Development of a European approach to assess the fire performance of facades

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Preface

The present project, Project Number: 2018/3848, has been financed by European Commission DG Grow. We would like to make a special thanks to Georgios Katsarakis at EC DG Grow for his help throughout the project. The report is presented in linguistic version EN PDF, and Media/Volume is PDF/Volume_01.

We would also like to thank EGOLF, who also contributed financially to the project, as well as giving valuable input to the project group.

Finally we would like to thank all sub-contractors for their support throughout the project:

IBS - Institut für Brandschutz-technik und Sicherheits-forschung Gesellschaft mbH, Austria	University of Liege, Belgium	University of Ostrava, Czech Republic
University of Zagreb, Croatia	Ministry of Interior, Cyprus	Efectis Nederland, Netherlands
DBI - Dansk Brand og sikringsteknisk Institut, Denmark	MVS – The Iceland Construction Authority, Iceland	VTT Expert Services Ltd, Finland
LS Fire Testing Institute S.R.L., Italy	MPA Leipzig, Germany	National Technical University of Athens, Greece
GTC – Gaisrinių tyrimų centras, Lithuania	AMT FÜR BAU UND INFRASTRUKTUR, Abt.Baubewilligungen, Ortsplanung; Fachbereichsleitung Baurecht und Brandschutz, Liechtenstein	ITeCons – The Institute for Research and Technological Development in Construction, Energy, Environment and Sustainability, Portugal
SP Fire research AS, Norway	ITB – Instytut Techniki Budowlanej, Poland	FIRES, Slovakia
FireSERT, UK	CNSIPC - Centrul Național pentru Securitate la Incendiu şi Protecţie Civilă, Romania	VKF - Vereinigung Kantonaler Feuerversicherungen, Switzerland
ZAG – Zavod za Gradbenistvo Slovenije, Slovenia	AFITI - Asociación para el Fomento de la Investigación y la Tecnología de la Seguridad Contra Incendios, Spain	CSTB, France

Finally, we would like to thank everybody else who have helped with the work to finalize this project, nobody mentioned and nobody forgotten.

June, just after midsummer, 2018

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1. INTRODUCTION

The objective of this project was to address a request from the Standing Committee of Construction (SCC) to provide EC Member States regulators with a means to regulate the fire performance of façade systems based on a European approach agreed by SCC.

In addressing this objective, the project team was asked to consider a number of issues which are presented and discussed in this report.

The initial stages of this project were focused on:

- establishing a register of the regulatory requirements in all Member States in relation to the fire performance of façade systems, and
- to identify those Member States who have regulatory requirements for the fire performance façade systems which go beyond the current EN 13501 (reaction to fire and fire resistance) classification systems and to collate the details of these additional requirements.

Having confirmed the regulatory needs in the member states, as established by the SCC, the report goes on to present:

- a testing and classification methodology based on BS 8414 - Fire performance of external cladding systems series and DIN 4102-20 - Fire behaviour of building materials and building components - Part 20: Complementary verification for the assessment of the fire behaviour of external wall claddings to address the identified key performance and classification characteristics
- a verification and validation proposal, in the form of a round robin programme to support the development of the proposed testing and classification methodology.
- an alternative test method which was developed on the basis of the comments from stakeholders during the project
- a summary of comments received during the project.

This report presents the research methodology and the results obtained as well as discussions on how and why certain choices have been made on the development of a European assessment procedure for the fire performance of façades in response to EU Tender ref 531/PP/GRO/IMA/16/1133/9108 based on the BS 8414 – *Fire performance of external cladding systems* series and DIN 4102-20 – *Fire behavior of building components – Part 20: Complimentary verification for the assessment of the fire behavior of external wall claddings*.

Where questionnaires or local data collections has been required this has been achieved by direct contact with regulators, end users, industry and broader stakeholders by project team members and sub-contractors, based in the Member States.

As expected, there are clearly a range of issues which have been identified between the current alternative assessment methods used by Member States and the current fire performance characteristics presented in the BS 8414 series and DIN 4102-20 test methods. This project has set out to acknowledge and address these differences. During the project, two different approaches to address and incorporate them into a proposed assessment methodology were proposed by the consortium:

- The approach preferred by the European Commission called “proposed test method” is detailed in the present final report (the assessment method is presented in Appendix E)
- The alternative test method developed during the project is presented in the Appendix G

The report also discusses the need for research and round robin studies, to support the development of the proposed test method for use as regulatory tools.

1.1. Background

As identified by the Invitation To Tender (ITT), the primary objective of this project is to develop a common method to allow the assessment of the fire performance of façade systems based.

The results of the workshops and seminars on the topic which have been held within Europe in the past 10 years, identify that the most difficult and important part of the task is the definition of a classification system which is acceptable by all Member States accounting for their national regulations and meeting the requirements of the Construction Products Regulation (CPR). The classification system should be transparent and should fit within the framework of existing national regulations, and should be as simple as possible, e.g. using the minimum number of classes required to enable Member States to effectively maintain their required safety levels. It has also been identified that the assessment method should be applicable to the wide range of façades systems available in the market including glazed façades, green façades and other emerging technologies.

Both the work from the EOTA PT4 façade testing task group and an EGOLF workshop held in October 2015 sought to collect data and experience on the current national regulations and test methodologies used in Europe. Both activities generated outlines for the development of possible classification systems and this experience has been used as part of this project. Key areas missing from the earlier studies included:

- The consideration of a façade kit as a construction product
- The consideration of a façade as a part of a specific building. In some national regulations this would mean that detailing such as window openings may also need to be considered.
- How to manage direct applications and extended applications including whether the performance of the façade system can be based on the fire characteristics of single components within the façade system
- Fire scenario identification for each of the Member States that regulate for the fire performance of the façade system based on alternative assessment methods.

The proposed test method has been developed from the data collected during the project and the findings from the associated workshops and meetings presented in this report. The methodology and associated findings provide the basis on which the tasks outlined in the ITT have been addressed.

These approaches are also designed to enable regulators to review local building regulation requirements to ensure required safety levels can be maintained and allow industry to have a clear understanding the scenarios and classification methods proposed for determining the classification of fire performance for façade systems.

The 1st and 2nd International Conference on Fire Safety of Façades provided a global forum to discuss from the current research fields of façades to the standardization work. Smolka et al. gave an overview of test methods in Europe (published and draft), Asia and North America[1]. This provides an overview of test standards in 9 European countries; including BS 8414 series used in UK, SP Fire 105 used in Sweden, LEPIR2 used in France and MSZ 14800-6 used in Hungary; as well as the assessment criteria from these test methods; known assessment criteria include temperature limits, flame spread, integrity, falling parts, etc.

The work in EOTA produced Technical Report N073 which provided an outline test methodology for the large scale fire performance testing with two different sub-methods and two different exposure types. In addition, the work that EOTA carried out also included a costed validation and verification

[1] Smolka, M.; Anselmi, E.; Crimi, T.; Le Madec, B.; Móder, I.; Park, K.W.; Rup, R.; Yoo, Y.; Yoshioka, H.; Semi-natural test methods to evaluate fire safety of wall claddings: Update; MATEC Web of Conferences 46, 01003 (2016); DOI: 10.1051/matecconf/20164601003

programme to enable the development of the test method, classification system and associated fields of application.

An overview of test methods and an introduction to regulation differences between countries is also presented in *Fire Hazards of Exterior Wall Assemblies Containing Combustible Components Final Report*[2], published in 2014 focusing on the question of combustible materials in façades. The report states that only large scale fire test can give proper answers of complete assemblies' fire performance.

An EGOLF Workshop on Façades was held on October 29, 2015, where representatives of fire laboratories shared and presented their national test methods and highlights of them. One of the outcomes from the workshop was to produce an outline for a classification system based on the test methods but this work did not fully address the needs of all Member States or regulators.

The consortium of the present project brought together the representatives from the main European countries that use large scale fire testing to determine the fire performance of façade systems. Combined with the subcontractors, the project group provides a strong partnership between European fire testing laboratories and institutes which link the project to national regulators as well as giving information on historical issues which could otherwise affect the work proposed.

All core partners have been involved in the development and delivery of testing and assessment methods in Europe for the fire testing of façades. Within the subcontractor group there is also strong representation from laboratories responsible for the development and execution of fire testing methods for construction products. This background knowledge has been important for successful delivery of the project objectives. Acknowledging and addressing the differences in the national regulations and testing methods, it has been possible to develop and present methodologies which are based on the preferred option described in the ITT, whilst acknowledging and addressing as far as practical for the needs of the individual national regulators.

1.2. Limitations - discussions

It has not been possible to include measurements for all characteristics identified as part of the initial regulatory survey. The proposed test method was developed to produce working assessment methodologies that can be presented to the European standards making body (CEN) as baseline documents for potential development into a European method for the assessment of the fire performance of façades.

The baseline test methods were defined in the ITT as the BS 8414 series and DIN 4102-20 protocols. It was therefore decided to investigate the differences between the prescribed methods and the other test methods used in the Member States, and to define whether any changes were required to the predefined methods to fulfil the requirements of the regulations in the Member States. Examples of modifications to the predefined methods included variations to the size of the test assembly, inclusion of a secondary opening, junction detailing between façade and floor and some performance criteria.

It has not been possible to find published comparable information on the key performance characteristics such as heat exposure to the test specimen for all the currently available test methods, so it has not been possible to undertake any comparisons on these key parameters between the proposed methods with other test methods currently used in the Member States as part of this project.

Another important factor that could affect the repeatability and reproducibility of the proposed methodology is the environmental conditions under which testing takes place. Both BS 8414 series and DIN 4102-20 testing in Europe takes place within laboratory buildings fitted with suitable extracts. Many of the alternative test methods currently in use are undertaken outside. For the

[2] Fire Hazards of Exterior Wall Assemblies Containing Combustible Components Final Report Prepared by: Nathan White CSIRO Highett, VIC, Australia Michael Delichatsios FireSERT, University of Ulster Jordanstown, Northern Ireland © June 2014 Fire Protection Research Foundation

proposed assessment method, the tests have to be performed indoors or at least in an environment where the ambient conditions are kept within certain limits during the full extent of a test.

The field of application is an important part of the methodology and implementation of the project. The field of application gives the rules on the deviations that can be made from the system as tested and classified. A limited field of application leads to a large test burden for the industry, and therefore it is important to develop a field of application that is as broad as possible, without lowering current levels of safety. Furthermore, the field of application is a dynamic document which will be extended over time when more knowledge is obtained.

However, the proposed test method will lead to a considerable number of tests for one product to be sold throughout in Europe because of the optional character of additional requirements for certain Member States, especially when the product is to be used in Member States who have additional requirements not covered by DIN 4102-20 or BS 8414. That was the reason to propose an alternative test method (Appendix G) which combines as many options as possible in one test method.

The measurement and classification system presented for the proposed test method does not address smoke or toxicity parameters as smoke classification is partially addressed by EN 13501-1 and the survey findings showed that most Member States do not consider them relevant to the façade fire performance objectives.

1.3. Supplementary data

The annexes to this report carry the supporting data for the project together with the details of enquiries and responses received during the project.

Appendix A – Questions to sub-contractors
Appendix B – Definition of façade
Appendix C – Additional requirements
Appendix D – Description of test methods
Appendix E – Proposed assessment method
Appendix F – Round Robin propsed test protocol
Appendix G – Alternative assessment method
Appendix H – Round Robin alternative test protocol
Appendix I – Collection of comments with answers from the project group: Comments after webinar on March 22, 2017; comments from AGF and stakeholders; Comments from subcontractors

Appendix G presents the assessment method proposed in the original draft final report (8th December 2017) as an alternative test method to the proposed test method which is presented in Appendix E.

2. Register of regulatory provisions

At the request of the SCC the project was established to provide a proposed European harmonised approach to the fire performance assessment and classification for façade systems. In order to ensure a clearly defined baseline was available on which to base this proposed approach and to capture all relevant regulatory data and experiences a concise and complete register of the regulatory provisions of all EU/EFTA Member States which have regulations on the obligatory assessment of construction products used to build façades was created.

The task was delivered by a group of project sub-contractors and supported by the consortium core project group. To enable the data to be collected in a consistent form a web-based survey form was developed by the consortium group who then worked with the sub-contractors to arrange for this to be completed for each of the Member States. The questions sent to the sub-contractors are presented in Appendix A.

Table 1 presents a summary of the responses from the 31 Member States (MS) including Switzerland and who responded to the enquiry, and the organisation which the respondent represented. Malta was the only MS that did not provide a response.

A set of tables summarising the findings from the survey have been generated and these were circulated to the sub-contractors, regulators and stakeholders to enable them to check and confirm the relevant entries. Confirmation of the responses have been received and some countries asked for modifications or updates to the entries. These changes have been completed and are included in the tables in this report.

Table 1. EU/EFTA countries and the respondents to the enquiry.

Austria	**Belgium**	**Bulgaria**
IBS - Institut für Brandschutz-technik und Sicherheits-forschung Gesellschaft mbH	Efectis France University of Liege	IBS - Institut für Brandschutz-technik und Sicherheits-forschung Gesellschaft mbH
Croatia	**Cyprus**	**Czech Republic**
University of Zagreb	Ministry of Interior	University of Ostrava Rockwool
Denmark	**Estonia**	**Finland**
DBI - Dansk Brand og sikringsteknisk Institut	RISE - Research Institutes of Sweden	VTT Expert Services Ltd
France	**Germany**	**Greece**
Efectis France	BAM – Bundesanstalt für Materialforschung und prüfung DIBt – Deutsches Institut für Bautechnik	National Technical University of Athens
Hungary	**Iceland**	**Italy**
ÉMI Nonprofit LLC	MVS – The Iceland Construction Authority	LS Fire Testing Institute S.R.L.
Latvia	**Lichtenstein**	**Lithuania**
GTC – Gaisrinių tyrimų centras	Efectis France AMT FÜR BAU UND INFRASTRUKTUR, Abt.Baubewilligungen, Ortsplanung; Fachbereichsleitung Baurecht und Brandschutz	GTC – Gaisrinių tyrimų centras

Luxembourg	Malta	Netherlands
Efectis France	-	Efectis Nederland
Norway	**Poland**	**Portugal**
SP Fire research AS	ITB – Instytut Techniki Budowlanej	ITeCons – The Institute for Research and Technological Development in Construction, Energy, Environment and Sustainability
Republic of Ireland	**Romania**	**Slovakia**
FireCERT	CNSIPC - Centrul Național pentru Securitate la Incendiu şi Protecţie Civilă	FIRES
Slovenia	Spain	Sweden
ZAG – Zavod za Gradbenistvo Slovenije	AFITI - Asociación para el Fomento de la Investigación y la Tecnología de la Seguridad Contra Incendios	RISE - Research Institutes of Sweden
Switzerland	**United Kingdom** **(England, Scotland, Wales and Northern Ireland)**	
VKF - Vereinigung Kantonaler Feuerversicherungen	BRE - Building Research Establishment	

2.1. Summary of responses

The survey form circulated to each Member State representative sought to obtain information on the regulatory provisions for that country based on:

- A working definition for the term façade, and
- Details of the regulatory requirements including any alternative test or classification methods.

2.1.1. Definition of façade

The definition of a façade can be wide ranging, varying from the outer skin of a building to the complete exterior wall structure. It is therefore important that a common understanding of the term façade is obtained. In the enquiry the following working definition for façades was suggested:

> "A complete external wall construction of any type (massive wall or curtain wall …etc.) or constitution (masonry, combustible material …etc.)."

The respondent was asked whether this definition adequately covered any national definition according to their building regulations. If it did not, they were asked to provide a suitable definition according to their national regulations.

The results show that the term façade is only rarely used in the regulations. More frequently are the terms "external wall", "cladding", or similar used. The proposed definition, with some fine tuning, was acceptable for most countries: of 24 countries 12 countries answered with "yes" – this working definition is in accordance to their national system, 4 answered that this definition suits their national system – even if it is not implemented yet. Swiss, German and Austrian regulations distinguish between the exterior wall and the cladding for which different requirements exist. The Swedish regulations refer to the exterior wall. The Belgian regulations refer to external wall construction of any type or constitution without any loadbearing function. All answers given through the enquiry are presented in in Appendix B.

2.1.2. Regulatory requirements

The questions asked in the enquiry on regulatory requirements were as follows:

- Are there regulations governing the fire performance of façades in your country?
- Are there any additional requirements for the fire performance of façades which are mandatory according to your national fire or building regulations and which are not covered by either reaction to fire or fire resistance classifications?
- Which standards or regulations detail the additional requirements for the fire performance of façades according to your national fire or building regulations (please list all that apply)
- Which additional requirements are detailed in these standards? Please provide answers for all building classes which are subject to these additional requirements according to your national fire or building regulations. Please also describe how these requirements are fulfilled according to the standard
- Please provide the name of the official reference document for the test method

All countries have regulations and/or guidance governing the fire performance of façades. These regulations are mainly covered by the existing European system on reaction to fire and fire resistance. A table with all results obtained for these questions is presented in Appendix C.

2.1.3. Additional requirements

14 countries stated that they have additional requirements that are not covered by the EN 13501-1 reaction to fire and/or EN 13501-2 fire resistance classification system. For some countries it is clearly stated that a specific test method shall be used but for other countries the regulation enables the use of performance based testing at medium or large scale to demonstrate performance against the requirements of the regulations.

A total of 12 different test methods have been identified as being either currently in use, or referenced in the regulations, throughout Europe. The different test methods, and the countries using them, are presented in table 2 below.

Table 2. Test methods used in Europe and countries using them.

Test methods	Countries using the test method
PN-B-02867:2013	Poland
BS 8414-1:2015 and BS 8414-2:2015	UK, Republic of Ireland
DIN 4102-20	Switzerland, Germany
ÖNORM B 3800-5	Switzerland, Austria
Prüfbestimmung für Aussenwandbekleidungssysteme	Switzerland/ Lichtenstein
Technical regulation A 2.2.1.5	Germany
LEPIR 2	France
MSZ 14800-6:2009	Hungary
SP Fire 105	Sweden, Norway, Denmark
Engineering guidance 16 (unofficial test method)	Finland
ISO 13785-2:2002	Slovakia
ISO 13785-1:2002	Czech Republic

During the final drafting stages of this report, information was received from Italy in relation to a recently finalized national fire performance assessment method for façades. The information received is presented below for completeness without comment or review. Therefore, it has not been fully assessed within the scope of this project.

Additional information from Italy:

It was decided to refer to an internationally recognized full scale method: the Room Corner Test, which allows precise measurements of spread of flame, RHR, smoke effluents etc.

Dimensions (3000 × 3000) mm allow a very reasonable cost and a realistic vertical and horizontal propagation rating, placing a 1250 mm burner of 300 kW power that can be reproduced and repeatable (ISO 9705).

Using a moving system for the 40-day prepared and seasoned wall allows the repetition of two or three tests per day; the walls are prepared on travelling platforms that can be placed under the Room Corner Test hood.

It’s possible –to insert an opening simulating a window into which the thermal attack penetrating into the window above the bottom window louvre - (3000×3000) mm sample base - is measured through flux meters and thermocouples; depending on the real cases, the window, two meters above the burner, will have its window sill.

3. COMPLEMENTARY VERIFICATIONS

As part of the regulatory survey the group also sort to identify any verification or assessment which are recorded in the register (and thus a part of the regulatory needs of the EU/EFTA Member States).

All participating countries have been asked during the inquiry whether they have additional requirements for the fire performance of façades which are not covered by the already harmonized methods according to EN 13501-1 and 2. 14 of 24 European countries answered that they have additional requirements. The main purposes of these requirements are:

- Limitation of fire spread on the surface and inside the façade system
- Demonstration of fire performance for systems which do not follow or cannot meet the fire performance characteristics for individual components, e.g. insulation which does not fulfil required reaction-to-fire class
- Requirement regarding fire spread through façades (external surface but also through cavity, façade floor-junction)
- Limitation or avoidance of falling parts and/or burning debris/droplets
- Limitation of smoldering fires

These additional requirements are covered by 12 different test methods which are in use in Europe. Four of the test methods are defined as medium heat exposure and all other are defined as large heat exposure tests. Two of the tests take fires from outside of the building into account (external fire) while all other test methods have fire scenarios representing fire inside the building and the impact on the façade of flames emerging from an opening.

The following list summarises the targets addressed by the façade tests in use:

- Flame spread – vertical and horizontal, surface and within the system
- Fire spread from one room to another (above)
- Junction between façade and floors
- Windows
- Detailing around window openings
- Smouldering
- Falling parts
- Smoke
- Heat
- Fire from inside
- Fire from outside
- Permanent changes to the system (assessed after the test)

3.1. Outline of test protocol

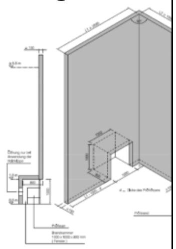
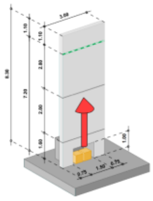
Several questions were asked in the enquiry regarding the test methods used nationally to verify the fire performance of façades. Appendix D presents the responses received to the questions. Table 3 below summarises the scope and scale of the test method, four of the methods are medium scale, and the remaining eight are large scale.

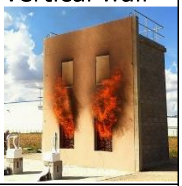
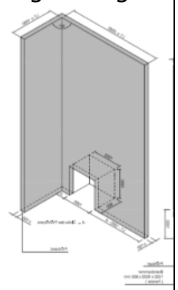
Three similar medium scale tests (DIN 4102-20, ÖNORM B 3800-5 and ISO 13785-1) are based on the fire scenario of a developing fire inside the building and the impact of flames emerging the opening on the lintel and the façade immediately above the opening. The fourth medium scale test (PN-B-02867, used in Poland) addresses the fire from outside the building.

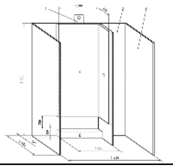
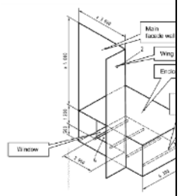
The other eight tests in use are large scale tests, seven are addressing a fully developed fire inside the building with flames emerging the opening, and one test addresses the fire from outside the building.

Six test methods in use have a test rig with a single wall and five have a corner configuration and one has two wings.

Table 3. Outline and scope of the national test methods.

Country	Test method	Scope of test method	Field of application	Scale	Configuration
Germany Switzerland	DIN 4102-20	Complementary test of the cladding systems (each part of the system has to be low flammable according to DIN 4102-1 or DIN EN 13501-1) for classification as low flammable as a system.	Complementary test of the cladding systems (each part of the system has to be low flammable according to DIN 4102-1 or EN 13501-1) for classification as low flammable as a system.	Medium scale	Two wings (i.e. corner) configuration 
United Kingdom (England, Scotland, Wales and Northern Ireland) Republic of Ireland	BS 8414 series	Part 1 - Fire performance of external cladding systems. Test method for non-load-bearing external cladding systems applied to the masonry face of a building. Part 2 - Fire performance of external cladding systems. Test method for non-load-bearing external cladding systems fixed to and supported by a structural steel frame.	Applicable to the system as tested.	Large scale	Right angle, return wall  Figure A1 Example of a typical test facilit
Poland	PN-B-02867	Determination of fire behavior of façades without window. The test philosophy is to determine the heat and flames influence contribution of the façade's combustion on the effect of exposure of standard fire source.	All façade systems	Medium scale	Single vertical wall without openings 
Switzerland	Prüfbestimmung für Aussenwandbekleidungssysteme	The test method is used for the evaluation and proof of the fire behavior of external wall covering systems on the original scale, when exposed to fire from a simulated apartment fire with flames	The test method is applicable to linings and surface coatings (paints, plasters, etc.) used on exterior walls. Included are elements with limited application area, such as de-	Large scale	Single vertical wall, no wing 

Country	Test method	Scope of test method	Field of application	Scale	Configuration
		emerging out through a window opening.	corative elements, cornices and balcony railing garments.		
France	LEPIR 2	Determination of fire behavior of façades of building with windows, test method and classification criteria	All façade systems including windows	Large scale	Single vertical wall 
Hungary	MSZ 14800-6	1. Combustible and ventilated façade solutions applied on non-combustible basis wall 2. Special façade solutions, where the vertical distance between the openings are smaller than a certain value (usually 1,3m) (For example between French windows) 3. Other façade structures with openings - solutions without non-combustible basis wall - solutions including a fire barrier - other innovative solutions	There are no provisions for extending the test results.	Large scale	Single vertical wall with two openings. 
Austria Switzerland	ÖNORM B 3800-5	This method simulates a fire from a window burnout of an apartment. The test simulates the flame height in the second floor over the fire floor (the test concept based on Kotthoff-theories). The behavior of the construction and material and the fire spread (flame spread) in the wall/cladding can be studied.	The test method described is applicable to: -ventilated façades -non ventilated façades -ETICS -(as well as for curtain walling according to Austrian building-regulations; from our point of view not possible for products according to EN 13830)	Medium scale	Vertical wall and a right angle wing 

Country	Test method	Scope of test method	Field of application	Scale	Configura-tion
Sweden Norway Denmark	SP Fire 105	This SP method specifies a procedure to determine the reaction to fire of materials and construction of external wall assemblies or façade claddings, when exposed to fire from a simulated apartment fire with flames emer-ging out through a win-dow opening. The behavior of the construction and material and the fire spread (flame spread) in the wall/cladding can be studied.	The test method described is appli-cable to: -external wall assemblies -and façade clad-dings added to an existing external wall. The test method is only applicable to vertical construc-tions. The method is not applicable for determination of the structural strength of an ex-ternal wall assem-bly or façade cladding construc-tion when exposed to fire.	Large scale	Single vertical wall 
Czech Republic	ISO 13785-1	Reaction-to-fire tests for façades — Part 1: Intermediate-scale test		Medium scale	Right angle, return wall 
Slovakia	ISO 13785-2	Reaction-to-fire tests for façades — Part 2: Large-scale test Test method for determination of fire behaviour of façades, classification criteria are not defined	According SK regulation for all external thermal insulating contact system on external walls. Use of this standard only in case the standard solution is not used (plus additional limitations).	Large scale	Right angle, return wall 
Germany	Technical regulation A 2.2.1.5	Test for ETICS with EPS insulation, shows fire performance of the system when a fire out-side the building occurs. A burning waste container is represented by a 200 kg wood crib.	Test for ETICS with EPS insula-tion, shows fire performance of the system when a fire outside the buil-ding occurs. A bur-ning waste con-tainer is rep-resented by a 200 kg wood crib.	Large scale	Two wings (i.e. corner) configuration 
Finland	Tekniikka opastaa 16 (Engineerin g guidance 16)	Test method, which de-termines the fire safety of the façade when insulation material is inflammable. The flame	Use of inflammable insulation material and render in 3-8 story buildings in reconstruction.	Large scale	Single vertical wall

Country	Test method	Scope of test method	Field of application	Scale	Configura-tion
		effect (flame spread and fire spread) on the surface of the wall and within the wall structure is examined.	Note: In practice the test method has been used for timber façades as well.		

3.2. Complimentary requirements with regard to DIN 4102-20 and BS 8414 series

This part of this task consists of an evaluation of the possibilities to cover the complimentary requirements which are in use at present and covered by the national tests with either DIN 4102-20 or BS 8414 series test protocols.

An inquiry was send to the Member States who have additional requirements for the fire behavior of façades to requesting information on the scope of their methods, data of measured temperatures and heat fluxes to the wall of the test rig (without specimen) and an assessment of whether the needs of the Member State can possibly be fulfilled with either the DIN 4102-20 or the BS 8414 series tests.

Switzerland and Lichtenstein have requirements on how tests are to be assessed if they are conducted according to DIN 4102-20 to be used to fulfill Swiss regulatory needs.

Austria uses the DIN 4102-20 test rig but has a slightly different fire load and temperature measurement locations. The fire performance criteria also differ from those presented in DIN 4102-20.

Both the DIN 4102-20 and the BS 8414 series are with wing configurations. The wing configuration is often referred to as the more severe configuration than a single wall configuration. Five national test methods use a single wall configuration.

The BS 8414 series and DIN 4102-20 test rig configurations have a fire scenario which represents a fire plume exiting an opening in the face of the building and laying back on to the face of the façade system in the area immediately above the opening. As part of the round robin test program it has been suggested that the impact of the fire load being placed directly in contact with the surface of the façade to be considered, representing an external fire load such as a rubbish bin being placed in contact with the external surface.

The size of the fuel sources in the national tests differ significantly, e.g. wood cribs in use range from 20 kg to 650 kg. However, the temperatures reached at different heights and the heat flux to the specimens (and the area where a certain level is reached) are not only dependent on the size of the fuel source but depend as strongly on the fire scenario as location of the fire source, ventilation and geometry of the test. Of significance to address is the needs to fulfill the national requirements is the exposure of the specimen. Therefore, it is important to compare temperature and heat flux levels in the different test methods to assess the severity of the tests and this will be investigated further as part of the round robin testing and will assist regulators in assessing the appropriate levels of performance between current and proposed methodologies.

Table 4 presents the limited literature values for temperature and heat exposure in the different test methods which have been found.

Table 4. Fire exposure in BS 8414 series and DIN 4102-20 (from Fire Hazards of Exterior Wall Assemblies Containing Combustible Components, N. White and M. Delichatsios, Springer 2015)

Fire exposure	**BS 8414 series**	**DIN 4102-20**
Heat exposure (non-combustible wall)	Mean within range of 45-95 kW/m² at height of 1 m above opening over continuous 20 min period. Typical steady state mean of 75 kW/m² at height of 1 m above opening	60 kW/m² at 0.5 m above opening 35 kW/m² at 1.0 m above opening 25 kW/m² at 1.5 m above opening
Temperature exposure (non-combustible wall)	> 600 °C above ambient within fire compartment > 500 °C above ambient on exterior of non-combustible wall 2.5 m above opening	Maximum temperature of 780-800 °C on exterior of non-combustible wall 1 m above opening soffit
Maximum height of flames above opening for non-combustible wall	App. 2.5 m	App. 2.5 m

Information on heat exposures to the test specimen of all methods used has been asked for, but very limited information has been obtained. Since very little information has been obtained on the heat exposure to the specimen, and the available information has been measured differently, it is not possible to compare the different methods.

Proposal:

The Member States with additional requirements and national test methods should be invited to undertake a comparative test program, on their own cost, as part of the round robin testing to establish the impact of recognizing the proposed the test method and classification system on their current Regulatory requirements and associated safety levels.

4. MECHANICAL PERFORMANCE OF SYSTEMS - FALLING PARTS

As identified in the survey Some Member States have requirements for falling parts and burning debris/droplets to be assessed. These requirements appear to reflect two scenarios:

- The protection of escape routes and the rescue services.
- The prevention of secondary fire arising from burning debris/droplets.

The robustness of façade systems with respect to falling off and burning debris/droplets is also required in some countries. The national requirements are defined differently, in some cases directly in the regulations and in other it is specified in the test methods. The requirements are also specified differently from very specific measurable quantities to quite loosely defined outputs such as '*no large pieces shall fall down*'. The requirements used in Europe are summarised in table 5.

Table 5. National requirements on falling off and burning debris/droplets.

Country	Requirement	Method
Austria	No more than 5 kg or more than 0.4 m²	ÖNORM B 3800-5
Denmark, Norway, Sweden	There may not be any large pieces falling down from the façade	SP Fire 105
Finland	No pieces of the specimen (parts of wall) in excess of 0.1 m^2 shall fall down	Engineering guidance 16
Germany	Falling parts recorded, burning and non-burning, including origin of a second fire on the floor	DIN 4102-20
UK, Republic of Ireland	Spalling, delamination or flaming debris is recorded and should be considered as part of the overall risk assessment when specifying the system. Burning debris and pool fire.	BS 8414 series
Greece	Falling parts recorded	SBI reaction-to-fire test
Hungary	Heavier falling part than 5 kg	MSZ 14800-6
Poland	Falling flaming parts	PN-B-02867
Switzerland, Lichtenstein	Falling parts recorded including the type and size of the parts and the location of occurrence	DIN 4102-20 / ÖNORM B 3800-5

In addition, there is an unofficial guidance document available in Sweden describing how to assess falling parts and burning droplets/debris, based on the following:

- More than a few drops (maximum 10) of melted burning material from the test specimen which continues to burn on the floor are not allowed. Each spot with burning material cannot exceed a diameter of 50 mm.
- Falling down of pieces of glass with thickness ≤ 7 mm with a total area of $60 \cdot 10^{-3}$ m^2 (0.2 x 0.3 m) is not allowed. For thicker glass the allowable size is scaled down linearly, i.e. an increase of the thickness of 10 % leads to a decrease of the allowable area of 10 %.
- Falling down of pieces of plaster/mortar with thickness ≤ 7 mm with a total area of $60 \cdot 10^{-3}$ m^2 (0.2 x 0.3 m) is not allowed. For thicker material the allowable size is scaled down linearly, i.e. an increase of the thickness of 10 % leads to a decrease of the allowable area of 10 %.
- Pieces of other types of material such as wood details, boards or metal profiles with an estimated weight above 1.5 kg are not allowed. If the piece falling down is assessed as sharp the acceptable weight is decreased to 1.0 kg.
- If more than one piece of material falls down each piece shall be judged separately as defined above, if it is not considered to be of danger.
- Small pieces of charred wood which falls down and continues to burn or glow is acceptable until it reaches the amount given for burning droplets above.

- Material (solid or liquid) which does not burn when falling down and is below the definitions on size and weight above but starts to burn when fallen down to the floor is accepted.

The requirements can be grouped into three main categories, criterion related to weight, area or requirement not expressed with measurements. The falling pieces are difficult to measure during (or after) test due to the time factor and damage of falling pieces. A time independent solution is needed which provides evaluation method of falling pieces before the large pieces reach the ground.

This solution can be the planimetric picture analysis (see Appendix E and Appendix G) which applicability for this purpose requires further investigation.

Proposal:

Falling parts and burning debris shall be monitored throughout the complete test duration of 60 minutes after the test start time.

Falling parts include all solid or liquid material falling from the test specimen. They are assessed by visual observations, until a suitable measurement technique is available.

The general criterion is that falling parts shall not be a risk for the evacuation, the rescue personnel nor the fire brigade.

The performance criteria are given in chapter 6.1.6.

5. Meeting regulatory provisions

Objective: to identify any EU/EFTA Member States which have regulatory provisions going beyond the preferred option of the use of the BS 8414 series and DIN 4102-20 as the basis for the European assessment methods and to propose adequate solutions to overcome any possible objections which may be identified during the execution of the contract.

We will also propose, if necessary, any additional technical work to develop assessment aspects to ensure satisfaction of the regulatory needs of those EU / EFTA Member States as well as propose a timetable and an estimation of the relevant costs.

As has been determined from the information provided as part of the regulatory survey of Member States in Task 1, 14 Members States have stated that their regulatory requirements, in relation to the fire performance of façade systems utilise test and classification methods other than those included in the current EN 13501-1 reaction to fire and EN 13501-2 fire resistance European classification standards. Appendix C summarises the details and scope of these test methods.

This project has identified the key performance characteristics for these additional tests and how these requirements are used in the regulatory framework to address the requirements of this task. The key areas addressed are:

- To determine the scenario behind the regulatory requirements to provide a context for working towards bringing the cited test and classification methods in-line with the BS 8414 series and DIN 4102-20. The scenario also provides an insight into the basis on which the test and classification methods cited in the regulation where developed together with the related critical performance characteristics which are specified in the regulation.
- A comparative analysis of the 10 additional test and classification methods identified in Task 1.

5.1. Regulatory scenarios

Appendix C presents the scopes of the additional test methods identified as part of the survey.

Both DIN 4102-20 and the BS 8414 series are based on a fire scenario where an initial fire starts in a room and protrudes through a window opening. The fire is simulating a flash over fire in the compartment. In the DIN 4102-20 test the fire exposure is downscaled.

The scenario basis for both the BS 8414 series of tests and DIN 4102-20, considers fire spread via the façade system. This addresses not only the spread of fire on the surface of the façade but also via any additional materials or cavities within the system. The tests are intended to assess the overall fire performance of the facade system and the interaction of the components within the system including cavity barriers and fire stops together with details surrounding openings such as windows. As the DIN 4102-20 test is downscaled in the fire exposure fire spread on the surface of a façade system and within might be considerably smaller than for the large fire exposure: DIN 4102-20 is a medium scale test and as such has a lower fire load scenario than the large scale BS 8414 series of tests. The fire source in the DIN 4102-20 test is 7,5 % (mass of wood crib) of the large fire source in the BS 8414 tests.

Figure 1 shows the mechanism of rapid fire spread that the test scenarios are designed to consider providing a basis for classification that can be used by Regulators to prevent this type of rapid fire spread.

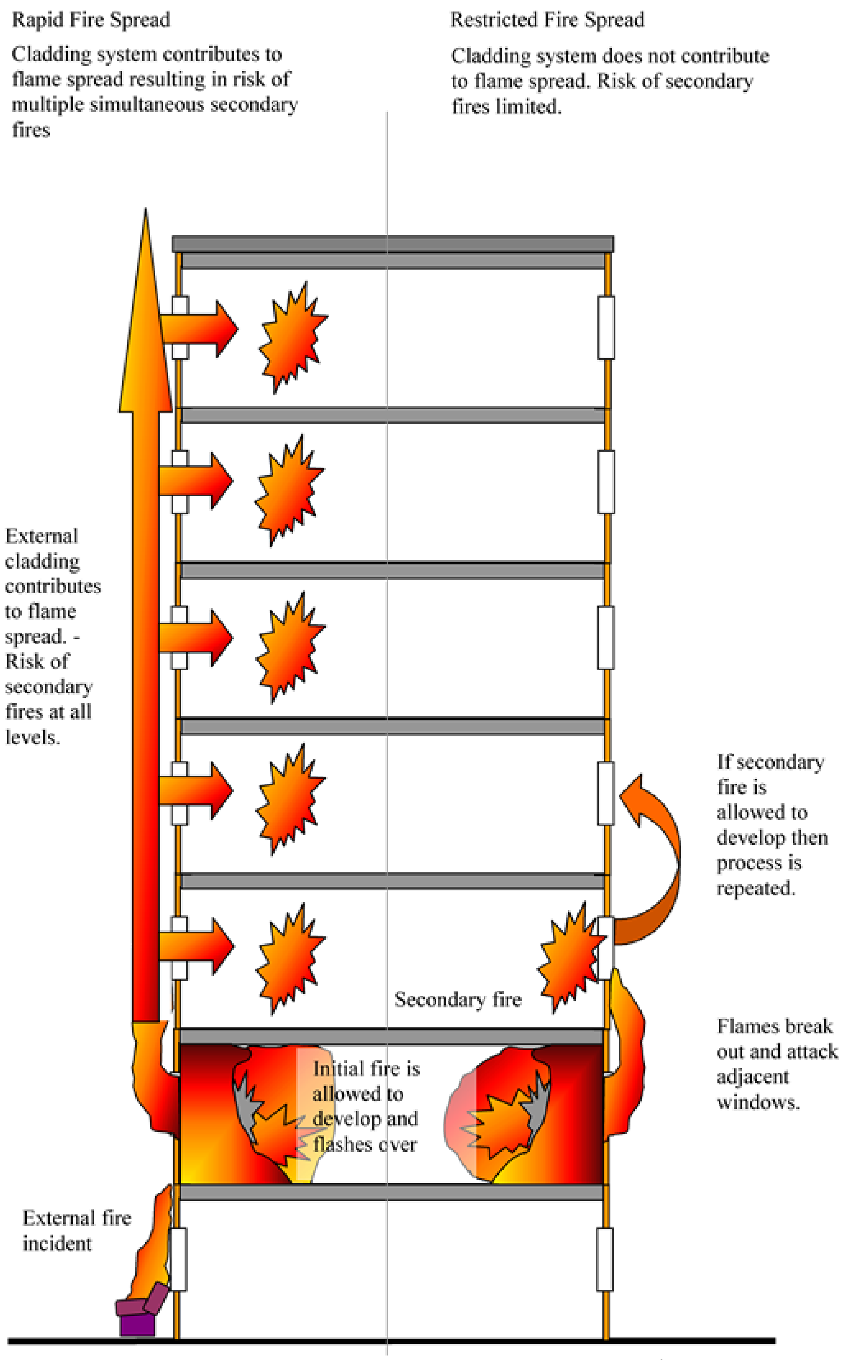


Figure 1. Possible fire scenarios (taken from BR135 3rd Edition).

Since it has not been possible to find data or information on the background of most of the additional test methods identified in the survey and recognized in the current national regulations. It has not been possible to compare the backgrounds or safety objectives of the different methods used in the Member States.

Furthermore, data on the heat exposure to the test specimen is very limited, and often presented and measured in different ways so a direct comparison is not possible.

To make a comparison possible, it would be of great value in the next step of the project in conjunction with the round robin project to invite the Member States with additional requirements and/or alternative methods to perform comparative tests to see whether there are any major differences with the current national methods and the proposed ones.

Proposal:

The two fire scenarios proposed, in accordance with the BS 8414 series and DIN 4102-20, represent a fire exiting through a window from a room with a fully developed fire. The fire exposure in the DIN 4102-20 test is downscaled. BS 8414 test series represents a fully developed fire from a room, or external fire, and the impact on the façade system. The DIN 4102-20 test has a medium scale heat exposure. Temperatures and heat impact close to the lintel appear to be similar to the large heat exposure. The method can be used to assess the lintel as weak point of a façade system.

Comment:

A fire exiting from a window will not affect the surface of the façade in exactly the same way as a fire from an external fire, e.g. a container or vehicle closed to the wall. Some unpublished theoretical work has been carried out, within the present project, based on CFD calculations to compare the heat distribution on the façade surface using different test methods. Additionally, temperature measurements from existing experiments have been used to assess the differences between tests. The conclusion from these calculations are that the temperatures close to the fire in the German "Sockelbrand" test can be elevated compared to the temperatures in the vicinity of the starter track in the BS 8414 series for a limited period of time. The total thermal energy impinging on the façade in the British method seems to be similar to the heat impact in the "Sockelbrand". However, the underlying fire scenarios are quite different and further experimental investigations can show the differences for a tested façade system.

5.2. Comparative analysis

A detailed comparison of the ten alternative test methods against the BS 8414 series and DIN 4102-20 methods based on key physical and performance characteristics is presented under Task 5 and shows that whilst there are many similarities between the approaches used, a quantification of the influence of all the differences was not possible as part of this project despite trying to gain additional supporting data from the consortium and sub-contractors who have experience of these test methods and this matter has been identified as requiring further investigation as part of future studies.

A simple analysis of the basic geometry of the test rigs show that both the BS 8414 series and DIN 4102-20 test rigs are fundamentally identical with respect to size and geometry and neither use secondary openings above the fire source as part of the test configuration, see table 6. The primary differences with the alternative test methods can be summarised as:

- The width of the test rigs used is generally larger. The only exception is the Polish PN-B-02867 method.
- Most test rigs are equal or higher, with the exceptions of PN-B-02867 and MSZ 14800-6.
- Only one other method that uses a wing and that wing is considerably larger.
- Four methods have windows or secondary openings included in the test rig, LEPIR 2, MSZ 14800-6, SP Fire 105 and Engineering guidance 16.
- LEPIR 2 and MSZ 14800-6 are using compartments on two levels

The impact of the fuel source and locations are discussed under Task 5.

Table 6. Geometry of test rig.

Method	Main wall	Wing	Windows	Comment
BS 8414	2.6 x 8.0 m^2	1.5 x 6.0 m^2	-	-
DIN 4102-20	2.5 x 6.0 m^2	1.5 x 6.0 m^2	-	-
Prüfbestimmung für Aussenwand-bekleidungs-systeme	3.0 x 8.3 m^2	-	-	Larger No wing
Technical regulation A 2.2.1.5	4.25 x 9.8 m^2	2.25 x 9.8 m^2	-	Larger
PN-B-02867	1.8 x 2.3 m^2	-	-	Smaller No wing
LEPIR 2	4.85 x 7.05 m^2	-	Yes, floor 1 and 2	Larger No wing indows Compartments
MSZ 14800-6	4.4 x 7.27 m^2	-	Yes	Other dimensions No wing Windows Compartments
ÖNORM B 3800-5	3.5 x 6.0 m^2	2,0x6,0 m^2	-	Test rig as in DIN 4102-20
SP Fire 105	4.0 x 6.0 m^2	-	Yes, floor 2 and 3	Wider No wing Windows
Engineering guidance 16	Min 4.0 x 8.0 m^2	-	Yes, floor 2 and 3	Larger No wing Windows
ISO 13785-2	3.0 x 5.7 m^2	1.2 x 5.7 m^2	-	Larger No windows
ISO 13785-1	1.2 x 2.8 m^2	0.6 x 2.8 m^2	-	Covered by DIN

Proposal:

The BS 8414 series and DIN 4102-20 test rigs are kept as they are. If falling parts/burning debris is to be assessed the complete rig needs to be uplifted, or extended, at least 0.5 m to ensure that the radiation from the combustion chamber not affect the falling material during the test.

5.3. Regulatory provisions going beyond the preferred option of the use of the BS 8414 series and DIN 4102-20

Table 7 shows a summary on the regulatory characteristics currently used in the Member States with additional requirements. In green and blue both the BS 8414 series and DIN 4102-20 with their characteristics are shown, respectively. As can be seen clearly some of the requirements of Member States are not covered by either BS 8414 or DIN 4102-20 nor by a combination of both. Namely, these regulation characteristics are junction between floor and façade, heat (through temperature or flux) and detailing. These characteristics are therefore marked in yellow.

Table 7. Summary of regulatory characteristics.

Regulation characteristics	Slovak republic	Hungary	Switzerland	Sweden	Austria	Germany DIN	Germany -technical regulation	Finland	Poland	England & Wales, Scotland, Irelands	France	Denmark-Norway
Flame spread – vertical	x	x	x	x	x	x	x	x	x	x	x	x
Flame spread horizontal		x	x		x	x	x			x	x	
Flame spread – internal	x		x	x	x	x	x	x	x	x	x	x
Junction between floor and facade		x		x							x	
Smouldering						x						
Falling parts [1]		x	x	x	x	x		x	x	x		x
Smoke [2]				x		x						
Heat (through temperature or flux)		x		x	x							x
Detailing (window openings, fire stop, etc)		x		x							x	x

[1] Falling parts are to be observed in several methods but the regulations on falling parts are very different
[2] Only to be observed and not assessed

Each additional or slightly different regulatory provision beyond the ones covered by BS and DIN standards is addressed in this report at the following location:

- In section 5.1.5 for the junction between floor and façade
- In section 5.1.4 for the falling parts/burning debris
- In section 5.1.5 for the detailing
- In section 1.2 for the smoke

Heat flux and other temperature measurements are made with the SP Fire 105 method. The heat flux in a window one floor above the combustion chamber is regulated in the Swedish building code for buildings with 16 or more floors. There is also a requirement on the temperature at the eave, 2.5 floors above the combustion chamber.

