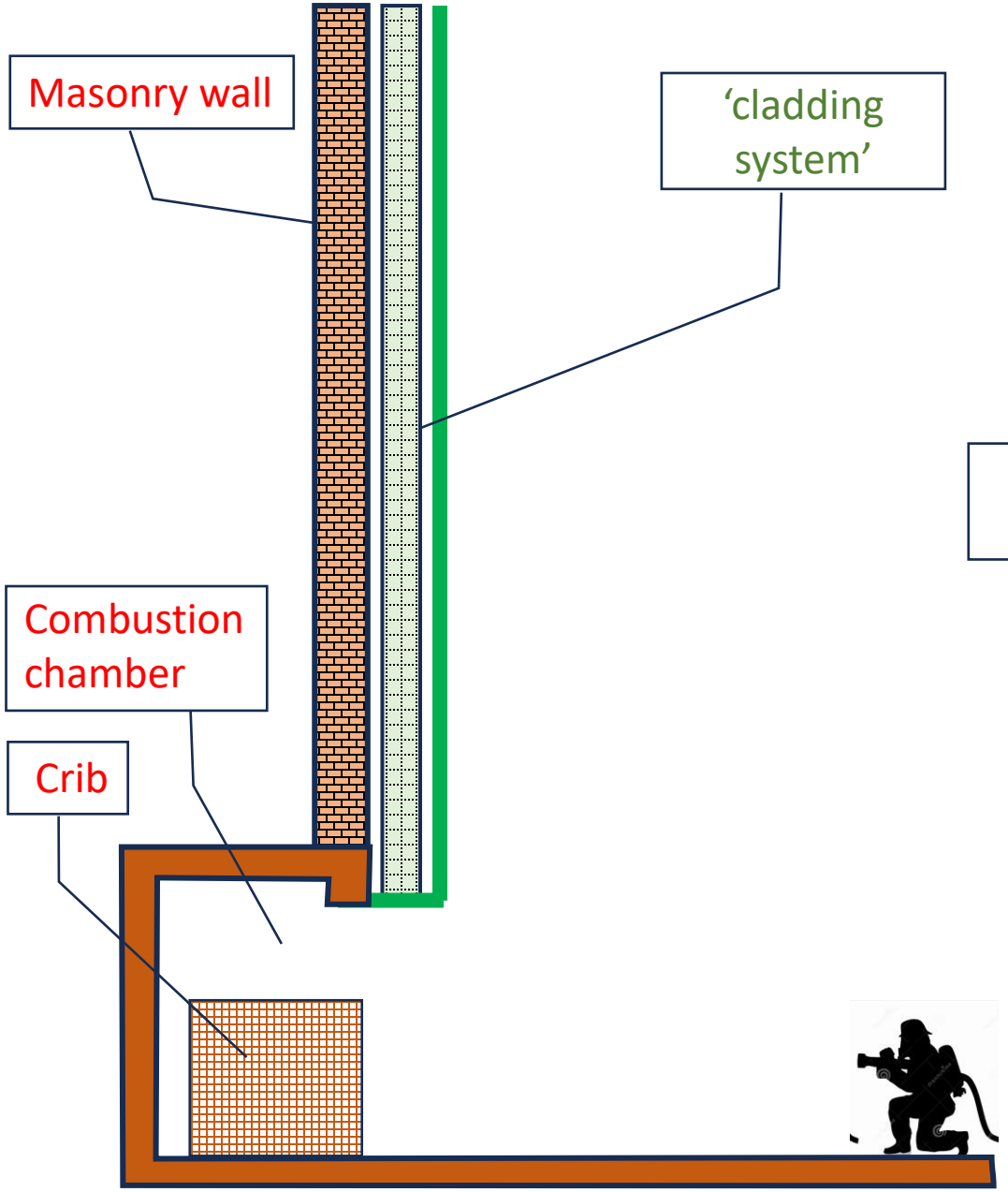
- **6. Additional Requirement**
- Where system burn-through occurs so that fire reaches the internal surface, failure is deemed to have occurred if continuous flaming, defined as a flame with a duration in excess of 60 seconds, is observed on the internal surface of the test specimen at or above a height of 0.5m above the combustion chamber opening within 15 minutes of the start time *ts*.