6. CLASSIFICATION METHOD

Objective: to develop criteria for the classification of the product performance taking into account the regulatory needs of the EU/EFTA Member States.

6.1. Definition of the classification method

There are large differences between the current national test and assessment methods. The main differences include:

- Heat exposure to the test specimen
- Duration time of the test (exposure period and observation period)
- Horizontal/vertical fire spread
- Falling parts/burning debris
- Detailing such as window openings
- Junction between façade and floor
- Smouldering fire

In the following sub-chapters these differences are discussed, and a proposal is made on how these current regulations could be incorporated in the assessment and classification methodologies.

6.1.1. Heat exposure

The heat exposure to the test specimen depends on many factors such as:

- fuel type,
- ventilation
  - conditions in the combustion chamber and
  - in the fire test facility room,
- placement of fire load in relation to the surface of the test specimen
- and others

Generally, the heat exposure on the test specimen is not measured and therefore it is difficult to evaluate the differences between the methods used in Europe. In table 8 the type and amount of fuel used for the fire loads is shown.

Table 8. Type and amount of fuel used in the national test methods.

Test method	Type and amount of fuel
DIN 4102-20	Gas burner: burner housing is made of 2 mm steel plates, dimensions: 800 mm x 312 mm x 200 mm (length x width x depth), the fuel is propane, supply rate is 7.4 ± 5 % g/s propane and 24 ± 5 % m^3/h air with 4 bar Wood crib: 30 ± 1.5 kg with density after conditioning 475 ± 25 kg/m^3, sawn softwood (e.g. spruce) in rods of 40 ± 2 mm x 40 ± 2 mm x 500 - 10 mm, wood air ratio of 1:1, base area of the crib: 500 mm x 500 mm, air supply to chamber: 400 ± 40 m^3/h from the back side
BS 8414 series	Wood cribs, 400 kg *Pinus silvestris* - Sawn Softwood sticks. Density 0.40 kg/dm^3 to 0.65 kg/dm^3. Square section 50 ± 2 mm, 100 of 1500 ± 5 mm lengths and 150 of 1000 ± 5 mm lengths. At the time of test, the softwood shall have moisture content in the range of 10 % to 15 % by mass.

	Ignition strips 16 strips of low density fibreboard, nominal dimensions 25 x 12 x 1000 mm. Crib construction Overall dimension of crib nominally: 1500 mm × 1000 mm in plane and 1000 mm high of softwood sticks. Crib is constructed of alternate layers of long and short sticks, with the first layer consisting of 10 long sticks of 1500 mm. The next layer shall consist of 15 short sticks evenly distributed to cover an area of 1500 mm × 1000 mm. To give a total of 20 layers of sticks using 150 short sticks and 100 long sticks. The crib is constructed on a solid platform positioned 400 ± 50 mm above the floor of the combustion chamber. The crib is located centrally in the combustion chamber and displaced 100 ± 10 mm from the back wall of the chamber. The heat source releases a nominal total heat output of 4500 MJ over 30 minutes at a peak rate of 3 ± 0.5 MW.
PN-B-02867	Wood cribs, 20 kg 600 x 300 mm in plane, made from pine wood lathes size of 600 x 40 x 40 mm and 300 x 40 x 40 mm, wood humidity shall be 12-15%; source of ignition – 200 ml of petrol (or pure alcohol or 200 mm wooden wool humidity of 8-12% placed under the crib.
Engineering guidance 16	Timber cribs and timber boards mounted on the walls of the test chamber. Fire load shall be min. 5000 MJ (corresponding about 600 MJ/m^2 with respect to floor area of the test chamber). The test condition shall be comparable to a flash over (flames coming out of the opening of the test chamber). The opening factor of the test chamber shall be 0.065-0.08 $m^{1/2}$
ISO 13785-1	100 kW propane gas burner
ISO 13785-2	Standard fuel: propane, alternative: liquid (e.g. heptane) or wooden cribs (400 kg)
LEPIR 2	Wood cribs, total mass of both cribs: 600 kg Two cribs 1000 x 1000 x 1800 mm made of pinewood of density 480 ± 50 kg/m^3 and moisture content between 9 and 15 %. Each crib is made of 9 layers of 4 pieces 70 x 60 x 1000 mm plus 20 layers of 5 pieces 40 x 60 x 1000 mm plus 17 layers of 6 pieces 23 x 100 x 1000 mm
MSZ 14800-6	Wood cribs, 650 kg The elements of the wood crib are wooden lath: 150 x 5 x 3 cm and 200 x 5 x 3 cm.
Prüfbestimmung für Aussenwandbe-kleidungssysteme	Wood cribs, 50 kg, spruce Stick cross section: 40 x 40 mm^2 Stick length: 500 mm and 1000 mm
SP Fire 105	Heptane, 60 litres
Technical regulation A 2.2.1.5	Wood cribs, 200 kg

	Spruce timber (raw density 475 ± 25 kg/m³) in rods of 40 ± 2 mm x 40 ±2 mm x 1100 ± 10 mm and a base area 1.1 m x 1.1 m, wood air ratio of 1:1
ÖNORM B 3800-5	Wood cribs, 25 kg 72 planed spruce wood sticks 40 x 40 x 500 mm are nailed crosswise to a crib 500 x 500 x 480 mm (wide x depth x height) so the relation wood: air is nearby 1 : 1.

It is clear that the national tests can be divided into two regimes, medium fire exposure and large fire exposure (often defined as medium size test and large scale test). In the large scale tests wood cribs are generally used and the amount on wood varies from 400 kg up to 650 kg. Also, in the medium scale tests wood cribs are generally used and the amount varies from 20 kg up to 50 kg. In addition to the different amounts of fuel, the specific surface and the porosity of the wood cribs varies which affects the fire.

In the SP Fire 105 method heptane is used as fuel which in the configuration used gives a very rapid temperature increase compared to that of wood cribs. The maximum heat release is of the same magnitude as the other large scale tests, but the duration is shorter. It should also be noted that the smoke density is different depending on the fuel, while gas burners generally gives a cleaner smoke heptane produces a heavy black smoke. The smoke radiates heat to the specimen so depending on the type of smoke the heat exposure to the test specimen may be different.

Another factor that may affect the heat exposure to the test specimen is the geometry and the ventilation conditions of the combustion chamber. In table 9 these parameters are specified for the different methods.

Table 9. Geometry and ventilation conditions of the fire room.

Test method	Geometry and ventilation conditions of the fire room
DIN 4102-20	Combustion chamber: 1 m x 1 m x 0.8 m (opening 1 m x 1 m) Ventilation: if using a gas burner air is mixed with the propane gas (no further ventilation) if using the wood crib – air flow of about 400 m³/h through a circular opening (diameter of 300 mm) in the middle of the back wall of the fire chamber
BS 8414 series	The combustion chamber shall be positioned at the base of the main vertical test wall such that the fire can project through the opening at the base of the main vertical test wall. The top of the chamber opening shall be 2000 ± 100 mm above the base of the test facility and shall be 2000 ± 100 mm wide. The combustion chamber shall be capable of enduring the effects of the test procedure without itself suffering undue damage or distortion. The chamber shall be constructed in accordance with the dimensions shown in the standard including the provision of a robust lintel across the head of the chamber opening and a suitable solid platform to support the heat source.
PN-B-02867	No combustion chamber (fire source close to specimen)
Engineering guidance 16	2200 x 4000 mm (floor and wall area), opening 2700-3000 x 1400 mm (width x height)
ISO 13785-1	No combustion chamber (fire source close to specimen)
ISO 13785-2	Fire chamber is built by masonry or concrete with volume from 20 m³ to 100 m³. Example of dimensions 4000 x 4000 x 2000 mm (wide x depth x height). Opening at the front 2000 x 1200 mm (width x height). Additional opening for ventilation is allowed to help to fulfil calibration requirements.

LEPIR 2	The combustion chamber is the first level Internal dimensions: 4.85 x 2.65 x 2.35 m (width x depth x height) Opening dimensions: 2 windows 1.00 x 1.50 m ± 0.02 m (width x height) without glass
MSZ 14800-6	4.30 x 4.00 x 2.65 m (length x width x height) Standard opening is 1.2 x 1.2 m. A wooden window with thermal glazing 4-16-4 is used. The ventilation is regulated manually
Prüfbestimmung für Aussenwandbe-kleidungssysteme	Depth: 0.8 m, Height: 1.0 m, Width: 1.5 m Front wall fully open (1.5 x 1.0m) Rear wall with a central opening (circular, diameter 300 mm) At the start of the test, fresh air is blown through the opening in the rear wall of the fire chamber by means of a suitable blower 400 m^3/h (± 40 m^3/h).
SP Fire 105	Fire chamber is built by light weight concrete: (wide x depth x height) 3000 x 1600 x 1300 mm. Opening at the front (width x height) 3000 x 710 mm. Air intake in the floor at the back of the chamber. Air intake dimension (wide x depth) 3140 x 300 mm.
Technical regulation A 2.2.1.5	No combustion chamber – wood crib in front of ETIC system in the corner
ÖNORM B 3800-5	Fire chamber is built by a steel frame with a gypsum cladding: (wide x depth x height) 1000 x 1000 x 1000 mm. Opening at the front (width x height) 1000 x 1000 mm. Air intake in rear side of the chamber. Air intake dimension ø 300 mm (400 m^3/h).

Since there are several factors that affect the heat exposure to the test specimen it is difficult to compare the methods with respect to the heat exposure to the test specimen. A way to compare the different methods would be to make calibration tests with an inert test specimen and using plate thermometers to measure the heat exposure on different heights and positions on the surface. This would give a good overview of the different heat exposures and provide a good basis on which regulators could review the current test methods and determine which heat exposure class to use in the regulation.

Proposal:
The two fire scenarios defined in BS 8414 and DIN 4102-20 respectively will be kept as they are.

Proposal:
Invite the Member States with alternative test methods to participate in the round robin to compare their current methods with the proposed one.

Comment:
Since different amounts of fuel, type of fuel, shape of combustion chamber, and ventilation conditions are used, and very limited data is available on the heat exposure to the test specimen,

it is not possible to compare the different test methods. Therefore, it has been chosen to keep the fire source and all specifications around it as it is in the BS 8414 series and in DIN 4102-20.

6.1.2. Duration time of test

The testing time is different and often based on the time for the fuel to burn out. There are also cases when a more specific test time is specified. The testing times are summarized in table 10.

Table 10. Test times specified in the different methods.

Test method	Test time
DIN 4102-20	Wood crib / gas burner are to be turned off / extinguished after 20 minutes, then a minimum of 40 minutes observation time follows (maximum of 15 hours)
BS 8414 series	60 minutes - 30 minutes heat exposure and 30 minutes monitoring post extinction of the heat source.
PN-B-02867	15 minutes exposure of the source period (after this time fire source shall be removed from the sample normally there is almost nothing to remove) and after that 15 minutes observation period (totally 30 minutes).
Engineering guidance 16	Test time is 30 minutes from the flash over. Burning time about 15-20 minutes and cooling phase about 10 minutes.
ISO 13785-1	30 minutes
ISO 13785-2	Full fire exposure 15 minutes, with gradual increase from 4 to 6 minutes and gradual decrease from 4 to 6 minutes. Test is finished when test specimen is self-extinguished.
LEPIR 2	First evaluation performed at 30 minutes Second evaluation performed at 60 minutes for ETICS
MSZ 14800-6	The max duration of the test is 45 minutes. (The wood burns more than an hour)
Prüfbestimmung für Aussenwandbe-kleidungssysteme	40 minutes
SP Fire 105	16 - 18 minutes
Technical regulation A 2.2.1.5	At least 25 minutes, crib can be extinguished but without harm to the specimen, after extinguishment at least 60 min of observation time has to follow
ÖNORM B 3800-5	30 minutes. If the façade is still burning after 30 minutes we observe the specimen until there is no fire appearance visible.

The heat exposure time varies from approximately 15 minutes up to 45 minutes. In some tests the fuel can burn out, and in others the fire load is extinguished after a prescribed time period. In addition, some methods require a prescribed observation time after the fire in the fuel has been extinguished.

Proposal: Keep the test durations of DIN 4102-20 and BS 8414 as they are.

6.1.3. *Fire spread*

All methods have requirements on vertical fire spread on and in the test specimen. There are three methods, BS 8414 series, LEPIR 2 and MSZ 14800-6, which have a requirement that the horizontal flame spread shall not reach the vertical edges of the test specimen. The flame spread is determined in different ways such as by visual observations or by temperature measurements.

Proposal:
Keep the test durations of DIN 4102-20 and BS 8414 as they are.

6.1.4. *Falling parts/burning debris*

Falling parts and burning debris is proposed to be applied in the classification, i.e. if the test has been successful with respect to falling parts it will fulfil a certain class, see 6.1.6.

Comment:
In the proposal the failure criteria are based on current regulations and on comments obtained during the project. It is known that other failure criteria are used in some countries. Different classes on falling parts and burning debris is proposed.

6.1.5. *Detailing*

Certain types of detailing are currently included in several national test methods. Details such as windows and penetration systems are already assessed through available European standards and will therefore not be addressed in this classification. There is one type of detailing that is considered important, and has been introduced, and that is the detailing around openings in the façade system.

Proposal:
A secondary opening has been included in the test set-up, to assess the mounting and behaviour of the façade system around openings. The secondary opening is optional.

Comment:
In the proposal the secondary opening is moved towards the edge of the main face of the test specimen. This is done to be able to evaluate the façade with and without secondary opening during the same test. This has not yet been verified and needs to be examined during the next step of the project.

The assessment of the junction between floor and façade as potential weak point may be required in some cases. It concerns the façade systems installed directly connected to floors of a building. The floors can be made of concrete but also alternative material like timber. Generally, the connection between the floor and the façade include a linear joint seal.

Proposal:
To give the possibility to consider this issue, a specific adaptation of the combustion chamber ceiling can be done in the test. The assessment of the junction between floor and façade is optional.

Comment: The junction between façade and floor will only be assessed along the width of the combustion chamber, and not the whole width of the test specimen.

6.1.6. Proposed classification system

A detailed classification system is proposed. This will be necessary to have the largest possible use of historical data. The classification system contains six different characteristics that may be included in the classification, see table 11. Only the heat exposure is mandatory, all other characteristics are optional. In table 12 below are the proposed limiting values given for the different classes.

Comment: In many national regulations there is no requirement to have a classification on the façade fire performance for all types of buildings, and therefore it is important that in the system for CE-marking the option to declare No Performance Determined (NPD) is included. Additional classification coming from other test standards than the assessment method proposed here can be envisaged, like for instance the EN 16733 for the consideration of smoldering fire hazards.

Table 11. Proposed classification system

Feature	Classification	Comment
Limited fire spread	LF, MF	LF when a large size fire has been used MF when a medium size fire has been used
Junction	J	Junction between façade and floor was present and the test successful regarding integrity and insulation performances
Secondary opening	W	If secondary opening was present and the test successful
Smouldering	S	If smouldering has been considered and the test is successful
Falling parts	F1, F2	If falling parts have been considered and the test has been successful • F1: subclass corresponding to part of small area and mass • F2: subclass corresponding to part of middle area and mass
Burning debris	D0, D1	If burning debris have been considered and the test has been successful • D0: No burning debris at all • D1: Limited duration burning debris

The following classes are available for the different fire exposure levels:

LF	J NPD	W NPD	F1 F2 NPD	D0 D1 NPD

36 different combinations

MF	S NPD	F1 F2 NPD	D0 D1 NPD

18 different combinations

For instance, façade systems tested to BS 8414 historically may be classified as LF-NPD-NPD-NPD-NPD, and a façade system tested to DIN 4102-20 may be classified as MF-S-NPD-NPD-NPD as long as the test was performed by an accredited laboratory, in an enclosed environment. Note that all NPD's cannot be changed to any other options.

Table 12. Proposed limiting values for the classification system

Feature	Classification	Proposed Limiting values
Limited fire spread	MF	Vertical fire spread medium fire exposure The vertical fire spread is determined with both observation of visual flames and thermal flame spread (temperatures of thermocouples). • No thermocouple positioned at the horizontal classification level at 3.5 m above the combustion chamber for the medium fire exposure test, shall indicate a temperature of more than 500 °C at any instance during the test time of 60 minutes after the test start. • There should be no burned damage to the specimen 3.5 m or more above the combustion chamber. • There should be no continuous visual flaming for more than 30 s, 3.5 m above the combustion chamber. • At no time must there be visual flames at the top of the specimen. Horizontal fire spread At no time there must be flames at the edge of the specimen. Lateral flame spread must not exceed 90 seconds after the fire source has been extinguished.
Limited fire spread	LF	Vertical fire spread large fire exposure Failure due to external and internal fire spread is deemed to have occurred if the temperature rise above T_s of any of the external thermocouples at level 2 (as defined in BS 8414) exceeds 600 °C for a period of at least 30 s, within 15 minutes of the start time, t_s. 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 s, is observed on the internal surface of the test specimen at or above a height of 0.5 m above the combustion chamber opening within 15 min of the start time, t_s. Horizontal fire spread The test specimen must be kept on the test rig for 60 minutes, and during that time the horizontal fire spread shall not reach the edge of the test specimen.
Junction	J	No thermocouple positioned at the connection between floor and façade shall exceed a temperature rise of 180 K. No continuous visual flaming for a period of time greater than 10 s shall be observed on the backside of the test specimen.
Secondary opening	W	If secondary opening was present and the test successful

Smouldering	S	No thermocouple positioned at for the smouldering application shall exceed 50 °C, 15 hours after the end of observation period/ extinguishment of the fire.
Falling parts	F1, F2	• F1: No part larger than 1 kg and 0.1 m² • F2: No part larger than 5 kg and 0.4 m²
Burning debris	D0, D1	• D0: No burning debris at all • D1: Limited duration burning debris < 20 s

6.2. Accounting for historical test data

The role of existing data from the medium and large scale testing has three key roles in this project:

- Maintenance of regulatory systems and associated industry databases.
- Potential for ongoing demonstration of performance for systems under the new proposed test and classification methods based on previously tested and classified products.
- Support of the development of new protocols for testing and classification.

As no testing to the proposed methodology has taken place at this time for the additional configurations (secondary opening, junction, etc), it is not possible to comment further on the relevance or ongoing applicability of these data sets at this time.

The project consortium recognises and have taken steps in the design of the present approach to endeavour to retain the applicability of this data wherever possible.

For the present approach (retention of current BS and DIN protocols), those currently working within these frameworks would continue to operate without the need for review.

For those Member States where this approach differed from current practice this would require Regulatory review and research to ensure maintaining the level of safety. Based on experience from the implementation of the previous EN 13501 series of fire performance classifications it would be expected that additional local research programmes would be required for both regulators and manufacturers not currently working with these protocols in order to develop experience and products to meet these changing classification and performance levels and this may lead to potentially take existing systems from the market.

Where the present approach builds on the historic data and the Regulatory and manufacturers experiences of the issues collectively identified and offers a pragmatic solution under which all users are able to review the current practice and understand and provides a level entry for all manufacturers to develop and support the new approach.

Whilst this project will provide some comments on the use of historic data the scope for the use of this historic data as part of any CE marking application for these products will need to be formalised as part of the direct and extended application standards developed around the test and classification standards.

In order for the historic evidence to be relevant and considered as part of the ongoing development of the new methodologies and any potential application for DIAP or EXAP applications, it will be important that a full disclosure and definition of the systems tested to the existing methodologies is available for any ongoing work in this area to be made available for those holding this data. The use of this data for general applications may not be possible as it primarily resides with commercial organisations.

7. ASSESSMENT METHOD

Objective: to propose a complete and detailed product assessment method and a corresponding classification for fire performance of products (kits) for façades. This should be done on the basis of the preferred option of the use of the BS 8414 series and DIN 4102-20 as the basis for the European assessment methods and taking into account the results of the previous tasks.

The result will be of suitable quality and detail that it can be immediately introduced in harmonised standards (by CEN Technical Committees) and in European Assessment Documents (by EOTA).

The basis of the present proposed method is to retain the existing standard test methods as currently presented and to add additional testing criteria and configurations to the testing and classification programme to support the delivery of the additional classification characteristics as identified in table 7, in section 5.3, above.

This approach may enable some existing BS 8414 and DIN 4102-20 data to be maintained as part of this approach.

Additional research will be required to develop the protocols and classifications for those characteristics not currently covered by the BS 8414 and DIN 4102-20 standards as the data an experience for these requirements under these test protocols does not currently exist. Appendix F sets out the framework for the testing protocol.

7.1. Review of field of application

The field of application shall include all products under Regulation EU 305/2011 which are today submitted in obligatory façade testing in at least one Member State.

This task will also identify the field of application of the assessment method, orienting it towards a direct field of application, but with a discussion of limitations with regards to extended field of application developed. It is not the intention of the project consortium to propose criteria for extended field of application. Consideration will be given here to the limitations of the medium fire exposure method and the large fire exposure method and their relationship with national regulations.

As no data or guidance was provided from any Member States as part of the project it has been assumed that this is probably handled through expert judgement in each Member State, and no written protocol currently exists.

Since there are many different types of façade systems the field of application will be different. A comparison can be made with fire doors, where there are different methods for the extended field of application based on the type of fire door. The same procedure will probably be needed also for façades. The direct field of application shall include the possible changes to be made based on one test, and which are more general. Some specific rules can be included for some specific types of façade systems such as ETICS.

Proposal:
The field of application will be an important part of the methodology. It has not been possible within the present project to propose the full field of application, since the scope of the methodology is very broad. Some examples on the direct field of application are presented in the assessment methodology.

Additional information will be sought as part of the round robin exercise.

7.2. Identification of scope of the assessment method

It was defined in the ITT that the assessment method should have as broad scope as possible. Therefore, at present there are no limitations except that reaction to fire and fire resistance covered by the EN 13501-series are not covered by this procedure. For some products, such as solar panels, it will be necessary to perform validation experiments to show whether the method is applicable or not for these special products/systems.

Proposal:
There is presently no limit on which type of façade system the methodologies are applicable for, except that the fire resistance of curtain walling is covered by EN 13501-2. Although, it will be necessary to validate the method for new types of façade systems. The classification will only be applicable for the whole façade system that has been tested, i.e. it will not be possible to classify materials or details in the system.

7.3. Factors affecting repeatability and reproducibility

This task will be to incorporate requirements to ensure repeatability and reproducibility in the assessment method.

There are several factors that may affect the repeatability and reproducibility of the proposed methods. The following factors have been identified as the most important to consider presently:

- Heat exposure to the test specimen
- Effect of environment
- Fuel source and control options
- Measurement technique
- How well the method is described

A fundamental factor is the thermal impact on the test specimen, i.e. the heat exposure. If a natural fire from wood cribs shall be used, it is important to define acceptable tolerances. This governs timber species, density, moisture content, geometry of the sticks, and geometry and placement of the wood crib in the fire room, as well as ventilation to the fire room. Also, the environmental conditions (wind and temperature) can influence the heat exposure. For the proposed assessment method, the tests most likely must be performed indoors. However, ambient conditions, especially ventilation conditions of the room, e.g. incoming and outgoing air flows as well as air velocity around the specimen will also be issues inside a room.

It will also be necessary to have measurements that show that the heat exposure is within certain predefined limits.

Comment:
Further studies are needed to ensure that the proposed method, offers good enough repeatability and reproducibility. There are several factors that must be studied, such as:

- Effect of ventilation conditions within the test building
- Tolerances needed for the fuel (the research community do not agree on the repeatability of wood cribs, especially on the size needed for these types). Factors affecting this are timber species, conditioning of the timber, density of the individual timber sticks, dimensions of sticks, amount of timber, and the tolerances needed.
- Mounting of thermocouples. There is a disagreement on how to mount the thermocouples in the best way, by drilling through the test specimen, or hanging them from the outside. Both methods have pros and cons.
- How to measure the heat exposure need to be examined. There are several options such as measurements with plate thermometers at defined heights above the combustion chamber or measurement of mass loss of the fuel.

7.4. Preparation and elaboration of assessment method

This task presents a combination of all the previous subtasks, as well as the elaboration of the work which was carried out in the previous tasks into a complete assessment method.

Each of the projects partners, having experience of development and application of façade assessment methods as well as standardisation, have contributed to the preparation of this document.

The projects partners are of the collective opinion that this way of working will result in a proposed assessment method which has most of the quality and detail required to be immediately introduced in harmonised standards (by CEN Technical Committees) and in European Assessment Documents (by EOTA).

Result:
A document "Assessment of the fire performance of façades" has been prepared, see Appendix E. It has the form of a standard, and includes all headings needed. There is still some material missing in the document, especially on the field of application. Furthermore, the method must be validated especially with respect to the repeatability and the reproducibility. It is also necessary to validate that the methods work for the large variability of façade systems, for example solar panels and green façades.

Proposal:
A theoretical round robin will be essential after the Final Report of the present project has been accepted, see chapter 9 and Appendix F. This round robin will show how well the assessment document is written, i.e. if the participants interpret the document in a similar way. After the theoretical round robin, the assessment method document can be improved.

8. TECHNICAL REFERENCE

Objective: to elaborate the complete and detailed Technical Terms of Reference which contains all necessary technical details to allow the Commission to conclude a contract for the realisation of the round-robin programme; and to provide a detailed cost estimation of a short and efficient round-robin programme to verify the repeatability and reproducibility of the finalised assessment method proposed in Task 6.

8.1. Technical reference

This task is the collection of the technical reference document for the proposed assessment method. It will be the combination of all the results of the work completed to date and the reporting of the project results and background. The technical reference will include a sound analysis of the findings of the project and will report on the projects conclusions as well as detailing all background information for the assessment and classification methods.

In the first step of the project, all sub-contractors answered an enquiry. The questions asked are presented in Appendix A. The answers (unedited) to these questions are collected in Appendix B, Appendix C and Appendix D.

- Appendix B deals with the definition of facades.
- Appendix C deals with questions regarding additional requirements outside those of reaction to fire and fire resistance.
- Appendix D deals with questions related to national test methods currently in use.

On March 22, 2017, a webinar was held giving the outline of the project. Some comments were achieved after this webinar and those comments are collected in Appendix I (unedited).

On June 16, 2017, a first draft on the assessment method included within the progress report was presented in Brussels for AGF and stakeholders.

On December 8, 2017, a first draft on the final report including the updating of the assessment method was presented in Brussels for AGF and stakeholders.

The comments on the progress report and on the draft final report, and how these comments have been handled, are presented in Appendix I.

The first draft on the assessment method was also sent to all sub-contractors and their comments (unedited) and how it has been handled is presented in Appendix I.

8.2. Round robin proposal

The present proposal on further studies is based on the development of the proposed test method approach. Details of the Round robin (RR) can be found in Appendix F. In the case the alternative test method would be considered, this proposal may need to be updated however the main part of the test program is the same for both cases.

A RR is an inter laboratory test series carried out by at least two, independent laboratories, to verify a test method or equipment. Since the outcome of this project is a test, evaluation and classification process to assess fire performance of façades we suggest including the following parts in a future project:

- Part 1 – a theoretical round robin on the assessment method.
- Part 2 – investigation on different important aspects identified.
- Part 3 - a round robin on the medium- and large heat exposure test methods.

The aim of this proposed project is to provide professional input for the standardization work for evaluating fire performance of façades. An interlaboratory test program is crucial to show that the proposed test method can be used as intended and meet regulatory needs whilst obtaining acceptance of the test method within the member states. The outcome of the proposed project would be a report.

The project is proposed to include three different parts, firstly a theoretical round robin on the proposed assessment procedure in which a set-up and drawing will be made and a classification performed on fictious data. This will show how well the procedure is written, and the results will be used to improve the assessment procedure so the risk for individual interpretations is minimized.

Secondly initial testing is needed for some important factors that affect the repeatability and reproducibility of the method. These factors are the effect of the environment on the test, the fuel source, mounting technique for thermocouples and measuring technique for determination of the heat exposure. These factors must be evaluated and fixed before the experimental round robin is performed.

The third part of the project will be an experimental round robin to show robustness and repeatability between tests done in different labs and member states. During this exercise it is also proposed to invite the Member States to perform comparative tests with the current national test method (on their own cost).

9. Reporting and meetings

Objective: the reporting of the projects progress and outcomes; as well as liaison with the commission services and the appointed Advisory Group Fire (AGF); as well as attending meetings and reporting from meetings with the Commission.

9.1. Reporting

An inception report, a progress report and a draft final report has been submitted to EC.

9.2. Project meetings

Table 13 outlines the physical meetings that have been held as well as the meetings that shall be held with the Commission services and AGF. In addition to the meetings presented in the table the project core group have weekly meetings over Skype.

Table 13. Outline of meetings

Meeting	Anticipated time (from day of signature of the contract)	Present	Meeting purpose
Kick-off meeting	Jan 18, 2017	– Project core group	– Set-up of the project
Kick-off meeting	Jan 19, 2017	– Project core group leader – Commission services	– Discuss project management and workplan – Identify any additional information requirements from the contractors side
Inception report meeting	March 16, 2017	– Project core group leader – Commission services	– Discuss the project inception report – Discuss any issue or risk of delay identified – Identify and resolve any misunderstandings between the parties involved
Project meeting	March 17, 2017	– Project core group	– Discuss obtained results – Set-up of the next stage of the project
Webinar	March 22, 2017	– Project core group leader – Stakeholders	– Presentation of project outline
Meeting	April 25, 2017	– Project core group – Stakeholders	– Discussion on project outline – Presentation of progress
Project meeting	April 25, 2017	– Project core group	– Discuss obtained results – Set-up of the next stage of the project
Project meeting	May 18, 2017	– Project core group	– Discuss obtained results – Set-up of the next stage of the project

Meeting	Anticipated time (from day of signature of the contract)	Present	Meeting purpose
Progress report meeting	June 16, 2017	– Project core group – Commission services – AGF	– Presentation and discussion of the progress report with the Commission and the AGF – Presentation of preliminary insights and results – Presentation of consequences of preliminary results
Project meeting	July 10-11, 2017	– Project core group	– Discuss obtained results – Set-up of the next stage of the project
Project meeting	September 20-21, 2017	– Project core group	– Discuss obtained results – Set-up of the next stage of the project
Draft final report meeting	December 8, 2017	– Project core group leader – Commission services – AGF	– Presentation and discussion of the draft final report with the Commission and the AGF
Final report meeting		– Project core group leader – Commission services – AGF	– Presentation and discussion of the final report with the Commission and the AGF

9.3. Comment handling

The consortium has received comments from regulators/stakeholders/sub-contractors throughout the project. All written comments have been assembled and handled with. All comments are presented in Appendix I.

A webinar was held on March 22, 2017, and the comments achieved after the webinar are presented in Appendix I.

A first draft on the assessment procedure was presented at the AGF meeting in Brussels on June 16, 2017. The draft assessment procedure was updated based on the comments received, and the draft final report was presented at the AGF meeting in Brussels on December 8, 2017. All comments given by AGF, stakeholders and EC are presented in Appendix I.

The draft assessment procedure was also sent to the sub-contractors and the comments on the document are presented in Appendix I.

10. RISK ANALYSIS AND RISK MITIGATION

A risk analysis on the current and future work is presented in table 14. The analysis is mainly based on the proposed assessment method. Since the proposed method was introduced after the draft final report had been published, on request from EC, it has not yet been circulated nor commented by AGF, stakeholders or sub-contractors.

Table 14. Risk analysis and risk mitigation

Description of risk	Proposed risk-mitigation measures	Current state
The assessment method will not be accepted	The proposed method as well as the alternative method should be sent to the Member States who will give their opinion on the alternatives. This should preferably be done prior to the next phase of the project.	It is clear from the comments received that the opinion on the content of the future harmonized methodology varies considerably. One opinion is that the DIN 4102-20 and BS 8414 series shall be kept in their present shape in order to get the best possibility to use historical data, and another opinion is to develop a new method with a clear and simple classification system. AGF, stakeholders and sub-contractors have been involved in the project and will in the future be informed on the progress. Up to date the comments received has mainly been on the alternative method.
The repeatability and/or reproducibility is not good enough	The main factors that may influence are judged to be the fire source and the environmental conditions. Limits on wind speed, temperature and humidity can be set.	Factors that may influence the repeatability and reproducibility have been identified. More experimental studies are needed in order to evaluate whether wood cribs are good enough, and to evaluate the necessary tolerances on the environmental conditions. Regarding the fuel source the DIN 4102-20 have two different options, wood cribs or gas burner. It is of importance to control that the results are equal independent on the fuel used during these tests. It is also necessary to define tolerances regarding the ambient conditions when carrying out tests.
The field of application must be identified	If the field of application is too restricted, the assessment method may not be accepted by the industry. Collaboration with laboratories, authorities and industry will be needed to define the field of application.	Very little information has been delivered from the sub-contractors.

The cost for producers may increase	A cost-benefit and economic impact studies on the construction market can be made, considering the possible application measures. In one hand the cost may increase for industry which considers only its national market. In another hand for industry considering the European market, the cost should decrease since national tests will not have to be repeated.	No studies on the impact with respect to costs have been made.
May the fire safety level of such test method be increased or decreased, compared to existing façade test method?	In the present document it is considered that at least for the large heat exposure the selected combination of fuel and ventilation parameter are either larger or comparable to those applied by national method. In addition, this method aims to cover all potential weak points identified by the experience of EU countries like opening detailing, junction, falling parts, etc.	Further experimental studies could be included in the next phase of the project, e.g. in the frame of the Round Robin, to compare fire safety levels between national method and future method.
Accounting historical data gained acc. to national test methods	The way to treat historical data for façade is the same as what is done for other products.	Some input data useful to treat such issue can come from the Round Robin phase especially if solutions tested nationally are retested, to assess for instance the safety level of the current method.
Proposed classification does not fulfil all Member States needs	Communication about basis of classification and performance of specimens with AGF to ensure that Member States needs are fulfilled	Ongoing process

There are several bodies that will be affected by a new assessment system, i.e. regulators, industry and laboratories. Since the request is different for the different bodies compromises must be done, probably by all bodies. This will be the main challenge within the project.

The present report is focusing on keeping the BS 8414 and DIN 4102-20 methods in their original shape, and to add optional measurements for characteristics that are regulated but not covered by the methods. In addition, an alternative method is included in the report in Appendix G, which goes a step further and merges the two methods into one. This option would give one test method and a simple classification system. In table 15 are the advantages and disadvantages listed for both the proposed method as well as for the alternative method.

Table 15. Advantages and disadvantages with the proposed and alternative methods.

Proposed assessment method	
Advantages	**Disadvantages**
• Historical data can be used for those MS using the BS and DIN methods (in four countries), but there most likely will be stricter limitations on the environmental conditions (tests must be done indoors) the use of historical data can be difficult • Easy work to make the methods into standards since they already exist	• Only a limited number of countries can use historical data • Difficult to get acceptance by the MS (it did not succeed in the EOTA work) • More tests will be needed • The classification system will be complicated – a lot of comments were achieved that this classification system is too complicated • Increase the work for regulators and industry due to the complexity of the classification system, interpretation of data in relation to the development of potentially new legislation and products • The large fire exposure test will not cover the medium fire exposure test
Alternative assessment procedure	
Advantages	**Disadvantages**
• Minimized the number of tests (one successful test can cover all regulations in Europe) • Easier to get acceptance by the MS • The large fire exposure test also covers the medium fire exposure test (limits the test burden for industry), and potentially also the external fire exposure • Simple classification system • The test methods will be upgraded with the current knowledge on façade testing	• The use of historical data may be limited • More work is needed to ensure the repeatability and reproducibility of the test methods

11. CONCLUSIONS

11.1. Test method

11.1.1. Fire scenario

Both DIN 4102-20 and BS 8414 series are based on a fire scenario where an initial fire starts in a room and exits through a window opening. The fire is simulating a flash over fire in the compartment. The difference between the DIN 4102-20 and BS 8414 series is that in the DIN 4102-20 a downscaling of the fire load and test rig has been undertaken.

Proposal: *Two fire scenarios are proposed, as prescribed in BS 8414 series and DIN 4102-20, represent a fire exit through a window opening from a room with a fully developed fire. Although fire from outside is a completely different fire scenario it seems possible that the BS 8414 test series can cover external fires up to a certain fire load.*

11.1.2. Size of test rig

The size and geometry of test rigs used in the Member States varies to a large degree. It has been judged that a height of the test sample above the lintel of the combustion chamber of 6 m will cover the requirements in the Member States.

Proposal - Proposed test method: *The BS 8414 and DIN 4102-20 test rigs are kept as they are. If falling parts/burning debris is to be assessed the complete rig needs to be uplifted, or extended, at least 0.5 m to ensure that the radiation from the combustion chamber not affects the material falling down during the test.*

Proposal - Alternative test method: *The width and height of the main face and the wing is 3.5 x 7 m and 1.5 x 7 m for the medium fire exposure and 3.5 x 8 m and 1.5 x 8 m for the large fire exposure. Since the height from the floor to the lintel of the combustion chamber is different in the two methods, 1 m for the medium fire exposure and 2 m for the large fire exposure, the heat exposed area will be the same for the two methods. In addition, the complete rig needs to be uplifted, or extended, at least 0.5 m to ensure that the radiation from the combustion chamber not affects the material falling down during the test.*

11.1.3. Fuel and combustion chamber

Since different amounts of fuel, type of fuel, shape of combustion chamber, and ventilation conditions are used, and very limited data is available on the heat exposure to the test specimen, it is not possible to compare the different test methods. Therefore, it has been chosen to keep the heat source and all specifications around it as it is in BS 8414 series and in DIN 4102-20.

Proposal: *Both the medium and large exposure tests are proposed to use wood cribs and combustion chambers as defined in DIN 4102-20 and BS 8414.*

11.1.4. Secondary opening

In some national test methods are details such as windows or detailing around window openings included and assessed. It is therefore proposed to include a secondary opening in the test method to evaluate the detailing of the façade system around openings. In the proposal the secondary opening is moved towards the edge of the main face of the test specimen. This is done in order to be able to evaluate the façade with and without secondary opening during the test. This has not yet been verified and needs to be examined during the next step of the project.

Proposal – Proposed test method: *A secondary opening may be included in the test set-up, to assess the mounting and behaviour of the façade system around openings. The secondary opening is optional in the proposed test method.*

Proposal – Alternative test method: *A secondary opening shall be included in the test set-up, to assess the mounting and behaviour of the façade system around openings. This secondary opening is mandatory in the alternative test method.*

11.1.5. Junction between façade and floors

In some national test methods are also details such as the junction between floor and façade included and assessed. It concerns only the façade systems installed directly connected to floors of a building. It is therefore proposed for these specific façade systems to include a junction in the test method in order to evaluate the risk that the fire goes through the junction.

Proposal – Proposed test method: *For concerned facade systems, a specific adaptation of the combustion chamber ceiling is done in the test. This measurement and classification is optional.*

Proposal – Alternative test method:
For concerned facade systems, a specific adaptation of the combustion chamber ceiling is done in the test. This measurement and classification is optional.

11.1.6. Measurement of fire spread

The methods used to evaluate the fire spread in and on the façade system is different in the Member States. The main methods used are visual observations during and after the fire test and temperature measurements at different locations on the test sample. Visual observations shall be avoided as far as possible for measures used for the classification. Measured values give a much better repeatability and reproducibility.

Proposal - Proposed test method: *Both BS 8414 and DIN 4102-20 are kept as they are.*

Proposal - Alternative test method: *A method for determination of flame spread, both vertical and horizontal, is proposed. The method is based on temperature measurements with thermocouples. It is similar as the ones used in BS 8414 and DIN 4102-20, but not exactly the same. The positions of the thermocouples have been altered to some extent. For the assessment of horizontal flame spread has thermocouples been introduced to replace visual observations.*

11.1.7. Test time

The time of the fire exposure to the test specimen varies from around 15 minutes up to 45 minutes in the Member States. Furthermore, in some countries is also an additional time used, after the fire source has been extinguished.

The MSZ 14800-6 has a longer duration compared to the proposed methods, as well as the German external fire test method. Two methods have a shorter duration, SP Fire 105 and ISO 13785-2. It would be possible to have both longer and shorter fire exposure times, but that would lead to more classes in the classification system. It has been decided to keep the classification system as simple as possible, based on the comments achieved during the project, and therefore has only the durations given in BS 8414 series and DIN 4102-20 been kept.

The test time is different in the BS 8414 series and the DIN 4102-20 method. Also, the starting time of the test is different.

Proposal – Proposed test method: *Test times remain as they are in the BS 8414 series and the DIN 4102-20 method.*

Proposal – Alternative test method: *Only one test time is proposed for the large scale and the medium scale test. The heat exposure from the combustion chamber will be 22 for the medium exposure or 30 minutes for the medium exposure, after the start time. After this time the fire in the combustion chamber will be extinguished, and an additional 30 or 38 minutes of observations and measurements will be made, i.e. a total test time of 60 minutes after the test time has been reached. This needs to be addressed in the coming studies and preferable result in a transparent system where the same procedures and times are used.*

11.2. Performance criteria

11.2.1. Fire spread

Proposal – Proposed test method:

Vertical fire spread medium fire exposure (DIN 4102-20)

The vertical fire spread is determined with both visual observation of flames and thermal flame spread (temperatures of thermocouples).

- *No thermocouple positioned at the horizontal classification level at 3.5 m above the combustion chamber for the medium fire exposure test, shall indicate a temperature of more than 500 °C at any instance during the test time of 60 minutes after the test start.*
- *There should be no burned damage to the specimen 3.5 m or more above the combustion chamber.*
- *There should be no continuous visual flaming for more than 30 s, 3.5 m above the combustion chamber.*
- *At no time must there be visual flames at the top of the specimen.*

Vertical fire spread large fire exposure (BS 8414 series)

Failure due to external and internal fire spread is deemed to have occurred if the temperature rise above T_s of any of the external thermocouples at level 2 exceeds 600 °C for a period of at least 30 s, within 15 minutes of the start time, t_s.

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 s, is observed on the internal surface of the test specimen at or above a height of 0.5 m above the combustion chamber opening within 15 min of the start time, ts.

Horizontal fire spread medium fire exposure (DIN 4102-20)

At no time there must be flames at the edge of the specimen. Lateral flame spread must not exceed 90 seconds after the fire source has been extinguished.

Horizontal fire spread large fire exposure (BS 8414 series)

The test specimen must be kept on the test rig for 60 minutes, and during that time the horizontal fire spread shall not reach the edge of the test specimen.

Proposal – Alternative test method:

Fire spread on and in the façade system shall be assessed. Fire spread in both vertical and horizontal direction shall be assessed. The fire spread is assessed through temperature measurements at different locations on and inside the test specimen.

Vertical fire spread (large fire exposure)

No thermocouple positioned at the horizontal classification levels (4.5 m and 5.9 m) shall indicate a temperature rise greater than 500 K over a period of 30 seconds during the test frame time of 60 minutes after the test start time.

Horizontal fire spread (large fire exposure)

No thermocouple positioned on the classification vertical lines located at 2.75 m from the corner on main face and at 1.45 m from corner on wing shall indicate a temperature rise greater than 500 K over a period of 30 seconds during the test frame time of 60 minutes after the test start time.

Vertical fire spread (medium fire exposure)

No thermocouple positioned at the horizontal classification levels (4.5 m and 5.9 m) shall indicate a temperature rise greater than 500 K over a period of 30 seconds during the test frame time of 60 minutes after the test start time.

Horizontal fire spread (medium fire exposure)

No thermocouple positioned on the classification vertical lines located at 2.75 m from the corner on main face and at 1.45 m from corner on wing shall indicate a temperature rise greater than 500 K over a period of 30 seconds during the test frame time of 60 minutes after the test start time.

Note1: The performance criteria on flame spread, i.e. the temperature level when the test is deemed to have failed, needs to be examined in the next project.

Note 2: In this proposal of the alternative test method is a temperature rise limit set to 500 K, but this may be changed based on data from the round robin project.

11.2.2. Falling parts and burning debris/droplets

The following performance criteria have been suggested as a starting point. In the present proposal the failure criteria are based on current regulations and comments received throughout the project. It is known that other failure criteria are used in some Member States.

Proposal – Proposed test method: *Falling parts and burning debris shall be monitored throughout the complete test duration. Falling parts include all solid or liquid material falling from the test specimen. They are assessed by visual observations, until a suitable measurement technique is available. The general criterion is that falling parts shall not be a risk for the evacuation, the rescue personnel nor the fire brigade.*

The following performance criteria shall be recorded:

- *No part larger than 1 kg and 0.1 m^2 – (class F1)*
- *No part larger than 5 kg and 0.4 m^2 – (class F2)*
- *No burning particle at all – (class D0)*
- *Limited duration burning debris < 20 s – (class D1)*

Both falling parts and burning particles/droplets are to be assessed during the test frame time of 60 minutes after the test start time.

Proposal – Alternative test method: *Falling parts are limited to a maximum of 1 kg and an area of 0.1 m^2 for each individual piece.*

More than a few drops (maximum 10) of melted burning material from the test specimen which continues to burn on the floor > 20 seconds are not allowed. Each spot with burning material cannot exceed a diameter of 50 mm.

Small pieces of charred wood which falls down and continues to burn or glow is acceptable until it reaches the amount given for burning droplets above.

Material (solid or liquid) which does not burn when falling down and is below the definitions on size and weight above but starts to burn after it has fallen to the floor is accepted.

11.2.3. Junction between facade system and floor

Some Member States assess the connection between facade and floor within the test. This has been included in the proposed methodologies, although as optional.

Proposal – Proposed test method: *When examining the junction between facade and floor thermocouples shall be mounted on the unexposed side of the joint. Observations with respect* *to continuous flaming shall also be done. Failure occurs when either of a temperature rise of 180 K or continuous flaming of more than 10 seconds occurs.*

Proposal – Alternative test method: *When examining the junction between facade and floor thermocouples shall be mounted on the unexposed side of the joint. Observations with respect to continuous flaming shall also be done. Failure occurs when either of a temperature rise of 180 K or continuous flaming of more than 10 seconds occurs.*

11.3. Classification

In the proposed methodologies are there large differences between the proposed and the alternative versions. The proposed test method has been optimized on the use of historical data which has the drawback that the classification system will be more complicated.

The alternative test method on the other hand has been optimized to get as few classes as possible, i.e. to have a very simple classification system.

Classification in the proposed test method

The classification system contains six different characteristics that may be included in the classification, see table 16. Only the heat exposure is mandatory, all other characteristics are optional.

Table 16. Proposed classification system – Proposed test method

Feature	Classification	Comment
Heat exposure	LF, MF	LF when a large size fire has been used MF when a medium size fire has been used
Junction	J	Junction between façade and floor
Secondary opening	W	If secondary opening was present and the test successful
Smouldering	S	If smouldering has been considered and the test is successful
Falling parts	F1, F2	If falling parts have been considered and the test has been successful • F1: No part larger than 1 kg and 0.1 m² • F2: No part larger than 5 kg and 0.4 m²
Burning debris	D0, D1	If burning debris have been considered and the test has been successful • D0: No burning debris at all • D1: Limited duration burning debris < 20 s

The following classes are available for the different fire exposure levels:

LF	J	W	F1	D0
	NPD	NPD	F2	D1
			NPD	NPD

36 different combinations

MF	S	F1	D0
	NPD	F2	D1
		NPD	NPD

18 different combinations

For instance, façade systems tested to BS 8414 historically may be classified as LF-NPD-NPD-NPD-NPD, and a façade system tested to DIN 4102-20 may be classified as MF-S-NPD-NPD as long as the test was performed by an accredited laboratory, in an enclosed environment. Note that all NPD's cannot be changed to any other options.

Classification in the alternative test method

A general comment on the classification was that a simple system, with as few classes as possible, is desirable. It is judged that the classification system presented in table 17.

Table 17. Proposed classification system

Heat exposure	Classification	Comment
Large heat exposure	LS1	Fulfilling requirements on flame spread and falling parts
	LS2	Fulfilling requirements on flame spread, but not falling parts
Medium heat exposure	LS3	Fulfilling requirements on flame spread and falling parts
	LS4	Fulfilling requirements on flame spread, but not falling parts

Some classes in the system will also cover other classes as follows:

- A classification in class LS1 also cover classes LS2, LS3 and LS4
- A classification in class LS2 also cover class LS4
- A classification in class LS3 also cover class LS4

11.4. Assessment method

Two different documents, both named "Assessment of the fire performance of façades" have been prepared. The proposed assessment method is presented in Appendix E and the alternative assessment method is presented in Appendix G. They both have the form of a test standard, and includes all headings needed to enable this to be presented to CEN for development. For the methods to be robust and accepted by CEN and end users they must be validated especially with respect to the repeatability and the reproducibility. It will be necessary to validate that the methods across the wide range of façade systems used and must be suitable for emerging technologies such as solar panels and green façades.

The section relating to the field of application contains details of the principles but without the data and experience from the validation program for the proposed test method we cannot fully draft this section.

11.5. Future work

The survey of Member States found that in many cases there is no requirement to have a classification on the façade fire performance, and therefore it is important that in the system for CE-marking the option to declare No Performance Determined (NPD) is included.

The Member States with additional requirements and national test methods should be invited to compare their test methods with the proposed ones within the round robin project. This would be of great value to get acceptance for the method to be proposed in the future.

The field of application will be an important part of the methodology. It has not been possible within the present project to propose the full field of application, since the scope of the methodology is very broad. Some examples on the direct field of application are presented in the assessment methodology.

There is presently no limit on which type of façade system the methodologies are applicable for, except that the fire resistance of curtain walling is covered by EN 13501-2. It will be necessary to validate the chosen method for new types of façade systems. The classification will only be applicable for the whole façade system that has been tested, i.e. it will not be possible to classify materials or details in the system.

Further studies are needed to ensure that the selected method has good enough repeatability and reproducibility. There are several factors that must be studied, such as:

- Effect of environment (especially wind speed and direction)
- Tolerances needed for the fuel (the research community do not agree on the repeatability of wood cribs, especially on the size needed for these types). Factors affecting are timber species, conditioning of the timber, density of the individual timber sticks, dimensions of sticks, amount of timber, and the tolerances needed.
- Mounting of thermocouples. There is a disagreement on how to mount the thermocouples in the best way, by drilling through the test specimen, or hanging them from the outside. Both methods have pros and cons.
- Measurement of heat exposure to the test specimen. It is important that the heat exposure can be reported after a test. There are different options such as measurement of temperature with plate thermometers pointing towards the fire, heat flux gauges measuring the radiation or mass loss measurement of the fuel source. A suitable method needs to be developed and validated.
- External fire. In some Member States is the externa fire scenario used. It may be that the proposed method would work well also for external fire, but this needs to be validated.

APPENDIX A – QUESTIONS TO SUB-CONTRACTORS

The following questions were sent to all sub-contractors.

1. What country are you responding for? Please note that we are gathering only one response per country and so the accuracy of the information provided is crucial.
2. A working definition for facades is: "A complete external wall construction of any type (massive wall or curtain wall…etc) or constitution (masonry, combustible material…Etc)." Does this definition adequately cover any national definition according to your building regulations? If it doesn't, please provide a suitable definition according to your national regulations.
3. Are there regulations governing the fire performance of facades in your country?
4. Does the national fire or building regulations include reaction to fire classifications, according to EN 13501-1?
5. Does the national fire or building regulations include fire resistance classifications, according to EN 13501-2?
6. Are there any additional requirements for the fire performance of facades which are mandatory according to your national fire or building regulations and which are not covered by either reaction to fire or fire resistance classifications?
7. Which standards or regulations detail the additional requirements for the fire performance of facades according to your national fire or building regulations (please list all that apply)?
8. Which additional requirements are detailed in these standards? Please provide answers for all building classes which are subject to these additional requirements according to your national fire or building regulations. Please also describe how these requirements are fulfilled according to the standard.
9. Please provide the name of the official reference document for the test method.
10. Describe the scope of the test method
11. Describe the direct field of application of the test method
12. What is the intended scale of the test method?
13. What is the configuration of the test method? E.g. is it a single vertical wall or is there a wing adjacent to the main panel?
14. Please describe the test rig in the method (e.g. number of storeys above the fire compartment, are there windows defined?).
15. Describe the combustion chamber used in the test method (dimensions, opening dimensions, ventilation).
16. What are the dimensions of the windows in the upper levels, if these are present?
17. What fuel is used in the test? Please also detail the amount of fuel and the configuration.
18. What duration does the test last for?
19. Is there a requirement to extinguish the fire at the end of the test?
20. Please describe how this extinguishment is carried out.
21. How do you start the fire in the test method?
22. Is there a requirement to control the temperature in the combustion chamber or at other control points (please give details)? If so, how is this achieved?
23. Are there any specific requirements regarding the test specimen, i.e. should it be as in practice with all detailing, cavity barriers, windows?
24. Can the test be performed outdoors? If so, what requirements are there on the weather conditions?
25. What requirements exist in the test method for conditioning of the test specimen prior to the test?
26. Are there any requirements to measure moisture content of the material in the test specimen or other material properties before the test (give details)?
27. What instrumentation is used in the test?
28. What are the main observations made during the test?
29. What are the main observations made after the test?
30. What are the failure criteria of the test?

31. Is there a prescribed calibration procedure?
32. E-mail address:
33. Other comments:

APPENDIX B – DEFINITION OF FAÇADE

Country	Definition
Austria	Only the cladding of an outer wall (e.g. with ETICS, ventilated façades, non-ventilated façades and so on)
Belgium	Not completely: An external wall construction of any type (massive wall or curtain wall…etc) or constitution (masonry, combustible material…Etc) without any loadbearing function
Bulgaria	Yes
Croatia	There is no official definition of the façades in the Croatian regulative but the requirements are set upon cladding of the outer wall (ETICS and ventilated façades).
Cyprus	-
Czech Republic	There is no specific definition of the term "façade" in fire safety regulations and standards. The term is usually used in connection with visible surface of external walls, systems of claddings od external walls (e.g. ETICS, ventilated façades), and curtain walling
Denmark	No definition of façades is given in the present version of the Danish Building Code but the suggested definition seems applicable. The Danish Building Code only uses the terms "external wall" and "façade" in non-fire related chapters. No definitions are given. Requirements on reaction to fire related to the external walls are assigned to "external surfaces" or "internal surfaces". Requirements on resistance to fire are not described specifically for the external walls but generally for the building as a whole. However, the proposed definition could be clarified to note that the façade includes windows.
Estonia	Yes
Finland	No national definition. Proposed definition is suitable.
France	Yes
Germany	No, term façade is not defined in German building regulations. In German building regulations exterior wall (load bearing and non-load bearing) is defined and cladding of the exterior wall (“Außenwandbekleidung”)
Greece	Yes
Hungary	This definition fully covers our definition of façades (Not these words are used).
Iceland	Yes
Italy	The definition must necessary cover, according the Italian standard document, also the double skin façades (ventilated façades). Instead of “wall construction” we suggest to indicate “vertical or almost vertical external envelopment of the building” and then we suggest the following definition: "A complete vertical or almost vertical external envelopment of the building (massive wall or curtain wall, double skin façades, ventilated façades etc) or constitution (masonry, combustible material…Etc)."
Latvia	Yes
Lichten-stein	No definition existing
Lithuania	Yes
Luxembourg	Yes
Malta	-
Netherlands	The Dutch Building Decree 2012 uses the term 'External separating structure' which has the following definition: structure separating an enclosed space in a building accessible to persons from the outside air, ground or water, including parts of other structures connected to that structure insofar as those parts affect the compliance of the separating structure with a regulation laid down under or pursuant to this Decree. Regarding reaction to fire the façade falls within the category 'Outer surface', which is defined as a side of a structural component which adjoins outdoor air. Regarding resistance to fire the regulations depend heavily on national standards NEN 6068 and NEN 6069. NEN 6068 uses the following definition for a façade: a separating structure adjoining the outdoor air, of which the smallest angle between the outward pointing normal and the above pointing vertical is equal to or smaller than 90° and larger than 25°. NEN 6069 speaks of external walls as the overall definition but also uses the term façades (which are both not specified further).
Norway	Yes
Poland	Yes

Country	Definition
Portugal	According to our national legislation, a façade is defined as each of the apparent faces of the building, constituted by one or more outer walls directly related to each other (Decreto Regulamentar n.º 9/2009, de 29 de Maio).
Republic of Ireland	Yes
Romania	Yes
Slovak republic	There is no definition of term "façade" in SK regulation: We use term external wall and its surface treatment (cladding).
Slovenia	In our national regulative the definition of façade is not very strict but generally understood as outer layers (decorative and sometimes functional) on the external wall without loadbearing construction
Spain	Yes
Sweden	The Swedish building code discuss "outer wall". The full outer wall does have a fire demand.
Switzerland	The Swiss fire protection regulations distinguish between "External wall construction" and "External wall covering system". External wall construction = external wall construction of any type including all its layers. External wall covering system = the outer layers of the external wall construction which are decisive for the external spread of fire.
UK	Yes

APPENDIX C – ADDITIONAL REQUIREMENTS

Country	Regu-lation	Addi-tional reg.	Reference	What are the additional requirements	Test method
Austria	Yes	Yes	OIB-guide line 2	Limitation of fire spread along and inside the façade and limitation of downfall from the façade that can harm evacuating people or fire brigade. For buildings with more than 4 floors above ground. This can be tested with test according to ÖNORM B3800-5.	ÖNORM B 3800-5
Belgium	Yes	Yes	ARRETE ROYAL DU 7 JUILLET 1994 FIXANT LES NORMES DE BASE EN MATIERE DE PREVENTION CONTRE L'INCENDIE ET L'EXPLOSION,	Sprinkler as alternative way for specific case	None
Bulgaria	Yes	No			
Croatia	Yes	Yes	Ordinance on fire resistance and other requirements to be met in the event of a fire (OG 29/2013, 87/2015)	Ordinance on fire resistance and other requirements to be met in the event of a fire (OG 29/2013, 87/2015) specifies requirements to external wall cladding systems (ETICS systems and ventilated systems) in the form of reaction to fire properties. For buildings with height up to 22 m divided into separate fire compartments, combustible external wall claddings and/or thermal insulations should be interrupted with the incombustible materials (materials with reaction to fire classes A1 or A2-s1, d0) at the borders of fire compartments. These interruptions should be executed vertically and horizontally in different lengths (from 1 to 5 m) depending on the location on the building. For buildings with height up to 22 m considered as one fire compartment,	None The aforementioned Ordinance does not recognize the full-scale tests as a mean to prove behavior of façades systems in case of fire.

Country	Regu-lation	Addi-tional reg.	Reference	What are the additional requirements	Test method
				combustible external wall claddings and/or thermal insulations should be interrupted with the incombustible materials (materials with reaction to fire classes A1 or A2-s1, d0) in the form of lintel protection around the openings and belts over the whole perimeter of buildings in each two storeys. For ventilated façades, requirements concern interruptions at the location of each two storeys in the form of the reactive or intumescent barriers, steel sheet barriers etc. For high rise buildings (height more than 22 m): external wall claddings and/or thermal insulations should be incombustible according to HRN EN 13501-1.	
Cyprus	-	-			
Czech Republic	Yes	Yes	ČSN 73 0810 Fire safety of buildings: General requirements	For buildings 12m-22,5m high: 1) 900mm horizontal barrier made of A1/A2 products at each floor and max 1m above the ground, and 250mm barriers around ventilation openings, electric switchboxes Any alernative solutions to 1) must be tested to ČSN ISO 13785-1 so that there is no spread of flame above 0,5m at 100kW during 30 min (national Annex to ČSN ISO 13785-1 specifies additional measurements and criteria). 2) 1,5m wide vertical barrier made of A1/A2 products both sides around external stairs and balconies used as escape routes, and all the way below such escape routes. 3) passages to be cladded with A1/A2 products	ISO 13785-1

Country	Regu-lation	Addi-tional reg.	Reference	What are the additional requirements	Test method
				4) bottom faces of balconies above certain size to be cladded with A1/A2 products 5) Uninsulated lightning conductors: walls to be cladded with A1/A2 products 250mm both sides 6) 900mm wide vertical barrier made of A1/A2 products between adjacent buildings 7) Windows of internal escape routes to be cladded with A1/A2 products min 1,5m around in all directions Any alernative solutions to 2)-7) must contain min 25mm thick layer of A1/A2 surface layer and be tested to ČSN ISO 13785-1 so that there is no spread of flame above 0,5m at 100kW during 30 min, and to ISO 13785-2 so that there is no loss of integrity of the surface layer and lower than ignition temperature of combustible layers beneath at 3MW for 30min. The same requirement applies if an additional ETICS is applied over existing combustible ETICS at these places. Calorific potential must be calculated for insulation products thicker than 200mm other than A1/A2	
Denmark	Yes	Yes	"Eksempelsamling om brandsikring af byggeri 2016", 2nd revised version 2016 including appendix from July 1.	See Swedish answer.	SP Fire 105
Estonia	Yes	No			

Country	Regu-lation	Addi-tional reg.	Reference	What are the additional requirements	Test method
Finland	Yes	No	No additional requirements. Possibility to prove the fire performance of façade.	None	Optional test method Tekniikka opastaa 16 (Engineering guidance 16), ”Kerrostalojen lisälämmöneristeen paloturvallisuus korjausrakentamisessa” (Fire safety of extra thermal insulation in reconstruction), 2001, published by SPEK
France	Yes	Yes	regulation for public-access building (ERP) arrêté du 24 mai 2010 (JO du 06/07/10) regulation for High Rise building (IGH) Arrêté du 30 décembre 2011 Home and dwelling buildings (Habitations) arrêté du 31/01/86 modifié Labour code (code du travail) Technical Instruction for façades (IT 249) Fire requirement for glazed façades (Arrêté du 10 septembre 1970 Amended in 2013)	Requirement regarding fire spread through façades (external surface but also through cavity, façade floor-junction.) Requirements are fufilled by using rules based on available combustible mass calculation and technical arrangement about installation (C+D rules). When thise rules cannot be matched, a test acc. to national test standard LEPIR 2 is required	LEPIR 2 (local expérimental pour incendie réel à deux niveaux)
Germany	Yes	Yes	The recent imple-mented Adminst-rative regulation (Verwaltungsvorschrift VV TB A 2016) regulates under A 2.1.5 the exterior walls and the claddings of exterior walls. For claddings to be classified as low flammable (according to VV TB A 2016) a reaction-to-fire test according to DIN EN 13501-1	For buildings with low height (up to 7 m, building class 1, 2 and 3 according to German building code): no additional requirements; all require-ments are according to DIN EN 13501-1 and-2. For buildings up to 22 m (building classes 4 and 5 according to German building code): additional requirements: systems have to be tested according to DIN 4102-20 and for ETICS with EPS insulation additionally have to be tested according to	E DIN 4102-20, Ergänzender Nachweis für das Brandverhalten von Außenwandbeklei-dungen (Complementary reaction-to-fire test for claddings of exterior walls)

Country	Regu-lation	Addi-tional reg.	Reference	What are the additional requirements	Test method
			for each component has to be passed and a DIN 4102-20 test for the system has to be passed. For ETICS with EPS as insulation material additionally sys-tems have to pass the test according to Technical regu-lation A 2.2.1.5 (Fire from outside the building, representing bur-ning waste containners). For exterior walls with systems with cavities (over more than one storey) the Technical regulation A 2.2.1.5 applies. This regulation gives constructive measures for fire barriers in the cavity.	technical regulation A 2.2.1.5 (fire from outside the building). For high rise buildings (height more than 22 m): no additional requirements (need to be non-combustible, according to DIN EN 13501-1 /-2). For buildings with special use (Sonderbauten) additional requirements can be mandated by German building authorities.	
Greece	Yes	Yes	There are no relevant standards, the additional regulations refer to the allowed area of openings over the total façade area.	There is no standard available. The additional requirements refer to the allowed area of openings over the total façade area and are valid only for "large" buildings, where the expected population is larger than 1000. The requirements are as follows: - Distance (façade to next building): < 3 m, Fraction of openings area: <15% - Distance (façade to next building): 3-5 m, Fraction of openings area: <25% - Distance (façade to next building): 5-10 m, Fraction of openings area: <50% - Distance (façade to next building): > 10 m, Fraction of openings area: <80%	The standard EN13823 (SBI test) is used, there is no specific "façade test"

Country	Regu-lation	Addi-tional reg.	Reference	What are the additional requirements	Test method
Hungary	Yes	Yes	MSZ 14800-6:2009 Fire resistance tests. Part 6: Fire propagation test for building façades	According MSZ 14800-6:2009 we can classify the fire propagation limit (Th=0, Th=15 min; Th=30 min; Th=45min.) Our fire regulation gives instruct-tions about the requirement of a certain building (depending the height, materials, risk classes etc.)	MSZ 14800-6:2009 Fire resistance tests. Part 6: Fire propagation test for building façades
Iceland	Yes	No			
Italy	Yes	Yes	"*Technical guideline for determining the fire safety requirements of façades in civil building*", issued by Italian Minister with Circular Letter n. 5043 of 15 April 2013. It's a normative document of voluntary application, referred to buildings with a "fire height" greater than 12 meters, that completely governs fire performances of façades	1) As alternative measures for double skin façades, automatic extinguishing system positioned inside of the two walls, commanded by appropriate fire detection system present at each floor of the building. The dispensing devices, located above each floor, must be directed towards the internal wall of the façade. In such cases Glass elements of the façade (curtain walls) must be "tempered" and provided with treatment "HST" (Heat Soak Test); 2) No requirements of fire resistance are provided for the elements of the façade that belong to compartments in which the value of the fire load density* is lower than 200 MJ/m^2; 3) No requirements of fire resistance are provided for the elements of the façade that belong to compartments in which the value of the fire load density* is greater than 200 MJ/m^2, if they are provided with an automatic extinguishing system; 4) In the case in which the façades are composed of brittle materials or materials that, in case of fire, may lead to breakage and chipping parts minute, it must be ensured that the landings of escape routes and safe places outside are protected from	No official standard

Country	Regu-lation	Addi-tional reg.	Reference	What are the additional requirements	Test method
				the fall of the parts of façade. The design of the system of exodus must necessarily take into account the difficulty of access to the building from the outside, in case of fire, by the rescue teams. However, it's possible to insert windows that must be easily opened by the rescue teams from the outside, in compliance with the accessibility requirements of the fire brigade means. 5) The use of the cavity (double skin façades) by the occupants for the purpose of evacuation is prohibited.	
Latvia	Yes	No			
Lichten-stein	Yes	Yes	See Switzerland	See Switzerland	See Switzerland
Lithuania	Yes	No			
Luxem-bourg	Yes	No			
Malta	-	-			
Nether-lands	Yes	No			
Norway	Yes	Yes	The building regulations TEK10 (Regula-tions on technical requirements for building works from 2010) are performance based, and examples of acceptable performance are given in the gui-delines (called VTEK 10). New building regulations will be issued in Norway during 2017, but there will probably not be introduced any Changes regarding fire performance of façades.	The guidelines to §11-9 in TEK10 specifies requirements to external façade systems used as additional insulation on outer walls. Insulation that do not satisfy class A2-s1,d0 can be used as external additional insulation on outer walls except in building class 3 (e.g. high buildings) and in risk class 6 (e.g. hospitals, hotels, care homes etc). These systems shall be documented through testing according to SP Fire 105: Large scale tes-ting of façade systems or according to an equivalent test method.	SP Fire 105

Country	Regu-lation	Addi-tional reg.	Reference	What are the additional requirements	Test method
Poland	Yes	Yes	Polish Building Code (Rozporządzenie Ministra Infrastruktury z dnia 12 kwietnia 2002 r. (Dz.U.nr 75, poz. 690 z późniejszymi zmianami) PN-B-02867: 2013 Ochrona przeciwpożarowa budynków. Metoda badania stopnia rozprzestrzeniania ognia przez ściany zewnętrzne od strony zewnętrznej oraz zasady klasyfikacji	Requirement regarding fire spread through fassades; classes: NRO class 'non spreading fire" SRO class "weakly fire spreading" SIRO class "highly fire spreading"	1. PN-B-02867:2013
Portugal	Yes	No			
Republic of Ireland	Yes	Yes	Building Regulation 2006 Technical Guidance Document B Fire Safety	BS8414 (BR 135) Note: Apply to Building over 18m	BS8414 (BR 135)
Romania	Yes	Yes	Regulations for fire safety of buildings: P118-1999 and Regulations for ventilated façades design: NP135-2013	There are provisions regarding the classes of reaction to fire and fire resistance. Additional constructive requirements for high and very high buildings are: using of A1 or A2-s1, d0 materials and resistance time 15 minutes, using of separations with high at least 1,20 meters and E30. Additional constructive requirements for curtain walls are: using of vertical separations without glazing with high at least 1,20 meters and E30, at the floor level and with the same thickness as the floor thickness using of interruptions of the free space between curtain wall and floor with A1 or A2-s1,d0 materials and E30. Alternative measures are: using of continuous screens with minimum high of 0,50 meters made from A1 or A2-s1,d0 materials and E30 and when the false ceilings are	No national standard test method

Country	Regu-lation	Addi-tional reg.	Reference	What are the additional requirements	Test method
				situated at the lower sc-reens limit, openings are been made for smoke exiting behind the screens. Alternative measure instead of using screens is to use water protection systems. Curtain walls are anchored with steel elements from resistance structure of the building. For ventilated façades constructive requirements are: maximum air gap is 5 centimeters, using vertical gap rhythmic interruptions (without, 2 floors and 1 floor interruptions) according to utility, number of floors and high of the building, using the reactive or intumescent barriers (different variants) as elements of interruption E30, using steel sheet barriers with minimum thickness 1,5 mm in 1 meter steps, using combustible elements interruptions at building joints (settlement, expansion, seismic) with incombustible products for 1 meter, using the horizontal interruptions at 20 meters or at building joints, using incombustible materials near to the evacuation ways for 3 meters of the evacuation stair. The openings glazed or not are been protected by jambs, lintels. For the photovoltaic panels façades and for "green" panels façades there are others additional mea-sures.	
Slovak republic	Yes	Yes	STN 73 0802/Z2: 2016 for buildings with permission for use issued before 2002 in case of their recon-struction (inc-luding ETICS) STN 92 0201-2: 2007 for other	Additional requirement is valid only for buildings for which STN 73 0802/Z2: 2016 is valid (see previous answer). Requirement for large scale test is specified in case the standard recommendations are not followed. The ISO 13785-2 is mentioned in reference standard but it is not clearly stated that only	-

Country	Regu-lation	Addi-tional reg.	Reference	What are the additional requirements	Test method
			buildings (under revision now)	tests according ISO 13785-2 are acceptable. The possibility to use large scale test as evidence for safety design of façade is limited by time (ETICS build from 2019), and condition the harmonised European test for ETICS will be published. Criteria for such test are not speci-fied now with idea that cri-teria from harmonised Eu-ropean test will be accepted. It means that practically it is not possible to follow this way and only standard recommendation for safety design can be used. The answers in the following part of this ques-tionnaire will therefore not reflect possibility of large scale test.	
Slovenia	Yes	No			
Spain	Yes	No			
Sweden	Yes	Yes	Swedish building code BBR §5:551 (version BFS 2011:6 with changes to BFS 2016:13)	Limitation of fire spread along and inside the façade and limitation of downfall from the façade who can harm evacuating people or fire brigade. This can be tested with test according to local fire test SP Fire 105.	SP Fire 105
Switzer-land	Yes	Yes	The Swiss fire protection regulations issued by the As-sociation of Cantonal Fire Insurance Com-panies (ACFI) in German: "Brand-schutz-vorschriften VKF"	Limitation of fire spread along and inside the external wall covering system. Buildings of medium height (Total height = 11m - 30m): Combustible external wall claddings and/or thermal insulations must be subdivided, so that a fire on the external wall cannot spread more than two storeys above the fire floor, before fire brigades start their fire fighting operations (approx. 20-30 minutes). High rise buildings (Total height = more than 30m): The external wall and the external wall covering System must consist of incombustible building materials. Exception: non-relevant construction parts	DIN 4102-20 / ÖNorm B 3800-5 / Prüfbestimmung für Aussenwand-bekleidungssysteme

Country	Regu-lation	Addi-tional reg.	Reference	What are the additional requirements	Test method
				in terms of area. These requirements can be fulfilled by the use of stan-dard measurements such as the use of incombustible materials, constructive barriers or the use of an approved con-struction. The approval procedure requires fire performance tests according to either DIN 4102-20, ÖNorm B 3800-5 or the Swiss testing pro-cedure for external wall covering systems.	
UK	Yes	Yes	Building Regulations - England & Wales 2010 Approved Document B - Fire Safety [AD(B)] Building (Scotland) Regulations 2004 Technical Handbooks 2016 - Fire Building Regulations (Northern Ireland) 2012 Technical Booklet E - Fire	BS8414 and BR135 can be used to demonstrate the fire performance of external wall constructions for systems which do not follow or cannot meet the fire performance for characteristics given in the guidance for individual for components	BS 8414 -1 :2015 & BS8414-2:2015

APPENDIX D – DESCRIPTION OF TEST METHODS

Country	Test method	Scope of test method	DIAP	Scale	Configuration
Austria	ÖNORM B 3800-5	This method simulates a fire from a window burnout of an apartment. The test simulates the flame height in the second floor over the fire floor (the test concept based on Kotthoff-theories). The behavior of the construction and material and the fire spread (flame spread) in the wall/cladding can be studied.	The test method described is applicable to: -ventilated façades -non ventilatet façades -ETICS -(as well as for curtain walling according to Austrian buil-ding regula-tions; from our point of view not possible for products accor-ding to EN 13830)	Medium scale	vertical wall and a right angle wing
Czech Republic	ČSN ISO 13785-1	Test method, which determines the fire safety of the façade when insulation material is inflammable. The flame effect (flame spread and fire spread) on the surface of the wall and within the wall structure is exa-mined.	This part of ISO 13785 specifies a screening met-hod for determining the reaction to fire performance of products and constructions of façades or clad-dings when exposed to heat from a simu-lated external fire with flames impinging di-rectly upon a façade. This test method is app-licable only to façades and claddings that are not free standing and that are used as an addition to an existing external wall.	Medium scale	vertical wall and a right angle wing
Denmark	SP Fire 105	See Swedish answer.	See Swedish answer. Though, as opposed to Sweden, the use of SP Fire 105 is limited to single-family houses and one-	Large scale	See Swedish answer.

Country	Test method	Scope of test method	DIAP	Scale	Configuration
			storey industrial buildings.		
Finland	Tekniikka opastaa 16 (Engineering guidance 16), ”Kerrostalojen lisälämmöneristeen paloturvallisuus korjausrakentamisessa” (Fire safety of extra thermal insulation in reconstruction), 2001, published by SPEK.	Test method, which determines the fire safety of the façade when insulation material is inflammable. The flame effect (flame spread and fire spread) on the surface of the wall and within the wall structure is examined.	Use of inflammable insulation material and render in 3-8 story buildings in reconstruction. Note: In practice the test method has been used for timber façades as well.	Large scale	Single vertical wall
France	LEPIR 2 (local expérimental pour incendie réel à deux niveaux)	Determination of fire behavior of façades of building with windows, test method and classification criteria	All façade systems including windows	Large scale	Single vertical wall
Germany	E DIN 4102-20, Ergänzender Nachweis für das Brandverhalten von Außenwandbekleidungen (Complementary reaction-to-fire test for claddings of exterior walls)	E DIN 4102-2: Complementary test of the cladding systems (each part of the system has to be low flammable according to DIN 4102-1 or DIN EN 13501-1) for classification as low flammable as a system. Technical regulation A 2.2.1.5: Test for ETICS with EPS insulation, shows fire performance of the system when a fire outside the building occurs. A burning waste container is represented by a 200 kg wood crib.	E DIN 4102-2 Complementary test of the cladding systems (each part of the system has to be low flammable according to DIN 4102-1 or DIN EN 13501-1) for classification as low flammable as a system. Technical regulation A 2.2.1.5 Test for ETICS with EPS insulation, shows fire performance of the system when a fire	Medium scale Large scale	E DIN 4102-20 and Techn Reg A 2.2.1.5: Two wings (i.e. corner) configuration

Country	Test method	Scope of test method	DIAP	Scale	Configuration
			outside the building occurs. A burning waste container is rep-resented by a 200 kg wood crib.		
Hungary	MSZ 14800-6:2009 Fire resistance tests. Part 6: Fire propa-gation test for building façades	1. Combustible and ventilated façade solutions applied on non-combustible basis wall 2. Special façade solutions, where the vertical distance bet-ween the openings are smaller than a certain value (usually 1,3m) (For example between French windows) 3. Other façade structures with openings - solutions without non-combustible basis wall - solutions including a fire barrier - other innovative solutions	There are no provisions for extending the test results.	Large scale	single vertical wall with two openings.
Lichtenstein	See Switzerland's answer.	See Switzerland's answer.	See Switzerland's answer.	See Switzer-land's answer.	See Switzerland's answer.
Norway	SP Fire 105	See Sweden's answer.	See Sweden's answer.	Large scale	See Sweden's answer.
Poland	1. PN-B-02867:2013	Determination of fire behavior of façades without window. Test method and classification criteria. The test philosophy is to determine the heat and flames influence contribution of the façade's combustion on the effect of exposure of standard fire source.	All façade sys-tems	Medium scale	Single vertical wall without openings
Republic of Ireland	BS8414 (BR 135)	BS8414-1 (2002), BS8414-2 (2005)	Applicable to the system (façade with its construc-tion materials) as tested	Large scale	Wing adjacent to the main panel
Slovak republic	ISO 13785-2	This part of ISO 13785 specifies a method of test for determining the reaction to fire of materials and construction of façade claddings when exposed to heat and flames from a simulated interior compartment fire with flames emerging through a window opening and impinging directly on the façade. The information generated from this test may also be applicable to the scenario of an external fire	-	Large scale	Wing adjacent to the main panel

Country	Test method	Scope of test method	DIAP	Scale	Configuration
		impinging on a façade; however, the results may not be applicable for all fire exposure conditions			
Sweden	SP Fire 105	From SP Fire 105 "This SP method specifies a procedure to determine the reaction to fire of materials and construction of external wall assemblies or façade claddings, when exposed to fire from a simulated apartment fire with flames emerging out through a window opening. The behavior of the construction and material and the fire spread (flame spread) in the wall/cladding can be studied."	From SP Fire 105 "The test method described is applicable to: -external wall assemblies -and façade claddings added to an existing external wall. The test method is only applicable to vertical constructions. The method is not applicable for determination of the structural strength of an external wall assembly or façade cladding construction when exposed to fire."	Large scale	Single vertical wall no wing
Switzerland	DIN 4102-20 / ÖNorm B 3800-5 / Prüfbestimmung für Aussenwandbekleidungs-systeme	For tests according to DIN 4102-20 or ÖNorm B 3800-5 please refer to the answers of Germany and Austria. The comparison between the three different test methods is regulated in our approval principles. It is required to comply with the design limit for flames, damage and temperature at the rated height (measured from the floor). - DIN E 4102-20 => rated height 4.5m - ÖNORM B 3800-5 => rated height 4.0m - Swiss test method => rated height 7.2m The following answers refer to the Swiss test method. The test method is used for the evaluation and proof of the fire behavior of external wall covering systems on the original scale, when exposed to fire from a simulated apartment fire with flames emerging out through a window opening.	The test method is applicable to linings and surface coatings (paints, plasters, etc.) used on exterior walls. Included are elements with limited application area, such as decorative elements, cornices and balcony railing garments.	Large scale	Single vertical wall, no wing

Country	Test method	Scope of test method	DIAP	Scale	Configuratio n
UK	BS 8414 -1 :2015 & BS8414-2:2015	Part 1 - Fire performance of external cladding systems. Test method for non-loadbearing external cladding systems applied to the masonry face of a building. The standard provides a test method for determining the fire performance characteristics of non-loadbearing external cladding systems, rain screen over cladding systems and external wall insulation systems when applied to the face of a building and exposed to an external fire under controlled conditions. The fire exposure is representative of an external fire source or a fully-developed (post-flashover) fire in a room, venting through an opening such as a window aperture that expo-ses the cladding to the effects of external flames, or from an external fire source. The stan-dard does not cover the per-formance of glazed window ope-nings or the detailing at such openings nor does it apply to curtain walling systems or systems that include glass panels. Part 2 - Fire performance of external cladding systems. Test method for non-loadbearing external cladding systems fixed to and supported by a structural steel frame. The standard provides a test method for deter-mining the fire performance characteristics of non-loadbearing external cladding systems, such as curtain walling, glazed elements, infill panels and insulated composite panels, fixed to and supported by a structural steel frame when exposed to an external fire under controlled conditions. The fire exposure is representative of an external fire source or a fully-de-veloped (post-flashover) fire in a room, venting through an ope-ning such as a window aperture that exposes the cladding to the effects of external flames, or from an external fire source. The standard does not apply to non-loadbearing external rain screen	Applicable to the system as tested.	Large scale	Right angle, return wall

Country	Test method	Scope of test method	DIAP	Scale	Configuration
		over cladding systems or external wall insulation systems applied to the face of a building, the fire testing of which are covered in BS 8414.			

Assessment of fire performance of facades – Based on DIN 4102-20 & BS 8414 Series

Prepared within the EC-funded project SI2.743702-30-CE-0830933/00-14

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0 INTRODUCTION

This paper sets out to provide a methodology to evaluate and classify the fire performance of facades systems based on the BS 8414 series and DIN 4102-20 test standards and includes additional testing requirements to determine the following performance characteristics:

- Floor junctions
- Falling parts/burning debris
- Secondary opening
- Smouldering

As part of this project it has also been necessary to review and where practical, take into account, the regulatory requirements of all Member States who utilize alternative fire test methodologies as part of their regulatory requirements for determining the fire performance of facades.

There are no modifications to the current versions of BS 8414 series and DIN 4102-20. The methodologies presented in this paper are in addition to the requirements of the standards as currently presented.

0.1 Smouldering

Smouldering is assessed and reported in DIN 4102-20. For classification based on BS 8414 series the smouldering characteristics of the façade system will be assessed via the European standard EN 16733.

0.2 Smoke

BS 8414 series and DIN 4102-20 do not measure or comment on smoke production. It is therefore envisaged that the current EN 13501-1 classification for smoke as referenced if require for classification purposes by Member States.

0.3 Falling parts and burning debris

Whilst both DIN 4102-20 and BS 8414 series require the production of falling parts to be noted there is no quantitative measurement method included in these standards.

Several of the additional methodologies currently used by Member States make reference to and in some cases prescribe quantitative approaches to determining these characteristics, it has therefore been suggested that the following performance criteria are recorded:

- No part larger than 1 kg and 0.1 m^2
- No part larger than 5 kg and 0.4 m^2
- No burning particle at all
- Limited duration burning debris < 20 s

There is at present no validated experimental method to quantify falling parts. Therefore, the present proposal is based on visual observations until a suitable method has been validated. The intention is to include this in the round robin project. There are different options such as a floor in front of the test rig with load cells so the impact of falling parts can be determined, or by means of Digital Image Correlation (DIC).

0.4 Test rig

See DIN 4102-20 and BS 8414 series.

0.5 Secondary openings

Neither DIN 4102-20 nor BS 8414 series has a secondary opening in the test set-up. The use of secondary openings will only be needed in the BS 8414 series, and it is treated as an additional test when secondary openings need to be assessed.

0.6 Locating instrumentation within the test samples

See DIN 4102-20 and BS 8414 series.

0.7 Heat exposure and fuel

See DIN 4102-20 and BS 8414 series.

0.8 External fire scenario

In BR 135 information is given that the BS 8414 series test covers fire scenarios with external fire sources as well. It does not quantify up to which fire load external fire scenarios are covered. An ongoing numerical investigation of both test scenarios, the BS 8414 series and the "Sockelbrandtest" quantifies the heat impact on the façade for both tests to see whether the external fire scenario used in the "Sockelbrandtest" is covered by the BS 8414 series.

0.9 Historical data

Tests performed in accordance with DIN 4102-20 or BS 8414 series may be considered for classification, as long the tests have been performed in accordance with the current versions and no changes to the methods are made, and no options such as falling parts are required.

0.10 Classification

There will be two different classification systems, one based on testing in accordance with DIN 4102-20 and one based on testing in accordance with the BS 8414 series.

0.11 Performance criteria

There are no performance criteria given in DIN 4102-20 or the BS 8414 series. Performance criteria on temperature measurements and on falling parts are therefore included in the present methodology. These are still not validated and need to be examined in more detail. The values given in the present document is taken from different sources and shall only be considered as examples.

1 SCOPE

This assessment method is applicable for external walls, façades, façade cladding systems vertically fixed to and supported by a structural frame or a concrete masonry sub-structure. The method will not address the load-bearing capacity of the tested system, nor inclined façade systems. This method addresses requirements which go beyond the requirements that can be addressed and classified according to EN 13501-1,2. The method includes assessment of detailing of the façade system around openings, but not any window detailing. Vertical and lateral fire spread on the surface and within façade systems is assessed. This method cannot directly assess the fire re-entry into the compartments above the combustion chamber, because window detailing is not tested. Vertical fire spread is limited to reduce the risk of fire re-entry into the building, see note below. The fire resistance characteristics of curtain walling systems are addressed through the European Standards EN 1364-3 and 4.

Note: generally, a fire re-entry into the building from one storey (origin of the fire) to the next one above via windows cannot be prevented. Limitation of vertical fire spread concentrates usually on the task to prevent further fire spread.

Examples of typical products and systems covered by this proposal include, but it does not exclude other products and systems:

- Exterior Thermal Insulation Composite Systems (EIFS, ETICS or synthetic stucco)
- Metal composite material cladding systems (MCM)
- High-pressure laminate facade and cladding systems
- Structural Insulation Panel Systems (SIPS) and insulated sandwich panel systems
- Rain screen cladding or ventilated facades
- Weather-resistive barriers (WRB)
- Wooden facades
- External walls

This proposal covers the fire performance of the façade system, not the individual components, products or elements in isolation.

This proposal includes two fire load scenarios:

- a medium fire exposure test – DIN 4102-20
- a large fire exposure test – BS 8414 series

The proposed assessment method enables both fire scenarios to be considered.

Note: It may be necessary, as part of the round robin test program to confirm that the large fire exposure conditions could also cover the external fire exposure used in some countries.

2 NORMATIVE REFERENCES

ISO 13943 Fire safety – Vocabulary

BS 8414-1, Part 1 Fire performance of external cladding systems. Test methods for non-loadbearing external cladding systems applied to the face of a building

BS 8414-2, Part 2 Fire performance of external cladding systems. Test method for non-loadbearing external cladding systems fixed to and supported by a structural steel frame

DIN 4102-20, Fire behaviour of building materials and building components - Part 20: Complementary verification for the assessment of the fire behaviour of external wall claddings

EN 60584-1 Thermocouples – Part 1: EMF specifications and tolerances

EN 1364-3 Fire resistance tests for non-loadbearing elements – Part 3: Curtain walling – Full configuration (complete assembly)

EN 1364-4 Fire resistance tests for non-loadbearing elements – Part 4: Curtain walling – Part configuration

EN 16733 Reaction to fire tests for building products – Determination of a building product's propensity to undergo continuous smouldering

EN 1363-1 Fire resistance tests – Part 1: General requirements

EN 13501-1 Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests

EN 13501-2 Fire classification of construction products and building elements – part 2: Classification using data from fire resistance tests, excluding ventilation services

LPS 1581 and 1582

ISO 13784-2: Reaction-to-fire tests for sandwich panel building systems -- Part 2: Test method for large rooms

3 TERMS, DEFINITIONS, SYMBOLS AND DESIGNATIONS

burned damage	Permanent consequences of the system including detachment, melting, charring (evidence by change of density, porosity or fissures) but not including deposition of soot or changes in color only.
element, component or product	In this context part of the façade system
external cladding system	Complete cladding assembly *Note: This includes sheeting rails, fixings, cavities, insulation and membranes, coatings, flashings or joints* *Note: The limits of the cladding system are taken to be as applied to and forward of the masonry substrate*
external wall	Complete system including any sheeting rails, cavities, fire barriers and weathering membranes or coatings
façade	There is no common definition of the term. In the present document the façade is defined as the tested system
falling parts	Material (solid or molten) separating from the specimen, with or without continuing to burn with a visible flame, during a fire or a fire test.
fire Ioad	Quantity of heat which could be released by the complete combustion of all the combustible materials in a volume, including the facings of all bounding surfaces *Note: Fire load is expressed in joules* *Note: Fire load may be based on effective, gross or net heat of combustion (thermal energy produced by combustion of unit mass of a given substance as required by the specifier)*
fire scenario	Detailed description of conditions, including environmental, of one or more stages from before ignition to after completion of combustion in an actual fire at a specific location or in a real-scale simulation
thermal flame spread	Propagation of a fire front defined by a maximum temperature rise of a thermocouple at any instance.
flash-over	Transition to a state of total surface involvement in a ventilated controlled fire within an enclosure
mass loss rate	Mass of material lost per unit time under specified conditions *Note: It is expressed in kilograms per second*
NPD	No performance determined
smouldering	Combustion of a material without visible flames or light, including glowing combustion. *Note: Smouldering is generally evidenced by an increase in temperature and/or by effluent*
system	In this context façade system that is applied to the external wall or external wall itself

4 TEST EQUIPMENT

See DIN 4102-20 or BS 8414 series.

In case a secondary opening shall be included in the test with BS 8414 series, see clause 4.1 for further explanation and instructions.

4.1 Secondary opening (only for BS 8414 series) - optional

The objective with the secondary opening is to include the special detailing around openings of the façade system, i.e. the detailing where features such as windows are to be mounted in practice.

The main face of the test specimen and the supporting construction shall incorporate a secondary opening aligned with the combustion chamber, see figure 1. In some cases, the window frame is used to protect the edge of the façade system, and for those systems it is possible to perform the test with a model of the window frame of the same material and dimensions as will be used in practice. In the figure below are given when no window frame is used.

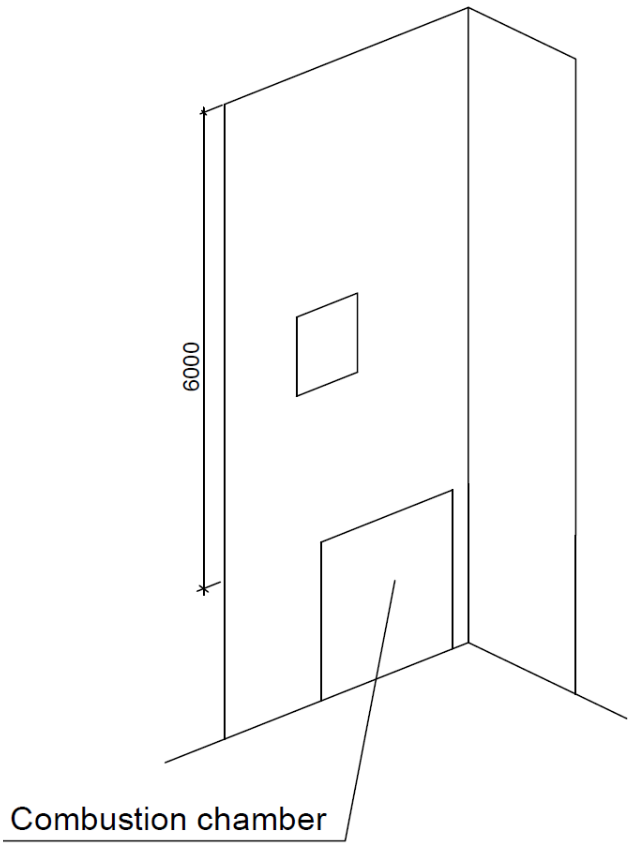

Figure 1. Principle drawing of the test method for the large fire exposure on the right with an added secondary opening.

When a supporting construction is used, the masonry infill shall have an indentation with a depth of >50 mm representing the opening, see figure 2.