Only for Part 2 Test

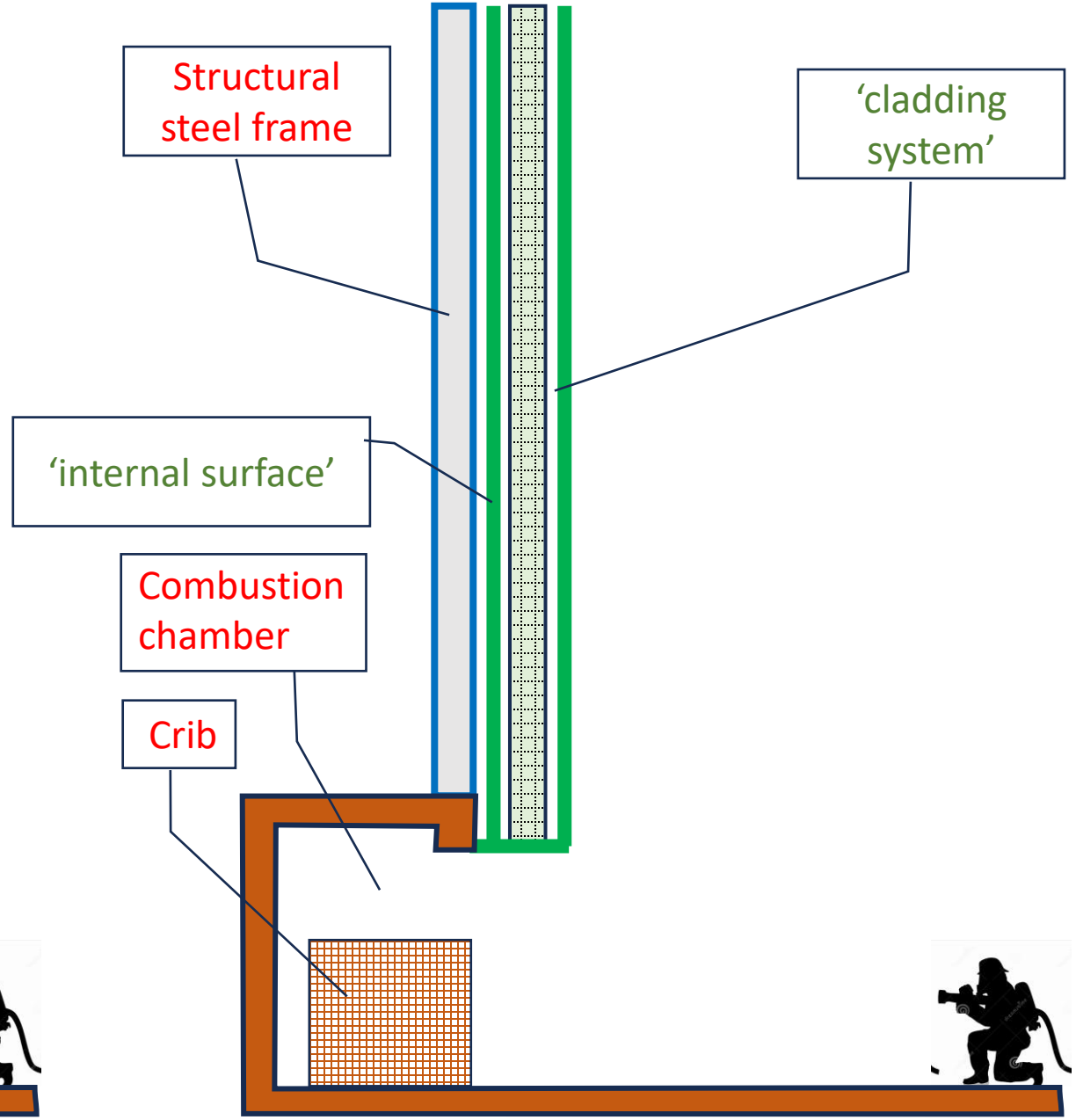
SIRIM Test Facility for BS8414

BS 8414-2

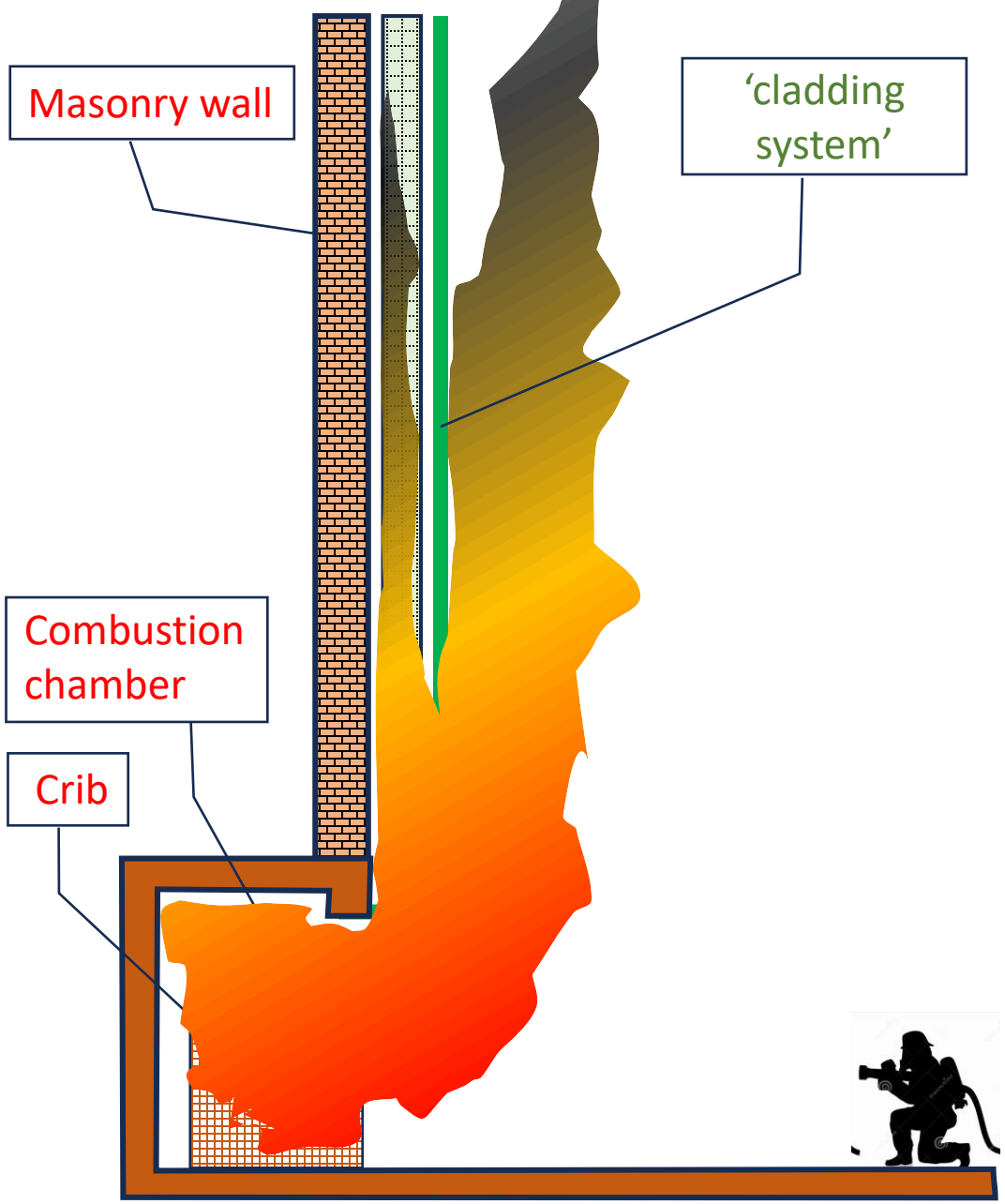

Crib