When the test specimen with secondary opening is mounted directly on the structural frame the backside of the opening shall be covered with a calcium silicate board with a thickness of > 20 mm, or similar fire resistant board, see figure 2.

See annex C for further information/explanation.

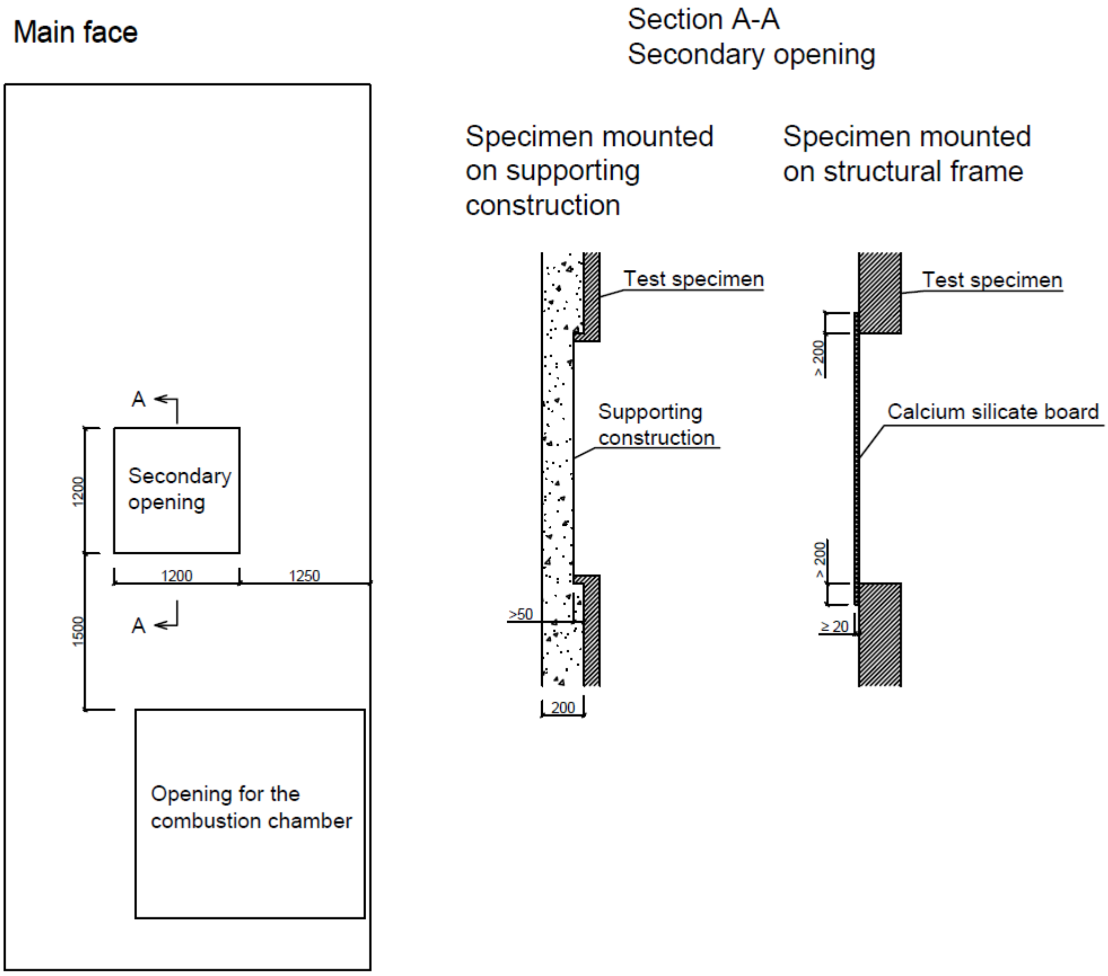

Figure 2. Main face with secondary opening.

4.2 Fuel source

See DIN 4102-20 or BS 8414 series.

4.3 Instrumentation

See DIN 4102-20 or BS 8414 series.

5 ENVIRONMENTAL CONDITIONS

The test shall be carried out in an enclosed environment which is free from the effects of the weather.

Note: Below are some examples shown from similar standards, and this must be defined within the next phase of the project.

- Wind speed (< 1.75 m/s from ISO 13784-2, 0.5 m/s DIN 4102-20)
- Distances to roof and walls (> 3 m in LPS 1581 and 1582)
- Ambient temperature (10-30 C from ISO 13784-2)

Equipment for monitoring wind speed, such as an anemometer, shall have an accuracy of ± 0.5 m/s for measuring the ambient air velocity.

If the test rig is positioned in a room, it shall be in a way that both the fire and the specimen are under natural ventilation conditions and the fire effluents are properly exhausted.

Mechanical ventilation above the test rig (exhaust duct) is allowed, as long as the requirement on wind speed is maintained.

6 TEST SPECIMEN

6.1 Size

See DIN 4102-20 or BS 8414 series.

6.2 Number

See DIN 4102-20 or BS 8414 series.

6.3 Design

See DIN 4102-20 or BS 8414 series.

6.4 Verification

See DIN 4102-20 or BS 8414 series.

7 MOUNTING OF THE TEST SPECIMEN

See DIN 4102-20 or BS 8414 series. In case the BS 8414 series test shall include a secondary opening and/or junction between façade and floor the following applies.

Secondary opening

The objective of simulating a window opening is to focus on the method applied by the manufacturer to treat the connection or interface between the façade system and a window. Therefore, no windows need to be installed. Examples on different possible assemblies and how to mount the test specimen are given in Annex C.

Junction between façade and floor

The assessment of the junction between floor and façade as potential weak point may be required in some cases. In order to consider this issue, a specific adaptation can be done in the test. Figure 3 show how the junction between the façade and the floor can be included in the test.

Note: The junction between façade and floor will only be assessed along the width of the combustion chamber, and not the whole width of the test specimen.

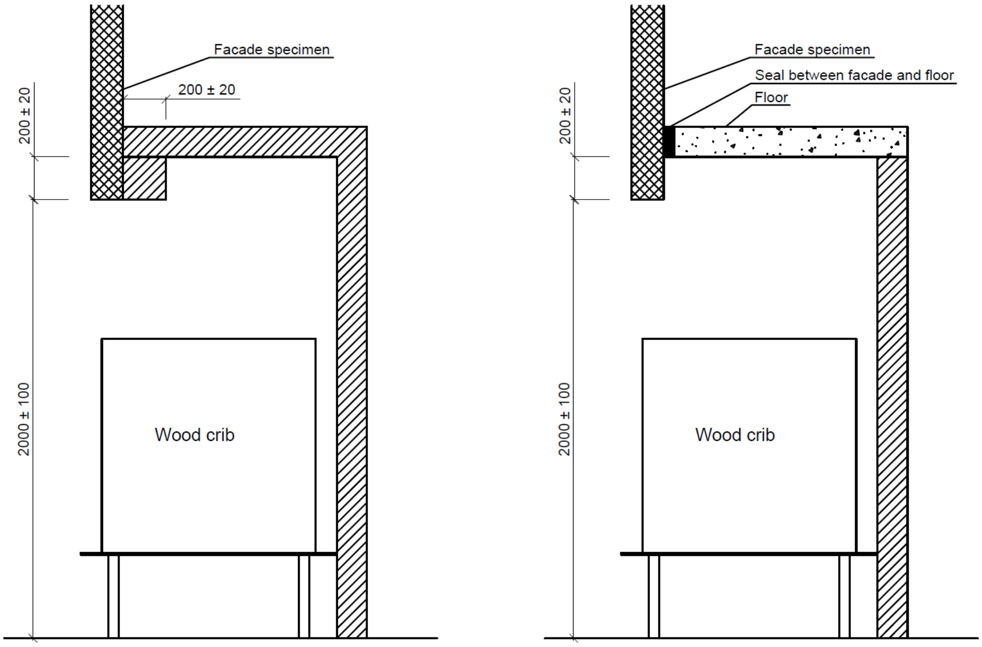

Figure 3. Mounting of façade system and floor at the combustion chamber. The normal procedure is shown to the left and the case when also the connection between façade and floor is evaluated to the right.

In case of façade systems connected directly to the floors, the combustion chamber upper part will be made of a slab. The material of the slab is made of aerated concrete, armoured concrete or even the slab material intended for end-use, e.g. timber floor.

In the neighbouring of the floor, the structural steel frame shall be protected by fire blanket.

See annex D for further information/explanation.

8 CONDITIONING OF TEST SPECIMEN

See DIN 4102-20 or BS 8414 series.

9 TEMPERATURE MEASUREMENTS

See DIN 4102-20 or BS 8414 series. In case the BS 8414 series test include junction between façade and floor, see 9.1 below.

9.1 Measurements on junction between façade and floor (optional)

Thermocouples with copper disc and insulating pad, in accordance with EN 1363-1, shall be installed as shown in figure 4.

If the linear seal is wider than 30 mm:

- Four thermocouples are located at mid-width of the seal.
- Four thermocouples are located on the floor at 15 mm from the seal

If the linear seal is narrower than 30 mm:

- Four thermocouples are located on the floor at 15 mm from the seal

A video camera is installed at the back of the structural frame at a location allowing capturing the complete length of the connection.

This camera will serve to control any integrity failure and help for the control of safety of the test rig.

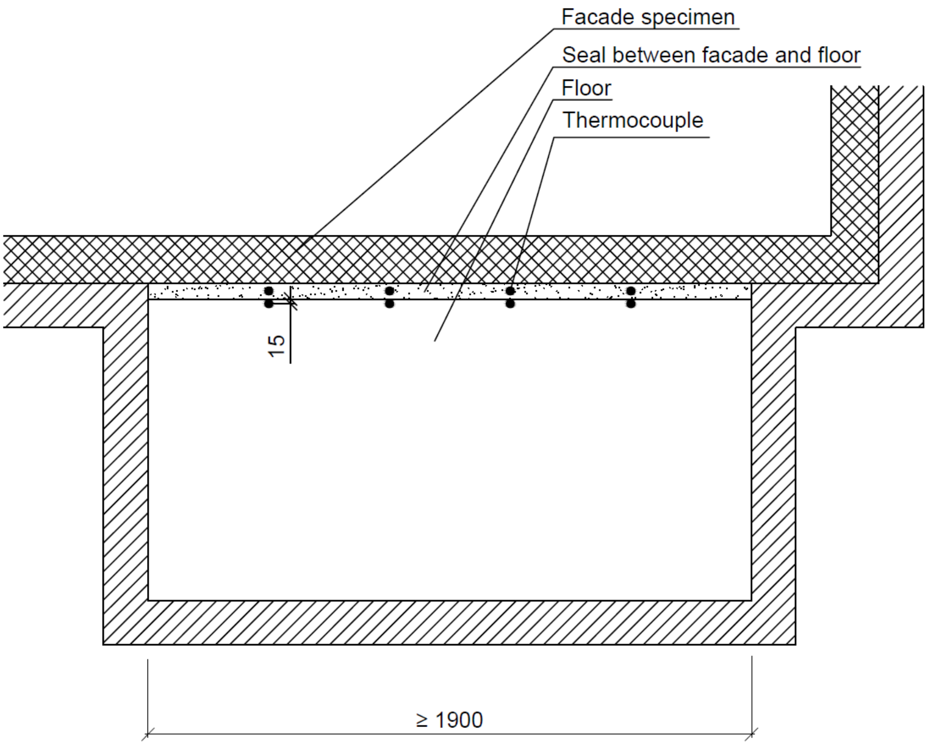

Figure 4. Instrumentation at the junction between façade and floor. The view is from above the floor (the roof of the combustion chamber).

10 TEST PROCEDURE

See DIN 4102-20 or BS 8414 series.

11 PERFORMANCE CRITERIA

In case a thermocouple used for determining the performance of the façade system fails during the test, a judgement may be done based on the visual observations as well as the measured values obtained by nearby thermocouples during and after the test.

The values to be observed and recorded for each performance criterion are:

Vertical fire spread medium fire exposure (DIN 4102-20)

The vertical fire spread is determined with both observations and thermal flame spread (temperatures of thermocouples).

- Maximal temperature of thermocouple positioned at the horizontal classification level at 3.5 m above the combustion chamber for the medium fire exposure test, during the test time of 60 minutes after the test start.
- burned damage to the specimen 3,5 m or more above the combustion chamber.
- Duration of continuous visual flaming 3,5 m above the combustion chamber.
- time of occurrence of visual flames at the top of the specimen.

Vertical fire spread large fire exposure (BS 8414 series)

Observe and record:

Maximal temperature rise above Ts of thermocouple external and internal at level 2 for a period of at least 30 s, within 15 minutes of the start time, ts.

Any occurrence of the system burn-through so that fire reaches the internal surface,

Any occurrence of continuous flaming, defined as a flame with a duration in excess of 60 s, observed on the internal surface of the test specimen at or above a height of 0.5 m above the combustion chamber opening within 15 min of the start time, ts.

Horizontal fire spread (DIN 4102-20)

Observe and record:

Time of occurrence of flames at the edge of the specimen.

Duration of lateral flame spread after the fire source has been extinguished.

Horizontal fire spread (BS 8414 series)

The test specimen must be kept on the test rig for 60 minutes

Observe and record during that time:

Time of occurrence of flames at the vertical edge of the test specimen

Falling parts

Falling parts and burning debris shall be monitored throughout the complete test duration.

Falling parts include all solid or liquid material falling from the test specimen. They are assessed by visual observations, until a suitable measurement technique is available.

Both falling parts and burning particles/droplets are to be assessed during the test frame time of 60 minutes after the test start time.

Façade-floor junction (optional)

Observe and record:

Maximal temperature rise of thermocouple positioned at the connection between floor and façade, see figure 11.

Duration of any continuous flaming.

Smouldering (optional)

Observe and record:

Maximal temperature of thermocouple positioned at for the smouldering application, 15 hours after the end of observation period/ extinguishment of the fire.

12 TEST REPORT

See DIN 4102-20 or BS 8414 series.

In addition, shall eventual optional tests and/or observations performed (secondary opening, falling parts and/or junction between façade and floor) be described, and the results presented.

13 DIRECT FIELD OF APPLICATION

Note: It is currently too early to define a set of direct field of applications (DIAP). The following gives examples on what can be considered in the DIAP.

14 CLASSIFICATION

The classification system contains six different characteristics that may be included in the classification, see Tables 1 and 2. Only the heat exposure is mandatory, all other characteristics are optional.

Table 1. Proposed classification system

Feature	Classification	Comment
Limited fire spread	LF, MF	LF when a large size fire has been used MF when a medium size fire has been used
Junction	J	Junction between façade and floor was present and the test successful regarding integrity and insulation performances
Secondary opening	W	If secondary opening was present and the test successful
Smouldering	S	If smouldering has been considered and the test is successful
Falling parts	F1, F2	If falling parts have been considered and the test has been successful F1: subclass corresponding to part of small area and mass F2: subclass corresponding to part of middle area and mass
Burning debris	D0, D1	If burning debris have been considered and the test has been successful D0: No burning debris at all D1: Limited duration burning debris

The following classes are available for the different fire exposure levels:

LF	J NPD	W NPD	F1 F2 NPD	D0 D1 NPD

36 different combinations

MF	S NPD	F1 F2 NPD	D0 D1 NPD

18 different combinations

For instance, façade systems tested to BS 8414 historically may be classified as LF-NPD-NPD-NPD-NPD, and a façade system tested to DIN 4102-20 may be classified as MF-S-NPD-NPD-NPD as long as the test was performed by an accredited laboratory, in an enclosed environment. Note that all NPD's cannot be changed to any other options.

Table 2. Proposed limiting values for the classification system

Feature	Classification	Proposed Limiting values
Limited fire spread	MF	Vertical fire spread medium fire exposure The vertical fire spread is determined with both observation of visual flames and thermal flame spread (temperatures of thermocouples). No thermocouple positioned at the horizontal classification level at 3.5 m above the combustion chamber for the medium fire exposure test, shall indicate a temperature of more than 500 °C at any instance during the test time of 60 minutes after the test start. There should be no burned damage to the specimen 3,5 m or more above the combustion chamber. There should be no continuous visual flaming for more than 30 s, 3,5 m above the combustion chamber. At no time must there be visual flames at the top of the specimen. Horizontal fire spread At no time there must be flames at the edge of the specimen. Lateral flame spread must not exceed 90 seconds after the fire source has been extinguished.
Limited fire spread	LF	Vertical fire spread large fire exposure Failure due to external and internal fire spread is deemed to have occurred if the temperature rise above Ts of any of the external thermocouples at level 2 exceeds 600 °C for a period of at least 30 s, within 15 minutes of the start time, ts. 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 s, is observed on the internal surface of the test specimen at or above a height of 0.5 m above the combustion chamber opening within 15 min of the start time, ts. Horizontal fire spread The test specimen must be kept on the test rig for 60 minutes, and during that time the horizontal fire spread shall not reach the edge of the test specimen.
Junction	J	No thermocouple positioned at the connection between floor and façade shall exceed a temperature rise of 180 K. No continuous visual flaming for a period of time greater than 10 s shall be observed on the backside of the test specimen.
Secondary opening	W	If secondary opening was present and the test successful
Smouldering	S	No thermocouple positioned at for the smouldering application shall exceed 50 °C, 15 hours after the end of observation period/ extinguishment of the fire.

Falling parts	F1, F2	F1: No part larger than 1 kg and 0.1 m² F2: No part larger than 5 kg and 0.4 m²
Burning debris	D0, D1	D0: No burning debris at all D1: Limited duration burning debris < 20 s

ANNEX A DETERMINATION OF FALLING PARTS (INFORMATIVE)

Step 1 – determine the volume density and area density of the product to be tested

a) take 3 samples
b) condition the samples a minimum of 24 hours at 20°C and 50 % relative humidity
c) determine the volume density and area density of each samples
d) take the average values: the average area density, D (kg/m^2) and the average volume density, ɣ (kg/m^3)

Step 2 – indicate a dot mesh (for example 20/20 cm) on the facade sample (at least in area of the possible falling parts)

Step 3 – carry out the test with continuous video recording from the same designated spot. The starting time of the test is t_0.

Step 4 – with the aid of the dot mesh and the pictures (from the video recording) – which were taken during the test (t_i) – determine the area of the part ($A_{fallen,\ i}$) has fallen at t_i. If the camera angle is such that perspective distortion occurs this shall be corrected for.

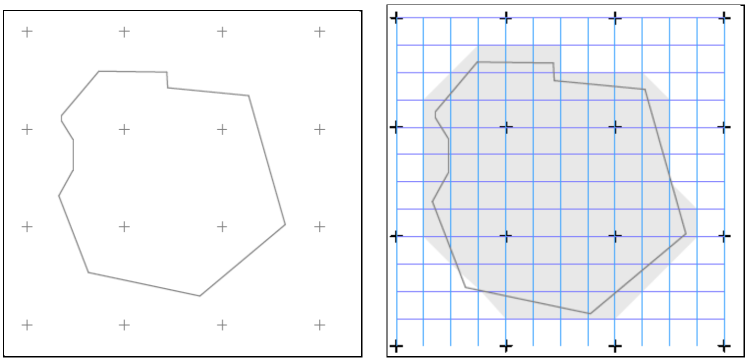

Figure A.1 Left: Corrected picture; Right: Mesh with area calculation.

Step 5 – compare the areas of each larger falling parts ($A_{fallen,i}$) with the limit.

Step 6 – calculate the weight of all larger falling parts: $m_i = D\ A_{fallen,i}$.

In case of other kind of falling parts (3D falling parts etc) an expert evaluation is necessary.

ANNEX B CALIBRATION (INFORMATIVE)

A test bench calibration record is to be maintained and the test bench is to be recalibrated after completion of any repair that could alter the flame distribution, air supply conditions and any other parameters impacting the heat exposure.

The calibration shall be made on an inert test specimen, like for instance the structural steel frame with infill masonry. Measurement like temperature by means with plate thermometers in front of the combustion chamber and on the wall, mass loss rate of the crib shall be performed to characterize the heat exposure.

Note: Full details on the calibration procedure will be defined after the round robin tests.

ANNEX C MOUNTING OF TEST SPECIMEN AT SECONDARY OPENING (INFORMATIVE)

The following give some examples on how the detailing around the secondary opening can be done. Four different examples based on how widows are mounted in practice are presented. In some cases, the window frame is used to protect the edge of the façade system, and for those systems it is possible to perform the test with a model of the window frame of the same material and dimensions as will be used in practice. In the examples below examples are given when no window frame is used as well as when a window frame is used.

Case 1

The window is mounted flush with the wall on the inside of the exterior wall, see figure C.1.

If the test specimen is mounted on a supporting construction (lightweight concrete) with an indentation for the secondary opening, the indentation must be deep enough to be able to simulate the mounting in practice. The façade system shall be applied a minimum of 25 mm into the indentation. In the case no window frame is used, there shall be a distance of at least 25 mm from the façade system to the supporting construction in the secondary opening.

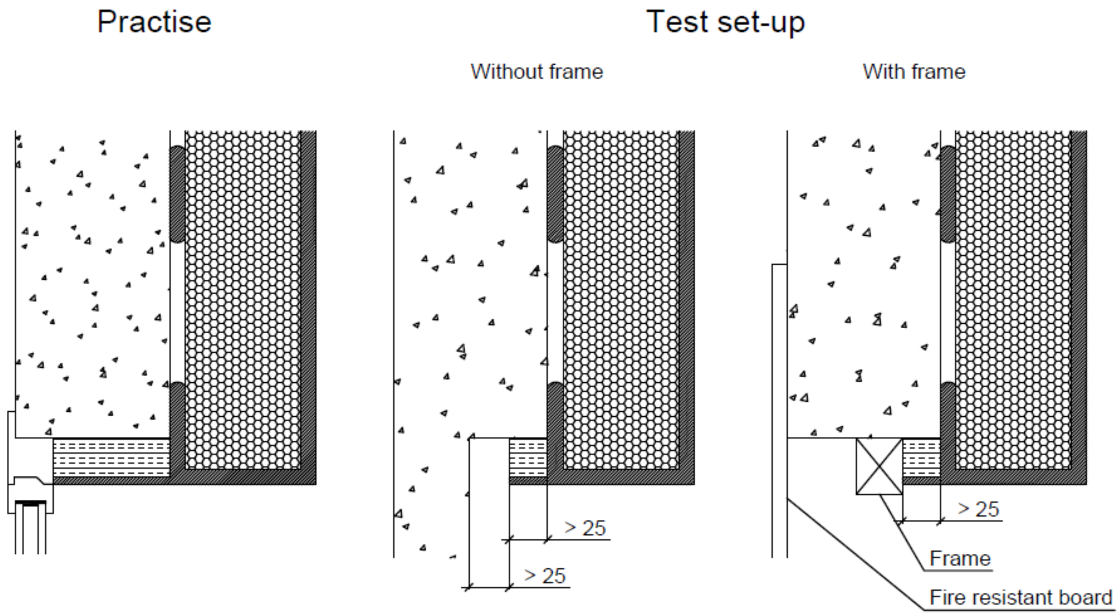

Figure C.1 Window mounted flush with the wall on the inside of the building.

Case 2

The window is mounted within the wall on which the façade system is mounted, see figure C.2.

If the test specimen is mounted on a supporting construction (lightweight concrete) with an indentation for the secondary opening, the indentation must be deep enough to be able to simulate the mounting in practice. The façade system shall be applied a minimum of 25 mm into the indentation. In the case no window frame is used, there shall be a distance of at least 25 mm from the façade system to the supporting construction in the secondary opening.

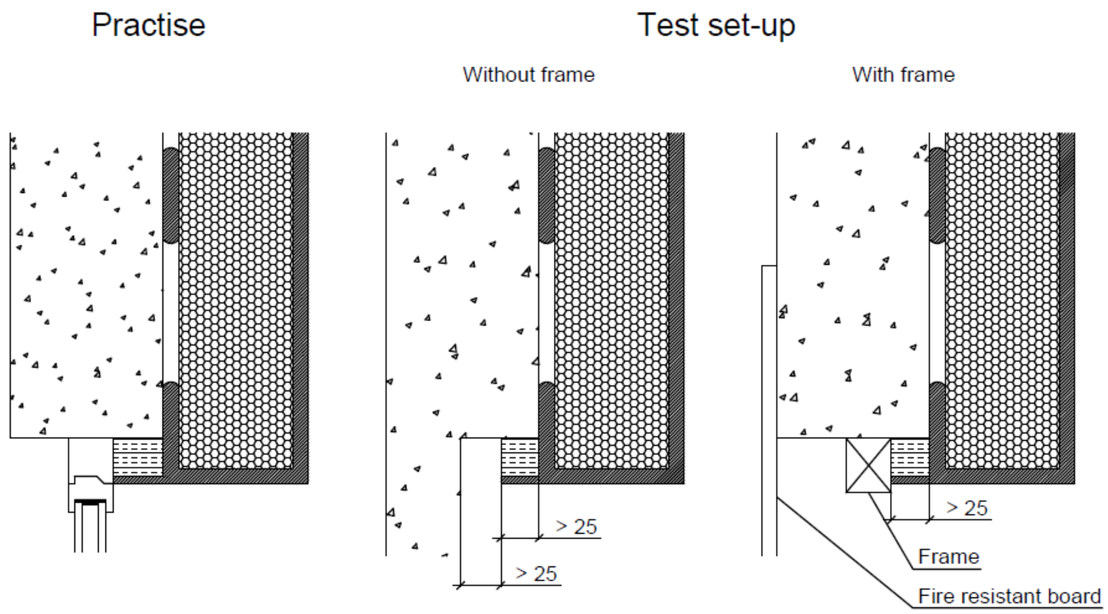

Figure C.2 Window mounted within the wall on which the façade system is mounted.

Case 3

The window is mounted flush with the outer edge of the wall supporting the façade system, see figure C.3.

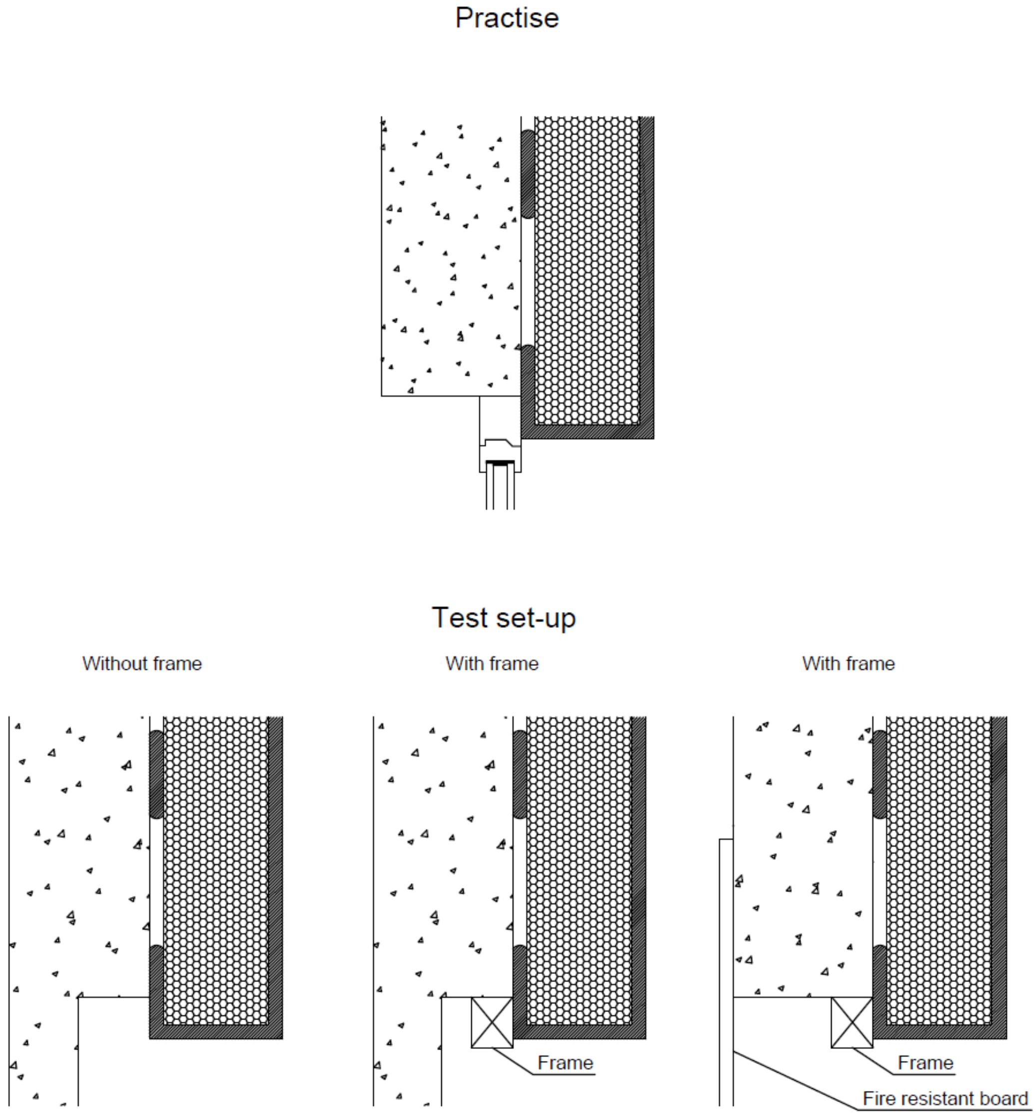

Figure C.3 Window mounted flush with the outer edge of the wall supporting the façade system.

Case 4

The window is mounted in the façade system to be tested, see figure C.4.

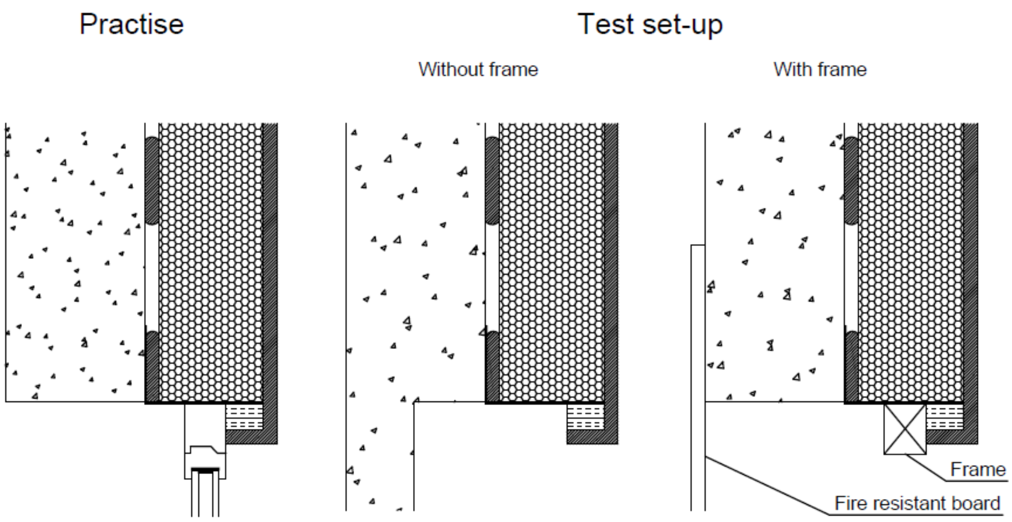

Figure C.4 Window mounted in the façade system to be tested.

ANNEX D FAÇADE-FLOORS JUNCTION (INFORMATIVE)

The assessment of the junction between floor and façade as potential weak point may be required in some cases. It concerns the façade systems installed directly connected to floors of a building.

The floors can be made of concrete but also alternative material like timber.

Generally, the connection between the floor and the façade include a linear joint seal

The objective of the test is to ensure that the fire cannot spread from one storey to the next superposed storey through the connection.

The way to fulfil this objective is to assess the integrity and the insulation of the connection during the façade test.

The following arrangement allows assessing this connection during the façade test. It has to be included within the test only for façade systems connected directly to floors.

In order to give the possibility to consider this issue, a specific adaptation can be done in the test.

Usually the combustion chamber includes a lintel which will support the façade system installed flush to the lintel. In case of façade systems connected directly to the floors, the combustion chamber upper part will be made of a slab, see figure 10. The material of the slab shall be made of the material intended to be used in practice and with the same thickness or smaller.

The slab simulates a floor and allows recreating partially the junction between floor and façade.

In the neighbouring of the floor, the structural steel frame shall be protected by fire blanket.

A mobile extinguishing system shall be prepared before the test in case the fire is developing at the junction.

Such test configuration allows thus to:

- Observe from behind the behaviour of the façade at the junction, especially any passage of flame or integrity failure
- Add some thermocouples to check any insulation failure.

APPENDIX F – ROUND ROBIN – THE PROPOSED METHOD

1 INTRODUCTION

The present proposal on further studies is based on the development of the proposed test method approach. In the case the alternative test method would be considered, the round robin described in Appendix H – Round robin – Alternative test method will instead apply.

A round robin is an inter laboratory test series carried out by at least two independent laboratories, to verify a test method or equipment. Since the outcome of this project is a test, evaluation and classification process to assess fire performance of façades we suggest to include the following parts in a future project:

- Part 1 – a theoretical round robin on the assessment and classification method
- Part 2 – investigation on different important aspects identified (called initial testing throughout this document)
- Part 3 - a round robin on the medium- and large heat exposure test methods (called experimental round robin throughout this document)

2 AIM

The aim of this proposed project is to provide professional input for the standardization work for evaluating fire performance of façades. An interlaboratory test program is crucial to show that the proposed test method can be used as intended and meet regulatory needs whilst obtaining acceptance of the test method within the member states. The outcome of the proposed project would be a report.

The project is proposed to include three different parts, firstly a theoretical round robin on the proposed assessment procedure. This will show how comprehensive and unambiguous the procedure is written, and the results will be used to improve the assessment procedure so that the risk for individual interpretations is minimized.

Secondly, initial testing is needed for some important factors that affect the repeatability and reproducibility of the method. These factors are the effect of the environment on the test, the fuel source, mounting technique for thermocouples and measuring technique for determination of the heat exposure. These factors must be evaluated and fixed before the experimental round robin is performed. However, to achieve faster execution of the project, the second part (initial testing) can be partially performed in parallel to the third part (experimental round robin). The drawback of this approach is that prerequisites of the experimental round robin will be defined before there is a clear understanding of how the conditions of the tests affect the repeatability. Thus, there is a slight chance that the outcome of the experimental round robin will be of less value compared to if it is performed completely after the initial testing.

The third part of the project will be an experimental round robin. During this exercise it is also proposed to invite the Member States to perform comparative tests with the current national test method (on their own cost).

3 SCOPE

3.1 Scope of theoretical round robin

The participants in the exercise shall make a set-up of a test in accordance with the proposed method. They will be given material/product descriptions and with this shall they make drawings on how the specimen will be set up and how they will instrument the specimen.

To the exercise some fictitious test data will also be provided, and from this the participants shall also make a classification.

The DIN 4102-20 needs to be translated into an official English version before the activity can start.

3.2 Scope of initial testing activities

Several factors may have a large impact on the repeatability and the reproducibility of the method and these must be studied to ensure that the method is good enough before the experimental round robin (or inter-laboratory phase) is carried out. It is therefore necessary to examine the impact of the following factors:

- Environmental conditions
- Tolerances of wood cribs as well as species of timber in the cribs
- Mounting of thermocouples without disturbing the test specimen or the test results
- Uplift of experimental rig for determination and no ignition of falling parts
- Comparison between wood crib and gas burners (Specifically for DIN 4102-20)
- Air flow rate from the fan in the fire room (DIN 4102-20)

Below are the test programs for BS 8414 and the DIN 4102-20 method defined individually.

First an average test of the BS8414 method will be conducted on an inert façade system to quantify the normal variations (repeatability) and to set a basis for varying thermal load that stems from the fire source such as, variations of density, moisture, and surface area/total mass of wood sticks as well as an imposed wind. These tests are relatively cheap and approximately 3 tests can be performed per day.

Table F.1. Parameters for the average BS 8414 inert triple test.

Property	**Value**
Average test	Triple test
Density	525 kg/m^3
Species	Pine (*Pinus Silvestris*)
Moisture	12.5 %
Specific surface	Medium
Wind	0.5 m/s
Uplift	As defined in BS 8414

These parameters will be set to the values given in Table F.1 and only one parameter is thereafter varied at a time. Parameters to vary concerning the environmental conditions, fuel specifics and rig position are given below.

Table F.2. Values of parameters to vary during initial testing of BS 8414. 12 tests.

Property	**Value**
Density	400 kg/m^3
	650 kg/m^3
Species	Spruce (*Picea Abies*)
Moisture	10%
	15%
Specific surface	Low
	High
Wind	1.0 m/s
	3.0 m/s
Uplift of rig	0.5 m
	1.0 m
	2.0 m

Similarly, for DIN 4102-20 method we will define two average tests to be repeated 3 times each. One using wood as fuel and one using gas (propane).

Table F.3. Parameters for the average DIN 4102-20 inert triple tests (3 for wood fuelled and 3 for gas fuelled).

Parameter	Values – wood fuel tests	Values – gas fuel tests
Fuel	Pine (*Pinus Silvestris*)	Propane
Density	475 kg/m^3	
Fuel moisture	As defined in DIN 4102-20	
Specific surface	Medium	
Gas flow rate		Medium
Wind	0.5 m/s	
Uplift	As defined in DIN 4102-20	

Parameters to vary, one by one, from the average tests are listed in

Table F.**4**. The air flow rate refers to the air injected into the combustion chambers of the wood fuelled test. The gas flow will be determined closer to the tests but will represent the upper and lower boundaries of the allowed flow from the DIN 4102-20 method.

Table F.4. Values of parameters to vary during initial testing of DIN 4102-20 tests. 7+2 tests.

Parameter	Values – wood fuel tests	Values – gas fuel tests
Wood density	450 kg/m^3	
	500 kg/m^3	
Air flow rate	360 m^3/h	
	440 m^3/h	
Uplift of rig	0.5 m	
	1.0 m	
	2.0 m	
Gas flow		Min
		Max

3.3 Scope of experimental round robin

The purpose of the experimental round robin is to show the robustness of the proposed method, i.e. the repeatability and the reproducibility. In this round robin a small number of participants (at least three participants are needed.) will be chosen due to the high cost of the tests.

At least two different façade systems need to be included, one inert façade and one where failure is deemed to occur. However, for completeness it is suggested that four different façade systems are included in the project, rainscreen and renders, ETICS, solid wood with ventilation gap and inert (previously performed at one laboratory) which are performed two times for each system.

Parameters to be checked during the round robin tests are;

- Falling parts;
- Vertical and horizontal fire propagation;
- Temperature measurements;

- Heat exposure;
- Impact of environment.

The tests with the inert façade will show the repeatability and reproducibility of the test method without influence of any combustible material except the fuel source. It will also show the burning characteristics (flame lengths, flame widths, flame shape over the test duration and thermal impact to the test specimen at different positions and other).

The test with facades that are deemed to fail will show whether the method is robust enough to give the same classification.

The member states are also invited to make comparisons between national test methods and the proposed method to give the possibility to countries to compare the safety levels between the national method and the future method at their own cost.

The total number of tests are 2 (test methods) x 4 (façade systems) x 1 (one test per system) x 3 (number of laboratories) which is at least 24 tests.

Note that the alternative test method may be implemented with a similar amount of testing (Appendix H – Round robin – Alternative test method), however here a detailed analysis on limits of fire spread, temperature criteria and the effect of the secondary opening is needed while there is no need to analyse the gas flow rate.

4 Task plan

The list of tasks and the proposed time frame can be found in Table F.5. It should be noted that some tasks can be performed simultaneously, i.e. some of the tasks are not dependent on the outcome from other tasks. It is estimated that a total time is around 24 months where at least 54 tests are performed.

Table F.5. Task plan for further studies and the round robins

Name	Actions	Duration
Task 1 – Theoretical round robin	Task 1.1 Define the questions to be answered.	2 months
	Task 1.2 Invite participants and await the answers	2 months
	Task 1.3 Analyse the response from the participants	1 month
Task 2 – Initial testing activities	Task 2.1 Literature survey	2 months
	Task 2.2 Define the test program	1 month
	Task 2.3 Perform the tests	4 months
	Task 2.4 Analyse the results	2 months
	Task 2.5 Update of assessment method	1 month
Task 3 – Experimental round robin	Task 3.1 Define the façade systems to be used	1 month
	Task 3.2 Design a suitable test rig that can be used by the participants	1 month
	Task 3.3 Invite participants	1 month
	Task 3.4 Purchase of façade systems to be tested	1 month
	Task 3.5 Send façade systems to participants and perform the tests	3 months
	Task 3.6 Analyse the results and report	2 months
Task 4 – Analysis	Task 4.1 Combine the results from the studies carried out	3 months
	Task 4.2 Finalize the assessment method	1 month
Task 5 – Management		24 months

In Table F.6 below the different tasks and sub-tasks are described in more detail. It should be noted that it is not possible to foresee the outcome of the different tasks, and therefore the plan and tasks can be changed during the project depending on the results.

Table F.6. Detailed tasks for further studies and the round robins

Task 1 – Theoretical round robin	
Task 1.1 Define the questions to be answered	A questionnaire will be produced with questions related to the test set-up, mounting of test specimen, instrumentation and classification. In addition, questions will be asked on the field of application.
Task 1.2 Invite participants and await the answers	Within this task will participants be invited to take part in the theoretical round robin. It is proposed that the EGOLF laboratories are invited, as well as stakeholders. The participants will get 1-2 months to answer the enquiry. The exercise will be done with full secrecy, i.e. only one administrator will have access to who has answered.
Task 1.3 Analyse the response from the participants	The analysis of the theoretical round robin will be done in accordance with ISO 17043. All answers will be collected in a spreadsheet, and the answers will be graded in a suitable way by a steering committee composed of at least 2 members. This exercise will show if there are parts of the assessment method that are interpreted differently, and if the method needs to be clarified. This procedure has been used successfully in previously performed theoretical round robins within EGOLF.
Task 1.4 Report and rewrite the assessment method	A report will be written on the theoretical round robin. The assessment and classification method will be updated and clarified where necessary.
Task 2 – Initial testing activities	
Task 2.1 Literature survey	At this stage a literature review is needed to minimize the amount of testing and to ensure that relevant tests are performed.
Task 2.2 Define the test program	With the information from the present project and from the literature review a test program will be set up. As far as possible the aim is to investigate multiple parameters during each test, to be as cost and time effective as possible. The identified factors that needs further studies are: – Effect of environment (especially wind speed and direction) – Tolerances needed for the fuel (the research community do not agree on the repeatability of wood cribs, especially on the size needed for these types). Factors affecting are timber species, conditioning of the timber, density of the individual timber sticks, dimensions of sticks, amount of timber, and the tolerances needed. – Mounting of thermocouples. There is a disagreement on how to mount the thermocouples in the best way, by drilling through the test specimen, or hanging them from the outside. Both methods have pros and cons. – Measurement of heat exposure to the test specimen. It is important that the heat exposure can be reported after a test. There are different options such as measurement of temperature with plate thermometers pointing towards the fire, heat flux gauges measuring the radiation or mass loss measurement of the fuel source. A suitable method needs to be developed and validated. – External fire. In some Member States is the externa fire scenario used. It may be that the proposed method would work well also for external fire, but this needs to be validated.
Task 2.3 Perform the tests	Most of the tests will be performed at one single location to ensure that the general conditions around the test are the same.
Task 2.4 Analyse the results	The analysis of the results will be done simultaneously as the test program is going (when possible).

Task 2.5 Update of assessment method	The aim of Task 2 is to get answers on several questions in order to finalize the assessment method before the experimental round robin is started.
Task 3 – Experimental round robin	
Task 3.1 Define the façade systems to be used	The round robin is proposed to include four different test specimens, inert, rain screen+renders, ETICS and ventilated wood facade, i.e. one inert specimen that never fails, and three facades that fails or are close to fail during the test. It is optimal if a test specimen can be designed so all performance criteria can be assessed, i.e. flame spread both vertically and horizontally, as well as fire spread within the test specimen, falling parts and burning debris/droplets, and connection between external wall and floor. At least one of the façade systems shall be tested with secondary opening for the large fire exposure test.
Task 3.2 Design a suitable test rig that can be used by the participants	Since almost all participants do not have a test rig for this test method, there are two options to keep the costs down. One option is to design a suitable rig from low cost and reusable material, such as a scaffolding system. The other option is to build a few de-mountable rigs that can be transported around to the participants.
Task 3.3 Invite participants	Laboratories that have the possibility to carry out this kind of test, within the tolerances given on environmental conditions, will be invited. It is important to note that this round robin do not have the same aim as normally, i.e. here the robustness of the test method will be examined, not how well the participants perform the test. Therefore, it is important that the tests are carried out by participants that are aware of the objective, and that the tests are performed in a way that is as perfect as possible.
Task 3.4 Purchase of façade systems to be tested	The façade systems to be tested shall be purchased at one manufacturer in order to minimize the spread in characteristics of the materials.
Task 3.5 Send façade systems to participants and perform the tests	All material needed for the tests, as well as clear mounting descriptions, will be sent to the participants. During the tests at least one member of the consortium shall witness and document the tests.
Task 3.6 Analyse the results and report	The test results, including descriptions of the mounting and conditioning, shall be sent to the consortium for analysis. All primary data, photographs, drawings, videos and other relevant information shall be included.
Task 4 – Analysis	
Task 4.1 Combine the results from the studies carried out	The results from the above three tasks shall be combined and analysed. The aim is to define the final assessment and classification method.
Task 4.2 Finalize the assessment method	The assessment method shall be drafted. In addition, shall the technical evidence behind the proposal be documented and presented.
Task 5 – Management	
	The management will include invitation to the round robins, contact point with the participants, arrange meetings and witness program, and responsible for reporting and contact with EC.

An estimation of the initial testing program is that around 30 tests will be needed.

For the experimental round robin it is judged that for the present project it would be enough to have three laboratories doing the tests, which would then end up in 24 tests.

A total of 54 tests are required for the proposed test series, including both initial tests and the round robin.

5 TIME FRAME

To complete the proposed project, including two testing programs is estimated to 24 months. A rough time schedule is presented in Table F.7.