collapse
zone



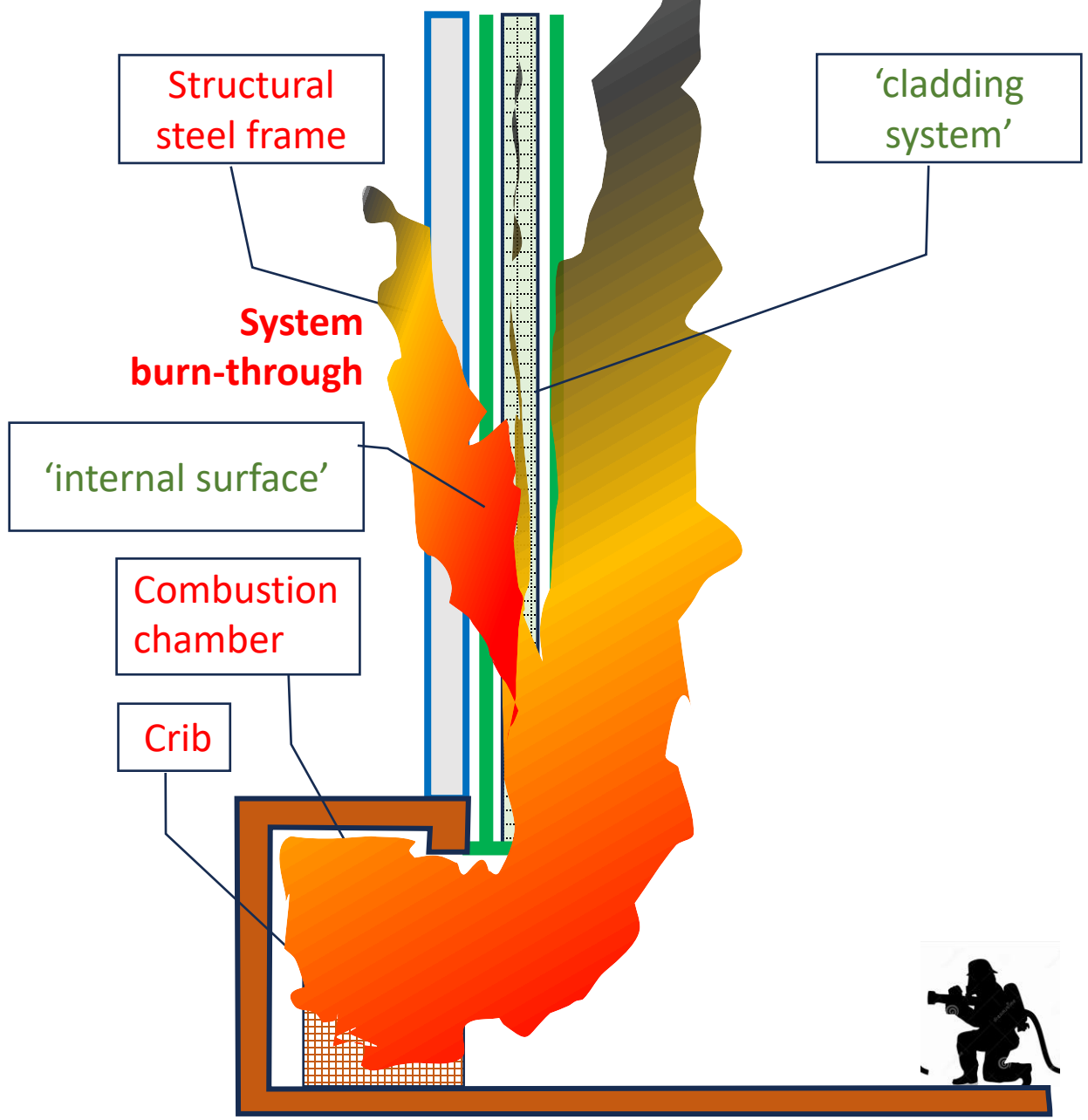
BS 8414-1



BS 8414-2



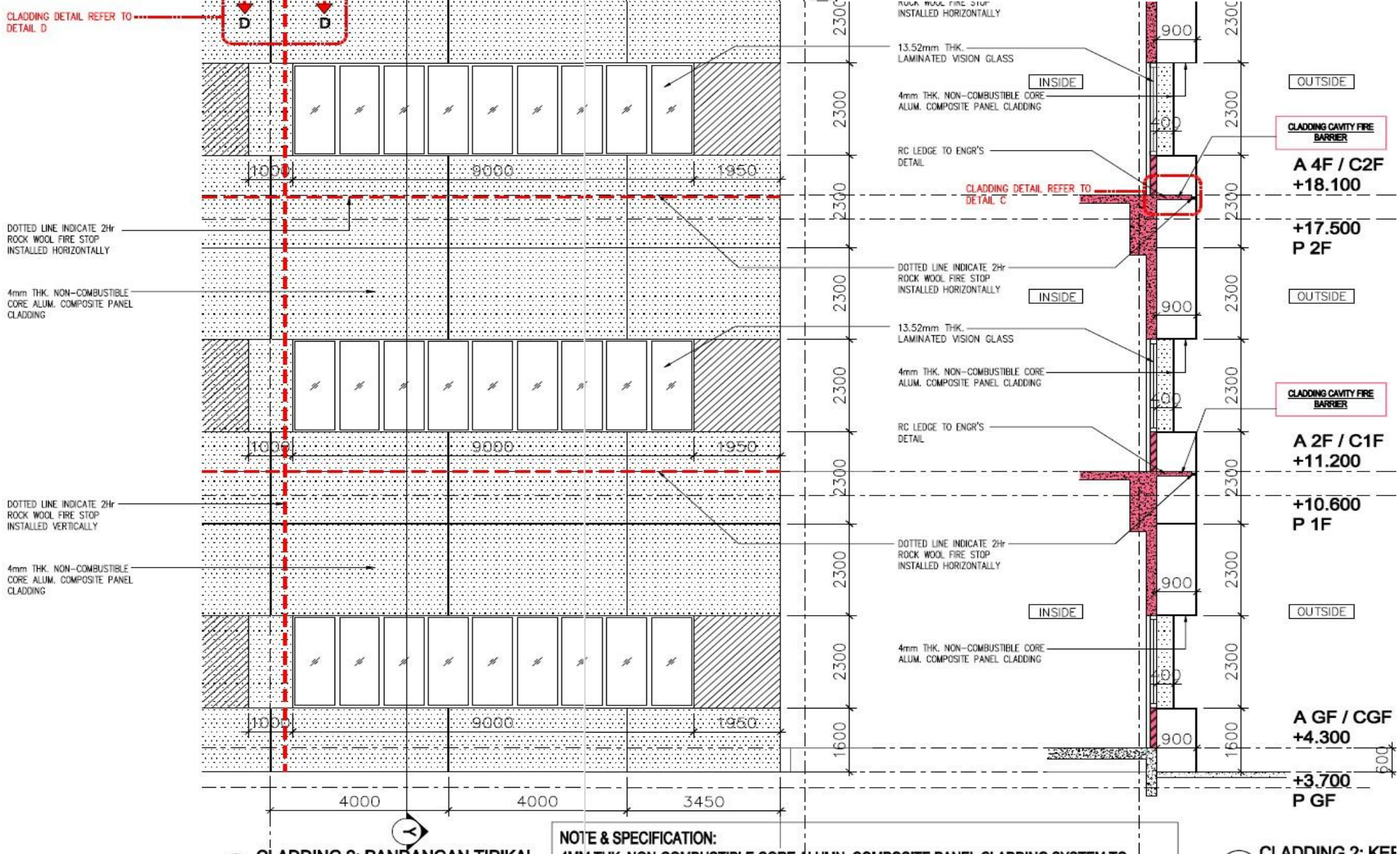
BS 8414-1



BS 8414-2

Extruded polyurethane XPS Rockwool PIR Rockwool

Case study

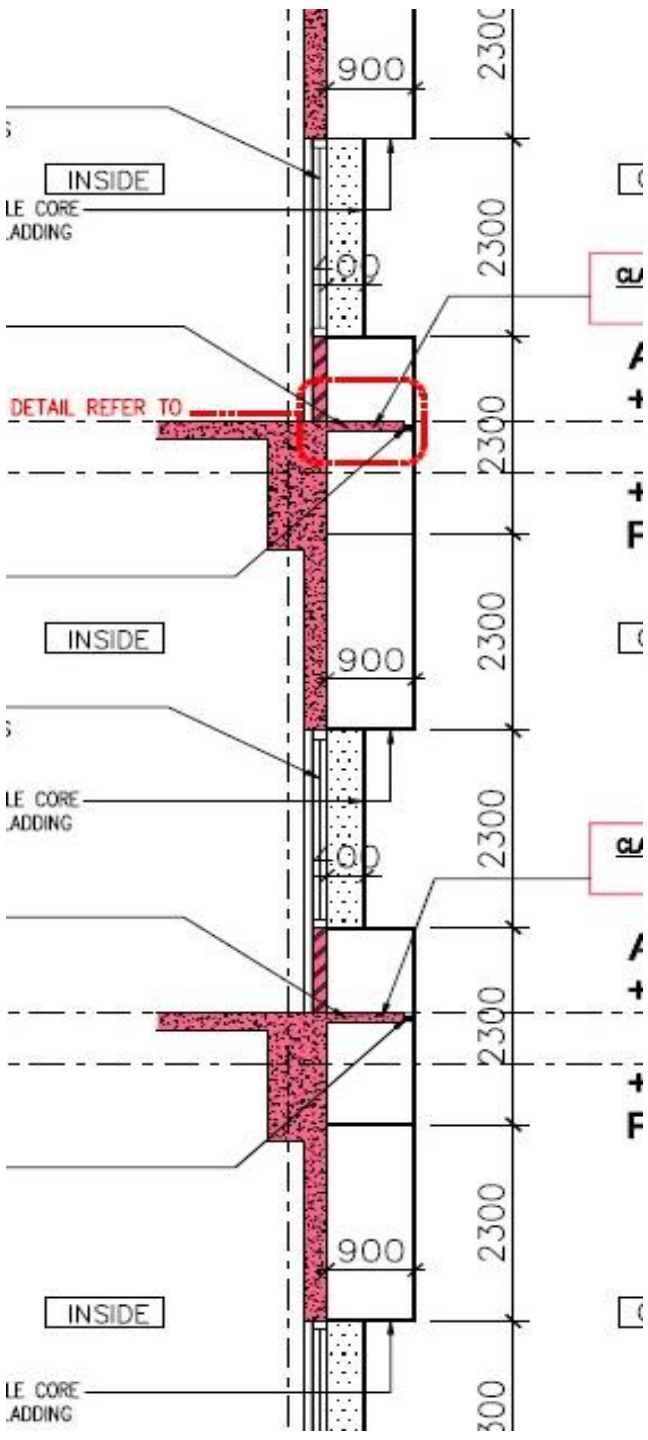


1 CLADDING 2: PANDANGAN TIPIKAL

Skala 1:100

NOTE & SPECIFICATION:
4MM THK. NON-COMBUSTIBLE CORE ALUMN. COMPOSITE PANEL CLADDING SYSTEM TO SPECT'S DETAIL.
ALL ACCORDANCE TO FULL COMPLIANCE WITH BS 8414