Table F.7. Proposed time frame for the proposed project

	Year 1				Year 2			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Task 1	x	x						
Task 2	x	x	x	x	x	x		
Task 3					x	x	x	
Task 4							x	x
Task 5	x	x	x	x	x	x	x	x

The time schedule of two years is already tight and leaves very little room or improvements, delays or mistakes. However, in response to a direct request from EC DG GROW to reduce the total project duration, we also propose a faster time frame. This will be achieved by starting Task 3 - the experimental round robin, in parallel with Task 2 – Initial testing. A consequence of this is that all parameters which have an unknown effect on the heat exposure and repeatability are not checked before the details of the round robin is defined and distributed to the partners. Thus, there is a risk that the outcome of the round robin will be of less value compared to if the experimental round robin starts after all initial testing.

To mitigate these risks the initial testing will start with the parameters that are deemed most decisive on the exposure such as wind and wood density and end with parameters expected to be of less importance such as uplift of rig and wood species. Having said this, the effect of any of these parameters are yet to be investigated. The faster time frame is presented in Table F.8.

Table F.8. Proposed time frame for the proposed project

	Year 1				Year 2	
	Q1	Q2	Q3	Q4	Q1	Q2
Task 1	x	x				
Task 2	x	x	x	x	x	
Task 3			x	x	x	x
Task 4					x	x
Task 5	x	x	x	x	x	x

6 BUDGET ESTIMATION

The total price of the proposed project is estimated to ~1.000.000 EUR, exclusive VAT.

The present proposal does not include any evaluation of external fire scenario. This could be included in the project, but that needs more theoretical work on defining the fire scenario and heat exposure to be used.

APPENDIX G – ALTERNATIVE TEST METHOD

Following the development of the initial test and classification method presented in this report it was noted from the comments received that some alternative options should be noted as potential input to the future development of the test and classification method. This appendix aims to capture for future reference some of these alternative options.

Since these alternative methods are different from the preferred method, the main changes are listed in table G.1, with the corresponding chapter

Table G.1. Impact of alternative assessment method on first chapters of the final report.

Section	Change
4	**Proposal:** Falling parts are limited to a maximum of 1 kg and an area of 0.1 m^2 for each individual piece. More than a few drops (maximum 10) of melted burning material from the test specimen which continues to burn on the floor > 20 seconds are not allowed. Each spot with burning material cannot exceed a diameter of 50 mm. Small pieces of charred wood which fall and continues to burn, or glow, is acceptable until it reaches the amount given for burning droplets above. Material (solid or liquid) which does not burn when falling and is below the definitions on size and weight above but starts to burn after it has fallen to the floor is accepted.
5.2	Although some of the national test rigs currently used are larger than the following proposal. It is judged that the proposed size would be sufficient to cover the regulatory requirements in all Member States. **Proposal:** The width and height of the main face and the wing is 3.5 x 7 m and 1.5 x 7 m for the medium fire exposure and 3.5 x 8 m and 1.5 x 8 m for large fire exposure. The fire exposed area, i.e. the height above the lintel of the combustion chamber is the same for both methods because the height from the floor to the lintel of the combustion chamber is different in the two methods, 1 m for the medium fire exposure and 2 m for the large fire exposure. In addition, the complete rig needs to be uplifted, or extended, at least 0.5 m to ensure that the radiation from the combustion chamber not affects the material falling down during the test.
6.1.1.	**Proposal:** The two fire scenarios defined in BS 8414 and DIN 4102-20 respectively will be kept as they are, with the exception that for the DIN 4102-20 method where only timber cribs will be used.
6.1.2	To simplify the classification and keep the number of classes at a practical level, it would be difficult to maintain this range of different exposure times. **Proposal:** Only one test time is proposed for each method. The heat exposure from the combustion chamber will be 22 or 30 minutes, after the start time. After this time the fire in the combustion chamber will be extinguished, and an additional 30 or 38 minutes period of observations and measurements will be made, i.e. a total test time of 60 minutes after the test time has been reached. **Comment:**

	The MSZ 14800-6 and LEPIR 2 have a longer duration compared to the proposed methods, as well as the German external fire test method. Two methods have a shorter duration, SP Fire 105 and ISO 13785-2. It would be possible to have both longer and shorter fire exposure times, but that would lead to more classes in the classification system. It has been decided to keep the classification system as simple as possible, based on the comments received during the project, and therefore only the durations given in BS 8414 series and DIN 4102-20 have been kept. **Comment:** The test time is different in the BS 8414 series and the DIN 4102-20 method. Also, the starting time of the tests is different. This needs to be addressed in the coming studies and the preferable result is a transparent system where the same procedures and times are used.
6.1.3	**Proposal:** A method for determination of flame spread, both vertical and horizontal, is proposed. The method is based on temperature measurements with thermocouples. Whilst similar to those used in BS 8414 and DIN 4102-20, but not exactly the same the positions of the thermocouples have been altered to some extent. For the assessment of horizontal flame spread thermocouples have been introduced to replace visual observations. **Comment:** Visual observations shall be avoided as far as possible for measures used for the classification. Measured values give a much better repeatability and reproducibility. **Comment:** The performance criteria on flame spread, i.e. the temperature level when the test is deemed to have failed, needs to be examined in the next project. Different temperature levels are currently used and the position of the thermocouples for the measurements has been moved. The round robin project will give the necessary data to choose a temperature level (initially proposed to be in the region of 500 K or 600 K, although other values may be decided upon). **Comment:** The 500 °C temperature limit in the DIN 4102-20 test was derived from large scale tests in Germany[3] where the visible flame plume was correlated to the 500 °C isothermal planes.
6.1.4	**Comment:** In the alternative proposal the failure criteria are based on current regulations and on comments obtained during the project. It is known that other failure criteria are used in some countries. The proposal here is chosen to get a simple classification and conservative to cover all current regulations.
6.1.5	**Proposal:** A secondary opening has been included in the test set-up, to assess the mounting and behaviour of the façade system around openings. The secondary opening is mandatory.
6.1.6	See section 14 of the present Appendix
6.2	The role of existing data from the medium and large scale testing has three key roles in this project: • Maintenance of Regulatory systems and associated industry databases.

	• Potential for ongoing demonstration of performance for systems under the new proposed test and classification methods based on previously tested and classified products. • Support of the development of new protocols for testing and classification As no testing to the proposed methodologies has taken place at this time for this alternative method, it is not possible to comment further on the relevance or ongoing applicability of these data sets at this time.
7	This alternative method was developed by the consortium taking into account the findings of the Tasks requested in the ITT and summarised in table 6, in section 5.2, above. This table shows that to address the range of characteristics required by the Member States utilising façade testing and classification methodologies there was a need to build on the BS 8414 and DIN 4102-20 methods as currently presented to provide an approach to determine these additional performance requirements as efficiently as possible. This approach led to the development of the present approach, a test scenario with a simple classification system and built on the comments received from project stakeholders (Appendix I). It was acknowledged that this approach would require research work to confirm the methodology as it would limit the ability of existing data to support it.
7.3	In this alternative method, the decision concerning the test environment, i.e. indoors or outdoors was considered as to be taken at a later stage. **Comment:** Further studies are needed to ensure that the alternative methods offer good enough repeatability and reproducibility. In addition to those presented in chapter 7.3, There are additional factors that must be studied, such as: Effect of environment (especially wind speed and direction)

PROPOSAL: ASSESSMENT OF FIRE PERFORMANCE OF FACADES

Prepared within the EC-funded project SI2.743702-30-CE-0830933/00-14

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TABLE OF CONTENT

0 INTRODUCTION

This paper sets out to provide a methodology to evaluate and classify the fire performance of facades systems based on the BS 8414 series and DIN 4102-20 test standards, as well as the comments achieved from AGF, stakeholders and sub-contractors, and is in response to Tasks 4, 5 and 6 of the current EC Facades project S12.743702-30-CE-0830933/00-14.

As part of this project it has also been necessary to review and where practical, take into account, the regulatory requirements of all Member States who utilize alternative fire test methodologies as part of their regulatory requirements for determining the fire performance of facades.

Some modifications to the BS 8414 series and DIN 4102-20 methodologies have been incorporated into the proposed test methodology in order to establish a protocol which addresses, as far as possible, the key regulatory requirements as identified during the project for those Member States that regulate beyond EN 13501-1 and EN 13501-2 and accounts for the comments received throughout the project.

0.1 Smouldering

The European standard EN 16733 has been developed for determining the smouldering behaviour of materials, therefore it is not necessary but possible to include the DIN 4102-20 method for assessing smouldering behaviour as part of the proposed protocol.

0.2 Smoke

Smoke is mentioned in some regulations, but it is not quantitatively assessed in any of the current medium or large façade test methods and is therefore outside the scope of the present project.

It is therefore envisaged that the current EN 13501-1 classification for smoke as referenced if required for classification purposes by Member States.

If smoke measurements are to be introduced into large scale test method, more research is needed.

0.3 Falling parts

Several of the additional methodologies currently used by Member States make reference to and in some cases prescribe quantitative approaches to determining these characteristics, it has therefore been suggested some following performance criteria regarding mass and size of falling parts but also burning duration

There is at present no validated experimental method to quantify falling parts, including burning particles. Therefore, the present proposal is based on visual observations until a suitable method has been validated. The intention is to include this in the round robin project. There are different options such as a floor in front of the test rig with load cells so the impact of falling parts can be determined, or by means of Digital Image Correlation (DIC).

0.4 Test rig

The DIN 4102-20 is based on a medium fire exposure and the BS 8414 series is based on a large fire exposure. The size, geometry and instrumentation layout of the test rigs in the two methods are similar, and therefore the proposal is to use one test rig for both the medium and the large fire exposure tests.

0.5 Secondary openings

The fire scenario underpinning both the DIN 4102-20 and BS 8414 series test methods is to determine the fire spread performance of the continuous façade system following the break out of a fire from an opening. The details around the opening are to be representative of those used in practice for the system under test.

As part of the consultation and comment process in this project it has become clear that whilst many MS who regulate for the fire performance behaviour of facade systems use the scenario identified for DIN 4102-20 and BS 8414 series, there is also a group of Member States who require the detailing around openings such as windows to be assessed at the levels above the fire source opening.

Earlier drafts of this groups proposed methodology had tried to develop a combined test sample which would incorporate the opening details at higher levels together with the full façade run currently detailed in the DIN 4102-20 and BS 8414 standards. This proposed solution is shown in figure 1 of this report, in section 4.1. The opening representative of a window is offset on the horizontal axis from the combustion chamber opening such that a portion of the test specimen above the combustion chamber opening does not include a representative window opening; whereas an adjacent portion of the specimen does include a representative window opening. The intention is to test the response of a façade to both of the scenarios identified, i.e. the secondary opening is mandatory and the method will cover all different set-ups used in the Member States. The performance of the portion of continuous system surface above the combustion chamber will be representative of the system performance under the scenario which is the basis of the DIN 4102-20 and BS 8414 series. The performance of the system around the representative window opening will be representative of the system performance under the alternative scenario.

0.6 Locating instrumentation within the test samples

There is significant experience with the testing of BS 8414 test specimens, for a range system build ups from ETICS to pre-formed panelised systems to show that the locating of the thermocouples within and drilling through the samples from the rear face to the exposed face to install instrumentation can be successfully achieved without impacting on the performance of the samples under test. We do not therefore envisage any problems with continuing to installed instrumentation using this technique.

A clear description of the installation method is given in the appropriate section of the proposed methodology.

However, comments have been raised in regard to drilling through the test samples and it is therefore proposed that the alternative approach used in “Sockelbrandtest” for ETICS were the thermocouple arrays are hung in front of the specimen be more formally investigated in the coming round robin series to ensure that the mounting techniques for the thermocouples is clearly defined and does not comprise the test specimen or the heat source and that the proposed techniques deliver comparable results.

0.7 Heat exposure and fuel

It is of importance that the heat exposure to the test specimen is the same from test to test. Some different measurement techniques have been identified and will be investigated as part of the round robin program to find a proxy methodology to enable this to be determined. The measurements under consideration are:

- Plate thermometers in front of the combustion chamber,
- Plate thermometers in the secondary opening,
- Mass loss rate of the crib in the combustion chamber

In the present procedure only wood cribs as fuel has been considered, since most methods currently use wood cribs. There are some important issues to be handled before it can be decided whether wood cribs can be used. First of all, the repeatability and the reproducibility of the method must be good enough. The following must be considered:

- Definition of species
- Acceptable tolerances of density
- Is density of each stick or for all material considered?
- Tolerances of wood stick dimensions

- Tolerances on the wood crib, and how the sticks are arranged
- Surface finish of wood sticks (raw sawn, fine sawn, planed)
- Conditioning

There are other types of fuel, such as gas, that have several advantages, such as the ability to control the fire exposure to the specimen, limited smoke production, good repeatability and reproducibility.

0.8 External fire scenario

Both the BS 8414 series and the DIN 4102-20 test simulating fires in a room with flames that emerge from an opening as do most of the European tests. However, two tests address an external fire scenario: the Polish test and the German "Sockelbrandtest". The "Sockelbrandtest" has been developed as a result of several severe fires caused by burning waste containers in front of combustible façade systems. The test has been developed mandated by German building authorities to investigate the behaviour of ETICS with EPS insulation when attacked by an external ignition source. The ignition source, a 200 kg wood crib, represents a burning waste container.

In BR 135 information is given that the BS 8414 series test covers fire scenarios with external fire sources as well. It does not quantify up to which fire load external fire scenarios are covered. An ongoing numerical investigation of both test scenarios, the BS 8414 series and the "Sockelbrandtest" quantifies the heat impact on the façade for both tests to see whether the external fire scenario used in the "Sockelbrandtest" is covered by BS 8414 series.

0.9 Historical data

Historical data may be used on a national level. This must be decided nationally and cannot be covered within this project.

For CE marking, the principles used for other products will be used also for facades.

There may be an opportunity for national bodies to sign up for the coming round robin to compare results obtained with the proposed method with their national method.

Furthermore, in the frame of the Round Robin tests, facades systems already tested according to national test methods may be retested according to the current project in order to give to Member States the necessary information to compare the safety levels between national test method and the current draft.

0.10 Classification

There have been many comments on the initially proposed classification system. It is too many classes and it is complicated. A simpler classification system is now proposed. This is possible by omitting smouldering and smoke from the assessment, and to have the secondary opening (detailing around openings in the façade) mandatory in the test set-up.

The classification method is based on the main requirements found surveying the national requirements in all Member States. The objective is to limit the amount of testing needed to acquire a fire safety classification for limited fire spread for a façade system valid within all EU Member States. In order to achieve this four different classes of limited fire spread (LS) are deemed necessary LS1, LS2, LS3 and LS4. We propose a classification method which is based on the exposure which the façade is exposed to in the test. Starting from the basis of the BS 8414 test as the foundation of the large scale method; and the DIN 4102-20 test as the foundation of the medium scale test method this results in two exposure classes: a large heat exposure (LS1 and LS2) and a medium heat exposure (LS3 and LS4). A classification based on the large fire exposure test will also cover the medium fire exposure test, i.e. a classification in LS1 will also cover LS3.

Since falling parts and burning debris are optional the classification is divided so both the medium and large fire exposure test can get two classifications, one where the criteria on falling parts and burning debris are fulfilled and one where the falling parts and burning debris are either not considered or the system failed the criteria for this.

With reference to section 0.5; evidence is required to be collected with regards to the suitability of the proposal of including an offset opening representative of a window above the combustion chamber opening in order to represent the different fire scenarios identified in one test setup it will be necessary to reflect the presence of absence of window openings in the proposed classification. Thus a 'w' after the proposed classification (e.g. LS1w) will reflect that the test was performed with an opening representative of a window centred above the hearth opening.

If suitable data can be collected, prior to implementation of the test method, that demonstrates that the proposed test setup can satisfactorily capture the performance of a system against the two scenarios identified then this 'w' will not be required.

Furthermore, in several national regulations, the façade test is not required for all building and in certain cases, the façade systems have to fulfil requirements in terms of:

- fire reaction performance
- fire resistance performance
- technical arrangements like for instance quantity of potential combustible mass, distances between two superposed openings (called C+D)

Of course, depending on the risk analysis of the concerned building, the level of required fire classes and of the other parameters will be adapted.

The present methodology will cover the risk for fire spread on and in the façade system as well as falling parts and the detailing around openings such as windows. The method will also be applicable to test the connection between façade/exterior wall and floor, but this will be optional and not included in the classification system.

Since there is a wish to keep the classification system as simple as possible, and use as few classes as possible, the present methodology will only cover one time period. This may be changed if a more diversified classification system is needed, for instance add longer or shorter fire durations.

It is important in the future when and if harmonized product standards are developed that for the fire performance of facades the option NPD (No Performance determined) is available, since in most MS it is only the high-risk buildings that have the requirement on large scale testing. Furthermore, it is also important to include other classes related to the fire performance such as smouldering, which has been omitted in the present methodology.

0.11 Performance criteria

Performance criteria on temperature measurements and on falling parts/burning debris are included in the methodology. These are still not validated and need to be examined in more detail. The values given in the present document is taken from different sources and shall only be considered as examples. Since the location of thermocouples has been changed from the ones used in the national methods, a re-calibration of the performance criteria is needed.

1 SCOPE

This assessment method is applicable for external walls, façades, façade cladding systems vertically fixed to and supported by a structural frame or a concrete masonry sub-structure. The method will not address the load-bearing capacity of the tested system, nor inclined façade systems. This method addresses requirements which go beyond the requirements that can be addressed and classified according to EN 13501-1,2. The method includes assessment of detailing of the façade system around openings, but not any window detailing. Vertical and lateral fire spread on the surface and within façade systems is assessed. This method cannot directly assess the fire re-entry into the compartments above the combustion chamber, because window detailing is not tested. Vertical fire spread is limited to reduce the risk of fire re-entry into the building, see note below. The fire resistance characteristics of curtain walling systems are addressed through the European Standards EN 1364-3 and 4.

Note: generally, a fire re-entry into the building from one storey (origin of the fire) to the next one above via windows cannot be prevented. Limitation of vertical fire spread concentrates usually on the task to prevent further fire spread.

Examples of typical products and systems covered by this proposal include, but it does not exclude other products and systems:

- Exterior Thermal Insulation Composite Systems (EIFS, ETICS or synthetic stucco)
- Metal composite material cladding systems (MCM)
- High-pressure laminate facade and cladding systems
- Structural Insulation Panel Systems (SIPS) and insulated sandwich panel systems
- Rain screen cladding or ventilated facades
- Weather-resistive barriers (WRB)
- Wooden facades
- External walls

This proposal covers the fire performance of the façade system, not the individual components, products or elements in isolation.

This proposal includes two fire load scenarios:

- a medium fire exposure test
- a large fire exposure test

The large fire exposure scenario is representative of a fully developed (post-flashover) fire in a room, venting through an opening such as a window aperture that exposes the cladding to the effects of external flames, or from an external fire source.

The medium fire exposure scenario is also based on a flash-over scenario, but the method has been down-scaled. The method has thus virtually removed one storey from the test set-up, and only focus on the façade part located two storeys above the fire room, i.e. the top of the flames. The project report BI5-8001 96-18 (Kotthoff) states in section 8.3.5.4 (translated): "*The thermal impact of a 25 kg wood crib is of course not comparable to a fire in a fully furnished room. At the area where the flames emerge the opening and directly above the lintel the exposure is similar to the exposure of a room fire*".

The proposed assessment method enables both fire scenarios to be considered.

> *Note: It may be necessary, as part of the round robin test program to confirm that the large fire exposure conditions could also cover the external fire exposure used in some countries.*

2 NORMATIVE REFERENCES

ISO 13943 Fire safety - Vocabulary

EN 60584-1 Thermocouples – Part 1: EMF specifications and tolerances

EN 1364-3 Fire resistance tests for non-loadbearing elements – Part 3: Curtain walling – Full configuration (complete assembly)

EN 1364-4 Fire resistance tests for non-loadbearing elements – Part 4: Curtain walling – Part configuration

EN 16733 Reaction to fire tests for building products – Determination of a building product's propensity to undergo continuous smouldering

EN 1363-1 Fire resistance tests – Part 1: General requirements

EN 13238 Reaction to fire tests for building products – Conditioning procedures and general rules for selection of substrates

EN 13501-1 Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests

EN 13501-2 Fire classification of construction products and building elements – part 2: Classification using data from fire resistance tests, excluding ventilation services

3 TERMS, DEFINITIONS, SYMBOLS AND DESIGNATIONS

cavity systems	Systems with a cavity. This includes (but is not limited to) what is generally referred to as ventilated facades.
charred material	Material that is judged to have been changed by pyrolysis. The assessment should be motivated by some charring characteristic, including (but not limited to) density changes, fissures, porosity etc.
collapse	Any part of the cladding system which becomes detached and/or falls off
element, component or product	In this context part of the façade system
external cladding system	Complete cladding assembly *Note: This includes sheeting rails, fixings, cavities, insulation and membranes, coatings, flashings or joints* *Note: The limits of the cladding system are taken to be as applied to and forward of the masonry substrate*
external wall assembly	Complete system including any sheeting rails, cavities, fire barriers and weathering membranes or coatings
façade	There is no common definition of the term. In the present document the façade is defined as the tested system
falling parts	Material (solid or molten) separating from the specimen, with or without continuing to burn with a visible flame, during a fire or a fire test.
fire barrier	Separating element which inhibits the passage of flame and/or heat and/or effluents for a period of time under specified conditions
fire Ioad	Quantity of heat which could be released by the complete combustion of all the combustible materials in a volume, including the facings of all bounding surfaces *Note: Fire load is expressed in joules* *Note: Fire load may be based on effective, gross or net heat of combustion (thermal energy produced by combustion of unit mass of a given substance as required by the specifier)*
fire scenario	Detailed description of conditions, including environmental, of one or more stages from before ignition to after completion of combustion in an actual fire at a specific location or in a real-scale simulation
fire stop	Fire safety measure to limit the fire propagation within the system
flame spread	Propagation of a fire front defined by the width or height to which any thermocouple indicates a temperature rise greater than 500 K over a period of 30 seconds during the test frame time of 60 minutes after the test start time
flash-over	Transition to a state of total surface involvement in a ventilated controlled fire within an enclosure
fully developed fire	State of total involvement of combustible materials in a fire
level 1 height	2000 mm above the top of the combustion chamber opening in the test apparatus
level 2 height	3500 mm above the top of the combustion chamber opening in the test apparatus
level 3 height	4500 mm above the top of the combustion chamber opening in the test apparatus
level 4 height	5900 mm above the top of the combustion chamber opening in the test apparatus
mass loss rate	Mass of material lost per unit time under specified conditions *Note: It is expressed in kilograms per second*
smouldering	Combustion of a material without flame and without visible light, including glowing combustion. *Note: Smouldering is generally evidenced by an increase in temperature and/or by effluent*
discoloration	Visual change of specimen not caused by burning, charring or melting
system	In this context façade system that is applied to the external wall or external wall itself

4 TEST EQUIPMENT

The test equipment consists of the following main components:

- Main face
- Wing
- Structural frame
- Combustion chamber and fuel source
- Instrumentation

The test rig shall consist of a main face, fitted with a combustion chamber and a return wing mounted to a structural frame. The rig utilizes a vertical structural test frame, representative of a structural steel framed building and shall be capable of enduring the effects of the test procedure without itself suffering undue damage or distortion, see 4.3 for details.

4.1 Main face and wing

The test rig shall include a main face and a wing, see figure 1, where the wing is mounted in 90 ° to the main face. Figure 1 show the minimum size of test rigs for medium fire exposure and large fire exposure. Figure 2 show a test rig with an opening for combustion chamber that can be used for both medium and large fire exposure. The main face shall have a minimum width of 3500 mm and a minimum height above the lintel of the combustion chamber of 6000 mm. The wing shall have a minimum width of 1500 mm and the same height as the main face. The test rig shall continue a minimum of 500 mm below the lower edge of the combustion chamber.

> *Note: The height given above is the height above the combustion chamber, so for the wing and the parts on the main face at the sides of the combustion chamber, the height of the combustion chamber must be added to the total height. Thus, the minimum height of the complete test rig for the medium fire exposure is 7500 mm and for the large fire exposure 8500 mm.*

The main face shall include one secondary opening, see 4.2 for details.

For non-loadbearing external wall systems such as glazed elements, infill panels and insulated composite panels, the façade can be directly fixed on the structural frame.

For non-loadbearing external cladding systems, rain screen over cladding systems and external wall insulation systems applied to the face of a building, a supporting construction of masonry infill shall be fixed onto the structural frame in such a way to be capable of enduring the effects of the test procedure without itself suffering undue damage or distortion.

The infill masonry shall be constructed in aerated concrete blocks or slabs with an apparent density of 650 ± 200 kg/m^3 and with a thickness of 200 mm, and the masonry shall be mounted in such way that it is air tight.

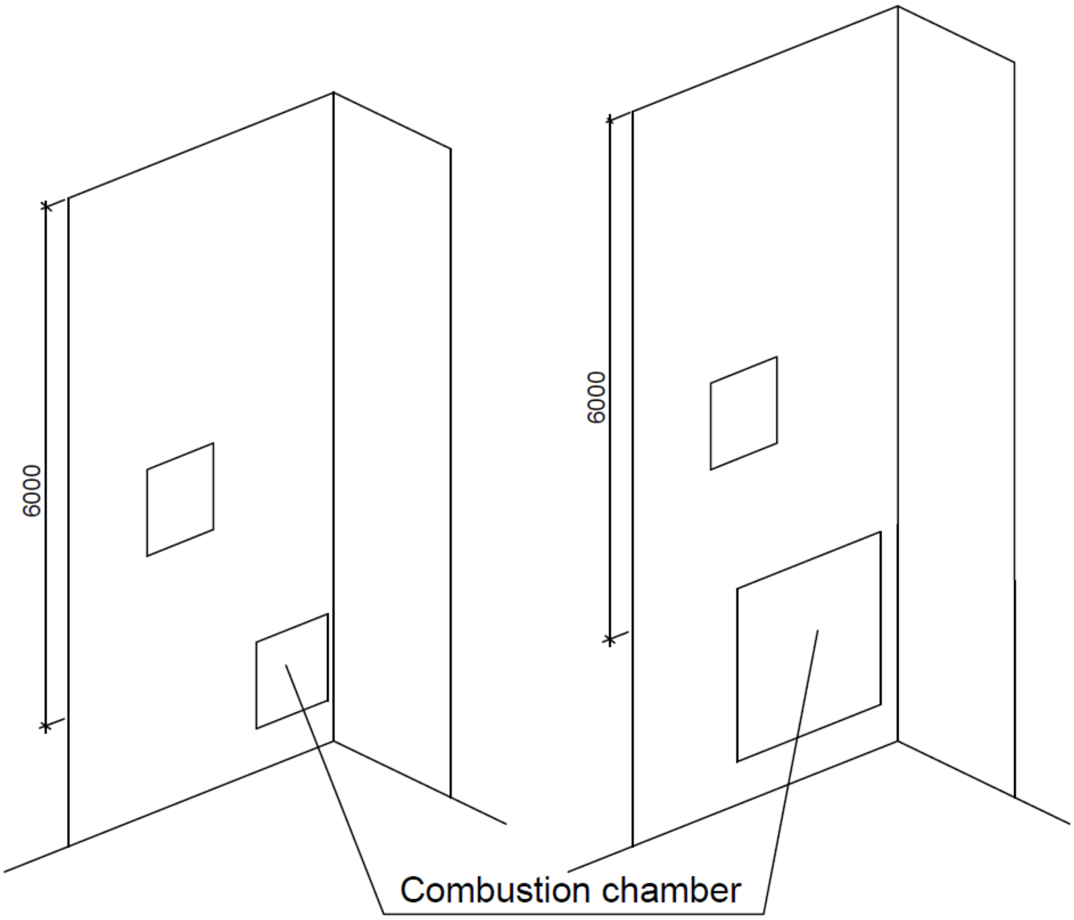


Figure 1. Principle drawing of the test method, medium fire exposure represented on the left and large fire exposure on the right.

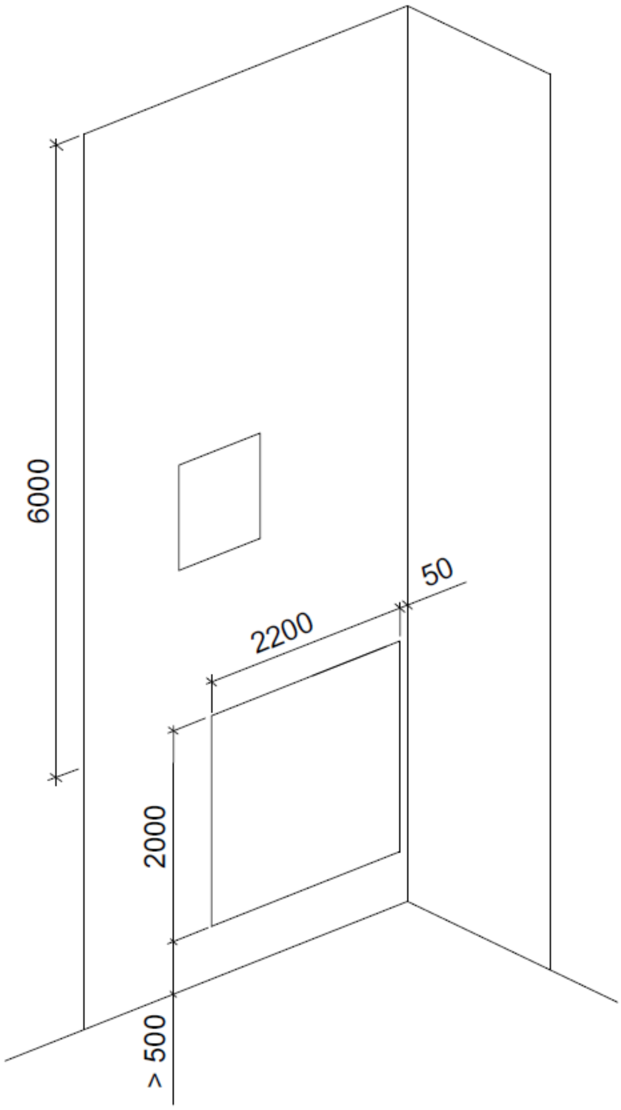


Figure 2. Test rig with opening for the combustion chamber that can be used for both medium and large fire exposure. It shall be noted that parts of the opening must be closed irrespectively of which fire exposure to be used.

4.2 Secondary opening

The objective with the secondary opening is to include the special detailing around openings of the façade system, i.e. the detailing where features such as windows are to be mounted in practice.

The main face of the test specimen and the supporting construction shall incorporate a secondary opening. In some cases, the window frame is used to protect the edge of the façade system, and for those systems it is possible to perform the test with a model of the window frame of the same material and dimensions as will be used in practice. In the figure below are given when no window frame is used.

When a supporting construction is used, the masonry infill shall have an indentation with a depth of >50 mm representing the opening, see figure 3.

When the test specimen is mounted directly on the structural frame, a secondary opening shall be included. The backside of the opening shall be covered with a calcium silicate board with a thickness of > 20 mm, or similar fire resistant board, see figure 3.

See annex C for further information/explanation.

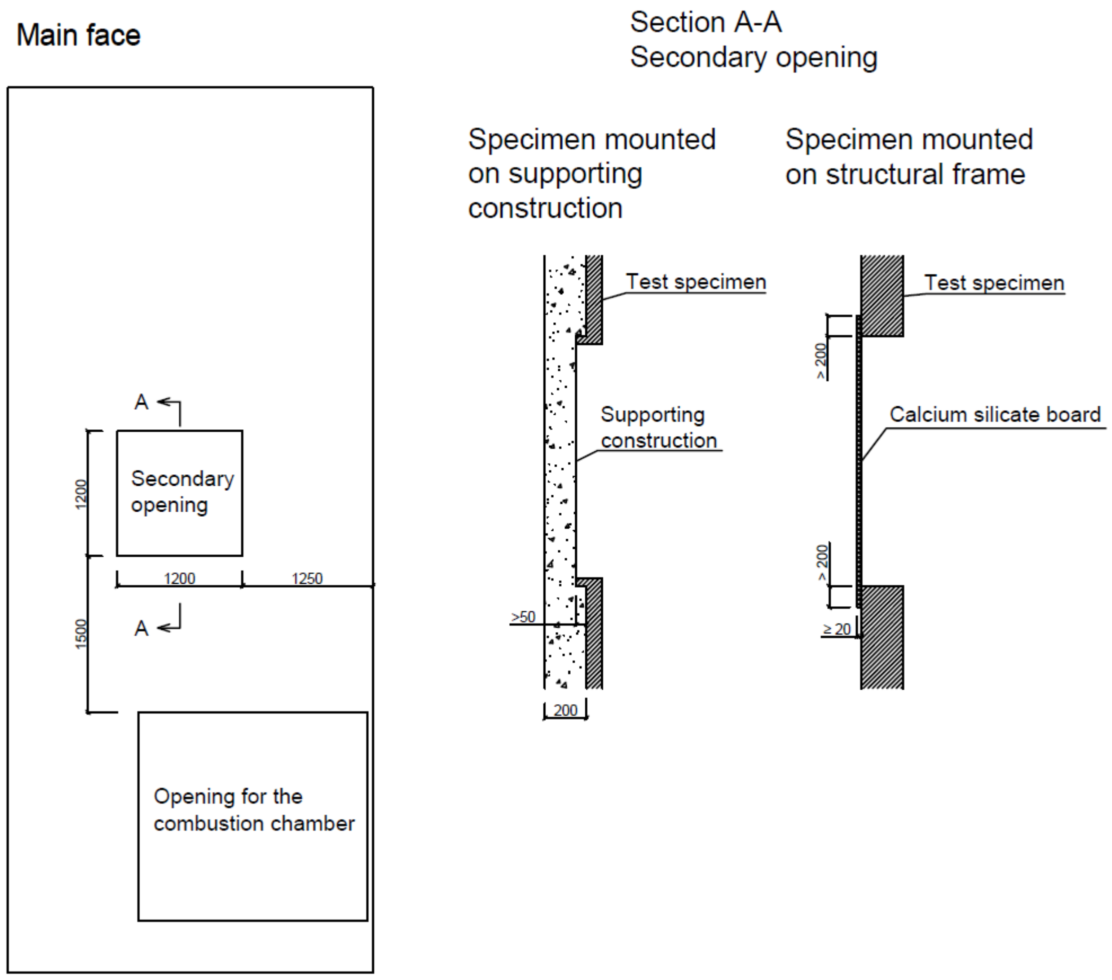


Figure 3. Main face with secondary opening.

4.3 Structural frame

The structural steel test frame shall be designed and constructed to withstand the expected loading imposed by the system under test and any subsequent distortions that can occur during the test program. Other structural test frames such as timber or concrete can be employed for specific applications. In figure 4 is an example of a structural steel frame shown.

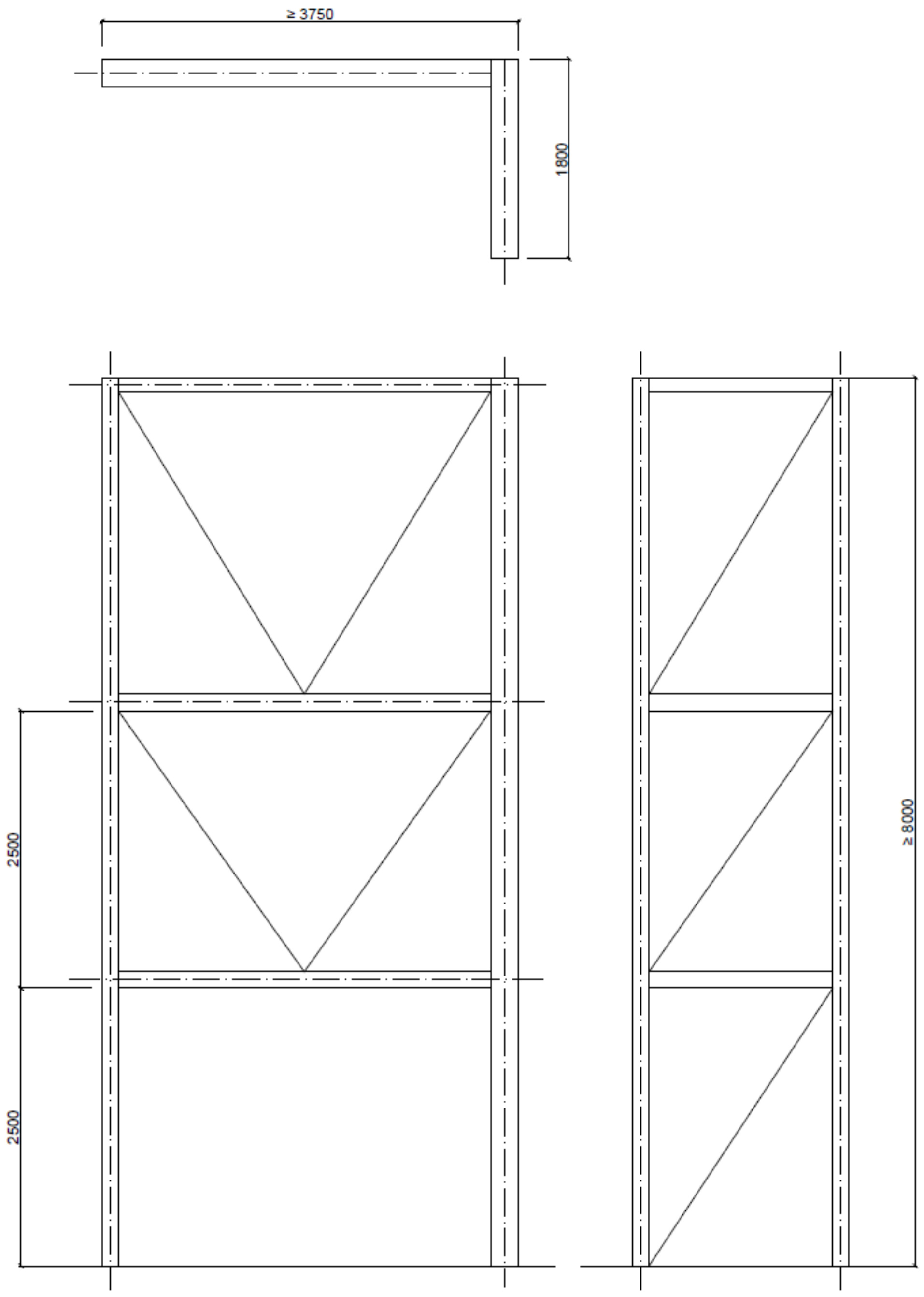


Figure 4. Example on a steel frame.

4.4 Combustion chamber

The design and location of the combustion chamber opening in the main test face shall be in accordance with the design details specified in table 1.

Table 1. Specification of combustion chambers.

Parameter	**Medium fire exposure**	**Large fire exposure**
Distance of combustion chamber opening from internal corner (from finished face of system) (mm)	50 ± 10	250 ± 10
Height of fire load base above ground type (mm)	200 + 5	400 ± 50
Height of combustion chamber opening (mm)	1000 ± 5	2000 ± 100
Width of combustion chamber opening (mm)	1000 ± 5	2000 ± 100
Depth of combustion chamber (mm)	800 ± 5	1000 ± 50
Opening for Forced Ventilation	300 mm diameter A fan shall be located behind the rear wall of the combustion chamber and blow 400 ± 40 m³/h fresh air in the combustion chamber	Not applicable
Crib location	100 mm behind front face of test rig	Back of crib 100 mm ± 10 mm from rear wall of fire load chamber
Combustion Chamber - Figure Reference	Figure 5	Figure 6

Note: The combustion chamber shall be produced by non-combustible aerated concrete blocks, apparent density 650 ± 200 kg/m³.

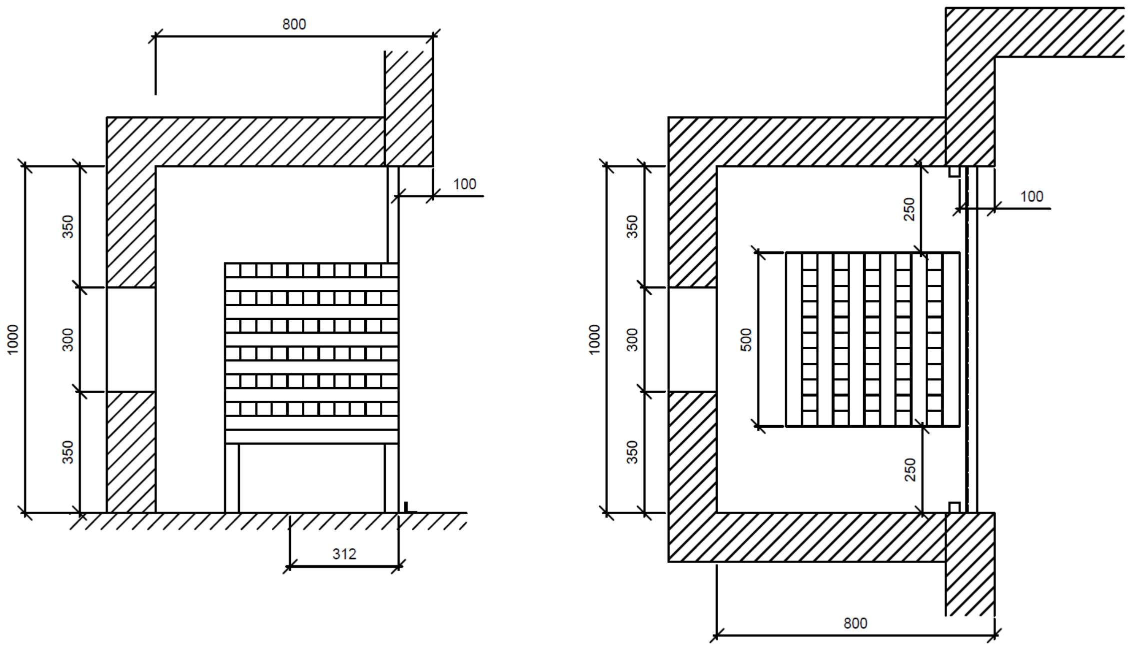


Figure 5. Combustion chamber for the medium fire exposure with wood crib as fuel.

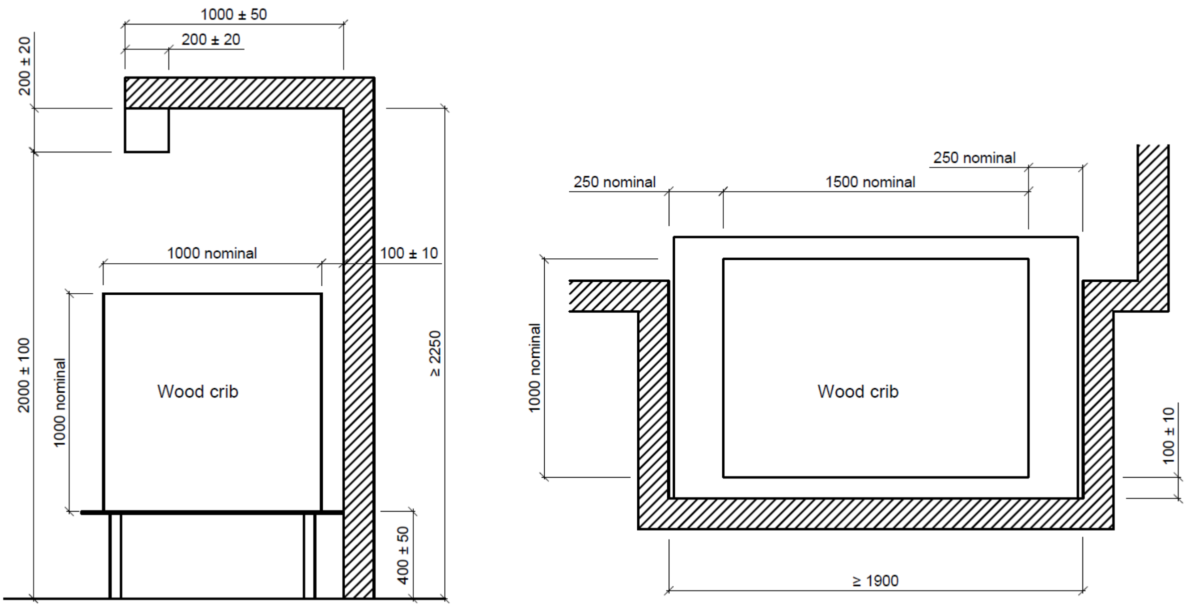


Figure 6. Combustion chamber for the large fire exposure.

In both case the distance between the back wall of the combustion chamber and the face of the supporting construction/structural steel frame shall be fixed, whatever the thickness of infill masonry if present and shall be located relative to the wing wall in accordance with table 1 above.

4.5 Fuel source

4.5.1 Medium fire exposure

The fuel source for the medium fire exposure scenario consists of the wood crib detailed below and located in the combustion chamber defined in section 4.4. The requirements for the crib ignition and extinguishment are also given in this section.

The wood used for the construction of crib shall be planed sawn softwood, e.g. spruce, with raw density after conditioning of 475 ± 25 kg/m³. The wood has to be conditioned until weight is constant and must be stored in a climate chamber according to EN 13238.

Construction of Crib

The crib is nominally 500 mm × 500 mm in plane.

It shall be constructed from:

- planed sawn softwood sticks with the dimensions of 40 ± 2 mm x 40 ± 2 mm x 500 – 10 mm

The crib shall be constructed in layers with shifted stacking, the sticks of the layers have 90 ° angels from layer to layer, the wood to air ratio is about 1:1. The sticks of the layer at the bottom are parallel to the rear wall of the combustion chamber. Each layer consists of 6 rods which are in line with the outer edge of the crib. The number of rods in the top layer is adjusted in a way that the mass of the crib is 30 ± 1.5 kg.

The wood crib is positioned on a metal construction which consists of an open frame of welded steel angles (40 mm x 40 mm) with a square base area of the used wood crib and 4 metal feet. Front edge of the crib is positioned 100 mm behind the front edge of the wall of the test rig. The distance between the crib and the side walls on both sides shall be the same. The distance between bottom edge of the wood crib and floor of the combustion chamber shall be 200 ± 10 mm, see Figure 5.

Ignition of the fire source

The crib shall be ignited by using 200 ml Isopropanol in two metal sheet pools (width 25 mm x length 500 mm x height 30 ± 5 mm), the pools shall be positioned in the second layer of wood rods.

The fire source is ignited with an open flame.