1 CLADDING 2: KEF

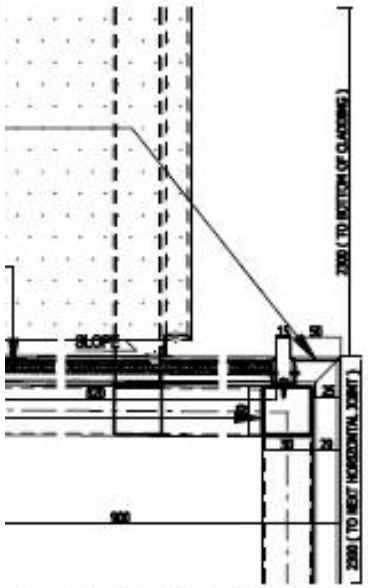

900
2300
INSIDE
LE CORE
ADDING
DETAIL REFER TO
2300
2300
INSIDE
900
2300
LE CORE
ADDING
2300
2300
900
2300
INSIDE
LE CORE
ADDING


5 Jan 2022 10:05:15

NOTE & SPECIFICATION:
4MM THK. NON-COMBUSTIBLE CORE ALUMN. COMPOSITE PANEL CLADDING SYSTEM TO SPECT'S DETAIL.
ALL ACCORDANCE TO FULL COMPLIANCE WITH BS 8414

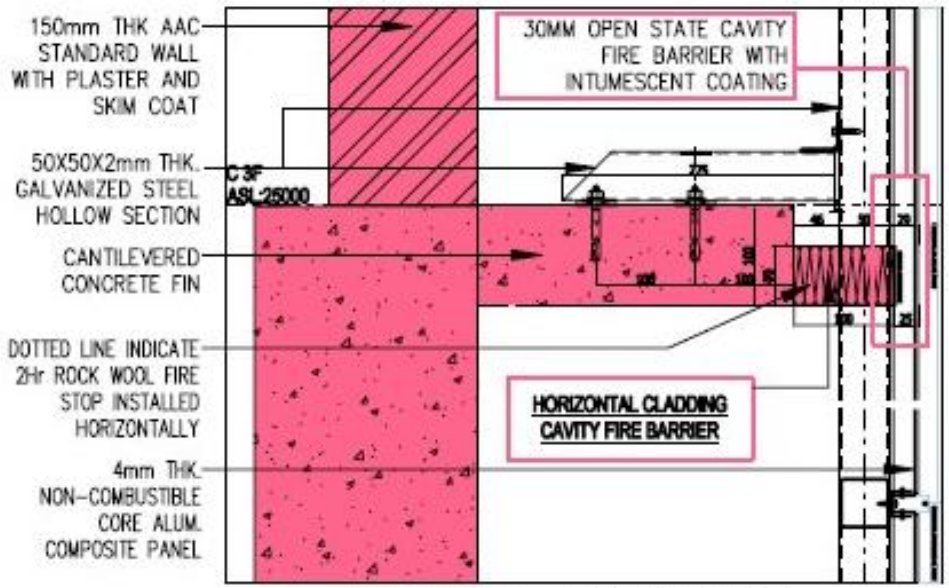
1 CLADDING 2: KERATAN TIPIKAL X-X

Skala 1:100



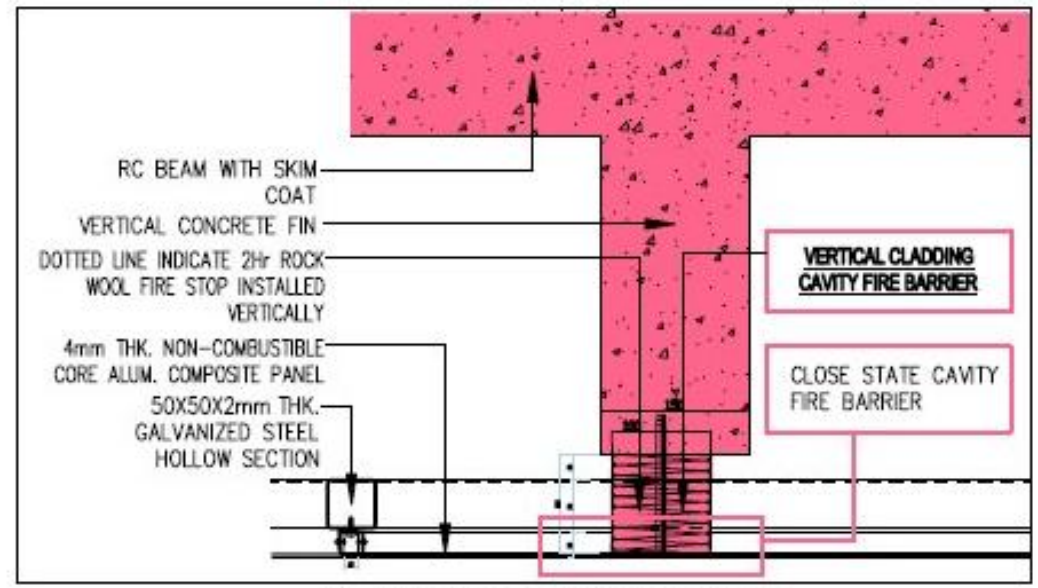
2: PERINCIAN B

Skala 1:10



1 CLADDING 2: PERINCIAN C

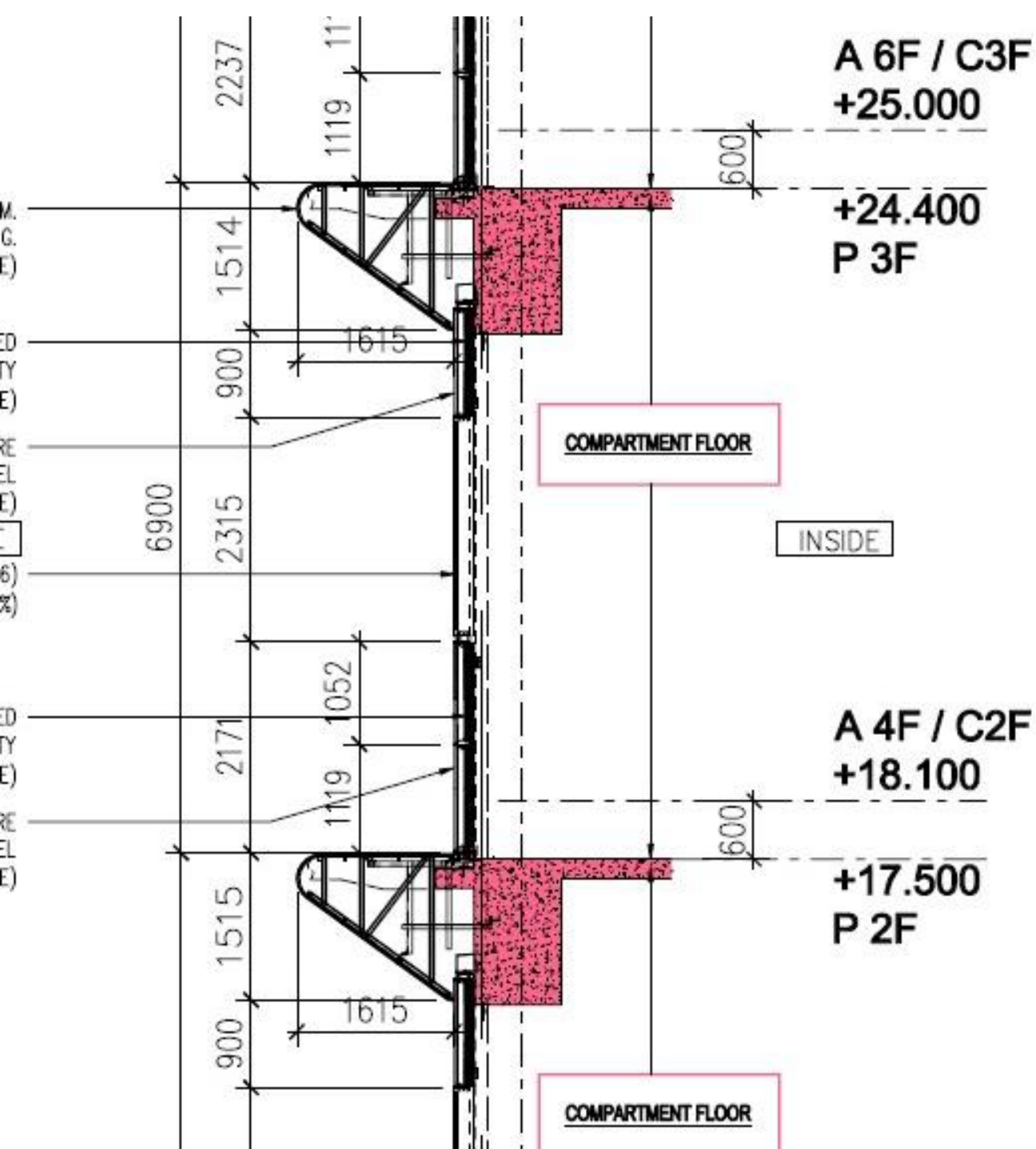
Skala 1:10

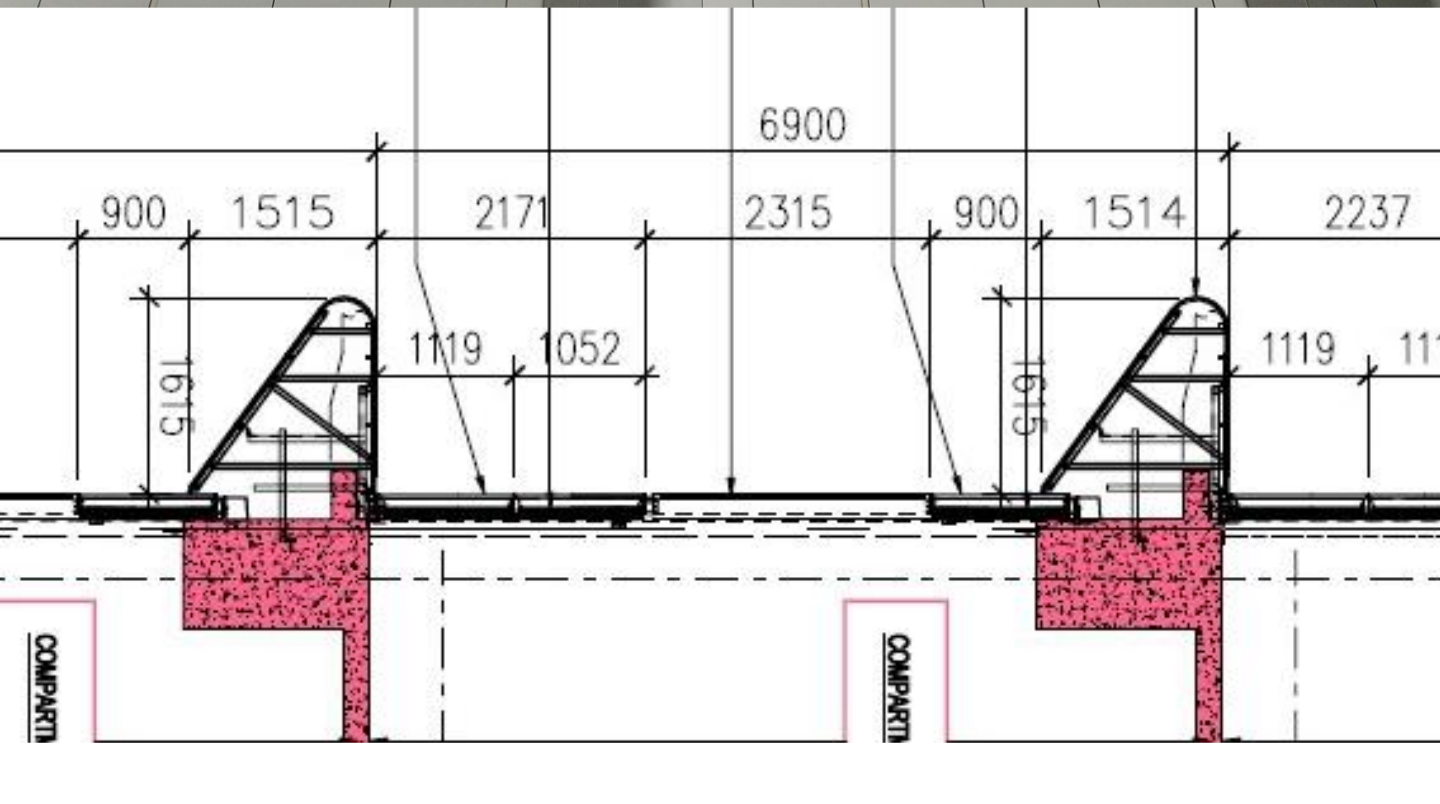


1 CLADDING 2: PERINCIAN D

Skala 1:10


vitaliy


A 6F / C3F
+25.000
600
+24.400
P 3F
2237
1119
1514
1615
900
6900
2315
COMPARTMENT FLOOR
INSIDE
1052
2171
1119
A 4F / C2F
+18.100
600
+17.500
P 2F
1515
1615
900
COMPARTMENT FLOOR


6900
900
1515
2171
2315
900
1514
2237
1615
1119
1052
1615
1119
COMPARTI
COMPARTI

Thank you