4.5.2 Large fire exposure

The fuel source for the large fire exposure scenario consists of the timber crib detailed below and located within the combustion chamber defined in section 4.4. The requirements for the crib ignition and extinguishment are also given section 4.4.

The timber used for the construction of crib shall be softwood sticks, *Pinus silvestris*, density 400 kg/m³ to 650 kg/m³ with moisture content in the range of 10% to 15% by mass.

Ignition of the crib shall be achieved by using 16 strips of low density fibreboard, having nominal dimensions of 25 mm × 12 mm × 1000 mm.

Construction of Crib

The crib is nominally 1500 mm × 1000 mm in plane and 1000 mm high.

It shall be constructed from:

100 long lengths 1500 ± 5 mm and

150 short lengths 1000 ± 5 mm

of softwood sticks with sawn square section 50 ± 2 mm.

The crib shall be constructed in alternate layers of long and short sticks, with the base layer consisting of 10 long sticks of 1500 mm. The next layer shall consist of 15 short sticks evenly distributed to cover an area of 1500 mm × 1000 mm. This process is repeated to give a total of 20 layers of sticks giving it a nominal height of 1000 mm.

The crib shall be built on a solid platform positioned 400 ± 50 mm above the floor of the combustion chamber and located centrally in the combustion chamber and displaced 100 ± 10 mm from the back wall of the chamber, see figure 6.

Ignition of the fire source

The crib shall be ignited by using 16 strips of low density fibreboard. The strips shall be soaked uniformly in 5 l of white spirit for a minimum of 5 minutes. Not more than 5 minutes before ignition, 14 strips of soaked fibreboard shall be inserted into the spaces between the timber sticks in the second layer of the crib (i.e. 50 mm above the platform) allowing approximately 30 mm to project from the front of the crib. The two remaining strips shall be laid horizontally across the 14 projected strip ends.

Ignition of the crib is achieved by igniting only the two horizontal strips across their full length.

Note: This heat source releases a nominal total heat *output* of 4500 MJ over 30 min at a peak rate of 3 ± 0.5 MW.

The crib is extinguished 30 minutes after ignition.

The crib shall be extinguished by applying the minimum amount of extinguishing agent (typically water applied as a fine spray mist). Care shall be taken during the application of the extinguishing media to reduce any impact on any burning of the test specimen.

Note: It has been found that dispersion and damping of the heat source is suitable.

4.6 Instrumentation

4.6.1 Thermocouples

The thermocouples shall have measuring junctions of nickel chromium/nickel aluminium (type K) wire as defined in EN 60584-1 contained within mineral insulation in a heat resisting alloy sheath of diameter 1.5 mm, the hot junctions being electrically insulated from the sheath.

When testing a façade-floors junction, install thermocouples with copper disc and insulating pad as described in EN 1363-1.

4.6.2 Data acquisition system

Data acquisition system, capable of recording data at a minimum of 10 s intervals shall be connected to the instruments.

4.6.3 Audio visual equipment

A continuous audio-visual record of the full height of the test faces shall be taken throughout the period of the test. One camera shall be used to cover the full height of both external faces, and additional cameras (four cameras are generally sufficient) may be needed to ensure good coverage of both the main face and the wing and the full height of the test specimen.

4.6.4 Mass loss

A balanced load cell platform with an accuracy of 1% of total load shall be used to measure the mass loss of the timber crib throughout the fuel source combustion period.

4.6.5 Ambient condition monitoring equipment

Ambient condition monitoring equipment, such as a suitable anemometer shall have an accuracy of ±0.5 m/s for measuring the ambient air velocity.

4.6.6 Timing device

The timing device used, such as a clock, shall have an accuracy > 5 s/h.

5 ENVIRONMENTAL CONDITIONS

The test shall be carried out in an environment in which the effects of the weather do not significantly affect the test. The specimen shall be shielded from the effects of high wind such that the wind speed in the vicinity of the specimen is less than 3 m s^{-1} during 15 minutes before the starting at a location between 2.5 m and 5 m above upper edge of the combustion chamber.

The test shall not be performed if it is raining or snowing nor during fog.

The ambient temperature prior to testing shall be between +5 °C and +35 °C.

Equipment for monitoring wind speed, such as an anemometer, shall have an accuracy of ±0.5 m/s for measuring the ambient air velocity.

If the test rig is positioned in a room it shall be in a way that both the fire and the specimen are under natural ventilation conditions and the fire effluents are properly exhausted.

Mechanical ventilation above the test rig (exhaust duct) is allowed, as long as the requirement on wind speed is maintained.

6 TEST SPECIMEN

6.1 Size

The test specimen shall extend horizontally from the finished corner of the test sample, at least 3200 mm on the main test face and at least 1200 mm on the wing. The system shall extend from the base of the test apparatus to a height of at least 6000 mm above the top of the combustion chamber opening on both faces. The test specimen shall not obstruct the combustion chamber opening.

6.2 Number

One specimen shall be tested. In the case that the mounting can be made in different ways (e.g. panels mounted vertically or horizontally), different details can be used (e.g. different types of fire stops or cavity barriers), or other features that can be done in different ways additional test specimens may be required.

6.3 Design

The test specimen shall include all relevant components assembled and installed in accordance with the manufacturer's instructions.

If the external cladding system does not offer any protection to openings in practice, the interface between the test specimen and the combustion chamber shall also remain unprotected.

Edge detailing and terminations shall also be representative of end use design. An example is that a ventilated system should be built with all accessories for the ventilation to function in a real application, such as ducts or channels. The dimensions of cavities and installations should be the same as in a real application.

If horizontal joints are incorporated into the external wall cladding system, the test specimen shall incorporate horizontal joints at intervals specified by the manufacturer, with at least one joint placed 2400 ± 100 mm above the combustion chamber opening.

If vertical joints are incorporated into the external wall cladding system, the test specimen shall incorporate vertical joints specified by the manufacturer, with a joint extending upwards on the centre line of the combustion chamber opening, with a tolerance of ± 100 mm.

6.4 Verification

The sponsor shall provide a description of all construction details, drawings and schedule of major components and their manufacturer/supplier, as well as an assembly procedure to the test laboratory, prior to the test. This shall be provided sufficiently in advance of the test to enable the laboratory to verify the conformity of the test specimen with the information provided. As far as possible, any area of discrepancy shall be resolved prior to starting the test. In case the construction details cannot be verified the laboratory shall either oversee the fabrication of the test specimen or request an additional test specimen. Where appropriate, the critical material properties shall be determined, e.g. density, moisture content and tolerances.

On occasion, it may not be possible to verify the conformity of all aspects of the construction of the test specimen prior to the test and adequate evidence may not be available after test. When it is necessary to rely on information provided by the sponsor this fact shall be clearly stated in the test report. The laboratory shall nevertheless ensure that it fully appreciates the design of the test specimen and shall be confident that it is able to accurately record the construction details in the test report.

7 MOUNTING OF THE TEST SPECIMEN

The method of construction including the tolerances and the erection shall be representative of the use of the façade system in practice. The standard of workmanship shall be as normally provided in buildings and shall include the same way of accessing the test specimen.

Construction details, such as fire stops, shall be detailed and positioned in the test specimen as in practice.

The sponsor shall be responsible for ensuring that the quality of construction of the test specimen is representative of the product in practice.

The installation of the test specimen shall be monitored and compared to the design drawings for reporting by the test laboratory. Photographic records shall be used to support this.

The specimen is to be applied directly on the structural frame (see 4.3) or on the masonry infill (see 4.1) of the test rig. The test shall be performed on a test specimen which in case of:

- an external wall assembly shall be mounted with a construction as intended in practice, directly onto the (steel) frame of the test rig. (The lightweight concrete wall is not mounted on the test rig in this case.) A secondary opening shall also in this case be included, and shall be closed as shown in figure 2.
- a facade wall cladding shall be mounted on the lightweight concrete wall of the test rig, see figure 2. The size and shape of the external wall assembly or facade wall cladding shall correspond to the lightweight concrete wall of the test rig.

Any modifications made to accommodate the installation of a test specimen on the test rig shall be such as to have no significant influence on the behaviour of the test specimen and shall be fully described in the test report.

All detailing shall be installed as in practice, including any compressing seal, finishing mastic, insulating material, filling material, cladding, fastening and thermal breaks.

The test specimen shall be mounted on both the main wall and the wing as in practice when this type of corner is present. It is not allowed to mount the specimen on the main face and the wing separately, and afterwards assemble the main face and the wing.

Secondary opening

The objective of simulating a window opening is to focus on the method applied by the manufacturer to treat the connection or interface between the façade system and a window. Therefore no windows need to be installed. Examples on different possible assemblies and how to mount the test specimen are given in Annex C.

Junction between façade and floor (optional test procedure)

The assessment of the junction between floor and façade as potential weak point is may be required in some cases. In order to give the possibility to consider this issue, a specific adaptation can be done in the test. Figure 7 show how the junction between the façade and the floor can be included in the test.

> *Note: The junction between façade and floor will only be assessed along the width of the combustion chamber, and not the whole width of the test specimen.*
>
> *Note: The junction between façade and floor is not covered by the classification system for facades.*

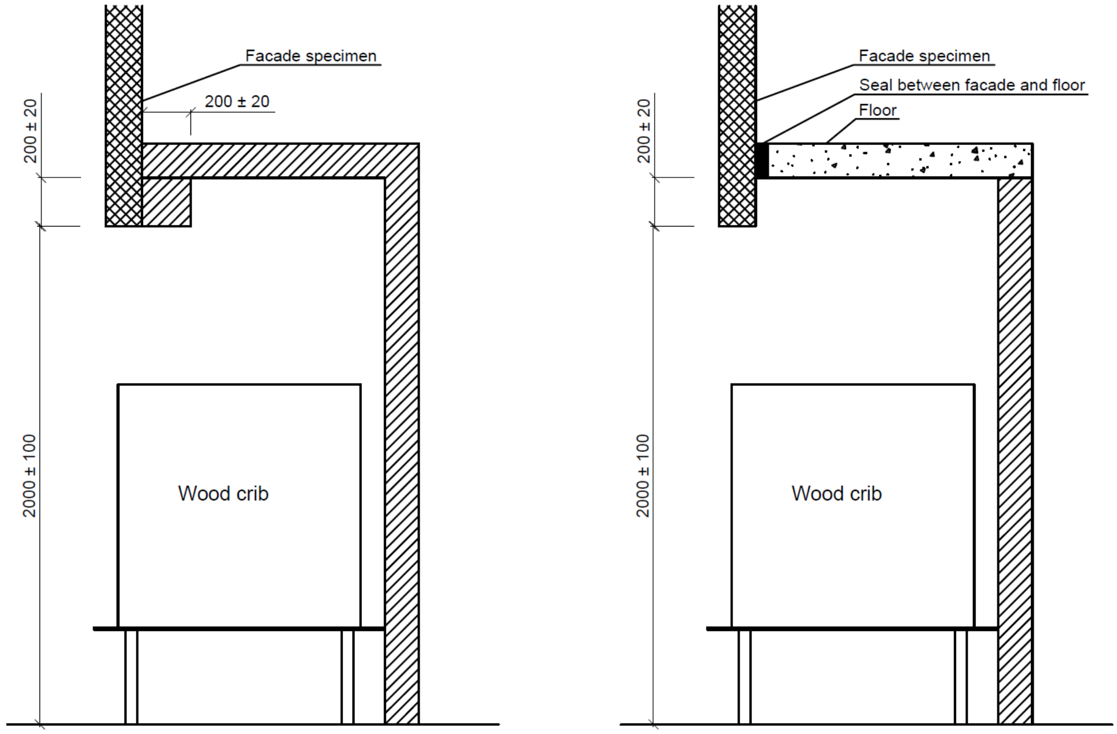


Figure 7. Mounting of façade system and floor at the combustion chamber. The normal procedure is shown to the left and the case when also the connection between façade and floor is evaluated to the right.

In case of façade systems connected directly to the floors, the combustion chamber upper part will be made of a slab. The material of the slab is made of aerated concrete, armoured concrete or even the slab material intended for end-use, e.g. timber floor.

In the neighbouring of the floor, the structural steel frame shall be protected by fire blanket.

See annex D for further information/explanation.

8 CONDITIONING OF TEST SPECIMEN

After application of the test specimen to the test rig, it shall be left for a period of time which is sufficient for all components to cure and conditioned in accordance with the test sponsor's installation specifications. It is acceptable to limit the conditioning to 28 days for materials that needs long curing times, although it is then important to specify the actual moisture content at the time of testing. This can be done by using a mock-up test specimen, see 8.1.

The test rig with the mounted test specimen shall be protected from adverse environmental conditions such as water, wind load and ambient temperatures outside the range +5 °C to +35 °C during the application, conditioning and test period.

At the time of the test, the strength and the moisture content of the test specimen shall approximate to those expected in normal service.

8.1 Mock-up test specimen

Façade systems including hygroscopic materials, where the fire performance is affected by the moisture content, it is important to measure the moisture content at the time of testing.

A small size mock-up of the facade shall be systematically prepared during the installation of the facade, using the same materials. This mock-up shall be used to estimate the moisture stabilization of the sample and to determine material characteristics (mainly moisture content). It shall be stored together with the façade specimen and in the same ambient conditions.

The size of the mock-up shall be not less than 200 mm x 200 mm x thickness of the tested façade system, and the side lengths shall be at least three times the thickness of the tested façade system. All sides of the mock-up, except the front surface, shall be covered in plastic to ensure that the drying is only from the front surface. The water movement shall only be in a direction going out through the surface of the façade system.

The whole mock-up shall be weighted on a daily basis until the weight change between two measurements, 24 h apart, is less than 0.1 %.

Certain materials may need a long conditioning time. If more than 28 days is needed, it is enough to state in the report that it was conditioned during 28 days, and also presents the measured moisture content in the materials after this conditioning time (the samples shall be taken from the mock-up test specimen). The moisture content is determined by weighting the material sample taken from the mock-up test specimen before and after drying in 105 °C. For some specific material, such as gypsum, other drying temperatures may be applied which then shall be clearly stated in the test report.

9 TEMPERATURE MEASUREMENTS

The installation of all thermocouples (internal and external) shall be achieved by drilling through the test specimens at the set instrumentation locations defined in section 9.1 and 9.2 to enable the thermocouples to be installed from the rear face of the sample to ensure no interference with the development of the ignition source or fire propagation on the sample under test.

The drilling of the samples shall be achieved by using equipment suitable for the type of façade systems and materials being tested. The openings in the systems shall be the minimum required to allow the thermocouples to pass from the rear of the samples to the front face, allowing for multiple thermocouples to located through the full deep of the system, see figure 8.

Care must be taken to ensure that damage or displacement of material in each layer is minimized.

Where the external thermocouples pass through the front face of the samples, the thermocouples shall be allowed to travel freely and shall not be restrained to the samples. If any form of closure is required on the external face of the sample around the opening this shall be achieved by use of non-combustible cementitious or packing materials.

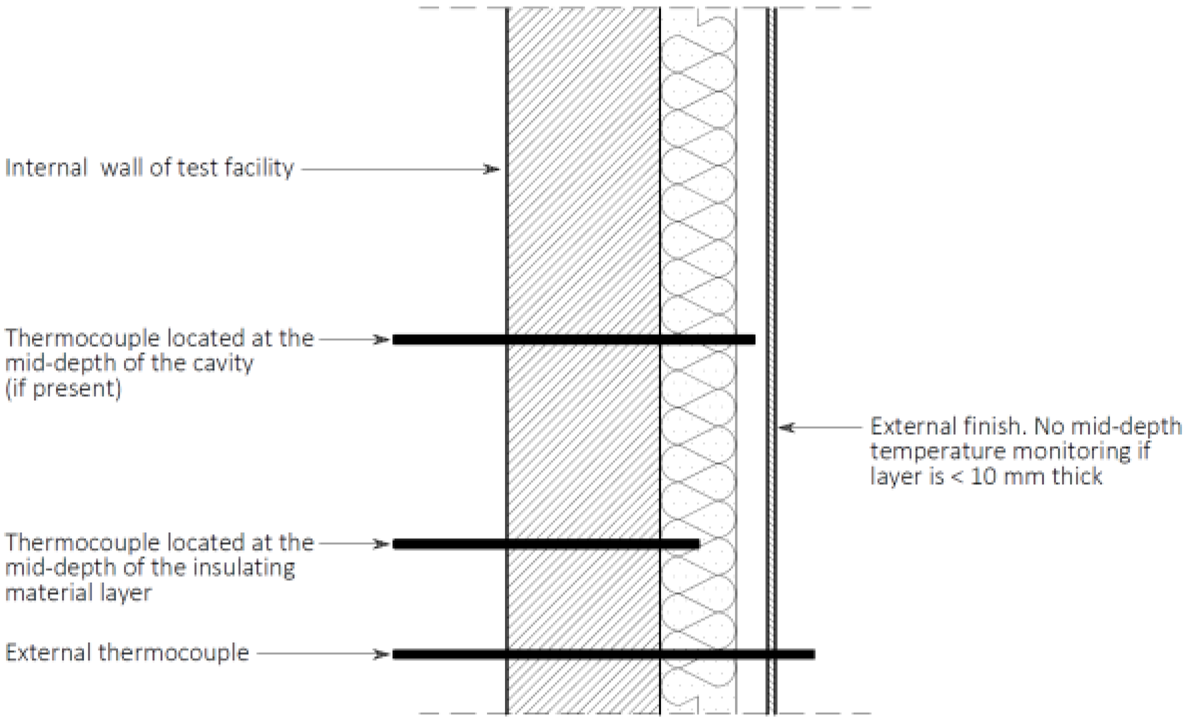


Figure 8. Principle drawing for the internal and external thermocouples for spread assessment

9.1 External thermocouples

All external thermocouples shall be positioned to a tolerance of ±10 mm with the hot junction positioned (50 ±5) mm in front of the face of the test specimen.

External thermocouples shall be located at the levels set by the fire scenario to be evaluated (medium or large fire exposure) on the test specimen as follows, see also figures 9 and 10.

For the medium fire exposure thermocouples shall be located at the horizontal lines at 2000 mm, 3500 mm and 5900 mm above the combustion chamber, as well as the vertical lines, see figure 9.

For the large fire exposure thermocouples shall be located at the horizontal lines at 2000 mm, 4500 mm and 5900 mm above the combustion chamber, as well as the vertical lines, see figure 10.

a) Thermocouples shall be positioned in front of the main test wall face at a distance of 100, 500, 1000, 1500 and 2000 mm from the finished face of the wing (five locations).

b) Thermocouples shall be positioned in front of the wing test wall face at 100 mm, 500 mm and 1000 mm from the finished face of the main test wall face (three locations).

9.2 Internal thermocouples

Internal thermocouples shall be positioned at the level used for determining the fire spread only to a tolerance of ±10 mm, i.e. not on the line 2000 mm above the combustion chamber. They shall be positioned at the mid-depth of each layer or cavity within the test specimen with a depth ≥10 mm.

For the medium fire exposure thermocouples shall be located at the horizontal line 3500 mm above the combustion chamber, as well as the vertical lines, see figure 9.

For the large fire exposure thermocouples shall be located at the horizontal line 4500 mm above the combustion chamber, as well as the vertical lines, see figure 10.

a) Thermocouples shall be positioned within each layer of the main test wall face at a distance of 100, 500, 1000, 1500 and 2000 mm from the finished face of the wing (five locations).

b) Thermocouples shall be positioned within each layer of the wing test wall face at 100 mm, 500 mm and 1000 mm from the finished face of the main test wall face (three locations).

In each position, where there are measurements in one or more layers, the thermocouples shall be positioned around the thermocouple for surface measurement at a distance of maximum 50 mm from the surface thermocouple.

If there are studs or other components at the give position, the thermocouple can be moved to a location not more than 50 mm from the component.

For the assessment of the horizontal fire spread (internally and on the façade surface), thermocouples are positioned at the mid-depth of each layer or cavity within the test specimen with a depth > 10 mm and through the test specimen so that the hot junction is positioned 50 ±5 mm in front of the face of the test specimen outside the façade at two levels as follows:

- On a vertical line located at 2.75 m from the corner on main face:
- On a vertical line positioned 1.45 m from corner on wing

A minimum of 12 thermocouples are regularly distributed on each line for both the medium and large fire exposure.

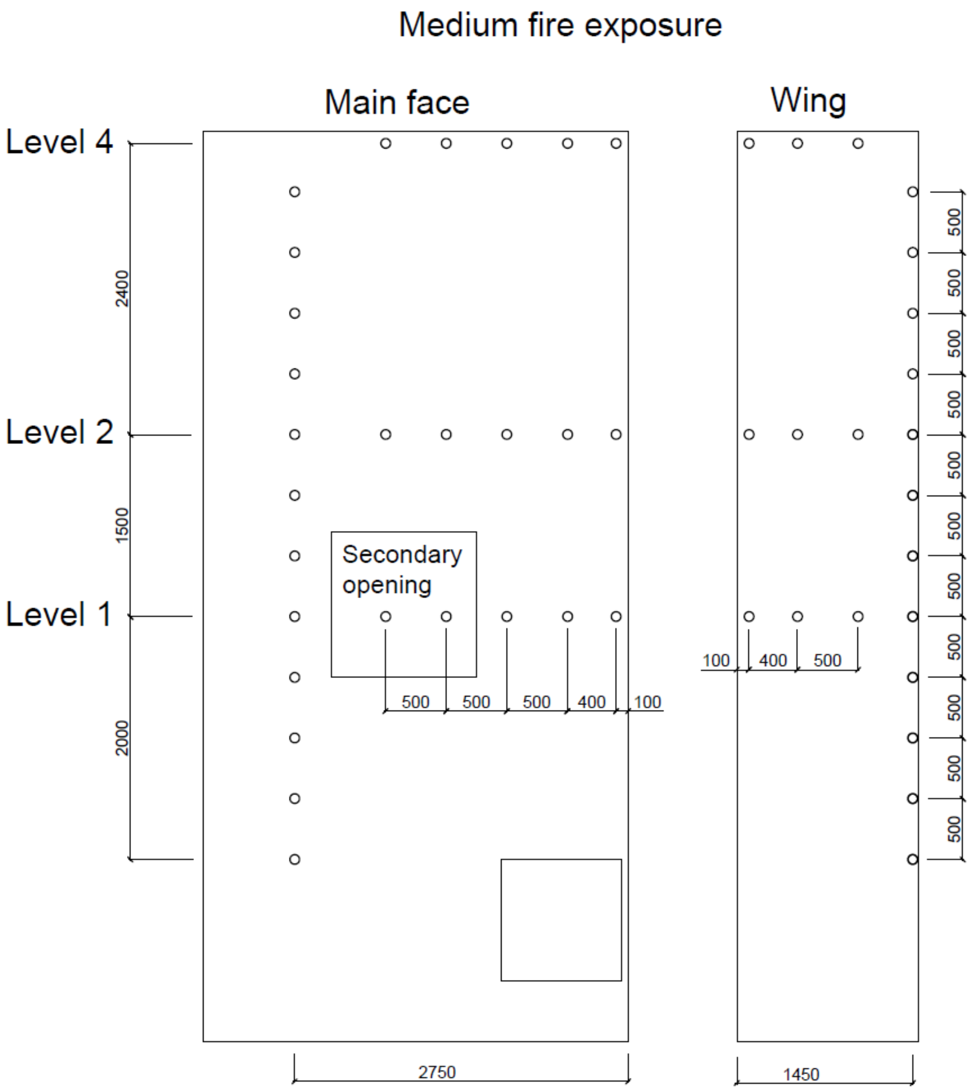


Figure 9. Positions of thermocouples to be used in the medium fire exposure test.

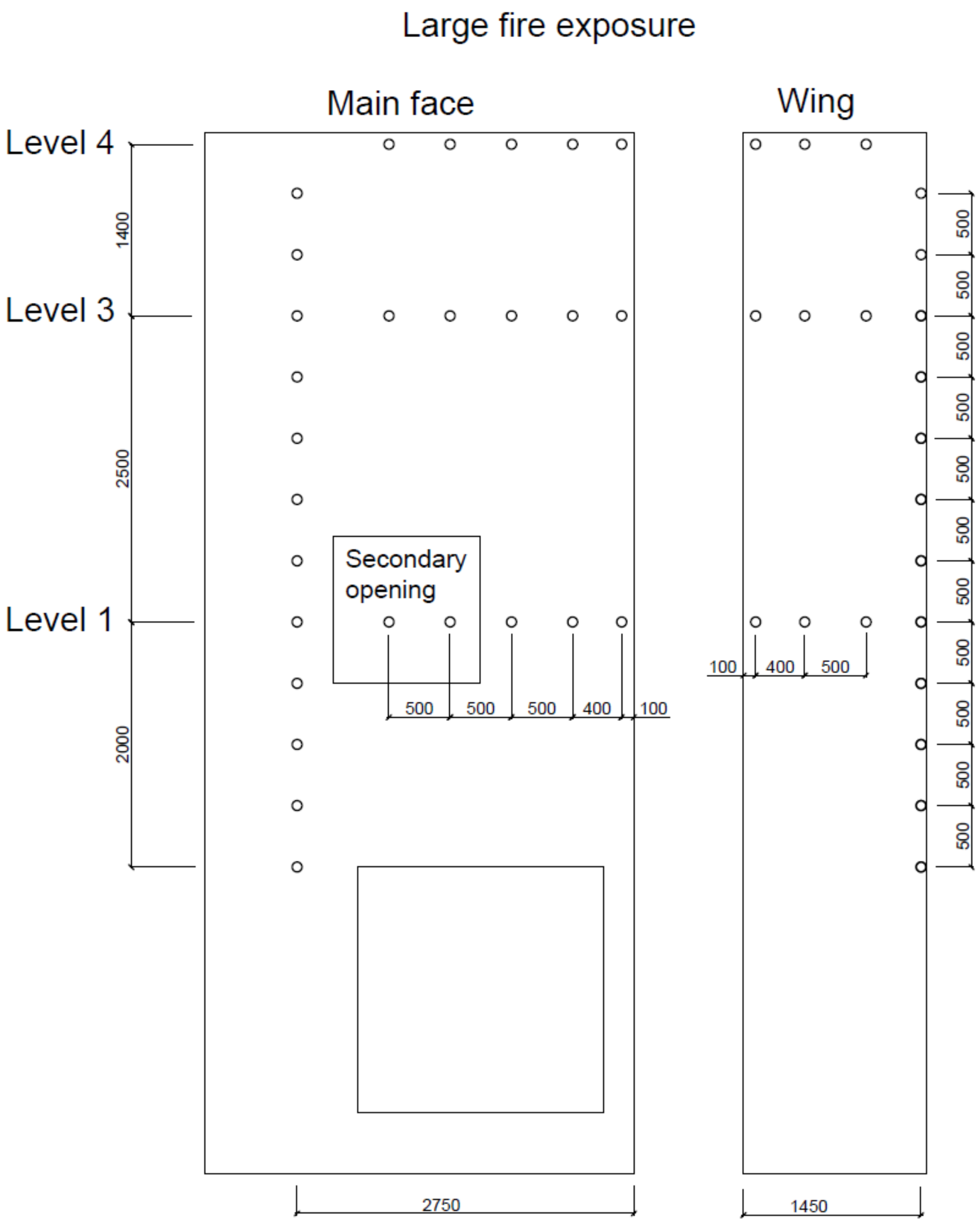


Figure 10. Positions of thermocouples to be used in the large fire exposure test.

9.3 Sample edge

Thermocouples shall be installed on the external surface and internally depths throughout the full depth of the sample as detailed in 9.2 at the outer edges (figures 9 and 10, section 9.1 & 9.2)

9.4 Mass loss

The load cell platform shall be located on the platform within the combustion chamber on to which the timber ignition crib is constructed.

9.5 Measurements on junction between façade and floor (optional)

Thermocouples with copper disc and insulating pad, in accordance with EN 1363-1, shall be installed as shown in figure 11.

If the linear seal is wider than 30 mm:

- Four thermocouples are located at mid-width of the seal.
- Four thermocouples are located on the floor at 15 mm from the seal

If the linear seal is narrower than 30 mm:

- Four thermocouples are located on the floor at 15 mm from the seal

A video camera is installed at the back of the structural frame at a location allowing capturing the complete length of the connection.

This camera will serve to control any integrity failure and help for the control of safety of the test rig.

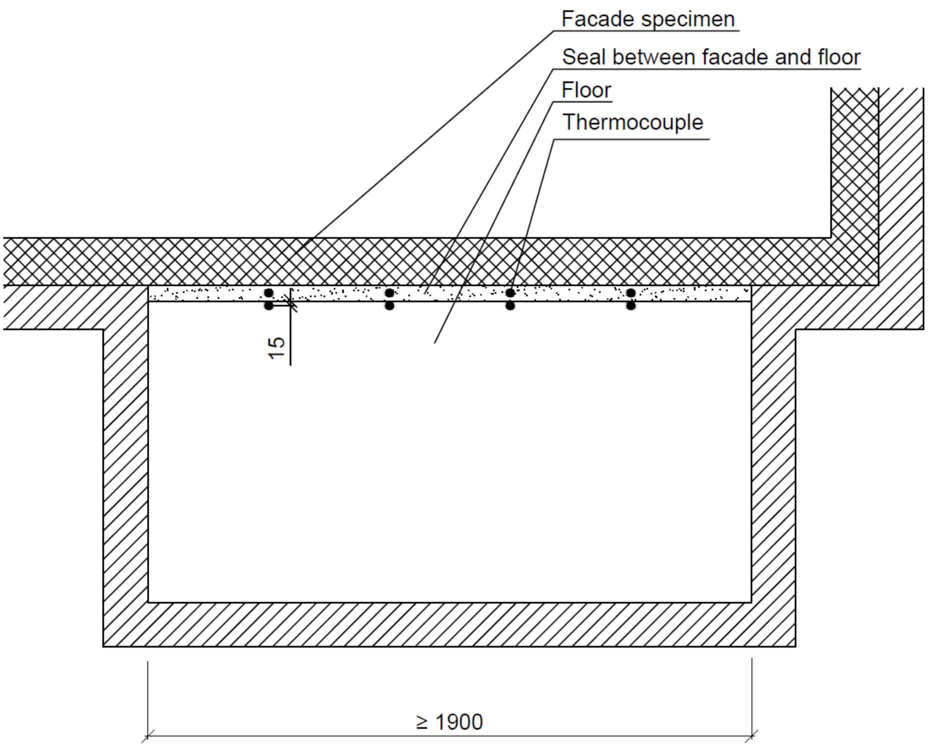


Figure 11. Instrumentation at the junction between façade and floor. The view is from above the floor (the roof of the combustion chamber).

9.6 Checking of smouldering (optional)

When the smouldering criterion is required, additional thermocouples in accordance with DIN 4102-20 shall be installed within the facade system.

10 TEST PROCEDURE

The test procedure follows the following steps;

- Document the test set-up
- Confirm that all measurement devices are functioning
- Determine the ambient test conditions; wind speed, precipitation and local temperatures
- Begin data logging and audio-visual recording equipment.
- Ignite the timber cribs following the relevant procedure for the selected fire load scenario
- Monitor and record the behaviour of the test sample during the full 60 minutes test period
- The fuel source shall be extinguished 30 minutes after the ignition using the technique detailed in the relevant clauses.
- Continue to record measurements and observations for the full duration of the test.
- Terminate of the test 60 mins after ignition of the timber crib.
- Record observations of permanent changes to the test samples following the test.

10.1 Test time

The test duration shall be 60 minutes for all fire exposure scenarios.

10.1.1 Medium fire exposure

Time	**Action**	**Reference Clause**
0	Ignition of the timber crib	4.5.2
4	Addition of air to the combustion chamber via a fan unit	4.4, table 1
22	Extinguish Timber Crib and switch off fan	10.3
60	Termination of test	

10.1.2 Large fire exposure

Time following ignition	**Action**	**Reference Clause**
-5	Soak fibreboard ignition strips and insert strips into cribs	4.5.1
0	Ignition of the timber crib	4.5.1
30	Extinguish Timber Crib	4.5.1 & 10.3
60	Termination of test	

10.2 Observations

Video records shall be made during the tests.

At least one camera that covers the complete test specimen.

More cameras may be needed to ensure that details of the behaviour of the test specimen can be recorded before, during and after the test.

Details and times of significant events shall be recorded during the test such as the change of flaming conditions and any change in the mechanical behaviour of the cladding system shall be recorded, especially the detachment of any part of the cladding system (whether flaming or otherwise) or any fire penetrations through fire stops incorporated within the cladding system.

10.3 Extinguishing of the fire source

The fire in the combustion chamber shall be extinguished after the actual test time (22 minutes for the medium fire exposure and 30 minutes for the large fire exposure). The fire shall be extinguished by spraying water on the wood crib. Care shall be taken to ensure that a minimum extinguishing agent is used to reduce impact of any burning of the test specimen. It has been found that dispersion and damping of the heat source is suitable.

It is important that water is only sprayed in the combustion chamber, and not on any part of the test specimen.

10.4 Post-test inspection

Observation of permanent changes of the tested system should be assessed after the end of the test and have to be documented. Examination of the test specimen should take place within 24 hours after the test, once the sample has cooled. The examination should record details of permanent changes, including (but not limited to) spalling, melting, deformation, softening, detachment, charring, discolouration and delamination. The examination should note size, shape, location and type of permanent changes. Both changes on the surface as well as within any layers or cavities of the system (both vertically and horizontally) should be noted. Any collapse or partial collapse of the test specimen should also be noted.

Areas should be expressed in square meters and lengths in meters or millimetres.

10.5 Early test termination criteria

The test shall be terminated if:

a) Flame spread extends beyond the test rig (vertically or horizontally) at any time during the test duration; or

b) There is a risk to the safety of personnel or impending damage to equipment.

11 PERFORMANCE CRITERIA

In case a thermocouple used for determining the performance of the façade system fails during the test, a judgement may be done based on the visual observations as well as the measured values obtained by nearby thermocouples during and after the test.

The values to be observed and recorded for each performance criterion are:

Vertical fire spread

Maximal temperature rise of thermocouple positioned at the horizontal classification levels (3.5 m and 5.9 m for medium test, and 4.5 m and 5.9 m for large test) over a period of 30 seconds during the test frame time of 60 minutes after the test start time.

Horizontal fire spread

Maximal temperature rise of thermocouple positioned on the classification vertical lines located at 2.75 m from the corner on main face and at 1.45 m from corner on wing over a period of 30 seconds during the test frame time of 60 minutes after the test start time.

Falling parts

Falling parts include all solid or liquid material falling from the test specimen. They are assessed by visual observations, until a suitable measurement technique is available.

The general criterion is that falling parts shall not be a risk for the evacuation, the rescue personnel nor the fire brigade.

The following parameters shall be determined:

- Mass
- Area
- Number of drops of melted burning material from the test specimen which continues to burn on the floor
- Maximal size of each spot with burning material
- Duration of the burning

Façade-floor junction (optional)

Maximal temperature rise of thermocouple positioned at the connection between floor and façade, see figure 11.

Duration of any continuous flaming.

Smouldering (optional)

Maximal temperature of thermocouple positioned at for the smouldering application, 6 hours after the end of observation period/ extinguishment of the fire.

12 TEST REPORT

A test report is to be written describing the execution and the results of the test. The report shall contain the following information and data:

a) Name and address of the test laboratory

b) Date of the test and date of issue of the test report

c) Name and address of the sponsor of the test

d) Statement of the test approach applied, medium or large fire exposure

e) Installation and assembly of the test specimen

- Description of the substrate
- Conditioning

f) Description of the façade system tested (in writing or by drawings) including:

- Name and type of the products used, dimensions, form
- Properties of the materials used, nominal and measured values, see chapter 8
- All elements included in the system such as fixing types, specifications, installation density (i.e. number per m^2 and layout patterns of fixings, coverage and type of application of adhesive etc.)
- The position of all components in the system
- Design of construction details such as lintel, joints, edges, openings, expansion joint details, fire stops, cavity and fire barriers

g) Position of the thermocouples in front and inside the specimen

h) Environmental conditions see chapter 5

i) Visual observations and photographs including the time during the test such as:

- visual flame spread on the surface of the test specimen, burning through joints or showing flames at the outer edges of the test specimen
- occurrence of burning debris of the test specimen including time and duration of burning
- occurrence, duration and extent of a secondary fire on the floor of the test rig caused by burning debris
- occurrence time, dimensions and amount of falling parts
- changes of the test specimen during the tests like deformations, colourations or delamination's
- description of the smoke development

j) permanent changes of the test specimen after finishing the test on the surface of as well as inside the test specimen

k) Graphs of temperatures versus time measured of all individual thermocouples

l) Signature(s) of the responsible staff(s) of the testing laboratory

As annexes the following shall be added to the test report:

a) Illustrations / drawings of:

- test assembly

- constructive design of specific details of the test assembly
- position of all thermocouples on both wings of the test specimen for measuring the temperatures

b) Photo documentation: description of the test course by significant pictures at special time points

The video of the test shall be archived by the test laboratory.

13 Direct field of application

Note: It is currently too early to define a set of direct field of applications (DIAP). Later when more information is available the DIAP can be defined in more detail. The following gives examples on what can be considered in the DIAP.

The results of the fire test are directly applicable to similar constructions where one or more of the changes listed below are made and the construction continues to comply with the appropriate design code for its stiffness and stability:

- decrease in distance of fixing centres of panels;
- increase in the number of horizontal joints, of the type tested, when tested with joints;
- increase in the number of vertical joints, of the type tested when tested with joints;
- the width of an identical construction may be increased if the specimen was tested on the large test rig provided joint were tested and provided distance of fixing centres is not increased;
- the height of the construction may be increased
- a non-combustible insulation of Euroclass A2 can be replaced with a non-combustible insulation of Euroclass A1 if the thickness and density is the same
- an insulation of Euroclass E can be replaced with an insulation of Euroclass B-D if the thickness and density is the same

14 CLASSIFICATION

The classification is based on the flame spread and on falling parts. There are two different fire scenarios, medium fire exposure and large fire exposure. For each of these exposures there are two possible classes, one if only the performance criteria on flame spread is fulfilled, and one if both the criteria on flame spread and falling parts is fulfilled.

Table 2. Proposed classification system

Classification	Comment
LS1	Large exposure test fulfilling flame spread and falling parts/burning debris
LS2	Large exposure test fulfilling flame spread but not falling parts/burning debris;
LS3	Medium exposure test fulfilling flame spread and falling parts/burning debris
LS4	Medium exposure test fulfilling flame spread but not falling parts/burning debris;

It is the intention that a successful classification to LS1 would satisfy requirements for a classification to LS3, or that a classification to LS2 would satisfy requirements for a classification to LS4. The list below reflects the equivalency of the different classifications, i.e. the classifications under LS1 and LS2 exposure which are covered by classifications under LS3 and LS4 exposure;

- LS1 will cover all other classes;
- LS2 will cover LS4 but not vice versa;
- LS3 will cover LS4 but not vice versa;
- LS2 does not cover LS3; and
- LS3 does not cover LS2.

Table 3. Proposed limiting values for the classification system

Feature	Classification	Proposed Limiting values
Limited fire spread	LS1 and LS2	<u>Vertical fire spread</u> No thermocouple positioned at the horizontal classification levels (d 4.5 m and 5.9 m) shall indicate a temperature rise greater than 500 K over a period of 30 seconds during the test frame time of 60 minutes after the test start time. <u>Horizontal fire spread</u> No thermocouple positioned on the classification vertical lines located at 2.75 m from the corner on main face and at 1.45 m from corner on wing shall indicate a temperature rise greater than 500 K over a period of 30 seconds during the test frame time of 60 minutes after the test start time.
Limited fire spread	LS3 and LS4	<u>Vertical fire spread</u> No thermocouple positioned at the horizontal classification levels (3.5 m and 5.9 m) shall indicate a temperature rise greater than 500 K over a period of 30 seconds during the test frame time of 60 minutes after the test start time. <u>Horizontal fire spread</u> No thermocouple positioned on the classification vertical lines located at 2.75 m from the corner on main face and at 1.45 m from

		corner on wing shall indicate a temperature rise greater than 500 K over a period of 30 seconds during the test frame time of 60 minutes after the test start time.
Junction	optional	No thermocouple positioned at the connection between floor and façade shall exceed a temperature rise of 180 K. No continuous visual flaming for a period of time greater than 10 s shall be observed on the backside of the test specimen.
Smouldering	optional	No thermocouple positioned at for the smouldering application shall exceed 50 °C, 6 hours after the end of observation period/ extinguishment of the fire.
Falling parts/burning debris	LS1 andLS3	Falling parts are limited to a maximum of 1 kg and an area of 0.1 m^2 for each individual piece. More than a few drops (maximum 10) of melted burning material from the test specimen which continues to burn on the floor > 20 seconds are not allowed. Each spot with burning material cannot exceed a diameter of 50 mm. Small pieces of charred wood which falls down and continues to burn or glow is acceptable until it reaches the amount given for burning droplets above. Material (solid or liquid) which does not burn when falling down and is below the definitions on size and weight above but starts to burn after it has fallen to the floor is accepted.

ANNEX A DETERMINATION OF FALLING PARTS (INFORMATIVE)

Step 1 – determine the volume density and area density of the product to be tested

a) take 3 samples

b) condition the samples a minimum of 24 hours at 20°C and 50 % relative humidity

c) determine the volume density and area density of each samples

d) take the average values: the average area density, D (kg/m^2) and the average volume density, ɣ (kg/m^3)

Step 2 – indicate a dot mesh (for example 20/20 cm) on the facade sample (at least in area of the possible falling parts)

Step 3 – carry out the test with continuous video recording from the same designated spot. The starting time of the test is t_0.

Step 4 – with the aid of the dot mesh and the pictures (from the video recording) – which were taken during the test (t_i) – determine the area of the part ($A_{fallen, i}$) has fallen at t_i. The perspective distortion shall enhance with suitable computer tools (see figure A.1).

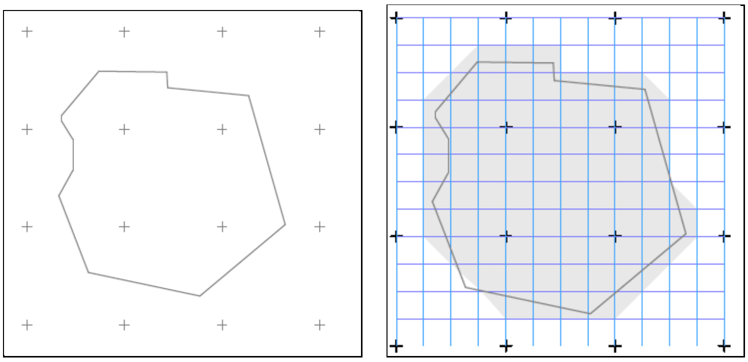


Figure A.1 Left: Corrected picture; Right: Mesh with area calculation.

Step 5 – compare the areas of each larger falling parts ($A_{fallen,i}$) with the limit. $A_{fallen,i}$ shall be less than 0,1 m^2

Step 6 – calculate the weight of all larger falling parts: $m_i = D\ A_{fallen,i}$. m_i shall be less than 1 kg

In case of other kind of falling parts (3D falling parts etc) an expert evaluation is necessary.

ANNEX B CALIBRATION (INFORMATIVE)

A test bench calibration record is to be maintained and the test bench is to be recalibrated after completion of any repair that could alter the flame distribution, air supply conditions and any other parameters impacting the heat exposure.

The calibration shall be made on an inert test specimen, like for instance the structural steel frame with infill masonry. Measurement like temperature by means with plate thermometers in front of the combustion chamber and on the wall, mass loss rate of the crib shall be performed to characterize the heat exposure.

Note: Full details on the calibration procedure will be defined after the round robin tests.

ANNEX C MOUNTING OF TEST SPECIMEN AT SECONDARY OPENING (INFORMATIVE)

The following give some examples on how the detailing around the secondary opening can be done. Four different examples based on how widows are mounted in practice are presented. In some cases the window frame is used to protect the edge of the façade system, and for those systems it is possible to perform the test with a model of the window frame of the same material and dimensions as will be used in practice. In the examples below examples are given when no window frame is used as well as when a window frame is used.

Case 1

The window is mounted flush with the wall on the inside of the exterior wall, see figure C.1.

If the test specimen is mounted on a supporting construction (lightweight concrete) with an indentation for the secondary opening, the indentation must be deep enough to be able to simulate the mounting in practice. The façade system shall be applied a minimum of 25 mm into the indentation. In the case no window frame is used, there shall be a distance of at least 25 mm from the façade system to the supporting construction in the secondary opening.

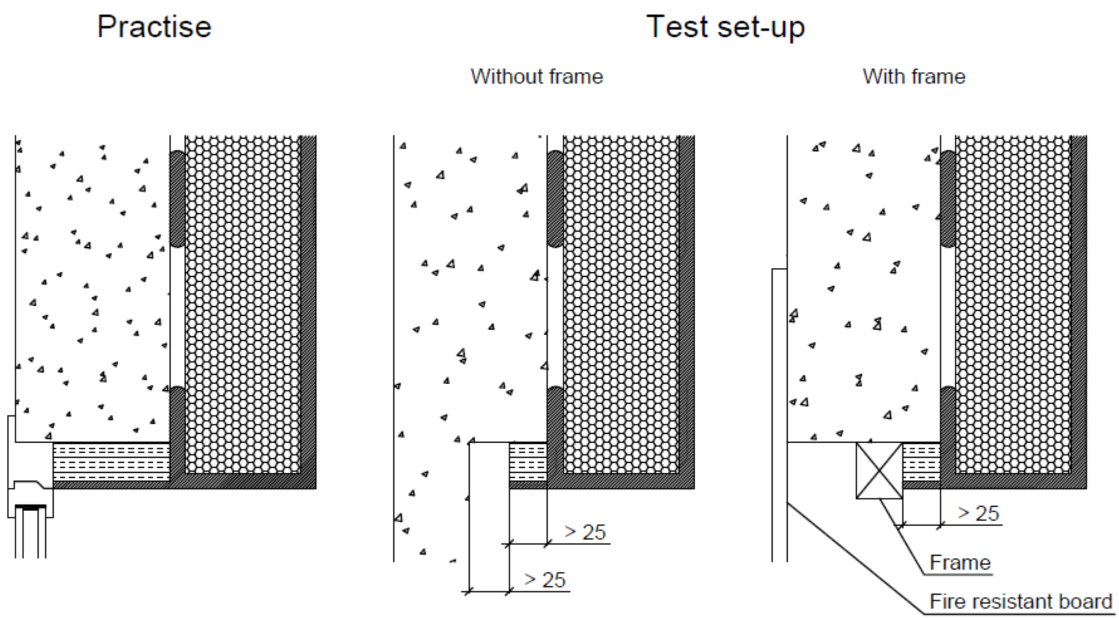


Figure C.1 Window mounted flush with the wall on the inside of the building.

Case 2

The window is mounted within the wall on which the façade system is mounted, see figure C.2.

If the test specimen is mounted on a supporting construction (lightweight concrete) with an indentation for the secondary opening, the indentation must be deep enough to be able to simulate the mounting in practice. The façade system shall be applied a minimum of 25 mm into the indentation. In the case no window frame is used, there shall be a distance of at least 25 mm from the façade system to the supporting construction in the secondary opening.

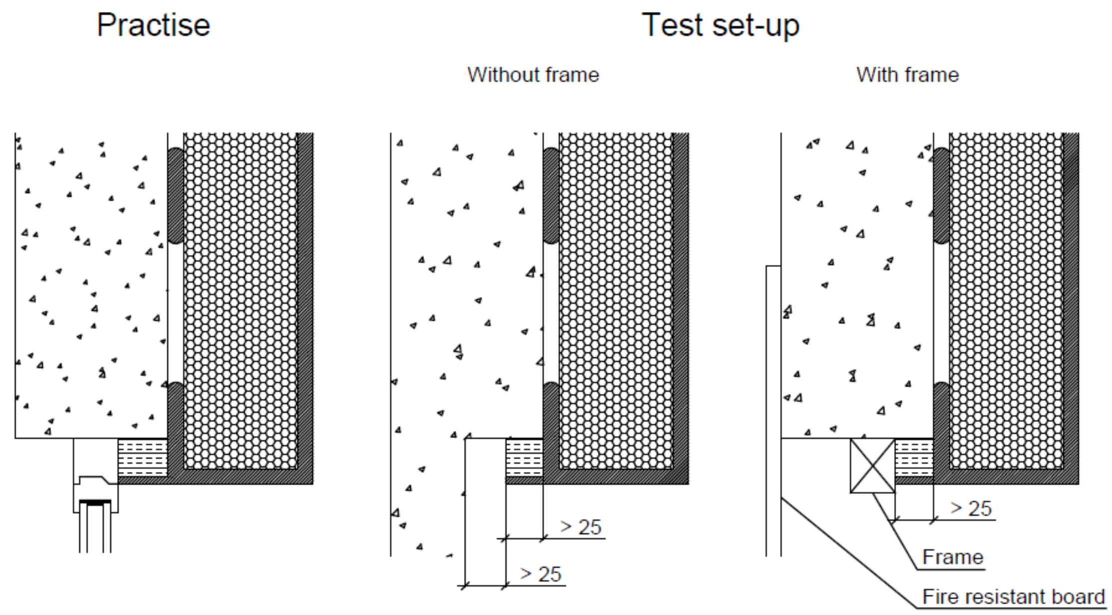


Figure C.2 Window mounted within the wall on which the façade system is mounted.

Case 3

The window is mounted flush with the outer edge of the wall supporting the façade system, see figure C.3.

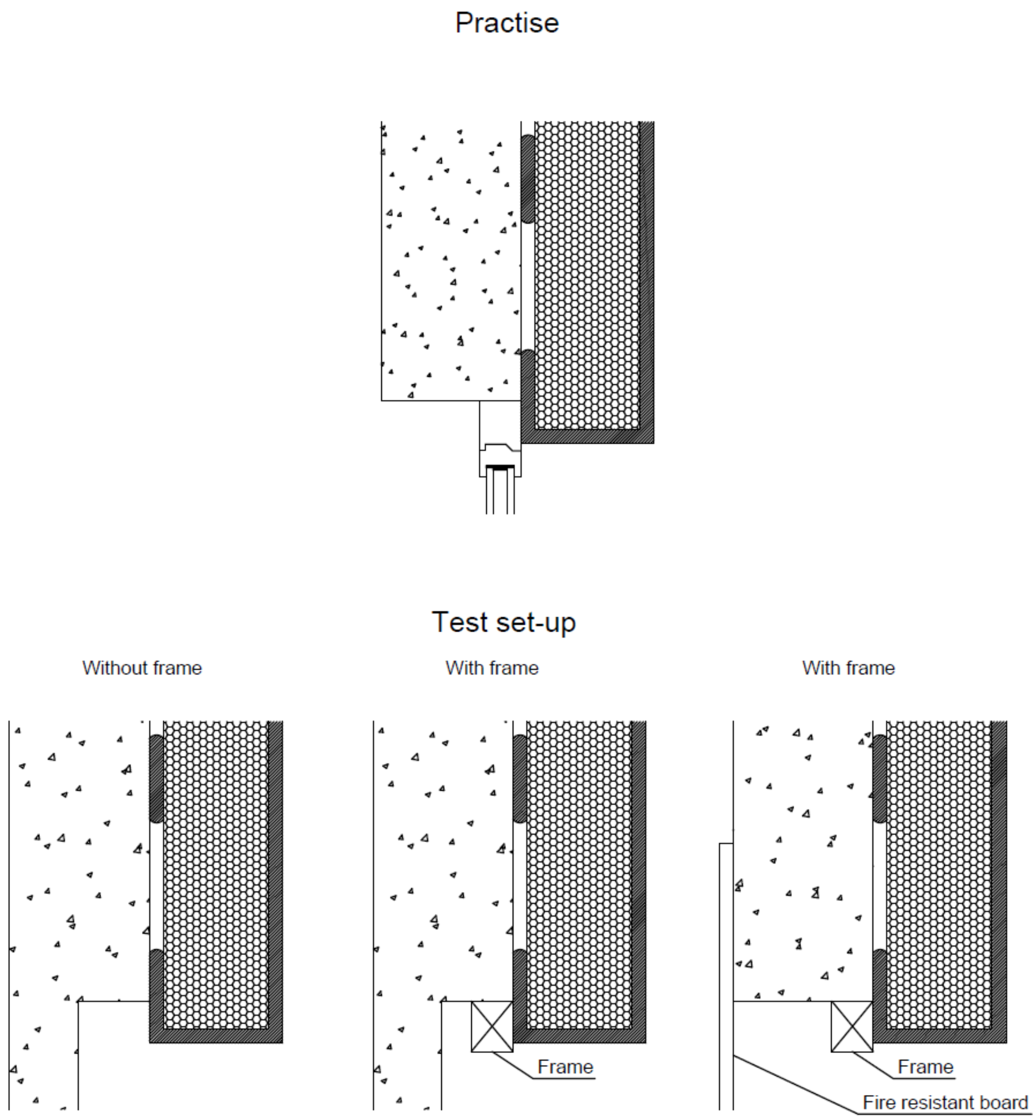


Figure C.3 Window mounted flush with the outer edge of the wall supporting the façade system.

Case 4

The window is mounted in the façade system to be tested, see figure C.4.

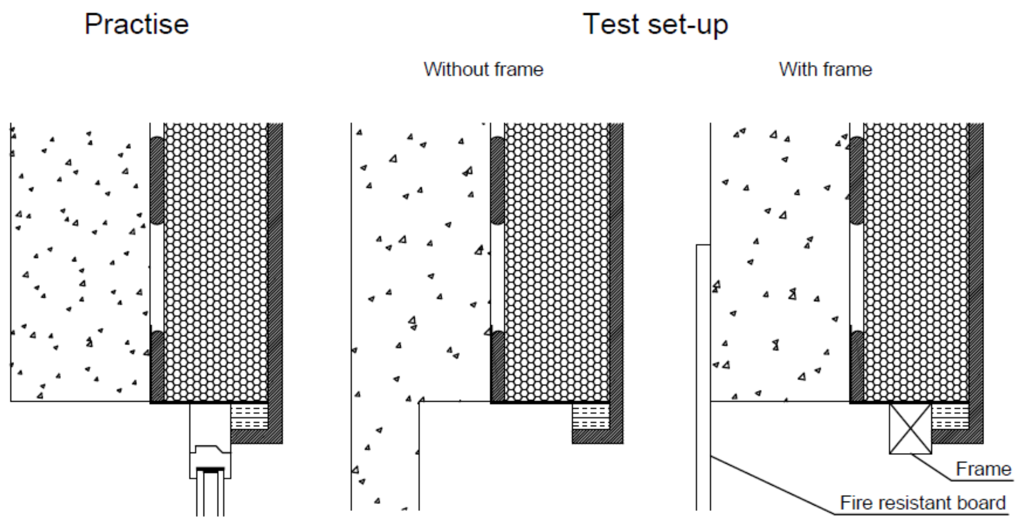


Figure C.4 Window mounted in the façade system to be tested.

ANNEX D FAÇADE-FLOORS JUNCTION (INFORMATIVE)

The assessment of the junction between floor and façade as potential weak point may be required in some cases. It concerns the façade systems installed directly connected to floors of a building.

The floors can be made of concrete but also alternative material like timber.

Generally, the connection between the floor and the façade include a linear joint seal

The objective of the test is to ensure that the fire cannot spread from one storey to the next superposed storey through the connection.

The way to fulfil this objective is to assess the integrity and the insulation of the connection during the façade test.

The following arrangement allows assessing this connection during the façade test. It has to be included within the test only for façade systems connected directly to floors.

In order to give the possibility to consider this issue, a specific adaptation can be done in the test.

Usually the combustion chamber includes a lintel which will support the façade system installed flush to the lintel. In case of façade systems connected directly to the floors, the combustion chamber upper part will be made of a slab, see figure 10. The material of the slab shall be made of the material intended to be used in practice and with the same thickness or smaller.

The slab simulates a floor and allows recreating partially the junction between floor and façade.

In the neighbouring of the floor, the structural steel frame shall be protected by fire blanket.

A mobile extinguishing system shall be prepared before the test in case the fire is developing at the junction.

Such test configuration allows thus to:

- Observe from behind the behaviour of the façade at the junction, especially any passage of flame or integrity failure
- Add some thermocouples to check any insulation failure.

Appendix H – Round robin – Alternative test method

1 Introduction

The present proposal on further studies is based on the development of the alternative test method approach (Appendix G – Alternative test method). It is similar, and in some aspects identical, to the round robin for the proposed assessment method based on BS 8414 and DIN 4102-20 (Appendix F – Round robin).

A round robin is an inter laboratory test series carried out by at least two, independent laboratories, to verify a test method or equipment. Since the outcome of this project is a test, evaluation and classification process to assess fire performance of façades we suggest including the following parts in a future project:

- Part 1 – a theoretical round robin on the assessment method
- Part 2 – investigation on different important aspects identified
- Part 3 - a round robin on the medium- and large heat exposure test methods

2 Aim

The aim of this proposed project is to provide professional input for the standardization work for evaluating fire performance of façades. An interlaboratory test program is crucial to show that the proposed test method can be used as intended and meet regulatory needs whilst obtaining acceptance of the test method within the member states. The outcome of the proposed project would be a report.

The project is proposed to include three different parts, firstly a theoretical round robin on the proposed assessment procedure. This will show how well the procedure is written, and the results will be used to improve the assessment procedure so the risk for individual interpretations is minimized.

Secondly, initial testing is needed for some important factors that affect the repeatability and reproducibility of the method. These factors are the effect of the environment on the test, the fuel source, mounting technique for thermocouples and measuring technique for determination of the heat exposure. These factors must be evaluated and fixed before the experimental round robin is performed. However, to achieve faster execution of the project, the second part (initial testing) can be partially performed in parallel to the third part (experimental round robin). The drawback of this approach is that prerequisites of the experimental round robin will be defined before there is a clear understanding of how the conditions of the tests affect the repeatability. Thus, there is a risk that the outcome of the experimental round robin will be of less value compared to if it is performed completely after the initial testing.

The third part of the project will be an experimental round robin. During this exercise it is also proposed to invite the Member States to perform comparative tests with the current national test method (on their own cost).

3 Scope

3.1 Scope of theoretical round robin

The participants in the exercise shall make a set-up of a test in accordance with the proposed method. They will be given material/product descriptions and with this shall they make drawings on how the specimen will be set up and how they will instrument the specimen.

To the exercise some fictitious test data will also be provided, and from this the participants shall also make a classification.

3.2 Scope of initial testing activities

There are several factors that may have a large impact on the repeatability and the reproducibility of the method that must be studied to ensure that the method is good enough before the experimental round robin or inter-laboratory test is carried out. It is therefore necessary to examine the following factors:

- Effect of the environmental conditions
- Tolerances of wood cribs as well as species of timber in the cribs
- Mounting of thermocouples without disturbing the test specimen or the test results
- Position of secondary opening
- Uplift of experimental rig for determination and no ignition of falling parts
- Air flow rate from the fan in the fire room (medium fire exposure)

Below are the test programs for the medium and large fire exposure defined individually.

All the tests defined in this phase of initial testing activities will include the mandatory secondary opening defined in annex G.

First an average test of the large fire exposure will be conducted on an inert façade system to quantify the normal variations and to set a basis for varying thermal load that stems from the fire source such as, variations density, moisture, and surface area/total mass of wood sticks as well an imposed wind. These tests are relatively cheap and approximately 3 tests can be performed per day.

Table H.1 Parameters for the average large fire exposure inert triple test.

Property	Value
Average test	Triple test
Density	525 kg/m^3
Species	Pine (*Pinus Silvestris*)
Mosture	12.5 %
Specific surface	Medium
Wind	0.5 m/s
Uplift	As defined in Appendix G
Secondary opening	As defined in Appendix G

These parameters will be set to the values given in Table H.1 Parameters for the average large fire exposure inert triple test.and one parameter is thereafter varied at a time. Parameters to vary concerning the environmental conditions, fuel specifics and rig position are given below.

Table H.2. Values of parameters to vary during initial testing of large fire exposure. 12 tests.

Property	**Value**
Density	400 kg/m^3
	650 kg/m^3
Species	Spruce (*Picea Abies*)
Moisture	10%
	15%
Specific surface	Low
	High
Wind	1.0 m/s
	3.0 m/s
Uplift of rig	0.5 m
	1.0 m
	2.0 m

Similarly, for the medium fire exposure we will define an average test, also to be repeated 3 times.

Table H.3. Parameters for the average medium fire exposure inert triple tests.

Parameter	**Value**
Fuel	Pine (*Pinus Silvestris*)
Density	475 kg/m^3
Fuel moisture	12.5 %
Specific surface	Medium
Wind	0.5 m/s
Uplift	As defined in Appendix G

Parameters to vary, one by one, from the average tests are listed in Table H.4. The air flow rate refers to the air injected into the combustion chambers of the wood fuelled test.

Table H.4. Values of parameters to vary during initial testing of medium fire exposure tests. 7 tests.

Parameter	Value
Fuel density	450 kg/m3
	500 kg/m3
Air flow rate	360 m3/h
	440 m3/h
Uplift of rig	0.5 m
	1.0 m
	2.0 m

The initial testing activities will thereafter investigate the presence of the mandatory secondary opening since this is not included in all test methods currently used throughout Europe. The secondary opening is eccentrically placed over the combustion chamber (Appendix G – Alternative test method) and it is therefore the intention to examine the heat exposure and damage around the opening compared to if it had been placed centrally over the combustion chamber. In addition, the heat exposure and damage to the continuous part of the façade compared to a case without an opening present at all will also be of interest for the final acceptance among the member states.

The investigation of the opening is planned to be performed on an inert and on a laminate specimen, preferably one of the systems chosen for the experimental round robin. The tests planned are listed in Table H.**5**.

Table H.5. Lists of additional tests performed to examine placement of the secondary opening. 6 tests.

Fire exposure	Specimen	Opening	Number of tests
Large	Inert	No opening	1
	Laminate	No opening	1
	Laminate	Symmetrically placed above combustion chamber	1
Medium	Inert	No opening	1
	Laminate	No opening	1
	Laminate	Symmetrically placed above combustion chamber	1

The tests on inert façades will be compared to the average inert large and medium fire exposure described in Table H.1 and Table H.3, respectively, where the opening is eccentrically placed. The tests using a laminate specimen will be compared to the tests on the same specimen performed in Task 3 of the round robin, see below.

In total, 31 tests are foreseen in the initial test project.

3.3 Scope of experimental round robin

The purpose of the experimental round robin is to show the robustness of the proposed method, i.e. the repeatability and the reproducibility. In this round robin a small number of participants (at least three participants are needed.) will be chosen due to the high cost of the tests.

At least two different façade systems need to be included, one inert façade and one where failure is deemed to occur. However, for completeness it is suggested that four different façade systems are included in the project, rainscreen and renders, ETICS, solid wood with ventilation gap and inert (previously performed at one laboratory) which are performed two times for each system.

Parameters to be checked during the round robin tests are;

- Falling parts;
- Vertical and horizontal fire propagation;
- Temperature measurements;
- Heat exposure;
- Effect of secondary opening;
- Impact of environment.

The tests with the inert façade will show the repeatability and reproducibility of the test method without influence of any combustible material except the fuel source. It will also show the burning characteristics (flame lengths, flame widths, flame shape over the test duration and thermal impact to the test specimen at different positions and other).

The test with facades that are deemed to fail will show whether the method is robust enough to give the same classification.

The Member States are also invited to make comparisons between national test methods and the proposed method to give the possibility to countries to compare the safety levels between the national method and the future method at their own cost.

The total number of tests are 4 (façade systems) x 2 (fire exposures) x 3 (number of laboratories) which is at least 24 tests. For one lab the inert façade has already been tested in the initial testing (if no changes to the test setup is imposed after initial testing). Thus, the list can be reduced with two tests summing up to 22 tests.

Note that the alternative test method may be implemented with a similar amount of testing as for the proposed test method, however here a detailed analysis on limits of fire spread and temperature criteria is needed.

4 TASK PLAN

The list of tasks and the proposed time frame can be found in Table H.6. Task plan for further studies and the round robins It should be noted that some tasks can be performed simultaneously, i.e. some of the tasks are not dependent on the outcome from other tasks. It is estimated that a total time is around 24 months where at least 53 tests are performed.

Table H.6. Task plan for further studies and the round robins

Name	Actions	Duration
Task 1 – Theoretical round robin	Task 1.1 Define the questions to be answered.	2 months
	Task 1.2 Invite participants and await the answers	2 months
	Task 1.3 Analyse the response from the participants	1 month
Task 2 – Initial testing activities	Task 2.1 Literature survey	2 months
	Task 2.2 Define the test program	1 month
	Task 2.3 Perform the tests	4 months
	Task 2.4 Analyse the results	2 months
	Task 2.5 Update of assessment method	1 month
Task 3 – Experimental round robin	Task 3.1 Define the façade systems to be used	1 month
	Task 3.2 Design a suitable test rig that can be used by the participants	1 month
	Task 3.3 Invite participants	1 month
	Task 3.4 Purchase of façade systems to be tested	1 month
	Task 3.5 Send façade systems to participants and perform the tests	3 months
	Task 3.6 Analyse the results and report	2 months
Task 4 – Analysis	Task 4.1 Combine the results from the studies carried out	3 months
	Task 4.2 Finalize the assessment method	1 month
Task 5 – Management		24 months

In Table H.7**.** Detailed tasks for further studies and the round robins **Table F.6** below the different tasks and sub-tasks are described in more detail. It should be noted that it is not possible to foresee the outcome of the different tasks, and therefore the plan and tasks can be changed depending on the results.

Table H.7. Detailed tasks for further studies and the round robins

Task 1 – Theoretical round robin	
Task 1.1 Define the questions to be answered	A questionnaire will be produced with questions related to the test set-up, mounting of test specimen, instrumentation and classification. In addition, questions will be asked on the field of application.
Task 1.2 Invite participants and await the answers	Within this task will participants be invited to take part in the theoretical round robin. It is proposed that the EGOLF laboratories are invited, as well as stakeholders. The participants will get 1-2 months to answer the enquiry. The

	exercise will be done with full secrecy, i.e. only one administrator will have access to who has answered.
Task 1.3 Analyse the response from the participants	The analysis of the theoretical round robin will be done in accordance with ISO 17043. All answers will be collected in a spreadsheet, and the answers will be graded in a suitable way. This exercise will show if there are parts of the assessment method that is interpreted differently, and if the method needs to be clarified. This procedure has been used successfully in previously performed theoretical round robins within EGOLF.
Task 1.4 Report and rewrite the assessment method	A report will be written on the theoretical round robin. The assessment method will be updated and clarified where necessary.
Task 2 – Initial testing activities	
Task 2.1 Literature survey	At this stage a literature review is needed to minimize the amount of testing and to ensure that relevant tests are performed.
Task 2.2 Define the test program	With the information from the present project and from the literature review a test program will be set up. As far as possible the aim is to investigate multiple parameters during each test, to be as cost and time effective as possible. The identified factors that needs further studies are: – Effect of environment (especially wind speed and direction) – Tolerances needed for the fuel (the research community do not agree on the repeatability of wood cribs, especially on the size needed for these types). Factors affecting are timber species, conditioning of the timber, density of the individual timber sticks, dimensions of sticks, amount of timber, and the tolerances needed. – Mounting of thermocouples. There is a disagreement on how to mount the thermocouples in the best way, by drilling through the test specimen, or hanging them from the outside. Both methods have pros and cons. – Measurement of heat exposure to the test specimen. It is important that the heat exposure can be reported after a test. There are different options such as measurement of temperature with plate thermometers pointing towards the fire, heat flux gauges measuring the radiation or mass loss measurement of the fuel source. A suitable method needs to be developed and validated.
Task 2.3 Perform the tests	Most of the tests will be performed at one single location to ensure that the general conditions around the test are the same.
Task 2.4 Analyse the results	The analysis of the results will be done simultaneously as the test program is going (when possible).
Task 2.5 Update of assessment method	The aim of Task 2 is to get answers on several questions in order to finalize the assessment method before the experimental round robin is started.
Task 3 – Experimental round robin	
Task 3.1 Define the façade systems to be used	The round robin is proposed to include four different test specimens, inert, rain screen, ETICS and wood facade, i.e. one inert specimen that never fails, and three facades that fails or are close to fail during the test. It is optimal if a test specimen can be designed so all performance criteria can be assessed, i.e. flame spread both vertically and horizontally, as well as fire spread within the test specimen, falling parts and burning debris/droplets, and connection between external wall and floor.
Task 3.2 Design a suitable test rig that can be used by the participants	Since almost all participants do not have a test rig for this test method, there are two options to keep the costs down. One option is to design a suitable rig from low cost and reusable

	material, such as a scaffolding system. The other option is to build a few de-mountable rigs that can be transported around to the participants.
Task 3.3 Invite participants	Laboratories that have the possibility to carry out this kind of test, within the tolerances given on environmental conditions, will be invited. It is important to note that this round robin do not have the same aim as normally, i.e. here the robustness of the test method will be examined, not how well the participants perform the test. Therefore, it is important that the tests are carried out by participants that are aware of the objective, and that the tests are performed in a way that is as perfect as possible.
Task 3.4 Purchase of façade systems to be tested	The façade systems to be tested shall be purchased at one manufacturer in order to minimize the spread in characteristics of the materials.
Task 3.5 Send façade systems to participants and perform the tests	All material needed for the tests, as well as clear mounting descriptions, will be sent to the participants. During the tests at least one member of the consortium shall witness and document the tests.
Task 3.6 Analyse the results and report	The test results, including descriptions of the mounting and conditioning, shall be sent to the consortium for analysis. All primary data, photographs, drawings, videos and other relevant information shall be included.
Task 4 – Analysis	
Task 4.1 Combine the results from the studies carried out	The results from the above three tasks shall be combined and analysed. The aim is to define the final assessment method.
Task 4.2 Finalize the assessment method	The assessment method shall be drafted. In addition, shall the technical evidence behind the proposal be documented and presented.
Task 5 – Management	
	The management will include invitation to the round robins, contact point with the participants, arrange meetings and witness program, and responsible for reporting and contact with EC.

An estimate on the initial testing program is that around 31 tests will be needed. For the experimental round robin it is judged that for the present project it would be enough to have three laboratories doing the tests, which would then end up in 22 tests. Thus, a total of 53 tests are required for the proposed test series, including both initial tests and the round robin.

5 TIME FRAME

To complete the proposed project, including two testing programs is estimated to 24 months. A rough time schedule is presented in Table H.8. Proposed time frame for the testing program of the alternative method.

Table H.8. Proposed time frame for the testing program of the alternative method.

	Year 1				Year 2			
	Q1	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
Task 1	x	x						
Task 2	x	x	x	x	x	x		
Task 3					x	x	x	
Task 4							x	X
Task 5	x	x	x	x	x	x	x	X

The time schedule of two years is already tight and leaves very little room or improvements, delays or mistakes. However, in response to a direct request from EC DG GROW to reduce the project period, we also propose a faster time frame. This will be achieved by starting Task 3 - the experimental round robin, in parallel with Task 2 – Initial testing. A consequence of this is that all parameters which have an unknown effect on the heat exposure and repeatability are not checked before the details of the round robin is defined and distributed to the partners. Thus, there is a risk that the outcome of the round robin will be of less value compared to if the experimental round robin starts after all initial testing.

To mitigate these risks the initial testing will start with the parameters that are deemed most decisive on the exposure such as wind and wood density and end with parameters expected to be of less importance such as uplift of rig and wood species. Having said this, the effect of any of these parameters are yet to be investigated. The faster time frame is presented in Table H.9. Shorter alternative time frame for the testing program of the alternative method.

Table H.9. Shorter alternative time frame for the testing program of the alternative method.

	Year 1				Year 2	
	Q1	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**
Task 1	x	x				
Task 2	x	x	x	x	x	x
Task 3			x	x	x	x
Task 4					x	x
Task 5	x	x	x	x	x	x

6 BUDGET ESTIMATION

The total price of the proposed project is estimated to ~1.000.000 EUR, exclusive VAT.

External fire scenario has not been included in the test plan given above. It can be included, but then some theoretical studies needs to be done on the fire and heat exposure during the test.

APPENDIX I – COMMENTS OBTAINED DURING THE PROJECT

In the following table are all written comments received during the project assembled. An explanation to the columns used are as follows:

Column 1 – Nº: Numbering of comments
Column 2 – Body Reference: The body who have given the comment
Column 3 – Comment on document: A reference to which document the comment belongs
Column 4 – Paragraph/Figure/Table: A reference to which part of the document the comment belongs
Column 5 – Comment: The comment received
Column 6 – Proposed change by the consortium: A short description on how the comment has been handled

Nº	Body Reference	Comment on document	Paragraph/ Figure/ Table	Comment	Proposed change by consortium
1	Roy Weghorst	Webinar	ge	Thanks for the presentation today. If I recall correctly the Netherlands was missing in the list of countries with a sub-contractor to it?	Included in the Final Report.
2	Minas Tapakis, PWD Cyprus	Webinar	ge	As regards to our role, what would that be? You 've asked us to work as subcontractors (see your email) and I assume is the "additional country – subcontractor Group 1: for Tasks 1, 4 and 7" which you wanted to perform. Do you still need us for that task? Because page 9 and 10 of the presentation does not include Cyprus. If you still need us, please sent relevant details the soonest.	Presentation has been corrected, and PWD Cyprus have been contacted.
3	Alberto Diego Cortés, ITeC	Webinar	ge	In our opinion it is soon to comment on the project. In that sense, we would like to know whether the Progress report will be made available to the involved stakeholders, as well as the outcome of the different meetings scheduled. If so, we will be willing to analyse these documents and give you our view on the matter. The only issue that perhaps should be mentioned at this point is the duality	The comment has been noted.

				between Product/kit (to be CE marked under Reg. 305/2011) and Façade constructive solution (to be tested and classified), being this also related to the key point of the definition of façade, as you highlighted. We think this duality should be took into account during the assessment method development, also bearing in mind the cost of a large-scale fire test and strategies that manufacturers (of different products installed in the same façade, and in other similar façades) may adopt. This issue may be related to several parts of the assessment method, such as the Method scope, Definition (and identification) of all the products installed in the façade and Field of test results application.	
4	Pavlos Vatavalis	Webinar	ge	I have some questions in view to the next steps: - Are you planning to distribute any material before the 25th April meeting? I am asking because if we have material in advance we can prepare ourselves and make the right questions during that time. - In case you will circulate material when is it planned to be done? For meetings with EC services, the most common period before the meeting is two weeks. - Can you be so kind to provide us with further information in regards to the background of the suggested classification for the different factors? I am raising this question because in between the tender of the European Commission and your slide 24, I see significant distance. - Results of the enquiry: We would be pleased to have this information in a table	Changes has been made in the documents. Information will be sent out in advance.

				to be in a position crosscheck it with our network. - Please note that you were missing information from Cyprus as well.	
5	Miroslav Smolka	Webinar	ge	Do the falling parts criteria contain (burning) droplets? It is a criterion in your SP FIRE 105 test, and I know of regulations that contai provisions against falling parts and burning droplets above escape exits from builidngs. I was suprised not to see ISO 13785-1 and ISO 13785-2 in your overview. Both are used and quoted in regulations in the Czech Republic. (reference: technical standard ČSN 73 0810; implemented as ČSN ISO standards; even containing national Annex with criteria and additional details how to perform the test). In Slovakia, both have been implemented as STN ISO standards but not quoted in regulations yet. May I have an addtional question after the ISO TC92 workshop on facades yesterday. Will you try to define reference scenarios as part of your work? I would guess this needs to happen when a new classification system is developed, as outlined in the Guidance Paper G	The falling parts contain also burning material/droplets. ISO 13785-1 & 2 are included. The definition of reference scenario is outside the scope of the present project. The scenarios has been defined by EC as BS 8414 and DIN 4102-20.
6	Jordi Roher	Webinar	ge	I contact you to learn what is the dissemination regime for this project. I believe that this is a public call so it may probably be explained to others that this work is going on (or not?) but I am not sure about disseminating the progress/contents of the works. We will appreciate your instructions on this issue.	Information on dissemination of the project results has been forwarded.

7	Edith Antonatus	Webinar	ge	- The purpose of the majority of the full scale facade tests in different European countries is, to limit the development and spread of fire (and falling parts) due to the outer layers of the building. The principles of fire resistance are not appropriate for this test. Resistance to fire tests are already in place in the European classification system and are used already today in most European countries for outer walls of buildings. Generally façade claddings and/or insulation systems are considered as a separate distinct product and do not contribute further to the resistance to fire of the outer wall. Harmonization of these test methods are the purpose of the project to define harmonized testing. Classification criteria: - As there probably will be modifications and extra observations included in the specification for the new tests, it will be important to o define the scope of the tests (which kinds of façade cladding/insulation shall be tested) o define all observations, which shall be made during a test o establish for the different types of façade systems, what the observations during the tests mean regarding risk for people in the building and for fire fighters. This needs to be done by reviewing test data from the relevant types of façade systems in the different test scenarios. Only after reviewing this it will be possible to define classification criteria in a sensible and coherent way. Therefore collection of multiple observations in all tests can then	The comments have been noted, and as far as possible been treated in the following work.

				aid in definition of classification criteria following the general accepted approach in other test developments. - In addition, the fire exposure class and the fire duration should not be separated – if we have 4 durations and 3 sizes of fire we could theoretically end up with 12 scenarios. This appears to be an enormous increase on conditions and hence of testing compared to the current situation. - The inclusion of fire stops should not end up in a classification being a measure for a specific system. If fire stops have been used, these should be part of the test report and the product description. Test scenarios: - Inclusion of extra windows is not an option for further exploration since in the test set-ups according to DIN 4102-20 and BS 8414 the flames are coming out of a window. If extra windows would be included, each type of window construction would need to be tested – this would lead to an unacceptable amount of testing. Further points for discussion: - What is the definition for fire spread? Up to now regulators and testing houses concentrate on vertical fire spread. The definition of horizontal fire spread is not clear and it needs to be discussed, whether this is relevant to the philosophy and scenario. - Field of application of the test results needs to be discussed. The scope of this exercise is to find a harmonized test specification which can be used throughout Europe in the framework of the CPR. It should be possible to define relevant façade-systems for classification, in order	

				to avoid the need for testing every single modification. This is necessary to limit the amount of testing necessary for CE marking. Also the number of possible variations of the classification (see above) needs to be limited, because otherwise again for application in each country a separate test has to be done with a corresponding cost burden. This would be contradictory to the purpose of the project and the aim of the CPR to remove barriers to trade. We hope, that these comments contribute to the development and help to find a useful outcome of this project	
8	FSEU	Progress report	ge	FSEU believes it would be wrong, based on this research and the experience of recent fires, to define a harmonized test method for Europe built upon 2 existing methods with two different fire loads. Therefore, CEN should be given a specific standardization request to develop one harmonised large-scale test and classification for facades. No existing test is robust enough to simulate all necessary risk scenarios on all types of façade systems on all building types. This is why FSEU reiterates its position: it would be wrong, based on this research and the experience of recent fires, to define a harmonized test method for Europe built upon 2 existing methods with two different fire loads (BS8414 1/2 & DIN 4102-20), especially since both these methods have limitations in their ability to predict real-life performance.	The scope of the project is set by the ITT from EC.
9	Spain	Progress report	Ge	Doubs about the final implementation of the new classes, as we consider that the option of testing every new system is	No impact on the test method. This is mainly a task for the ExAp, which is outside the scope of the present project.

				excessive, regarding the costs that it would imply which may make this methodology inefficient.	
10	Spain	Progress report	Ge	We suggest that independent cost-benefit and economic impact studies on the construction market are made, considering the possible application measures.	No change in the assessment method. The issue is outside the scope of the present project.
11	Spain	Progress report	Ge	Extended field of application is needed.	No change in the assessment method. The issue will be discussed in the Final Report.
12	Sweden	Progress report	ge	The opinion of the Swedish experts is that the proposal can be supported in general but suggest that the classification system should be altered so that one test could be used to get a full classification.	It is not possible today to say which the worst case is. The issue will be discussed in the final report.
13	Sweden	Progress report	ge	Also, a more modern approach would be preferable to enhance repeatability and reproducibility, for instance by using gas burners and performing the testing indoors. The ISO test method which is similar to the British test method could then serve as a basis regarding the fire load.	This is outside the scope of the project since the ITT from EC clearly defined that the methodology shall be based on BS 8414 and DIN 4102-20. Since DIN 4102-20 allows for both wood cribs and propane gas, both these options must be dealt with and compared in the next step of the project, the round-robin.
14	Czech Republic	Progress report	Ge	For testing of fire performance of facades, we repeatedly recommend using large-scale fire test and intermediate-scale fire test according to ISO 13785-2, resp. ISO 13785-1. Both proposed methods, BS 8414 and DIN 4102-20, are defined by EN ISO 13943 as large-scale fire tests; the difference is only in the fire load. Especially when construction details are tested, we recommend intermediate-scale fire test as a first (basic) test method, in particular for technical and economic reasons. We recommend that the ISO and CEN experts	This is outside the scope of the project since the ITT from EC clearly defined that the methodology shall be based on BS 8414 and DIN 4102-20.

				join their efforts with the aim to refine existing ISO methods.	
15	EAE Ralf Pasker	Progress report	ge	It will be essential that Member States make a clear commitment, that after a European test method allowing to achieve different classes of fire performance has been developed, they will accept this test without further tests at national level.	No change in the assessment method. This is more a recommendation for EC.
16	EURIMA	Progress report	ge	The proposal is trying to put together all the existing requirements therefore the classification and the test are becoming very complex. The proposal could be greatly simplified by removing the smouldering classification and testing only with windows Also, the test should not create an unnecessary burden by introducing test parameters and requirements that bear no link to real fire risks and have not been confirmed by real fire incidents. As an example, to specify requirements for smouldering when there have been no known issues with this property is inappropriate. Furthermore, the safety risk regulated at the EU level is continuous glowing/smouldering combustion tested to EN 16733 and declared for certain types of insulation products used in facades. This type of measurement just adds to the complexity of testing, prolongs the test time significantly without any added value. Façade insulation and cladding products are tested to EN 16733 in the same end-use position as applied on facades. No European country regulates for smouldering in façade systems. It is only Germany that regulates for continuous glowing/smouldering combustion on	Since smouldering is a part of the DIN 4102-20 method, it will still be an optional part of the medium heat exposure test. Smouldering will not be included in the proposed large fire exposure assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.

				products (also those used as components for façade systems).	
17	EURIMA	Progress report	ge	While we understand it is important to respect the current regulatory requirements in the Member States, we hold the view that this is an opportunity to introduce a high-quality test method that will reflect the real safety risks related to facades, including those that have been seen during real fire incidents. This would be in line with the principles outlined in the Guidance Paper G which refers to facades already.	This is outside the scope of the project since the ITT from EC clearly defined that the methodology shall be based on BS 8414 and DIN 4102-20.
18	EURIMA	Progress report	ge	We assume that this proposal will be finalized and published in CEN TC127.	A technical methodology will be proposed. This will be delivered to EC.
19	Esko Mikkola	Progress report	0	Is 1,5 m enough? Maybe 2 m needed	No change will be made since there are no arguments in the direction that a larger wing is needed.
20	PU EUROPE	Progress report	0	Testing of windows: It is not in the scope of the project to assess building details and details of products which are not façade cladding products, but constructions also used within an outer wall. The purpose of this study is to evaluate a method for CE marking of façade insulation systems with a fire classification. It would not be feasible in terms of costs and also available testing capacity, to do a test of this size for every different detail of a façade construction. If window details would be part of the classification an unacceptable amount of testing would be necessary.	It is not a test of windows or other components to be installed on the façade. In the test will an opening be included, so the façade detailing around openings can be assessed.
21	EURIMA	Progress report	0	The inclusion of windows in the façade system is justified and should be part of the standard test setup. The window details fire performance from all sides is the crucial parameter that makes sense to evaluate, regardless of current national regulations. The windows should be placed directly	The intention is to find a method which enables test of façade systems with and without detailing around openings in one single test. It is not known at present which cases (with or without opening details) is the worst; therefore both are used at present. An possible option is to

				above each other including the combustion chamber opening so that the flame impingement represents real-life situations. This would be in line with the current tests used in France, Hungary, and Sweden. Contribution of the façade system to vertical fire spread would be correctly evaluated this way.	combine both in the same test, and then the design of the test set-up must be so that both the opening details as well as the façade face will be exposed at the same time with the same heat exposure. This will be part of the round robin project.
22	DIBt (Germany)	Progress report	0	It seems that figure 1 doesn't consider the latest German large-scale test for the fire scenario „external fire source near the base of a building" (in opposition to the explanation below the figure), because for this test method the height of the test rig is about 10 m instead 8.8 m as states in the drawing. The proposed height of the test rig of at least 6.0 m is not sufficient to consider the latest German large-scale test for the fire scenario „external fire source near the base of a building". For that a height of at least 10.0 m is required.	This is outside the scope of the project since the ITT from EC clearly defined that the methodology shall be based on BS 8414 and DIN 4102-20. It may be possible that also external fires can be covered by the method. A theoretical study, based on calculations, is in process. It may also be introduced in the round-robin.
23	EMO Kay Beyen	Progress report	0	Precision needed	Including the size of the combustion chamber of the larger BS 8414 the proposed dimensions of the test rig thus would be: Main face: 8.0m x 3.5m (height x width) Wing wall: 8.0m x 1.5m
24	French govern-ment	Progress report	0	From this point of view, the 2 fire sources envisaged do not appear satisfactory compared to that used in the French test LEPIR, that seems more conservative. The calorific loads mentioned in the EUROCODE 1 fire part are also much higher.	The total quantity of timber in the LEPIR 2 test, although it is divided between two different fire rooms, so it is not obvious that the heat exposure to the test specimen would be more severe compared to the BS method.
25	French govern-ment	Progress report	0	The new test must be compatible with MS fire safety strategies. In particular, how many levels are accepted to be lost above the origin of the fire. In France, it is only one.	The proposed methodology complies with this requirement, since the vertical fire spread shall not exceed 4.2 m above the combustion chamber (corresponding to the 3rd storey).

26	FSEU	Progress report	1	The proposed approach is for one test method with 2 different fire loads (medium and large), for 8 potential systems, and different exposure times. This approach leaves the door open for many different kinds of testing and will not lead to increased fire safety.	The scope of the project according to the ITT from EC clearly defines that the methodology shall be based on BS 8414 and DIN 4102-20. An alternative solution, based on a combination of the two methods, will also be included in the final report.
27	FSEU	Progress report	1	The use of the lower fire exposure (DIN 4102-20) cannot be justified based on building height. The starter tracks will be evaluated using the large fire, so there is no logic to apply different fire loads on different components. The fire development does not depend on the height of the floor where the fire starts. It is mentioned that the medium fire exposure test simulates a fire which has not reached the flash-over. But where to use this kind of test and how can one know if the fire will reach the flashover or not? Tests should always be based on worst case scenario which in this case is the flash-over.	The scope of the project according to the ITT from EC clearly defines that the methodology shall be based on BS 8414 and DIN 4102-20. An alternative solution, based on a combination of the two methods, will also be included in the final report.
28	FSEU	Progress report	1	Additionally, the proposal to have two different exposure levels seems deeply flawed also from a cost perspective: since the test rigs are the same size, the cost will be almost identical for the two tests. It is not the cost of fuel that makes it expensive, is rather building up the test specimen and adding all the thermocouples.	The scope of the project according to the ITT from EC clearly defines that the methodology shall be based on BS 8414 and DIN 4102-20. An alternative solution, based on a combination of the two methods, will also be included in the final report.
29	EAE Ralf Pasker	Progress report	1	Regarding the wording "masonry sub-structure" Add "concrete" To be in line with the scope of the ETICS mandate M/489, and ETAG 004.	Agree. Change to: Concrete masonry sub-structure
30	EAE Ralf Pasker	Progress report	1	Regarding the wording of the first alinea we should preliminary use the terms given in European documents (CEN, ETAG 004, EADs).	Agree. Change to: Exterior Thermal Insulation Composite Systems (ETICS, EIFS or synthetic stucco)

31	EAE Ralf Pasker	Progress report	1	Regarding the last alinea, the intention of the test is to assess wall claddings, but not the entire wall construction. Delete "external walls"	Do not agree. The methodology should cover all products/systems that are currently regulated, as it is defined in the ITT from EC. Also external walls can be evaluated, but only with respect to the characteristics evaluated, i.e. not the load-bearing capacity or fire resistance.
32	EAE Ralf Pasker	Progress report	1	(on DIN method): The remark regarding flash over is not correct. It is a model, scaled after performing real fire tests.	The DIN 4102-20 is based on a flash-over scenario, but the method has been down-scaled. The DIN method has thus virtually removed one storey from the test set-up, and only focus on the part located two storeys above the fire room, i.e. the top of the flames.
33	EAE Ralf Pasker	Progress report	1	(on German external fire method): Note: this test standard has not yet been completed. It is currently under development, requiring further detailing and scientific evaluation. Basic information is given in MVV TB (2017-08-31).	This out of the scope of the present project. The work shall be based on the DIN and BS methods, which both are based on a fire protruding through an opening from a room with a fully developed fire. It may be possible that also external fires can be covered by the method. A theoretical study, based on calculations, is in process. It may also be introduced in the round-robin.
34	Spain	Progress report	1	Limit the variability of the composition of the façade kit to be tested.	According to the ITT from EC the test method shall be as universal as possible. It would be for the classification and field of application to address the variability within the system submitted.
35	DIBt (Germany)	Progress report	1	Please make clear in more details which type of facades shall be tested – only cladding systems which are normally mounted onto a room-closing external walls or complete external walls too? In our opinion the test method should only be applicable to the first one. For the latter one other appropriate test methods already	According to the ITT from EC the test method shall be as universal as possible. It would be for the classification and field of application to address the variability within the system submitted.

				exist (e. g. with regard to their fire resistance).	
36	DIBt (Germany)	Progress report	1	Furthermore HPL- and MCM-cladding systems are typical examples of rain screen cladding / ventilated cladding. The listing of typical systems to be covered by the proposal should therefore be revised.	According to the ITT from EC the test method shall be as universal as possible. It would be for the classification and field of application to address the variability within the system submitted.
37	Spain	Progress report	1	The new test should be applied to more sophisticated façade kits…	According to the ITT from EC the test method shall be as universal as possible. It would be for the classification and field of application to address the variability within the system submitted.
38	Finnish industries	Progress report	1	How about constructions made of concrete or wooden frames. In case of frame wall, which part of the wall will be tested? Will also load-bearing wooden frame with the insulation filling have the same classification than façade? → Test method should cover all construction types	This is a non-load-bearing test. The design of the test method is changed to allow different frame types such as concrete and timber.
39	Finnish industries	Progress report	1	"External wall" is given as one example of typical products. Which layers or the wall are exposed? → Some organizations define facades as construction part which is located external side of load-bearing structure (= insulation + façade layers)	It is always the outside of the wall that is fire exposed.
40	Finnish industries	Progress report	1	Can you test solar panels used in facades with this test method? → Testing of solar panel facades should be included to the scope. Effect of high voltage needs also to be taken into account.	The aim is to include also solar panels. Although, this will need further studies in order to define how and what to include in the test. One risk is that rescue services can be electrified, another is the fire spread of the materials, and a third is that malfunc-tions due to fire on the outside leads to short circuit and ignition of fire behind the panels. This must be

					solved before it can be introduced into the method.
41	Finnish industries	Progress report	1	Will this test also give classification for fire barriers used in test on façade or ventilation gap?	No. The classification is for the whole system. If fire barriers are used in the test, they must also be used in practice. If no fire barriers were used in the test, it may be possible to add them in practice. A test method of cavity barrier itself is already under construction. See prEN 1364-6 or EOTA TR 31.
42	Czech Republic	Progress report	1	We consider testing of structural details of facade systems such as window overheads (lining), foundations, etc. very important. We support the testing of samples containing window openings in large-scale fire tests.	It is included.
43	Esko Mikkola	Progress report	1	This means that extended application rules of test results are needed and is very essential	No change in the assessment method. The issue will be discussed in the Final Report.
44	Esko Mikkola	Progress report	1	These exposures need to be given in heat fluxes (kW/m2) to be able to use in national requirements in relation fire exposure/protective needs in terms of standard fire exposure. Also relevance of these fire exposures to different sizes of window openings of flashover fires would be needed.	At which location shall the heat flux be measured, and to what shall it be used? Some kind of information will be given on the fire exposure, at least on an inert façade. It could be the HRR or heat flux at certain levels. This may be included in the round robin.
45	PU EUROPE	Progress report	1	Terms and definitions are not given, the scope is unclear – the technical terms should be reviewed for consistency, for example: - test protocol vs. assessment method / methodology, - element vs. product vs. system, - facade vs. facade (cladding) system	Agree, terms and definitions need to be rewritten and clarified.

46	FSEU	Progress report	1	The report omits the need for definitions. We not only need to harmonize the test method, but we also need to harmonize definitions to ensure consistency and robustness of application of the test. To give an example, "External wall" was given as one example of typical products. But which layers or the wall are exposed? Some organizations define facades as construction part which is located external side of load-bearing structure (= insulation + façade layers). FSEU advises to include definitions at the next stage.	Agree, terms and definitions need to be rewritten and clarified.
47	EAE Ralf Pasker	Progress report	1	A clause with terms and definitions should be included for clarification, e.g. product, system, facade cladding.	Agree, terms and definitions need to be rewritten and clarified.
48	PU EUROPE	Progress report	1	It is not the task of this group to define which fire scenarios are represented – there might be different interpretations and background for the use of the different test scenarios in different countries. The BS test for example has been designed for representing a room fire and an external fire might lead to different conditions.	Agree, the project has not defined any new fire scenarios, but worked within the prescribe scope given by EC in the tender documentation. Although, part of the project has been to see how different national regulations can be incorporated in the two prescribed methods.
49	DIBt (Germany)	Progress report	1	Please note, that the test method acc. to DIN 4102-20 also considers the scenario "flames of a fully-developed room fire venting out of an external wall opening", but with a downscaled fire exposure. Therefore please change the last sentence of the fifth paragraph accordingly.	The DIN 4102-20 is based on a flash-over scenario, but the method has been down-scaled. The DIN method has thus virtually removed one storey from the test set-up, and only focus on the part located two storeys above the fire room, i.e. the top of the flames.
50	PU EUROPE	Progress report	1	The reference to German regulatory requirements regarding external fire is not adequate. No standard exists and acceptance criteria have not been defined in Germany.	This out of the scope of the present project. The work shall be based on the DIN and BS methods, which both are based on a fire protruding through an opening from a room with a fully developed fire. It may be possible that also external fires can be covered by the method. A

					theoretical study, based on calculations, is in process. It may also be introduced in the round-robin.
51	EAE Ralf Pasker	Progress report	1	The inclusion of window openings should be considered carefully. On the one hand, air flows and thermodynamic effects on a test rig will be different from natural fires. On the other hand, it should be avoided to increase the number of tests to be performed if test results might only be applicable for a limited number of constructions.	The intention is to find a method which enables test of façade systems with and without detailing around openings in one single test. It is not known at present which cases (with or without opening details) is the worst; therefore both are used at present. An possible option is to combine both in the same test, and then the design of the test set-up must be so that both the opening details as well as the façade face will be exposed at the same time with the same heat exposure. This will be part of the round robin project.
52	FSEU	Progress report	2	A criterion for the developed smoke internally and externally is missing.	Since there is no regulation on smoke (so far) this has been omitted, and is outside the scope of the present project. If smoke is to be introduced in the test method, more research is needed. It is important that the smoke from the test specimen can be distinguished from the smoke coming from the fire source. This may be possible by using gas burners.
53	EURIMA	Progress report	ge	In contrast, generation of smoke could be a safety problem even causing fire casualties during façade fires. Information about the smoke opacity class is part of EN 13501-1 classification.	Since there is no specific regulation on smoke for facades, except those defined by the reaction to fire classes, this has been omitted, and is outside the scope of the present project. If smoke is to be introduced in the test method, more research is needed. It is important that the smoke from the test specimen can be distinguished from the smoke coming from the fire source. This may be possible by using gas burners.

54	EAE Ralf Pasker	Progress report	2.1	Delete in first paragraph" i.e. one test geometry can be used."	No action.
55	DIBt	Progress report	2.1	Same comment as given to clause 0 – a height of the test rig of about 6.0 m is not sufficient to consider the latest German test method for the fire scenario „external fire source near the base of a building".	This out of the scope of the present project. The work shall be based on the DIN and BS methods, which both are based on a fire protruding through an opening from a room with a fully developed fire. It may be possible that also external fires can be covered by the method. A theoretical study, based on calculations, is in process. It may also be introduced in the round-robin.
56	Finnish industries	Progress report	2.1	Effect of edges and ventilation openings around windows should be included in the test around the fire room opening. Meaning and layout of window openings higher up need clarification (these may stop fire spread – are the results then valid also for facades without windows?)	In the proposal is secondary openings optional for those Member States that require this. An alternative solution is also included where the secondary opening is mandatory for the large fire exposure test. The intention is to find a method which enables test of façade systems with and without detailing around openings in one single test. It is not known at present which cases (with or without opening details) is the worst; therefore both are used at present. An possible option is to combine both in the same test, and then the design of the test set-up must be so that both the opening details as well as the façade face will be exposed at the same time with the same heat exposure. This will be part of the round robin project.
57	Esko Mikkola	Progress report	2.1	Distance of combustion chamber from corner will effect test results!	Yes, therefore it will be clearly defined.

58	EMO Kay Beyen	Progress report	2.1	Any description on the location of the test rig? Open space or protected area / housing?	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
59	AIMCC (France)	Progress report	2.1	The position and geometry of windows needs to be specified in a way that agrees with French requirements for fire safety regulations of facades (C+D rule).	It will be specified in the assessment methodology.
60	AIMCC (France)	Progress report	2.1	The evaluation of windows is a good idea but the proposed assembly does not allow to test the perimeter of the bay window.	In the proposal is secondary openings optional for those Member States that require this. An alternative solution is also included where the secondary opening is mandatory for the large fire exposure test. The intention is to find a method which enables test of façade systems with and without detailing around openings in one single test. It is not known at present which cases (with or without opening details) is the worst; therefore both are used at present. An possible option is to combine both in the same test, and then the design of the test set-up must be so that both the opening details as well as the façade face will be exposed at the same time with the same heat exposure. This will be part of the round robin project. Therefore bay windows and other window types are not included in the test.
61	Greece	Progress report	Figure 2	The proposed location of the window openings, shown in Figures 2 and 4, results in the windows not being vertically "aligned" with the combustion chamber. This is more evident especially in the "medium heat exposure" arrangement. In practice, building windows are almost always aligned along the vertical direction.	In the proposal is secondary openings optional for those Member States that require this. An alternative solution is also included where the secondary opening is mandatory for the large fire exposure test. The intention is to find a method

				It is suggested to "move" the windows towards the corner of the test rig, aiming to achieve a better vertical alignment with the combustion chamber (which is supposed to represent another window of the building), especially in the "medium heat exposure" arrangement.	which enables test of façade systems with and without detailing around openings in one single test. It is not known at present which cases (with or without opening details) is the worst; therefore both are used at present. An possible option is to combine both in the same test, and then the design of the test set-up must be so that both the opening details as well as the façade face will be exposed at the same time with the same heat exposure. This will be part of the round robin project.
62	EAE Ralf Pasker	Progress report	Figure 2	Existing geometries (Figure 2): Should be changed: medium fire exposure should be given at the left, and large fire exposure to the right to be in line with figure 1 and to avoid confusion	Accepted.
63	French govern-ment	Progress report	0	The fire / smoke propagation at the facade / floor junction can not be measured (there is no floor in the project!). This will require a complementary test which will further increase the fire validation of a facade system (the LEPIR has a floor and so is a 2-in-1 test).	This have been included in the test method. It has been added as an option.
64	Finnish industries	Progress report	2.2	Inner surface of ventilation gap (surface of insulation material or wind protection board) has a great role in ventilated façade fire. It haven`t been mentioned in method how insulation materials are fixed.	All layers of the façade included in the test shall be mounted as in practice, as far as this is possible, end use conditions.
65	DIBt (Germany)	Progress report	2.2	2nd paragraph: It should be stated clearly that the test apparatus shall stand weather-protected in a closed test hall in order to avoid inacceptable weather impacts on conditioning and test results and to ensure good repeatability and reproducibility.	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
66	DIBt (Germany)	Progress report	2.2	2nd paragraph: EN 1364-3 and -4 are test standards and therefore applicable to any variations of curtain walling. Please make	Agree. The text has been changed.

				clear that curtain walling shall not be covered by this proposal in general.	
67	EAE Ralf Pasker	Progress report	2.2.1	2.2.1 Existing geometries (on window details): Broader description is more flexible.	Agree.
68	Finnish industries	Progress report	2.2	Façade test should include all material layers which are external side of load-bearing structure.	Do not agree, the methodology should cover all products/systems that are currently regulated. Also external walls can be evaluated, but only with respect to the characteristics evaluated, i.e. not the load-bearing capacity or fire resistance.
69	Greece	Progress report	2.2	In Sections 2.2 and 2.9 it is stated that depending on the system to be tested, a lightweight concrete wall should either be installed or not be installed in front of the structural steel frame of the test rig. Since this provision would result in increased testing costs (since the lightweight concrete wall should alternatively be built and demolished, depending on the system being tested), could there be another way to install both kinds of systems, without having to construct and demolish the concrete wall?	It would be up to the lab to see how they will treat this. The lightweight concrete wall can be used several times, so there is no need to demolish that.
70	FSEU	Progress report	2.2	Test apparatus: Inner surface of ventilation gap (surface of insulation material or wind protection board) has a great role in ventilated façade fire, yet it is not mentioned in the test method how insulation materials are fixed. The test should include all material layers which are on the external side of load-bearing structure.	All layers of the façade included in the test shall be mounted as in practice, as far as this is possible, end use conditions.
71	FSEU	Progress report	2.2	Structural steel test frame – the proposed test seems to neglect other façade systems, apart from wall claddings – e.g. sandwich panel walls, timber-frame walls. Such systems may require a different test rig than the one described currently.	Text has been revised.

72	EMO Kay Beyen	Progress report	2.2	For tests of systems which are applied to the face of a building , it should be possible that the masonry subconstruction can also be built as a stand alone wall of blocks or slabs without the steel structure.	Text has been revised.
73	EAE Ralf Pasker	Progress report	2.4	Combustion chamber (last sentence): This should be a European harmonised test procedure. This means, that no (additional) national requirements shall be allowed regarding the test design. Here consensus should be achieved among national test standards.	Text has been revised.
74	EMO Kay Beyen	Progress report	2.4	Would it be feasible to consider fixed positions for the combustion chambers, two fixed and defined positions for each of the two cases? - Any description of the window openings? How should they be done? Dimensions? Position?	It will be a fixed position for the combustion chamber, i.e. a fixed distance from the corner between the main wall and the wing. The fictitious window openings will be prescribed in more detail. We will get more scientific evidence on this after the round robin.
75	PU EUROPE	Progress report	2.5.1	Thermocouples have to be installed in a way, that they do not influence the test results. Therefore TCs for measurement of the outside flame spread cannot be drilled from the backside through the system, damaging the outer layer.	There are pros and cons with the different ways to mount the thermocouples, and it may also depend on the type of system/materials to be tested. There is a long time experience of drilling through the specimen, without any problems that the test specimen has been damaged. Therefore we do not see any problems to use this technique. A clear description on how to fix the thermocouples will be given.
76	AIMCC (France)	Progress report	2.5.1	Regarding vertical temperature measurements (section 2.5.1), instrumentation at mid-depth of each layer will affect comparison to calculation and simulation results. It is more appropriate to position the thermocouples at the interface between layers, instead of mid-depth.	The method is not intended for the use in calculations or fire safety engineering. It is intended to be used for classification of façade kits A clear description on how to fix the thermocouples will be given.

				Furthermore, it needs to be specified that K-type thermocouples are required.	The type of thermocouples will be defined.
77	Finnish industries	Progress report	2.5.1	The proposed height for the thermocouples (4,2m and 5,9m) should be marked to the picture. In real life there is only ~1,2m high external wall area between chamber opening and the window above and it is essential that the window above stays intact. Therefore thermocouples should be installed below the window.	This is generally not the case. The window above the combustion chamber will always break (if not fire resistant windows are used). The requirements are that the flame spread not should reach the window two storeys above the combustion chamber, and therefore it is not necessary to measure at the window directly above the combustion chamber.
78	DIBt (Germany)	Progress report	2.5.1	A measure line of thermocouples in a height of 2.5 m above the lintel of the combustion chamber for the medium exposure is not in line with the current DIN 4102-20. The correct height must be 3.5 m – please change it accordingly.	This has been adopted in the medium heat exposure test. Although, also an alternative solution is proposed which will give one single test set-up and a simple classification system where the position of the thermocouples has been changed. The position of temperature measurements to determine flame spread are made differently in all current methods, i.e. in BS it is 2.0 and 5.0 m above the combustion chamber and in DIN it is 2.8, 3.5 and 4.5 m. In order to have one test set-up, that can be used it is necessary to define one configuration. We have not got any evidence that a certain position is more important than any other, and therefore we have made a compromise of the current methods. Since it is the flame spread that is assessed, the measurements shall be made at a certain distance from the main flame from the fire source. New is to have TC's on 2.0, 3.5, 4.5 and 5.9 m.

79	EMO Kay Beyen	Progress report	2.5.1	Currently the location of the thermocouples is located only at 3.5m above the combustion chamber. Figure 4 shows actually 3 vertical lines against the above description.	See comment above
80	EMO Kay Beyen	Progress report	2.5.1	Currently the location of the thermocouples are located at 2.5m and 5.0m above the combustion chamber. Figure 4 shows actually 3 vertical lines aginst the above description.	See comment above
81	DIBt (Germany)	Progress report	2.5.1	Positioning of the thermocouples in front of the surface of the test assembly should not be throughout the whole assembly from the backside. For fixing of these thermocouples cables could be used alternatively hanging from the ceiling of the test room.	There are pros and cons with the different ways to mount the thermocouples, and it may also depend on the type of system/materials to be tested. There is a long time experience of drilling through the specimen, without any problems that the test specimen has been damaged. Therefore we do not see any problems to use this technique. A clear description on how to fix the thermocouples will be given.
82	EMO Kay Beyen	Progress report	2.5.1	External thermocouples shall not be positioned from the back of the rig to the front of the façade because in this case the façade surface will be damaged. It is common understanding that external thermocouples are positioned in front of the façade by means of a steel frame or chains hanging top to bottom.	There are pros and cons with the different ways to mount the thermocouples, and it may also depend on the type of system/materials to be tested. There is a long time experience of drilling through the specimen, without any problems that the test specimen has been damaged. Therefore we do not see any problems to use this technique. A clear description on how to fix the thermocouples will be given.
83	Esko Mikkola	Progress report	Figure 3	This figure (fig 3) shows a closed ventilation cavity. Also open cavities need to be tested.	Yes, the specimen shall be built as in practice.

84	EAE Ralf Pasker	Progress report	Figure 3	Vertical temperature measurements (Figure 3): External thermocouples shall not be installed from the back to avoid distortion of the external finish. They should be installed in a distance of 10 cm in front of the finish surface.	There are pros and cons with the different ways to mount the thermocouples, and it may also depend on the type of system/materials to be tested. There is a long time experience of drilling through the specimen, without any problems that the test specimen has been damaged. Therefore we do not see any problems to use this technique. A clear description on how to fix the thermocouples will be given.
85	EMO Kay Beyen	Progress report	Figure 3	Distance of the thermocouples?	All distances will be clearly defined.
86	FSEU	Progress report	2.5.1	Omission of temperature criteria – there should be clear criteria in the European test for maximum allowed temperatures to evaluate ignition of internal layers and external fire spread. Temperature measurement are usually the basis for European Classifications therefore it cannot be left for Member States to decide what criteria to apply; Member States should choose from classes resulting from the criteria. Temperature should be measured in lowest point of window above. Wooden crib takes time to ignite and burn the 15 minutes' limit seems too short for temperature observation.	Temperature criteria are defined in the document. Do not agree that temperature shall be measured at the lower edge of the "window" above the combustion chamber. The regulations are generally accepting a fire spread one storey, but not two and therefore is the criteria based on the measurement at the lower edge of the "window" two storeys above the combustion chamber. There is a measurement at 2.0 m above the combustion, used to determine the start of test, i.e. that the wood crib has started to burn. The 15 minutes time limit is enlarged to 30 minutes.
87	FSEU	Progress report	2.5.1	A criterion for internal fire spread and protection of structure by façade systems is missing. Part of these is temperature criteria, but observation for the presence of combustion of internal layers and additional cavities should be included as well.	The criterion will be based on the temperature measurements, both on the exterior side and within the system. Visual observations shall also be done after the test, but these will not be part of the assessment criteria.

88	Finnish industries	Progress report	2.5.1	The amount of thermocouples is quite high which usually increases a testing costs (47 pc in figure 4.) Together with smoldering thermocouples the amount raises extremely high. If thermocouples are attached as described in document, they might act as fasteners and keep the material layers or falling parts together.	The amount of TC's depends on the type of test. In the medium heat exposure test smouldering may be assessed and many TC's are required. If smouldering not is to be assessed the number of TC's is reduced.
89	DIBt (Germany)	Progress report	2.5.2	Location of the vertical line of thermocouples of 2.75 m from the corner on the main face for the medium exposure seems to be too far away from the combustion chamber. The line of thermocouples should only be located about 2.0 m away from the corner of the test rig.	The location for the measurement of horizontal fire spread is kept at a distance of 2.75 m from the corner between the main face and the wind. According to the comments achieved proposals are made to have it closer as well as further away. This will be examined further within the round robin project.
90	EMO Kay Beyen	Progress report	2.5.2	The distance seems too close to the opening of the combustion chamber.	The location for the measurement of horizontal fire spread is kept at a distance of 2.75 m from the corner between the main face and the wind. According to the comments achieved proposals are made to have it closer as well as further away. This will be examined further within the round robin project.
91	Greece	Progress report	Figure 4	In Figure 4, a number of thermocouples is proposed to be installed along 3 height levels in both "large heat exposure" and "medium heat exposure" arrangements. However, the proposed performance criteria in Section 4 regarding the "vertical fire spread" make use of temperature measurements obtained only at 2 height levels (2.5 m and "upper edge" for the medium heat exposure and 4.2 m and "upper edge" for the large heat exposure, respectively). In addition, in section "2.5.1. Vertical Temperature Measurements",	Checked and corrected.

				there are only 2 height levels reported for each test arrangement, (2.5 m and 4.2 m for the medium heat exposure and 4.2 m and 5.9 m for the large heat exposure, respectively). So, there seems to be an inconsistency among the respective requirements, as stated in "Section 2.5.1", "Figure 4" and "Section 4".	
92	EAE Ralf Pasker	Progress report	Figure 4	Vertical temperature measurements (Figure 4): Should be changed: medium fire exposure should be given at the left, and large fire exposure to the right to be in line with figure 1 and to avoid confusion.	Agreed. This is changed.
93	Finnish industries	Progress report	2.5.3	Measurement of glowing combustion in this test is not relevant as there is already a method for that.	Since smouldering is a part of the DIN 4102-20 method, it will still be an optional part of the medium heat exposure test. Smouldering will not be included in the proposed large fire exposure assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.
94	AIMCC (France)	Progress report	2.5.3	Regarding the measurement of smouldering, the proposed thermocouple grid is very dense, which will increase the cost and complexity of the protocol without necessarily providing better results. A coarser grid should be considered	Since smouldering is a part of the DIN 4102-20 method, it will still be an optional part of the medium heat exposure test. Smouldering will not be included in the proposed large fire exposure assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.
95	Czech Republic	Progress report	2.5.3-2.6	Based on our practical experience, we do not recommend using radiometers for measuring of facade system performance (low resistance, reliability issues). Instead,	Since smouldering is a part of the DIN 4102-20 method, it will still be an optional part of the medium heat exposure test.

				we recommend measurement methods based on temperature measurement using plate thermocouples. We also consider the network of thermoelectric couples according to the DIN method to be unnecessarily dense.	Smouldering will not be included in the proposed large fire exposure assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733. Agreed on using plate thermometers instead of heat flux gauges.
96	Esko Mikkola	Progress report	2.6	Use of wood cribs will make very difficult to achieve repeatable and reproducible heat exposures.	This is outside the scope of the project since the ITT from EC clearly defined that the methodology shall be based on BS 8414 and DIN 4102-20. Since DIN 4102-20 allows for both wood cribs and propane gas, both these options must be dealt with and compared in the next step of the project, the round-robin.
97	EMO Kay Beyen	Progress report	2.6	How is measured the mass loss rate of the crib ?The crip after the test is soaked with water.	The mass loss can be measured continuously with load cells during the test.
98	FSEU	Progress report	2.7	Test time: this must be standardized to 30 minutes from ignition and 30 minutes' observation.	Since the ITT defined that the preferred option is to use BS 8414 and DIN 4102-20, the already defined test times have to be used. An alternative solution is also included where changes can be dome. The project group agree that a test time of 30 minutes during the fire and 30 minutes observation is preferable. Although, the start of the test is not when the fuel is ignited, but when 200C has been reached at 2.0 m above the combustion chamber.
99	Sweden	Progress report	2.7	The use of wood as fire load does not have a very good repeat ability and is hard to handle in the same way in different Member	This is outside the scope of the project since the ITT from EC clearly defined that

				States and test facilities. The actual load varies depending for example on the species, density and moisture content of the wood. Other factors affecting the heat release rate if wood cribs are used as fire load are ventilation and weather conditions. The round robin tests could be used to establish the fire load from the combustion chamber to enable use of alternative fuels in the future, e.g. gas burners.	the methodology shall be based on BS 8414 and DIN 4102-20. Since DIN 4102-20 allows for both wood cribs and propane gas, both these options must be dealt with and compared in the next step of the project, the round-robin. Furthermore the use of a starting time, by using the measurement of temperature at 2.0 m above the combustion chamber, will improve the repeatability.
100	DIBt (Germany)	Progress report	2.7.2	A total test duration of about 60 minutes (exposure time + monitoring time) is not sufficient to assess smouldering / glowing combustion. If test results with the large fire exposure shall also be valid for the medium fire exposure (cf. statements and scheme in clause 7) the same test duration and termination criteria are needed as given in clause 2.7.1 in order to assess smouldering / glowing combustion. Please revise clause 2.7.2 accordingly.	Since smouldering is a part of the DIN 4102-20 method, it will still be an optional part of the medium heat exposure test. Smouldering will not be included in the proposed large fire exposure assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.
101	EMO Kay Beyen	Progress report	2.7.2	Large Fire Exposure: Maximum assessment time?	Since the ITT defined that the preferred option is to use BS 8414 and DIN 4102-20, the already defined test times have to be used. An alternative solution is also included where changes can be dome. The project group agree that a test time of 30 minutes during the fire and 30 minutes observation is preferable. Although, the start of the test is not when the fuel is ignited, but when 200C has been reached at 2.0 m above the combustion chamber.

102	AIMCC (France)	Progress report	2.7.2	There is agreement on elaborating a common method for assessing façades provided that important parameters of the French test (LEPIR 2) are included in the new test, as it is feared that the local historical data could not be used any more. For instance, in the Large heat exposure configuration (LF), the heat source is smaller (approx. 2/3) than the one used in LEPIR 2. Additionally, the former includes a wing, where the latter does not. Thus, it will be difficult to compare results from both tests and to make use of historical data. It is important to insure that results from tests evaluated without a wing are acceptable and that the addition of the wing does not discard all the façade testing knowledge developed in France	The total quantity of timber in the LEPIR 2 test, although it is divided between two different fire rooms, so it is not obvious that the heat exposure to the test specimen would be more severe compared to the BS method. The use of historical data will be possible on a national level, but not for CE-marking. The possibility to retest and compare the current national test method with the new European method in the frame of the round-robin project can be discussed with EC.
103	Esko Mikkola	Progress report	2.8	No outside testing, never, ever! More narrow limits needed on ambient conditions.	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
104	PU EUROPE	Progress report	2.8	The limits for wind speed near the specimen are too wide. With good reasons in existing standards lower limits are set (2 or even 1 m/s). In addition it is necessary to do the test in a defined environment (closed hall with defined minimum distance in all directions to the specimen) in order to get reproducible tests.	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
105	Greece	Progress report	2.8	In Section "2.8 Environmental conditions" a maximum wind speed requirement is proposed, in order to allow testing in outdoor facilities. However, no information is given regarding the "direction" of the wind speed that should be measured (perpendicular or parallel to the facade, and if parallel, along the horizontal or the vertical axis).	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.

106	EAE Ralf Pasker	Progress report	2.8	Distortion by wind and any other weathering should be avoided to achieve comparability of test results. This can be achieved best if the test is performed indoor.	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
107	Sweden	Progress report	2.8	Environmental conditions: Fire testing should preferably be carried out indoors to avoid influence of weather conditions. Another reason for indoor testing is the environmental aspect. It seems out of date to develop a test method that is lacking possibilities of emission control.	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
108	DIBt (Germany)	Progress report	2.8	A maximum wind speed of 3 m/s is too high. As limit 1 m/s (single measure value) and 0,5 m/s (as average value) should be used (cf. DIN 4102-20 or EOTA draft technical Report "Large-scale fire performance testing …").	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
109	DIBt (Germany)	Progress report	2.8	See comment to clause 2.2, first bullet point –the test rig should stand weather-protected in a closed test hall in order to avoid any unwished weathering impacts during conditioning time as well as within the tests.	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
110	DIBt (Germany)	Progress report	2.8	The ambient temperature range is too high. Temperatures near or below 0 °C cannot be accepted because they influence the test results essentially. Please use the proposed range of the EOTA draft Technical report "Large-scale fire performance tests …" of (20 ± 10) °C inside the test room.	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
111	AIMCC (France)	Progress report	2.8	Concerning wind measurement, the methodology (probes, location…) should be defined if the test is to be performed outdo	This will be defined.
112	EMO Kay Beyen	Progress report	2.8	This criteria may only be considered when the test rig is exposed to these conditions. When the test rig is located in a fully protected area / housing weather conditions are excluded to influence the test result.	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.

113	Finnish industries	Progress report	2.9	Mounting of the test specimen: This part of the text is very unclear.	Checked and updated.
114	EAE Ralf Pasker	Progress report	2.9	Mounting of test specimen: If this is a product assessment method, manufacturer's instructions are relevant, especially as he will use the test results for setting-up his DoP.	This is already included in the text.
115	EAE Ralf Pasker	Progress report	2.9	Mounting of test specimen: Problem: the more detailed the situation around openings is described, the more test results will only be applicable for the specific arrangements tested (e.g. one specific window type). Basically, this might lead to an increasing number of tests to be performed. It should be considered, how generic situations might be described/tested. In practice, the window above the origin of fire will be destroyed. This cannot be representatively tested using this test rig.	It is not a test of windows or other components to be installed on the façade. In the test will an opening be included, so the façade detailing around openings can be assessed.
116	EAE Ralf Pasker	Progress report	2.9	Mounting of test specimen: Clarification required. In general claddings shall be installed according to the manufacturer's manual.	This is already included in the text.
117	FSEU	Progress report	2.9	Again, this only represents 2 of the 8 possible facades systems. Tests will be required for mounting systems on all kinds of facades.	There are two configurations available, either you mount the test specimen on a substrate simulating masonry, or you fix it to a frame (a load-bearing structure). With these two configurations it would be possible to test all kind of façade/external wall systems. The 8 possible façade systems are only examples given. The method is supposed to be universal, i.e. whatever vertical façade system you have, it should be possible to assess it.
118	AIMCC (France)	Progress report	2.9	The protocol needs to define what is meant by "windows details" and to select a generic configuration.	It is not a test of windows or other components to be installed on the façade. In the test will an opening be

					included, so the façade detailing around openings can be assessed. A generic dimension of the openings will be included in the text.
119	AIMCC (France)	Progress report	2.9	Regarding the mounting of the test specimen (section 2.9), the joint location should be at a distance representative of what is used in practice, without the mentioned constraint (2400 mm).	This will be included in the method, as well as a proposal on standard configuration giving the widest field of application.
120	Esko Mikkola	Progress report	2.10	More narrow limits needed and also limits humidity	Agreed. More limited will be included.
121	DIBt (Germany)	Progress report	2.10	Conditioning of the test assemblies must happened in a temperature range significantly above 0 °C. Temperatures near or below 0 °C during the conditioning time cannot be accepted because they influence moisture stabilization and as consequence the test results essentially.	This has been changed.
122	DIBt (Germany)	Progress report	2.10	Which criteria shall be used for reaching moisture stabilization (equilibrium)?	This will be included. The mass stabilization is measured with a mockup test specimen.
123	DIBt (Germany)	Progress report	2.12	The referenced clause 3.1 at the end of clause 2.12 is missing.	This is fixed.
124	FSEU	Progress report	4	Windows should be standard and not optional. 3 Member States (France, Hungary, and Sweden) currently include the window (w) detailing in their test specimen. If the intention of the testing is to simulate real life fire performance, the inclusion of windows in the façade system is justified and should be part of the standard test setup. The window details fire performance from all sides is the crucial parameter that makes sense to evaluate, regardless of current national regulations. Windows can break already in temperature of ~450°C. Proper measurement should be done to evaluate blazing break risk. It's important to reflect real life conditions: for this purpose, windows should be positioned	It is not a test of windows or other components to be installed on the façade. In the test will an opening be included, so the façade detailing around openings can be assessed. The intention is to find a method which enables test of façade systems with and without detailing around openings in one single test. It is not known at present which cases (with or without opening details) is the worst; therefore both are used at present. An possible option is to combine both in the same test, and then the design of the test set-up must be so that both the opening details as well as the façade face will be exposed at the

				above one another together with the combustion chamber opening. Contribution of the façade system to vertical fire spread would also be correctly evaluated this way.	same time with the same heat exposure. This will be part of the round robin project.
125	Czech Republic	Progress report	4	According to the practical reality in the Czech Republic and the materials used here so far, we consider the justification of assessment of smouldering insufficient and, therefore, unnecessary and unjustified from our point of view. Measuring of smouldering would only increase the complexity of testing, extend the length of the testing period significantly with no added value in terms of better quality of information obtained. We would accept and support this measuring eventually if this phenomenon is proven to be truly dangerous (for example, by means of the analysis of real fires) which we firmly believe it is not the case. In addition, this characteristic can be assessed according to EN 16733.	Smouldering is no more included in the proposed assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.
126	Czech Republic	Progress report	4	We recommend the assessment of falling parts/burning particles during the testing.	Falling parts/burning droplets are included in the method.
127	EAE Ralf Pasker	Progress report	4	Proposed performance criteria (falling parts): What does that mean? Not understandable in this context.	The method and assessment criteria has been improved.
128	DIBt (Germany)	Progress report	4	Which criteria shall be used for assessing the characteristic “Flaming droplets / burning particles”? These should also be added to the proposal.	This has been included. A performance criterion has been proposed.
129	EURIMA	Progress report	4	We lack the definitions of burning particles/droplets and how they are evaluated.	This has been included. A performance criterion has been proposed.
130	AIMCC (France)	Progress report	4	Falling parts/burning particles: the benefit of this quantification is not clearly defined. Please elaborate why the specific surface of 0.2 m2 is chosen. Measuring this	The method and assessment criteria will be improved. It will be possible to check this visually or to use more complex methods. An example will be given in an informative annex.

				phenomenon would certainly increase the cost and complexity of the setup.	
131	Greece	Progress report	4	Although in Section "2.5.3 Measurement of Smoldering" an alternative method of using an infrared camera is suggested (instead of installing an extensive thermocouple grid), no relevant information is given in Section "4. Proposed performance criteria", regarding the way that the infrared camera measurements could be used for performance assessment (taking into account that the infrared camera is capable of measuring only the temperature at the exposed wall surface).	Smouldering is no more included in the proposed assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.
132	PU EUROPE	Progress report	4	The temperature limit for identifying flame spread (instead of convective heat from a fire below) should be 600° C as stated in the criteria of the present BS 8414 and DIN tests (which allows better discrimination between convective heat and flame spread)	The criteria to be used shall be based on scientific evidence, and not on what is written in old standards.
133	DIBt (Germany)	Progress report	4	The thermocouples for the horizontal classification level of the medium exposure must be located at a height of 3.5 m above the combustion chamber (cf. comment to clause 2.5.1). Please change it accordingly.	This has been changed.
134	EAE Ralf Pasker	Progress report	4	Proposed performance criteria: What about thermocouples installed in front of the surface of the test specimen (external thermocouples)? Will they not automatically be exposed to the fire and therefore reach a temperature rise of more than 600 K? Clarification needed.	The thermocouples located at the horizontal line 2.0 m above the combustion chamber are used for determining the start of the test (200 K temperature rise). The thermocouples located at the horizontal lines 3.5 and 4.5 m above the combustion chamber are used for the assessment of fire spread (500 K temperature rise).
135	PU EUROPE	Progress report	4	The definition of horizontal fire spread is arbitrary. Especially for the large scale test by radiation of the fire source only, the temperature limits near the edge,	Do not agree. These thermocouples mainly register the gas temperature, not the radiation, and therefore they will show whether there is a horizontal flame spread or not.

				especially of the short wing may already be exceeded. This should be removed.	This will also be confirmed visually during the test.
136	Finnish industries	Progress report	4	How the criteria can take into account that e.g. there has been no fire spread to the insulation material within 30 minutes at certain height above the fire room?	This is taken into account by means of the thermocouples mounted within the façade structure, in each layer/cavity (located at 3.5 m for the medium size test and 4.5 m for the large size test).
137	Finnish industries	Progress report	4	How about fire spread downwards? How is it measured?	No regulation requirement was expressed by any Member State about this topic.
138	Finnish industries	Progress report	4	Smoldering should not be a criterion. Smoke is much greater risk in façade fire as it might kill the people and harm the evacuation before the flames.	Smouldering is no more included in the proposed assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.
139	FSEU	Progress report	4	In contrast, we challenge the inclusion of smouldering in the performance criteria given that it is already covered by European standard, and the case has not been made to prove that smouldering is a true fire safety risk (based on fire incidents for example). This type of measurement just adds to the complexity of testing, prolongs the test time significantly without any added value.	Smouldering is no more included in the proposed assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.
140	Esko Mikkola	Progress report	4	This temperature criteria (500 K) may be relevant for surface coverings, but it too high for insulation materials.	The temperature criterion is not yet fixed, but need some more investigations. It must be a balanced number, the shows that a flame spread has occurred. In absence of information the 500 K will be kept.
141	Esko Mikkola	Progress report	4	The criteria should be possible to apply also for test time 30 minutes, 45 minutes and 60 minutes.	It would be possible, but then it conflicts the opinion of the majority that the classification system should not be

					complicated with several different classes. At present the assessment will only cover the 30 minutes exposure / 60 minutes assessment.
142	DIBt (Germany)	Progress report	4	For the medium exposure a test frame time of at least 20 minutes is compulsory (cf. DIN 4102-20 and statement in clause 2.7.1 of this proposal) from the point of the German regulators view. Please change it accordingly.	The test will have an exposure time of 30 minutes and additional 30 minutes observation, which cover your 20 minutes requirement.
143	Esko Mikkola	Progress report	4	Smoke requirements are related to reaction to fire requirements, which are applicable for facades.	Since there is no regulation on smoke (so far) this has been omitted, and is outside the scope of the present project. If smoke is to be introduced in the test method, more research is needed. It is important that the smoke from the test specimen can be distinguished from the smoke coming from the fire source. This may be possible by using gas burners.
144	FSEU	Progress report	4	Performance criteria: The generation of smoke is excluded although it is a well-known safety problem causing casualties during façade fires. Information about the smoke opacity class making part of EN 13501-1 classification has very little relevance in the scenario of façade fire exposure where the fire exposure is approximately 100 times higher than those used in the SBI test. Smoke opacity is a very simple measurement, can easily be added to the test method and can provide information which is very much relevant for the tested system fire performance and risks for the safe rescue and firefighting operations.	Since there is no regulation on smoke (so far) this has been omitted, and is outside the scope of the present project. If smoke is to be introduced in the test method, more research is needed. It is important that the smoke from the test specimen can be distinguished from the smoke coming from the fire source. This may be possible by using gas burners.
145	FSEU	Progress report	4	Additionally, one should consider that solar panels are increasing added to façade systems, and this should be addressed	The aim is to include also solar panels. Although, this will need further studies in order to define how and what to include

					in the test. One risk is that rescue services can be electrified, another is the fire spread of the materials, and a third is that malfunctions due to fire on the outside leads to short circuit and ignition of fire behind the panels. This must be solved before it can be introduced into the method.
146	DIBt (Germany)	Progress report	5	The first sentence of this clause is correct and therefore all further statements in this clause should be deleted. It is not possible to give rules for direct as well as extended application of test results at the moment. This can be done after a round robin / validation test program at the earliest!	The field of application will at this stage only include some examples.
147	AIMCC (France)	Progress report	4	There is a redundancy in section 4 on vertical fire spread, where the 2nd paragraph covers what is mentioned in the 1st paragraph.	This has been corrected.
148	PU EUROPE	Progress report	5	The EXAP rules are incomplete and only focusing on ventilated façade claddings - ETICS/EIFS for example are not covered at all. They could better be covered in the relevant product standards.	The field of application will at this stage only include some examples.
149	EAE Ralf Pasker	Progress report	5	In order to limit the number of tests required, EXAP rules should be included to the relevant technical product specifications (e.g. ETICS specification) and/or national regulation (for products not falling under the scope of an hEN). Furthermore, it should be discussed, how the classification system could be simplified.	The field of application will at this stage only include some examples.
150	FSEU	Progress report	5	For insulation we propose the following: • Non-combustible insulation (RtF class A1/A2) => e.g. mineral wool => test with "A2" is OK for "A1"-material • Thermosetting insulation - (rtf-class B-E) => PU/PF/composites, also organic fiber	Included.

				boards .....=> test with "E" or higher is OK for higher class within the same product family • Thermoplastic insulation – (rtf class B-F) => EPS/XPS.....=> test with "E" or higher is OK for higher class within the same product family	
151	EAE Ralf Pasker	Progress report	6	To avoid a costly burden for the industry, the use of historical data shall be possible.	The use of historical data will be possible on a national level, but not for CE-marking. The possibility to retest and compare the current national test method with the new European method in the frame of the round-robin project can be discussed with EC.
152	EAE Ralf Pasker	Progress report	6	When performing the Round Robin tests, probably correlation tests or comparisons of available data might help answering this question. Finally, there should be a common agreement among Member States, which historical data can be used for which classification.	The use of historical data will be possible on a national level, but not for CE-marking. The possibility to retest and compare the current national test method with the new European method in the frame of the round-robin project can be discussed with EC.
153	FSEU	Progress report	6	This does not need to be part of the method. Member States could decide on the use of historical data in their countries.	The use of historical data will be possible on a national level, but not for CE-marking. The possibility to retest and compare the current national test method with the new European method in the frame of the round-robin project can be discussed with EC.
154	EURIMA	Progress report	6	The use of historical data can be left up to the Member States on their territories during the transition period. Not as part of the EN standard.	The use of historical data will be possible on a national level, but not for CE-marking. The possibility to retest and compare the current national test method with the new European method in the frame of the round-robin project can be discussed with EC.
155	AIMCC (France)	Progress report	6	Hence, AIMCC can only support this project if the contractor demonstrates how historical data can be used and ensures that the results of the new protocol can be	The use of historical data will be possible on a national level, but not for CE-marking. The possibility to retest and compare the current national test

				correlated with the results obtained from LEPIR 2 tests. This will allow the industry to benefit from existing tests, avoid repeating all the tests, and to allow a smooth transition	method with the new European method in the frame of the round-robin project can be discussed with EC.
156	DIBt (Germany)	Progress report	7	A proposal for a classification system is not necessary. The test standard to be developed should only describe the test approach and provide all relevant attributes which have to be considered within the tests and reported in the test reports. It's task of the Member States to define the requirements which must be meet by the tested cladding systems in order to ensure the relevant national safety levels.	Do not agree. This is required from EC, and is included in the call for tenders.
157	FSEU	Progress report	7	The proposal is too complex. We would propose to keep a simple classification. Each classified façade system or an external wall assembly would be deemed to satisfy: • Exposure 30 minutes – large/medium fire exposure + additional 30 min observation • Window must be specified in detail and must be mandatory. - Passing both the starting track test and the window plume test including the successful performance of structural details of the windows above the fire chamber • The avoidance of fire spread beyond certain limits (both vertical & horizontal) Falling parts and droplets both flaming and non-flaming (this may be a sub-class or a set of). The droplets are important to evaluate fire spread downwards, which is already a criterion in the Swedish test. Smoke, at least its opacity (a set of sub-classes depending on the measured smoke emissions)	A simpler classification system has been introduced. Since there is no regulation on smoke (so far) this has been omitted, and is outside the scope of the present project. If smoke is to be introduced in the test method, more research is needed. It is important that the smoke from the test specimen can be distinguished from the smoke coming from the fire source. This may be possible by using gas burners.

158	AIMCC (France)	Progress report	7	AIMCC continues to defend the existing testing method currently used in France. However, the efforts are appreciated, since the goal is to develop a new European façade test based on current test methods and criteria used in few countries in Europe. As a result, complex classifications and testing setups were proposed	A simpler classification system has been introduced.
159	AIMCC (France)	Progress report	7	It is essential that regulators are given the choice to require the need of testing with or without windows and to select the appropriate scale (MF or LF).	A simpler classification system has been introduced. In the proposed test method detailing around an opening shall always be assessed.
160	EAE Ralf Pasker	Progress report	7	Problem: it should be avoided to multiply the number of tests to be performed to cover all national requirements. EXAP rules shall be included to national regulation or the respective European product standard (ETICS specification), to explain, that e.g. tests successfully performed with insulation thickness 200 mm also covers system configurations with lower insulation thicknesses. The classification system shall be hierachical, so that one can decide to perform a more severe test in order to cover the widest range of application in Member States.	The field of application will at this stage only include some examples.
161	Esko Mikkola	Progress report	7	There is a smouldering test method already available. Thus, there is no need to have a smoke (should probably be smouldering) classification in this method.	Smouldering is no more included in the proposed assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.
162	Finnish industries	Progress report	7	Classification: At the moment there are too many options where to choose and extended application rules seem to be out of scope of the project.	A simpler classification system has been introduced. The field of application will at this stage only include some examples.

163	Finnish industries	Progress report	7	Which parts of the façade this classification is for? It seems that the test method is only for systems holders as material manufacturers can`t use this classification for their products.	The tested façade system will be classified. This is not a material test; it is a test of a system.
164	Sweden	Progress report	7	7. Classification: It is not good for industry and harmonization in general if two expensive tests have to be carried out in order to get a classification that can be used in all Member States, i.e. one test with windows and one test without windows. The reason for having windows in the test rig is to test the details around the windows because they may constitute week spots in the façade system. This test scenario could therefore be considered as more severe than without windows. If that is the case only one test has to be carried out to have a full classification (LFw-F,S). The argument against the window scenario being more severe is as we can understand that the window opening could be considered to be a fire barrier that stops fire spread along the facade. Therefore it would be necessary with another test without the window. However, since the combustion chamber is wider than the window opening and the test rig includes the corner wing without any openings, there are areas directly around and above the combustion chamber that has no openings and allows vertical flame spread along the test rig all the way to the top (see figure 2 from the proposal). Even if the part to be tested then is a bit narrower than without the window, it could	A simpler classification system has been introduced. In the proposed test method detailing around an opening shall always be assessed.

				be considered as good enough for assessment of flame spread.	
165	Finnish industries	Progress report	7	7. Classification: At the moment there are too many options where to choose and extended application rules seem to be out of scope of the project.	A simpler classification system has been introduced. The field of application will at this stage only include some examples.
166	Finnish industries	Progress report	7	Which parts of the façade this classification is for? It seems that the test method is only for systems holders as material manufacturers can`t use this classification for their products.	The tested façade system will be classified. This is not a material test; it is a test of a system.
167	AIMCC (France)	Progress report	7	Concerning the proposed classification (section 7), it is important to highlight that the presented table is not an "equivalency table" due to its non-reciprocity (one way only).	A simpler classification system has been introduced.
168	RISE FR	Assessment method – for commenting		The wording can be improved to be clearer	Wording improved
169	University Ulster	Assessment method – for commenting		The wording can be improved to be clearer	Wording improved
170	DBI	Assessment method – for commenting		Generally, it is undesirable, from the test sponsors point of view, to have two different fire load scenarios (medium and large) and two different window configurations (with and without). The test sponsor would have to decide which Member States to aim for prior to the testing instead of letting the test results govern where they have a potential market. It would be much better for the test sponsors if there was only one way to run the test. And then the differentiation could be made with the classification criteria	The project was defined by EC. The aim here is, if possible, that if you perform the large exposure test, it would also cover the medium exposure test. The intention is to find a method which enables test of façade systems with and without detailing around openings in one single test. It is not known at present which cases (with or without opening details) is the worst; therefore both are used at present. An possible option is to combine both in the same test, and then the design of the test set-up must be so that both the opening details as well as the façade face will be exposed at the same time with the same heat exposure.

					This will be part of the round robin project.
171	Efectis Nederland	Assessment method – for commenting		I am missing a methodology for verification of the test specimen. The mock-up is described (although without minimum measurements). But it is not stated that the installation of the mock-up, including all it's components should be documented. For the traceability of the specimen (regarding CE) this should be incorporated. I don't think sampling is in order and I think the specimen will be built on site, however visitation of factory may be mentioned.	A mock up test is proposed. The procedure on sampling has not been included in the present proposal.
172	VKF	Assessment method – for commenting		The explication of terms and the necessary definitions are missing.	Agree, terms and definitions need to be rewritten and clarified.
173	VKF	Assessment method – for commenting		The consistency of the terms used is to be reviewed.	Agree, terms and definitions need to be rewritten and clarified.
174	VKF	Assessment method – for commenting		The testing of window details is difficult on such large specimen and the costs would be very important if every detail needs to be tested. Do not include window details.	The intention is to find a method which enables test of façade systems with and without detailing around openings in one single test. It is not known at present which cases (with or without opening details) is the worst; therefore both are used at present. An possible option is to combine both in the same test, and then the design of the test set-up must be so that both the opening details as well as the façade face will be exposed at the same time with the same heat exposure. This will be part of the round robin project.
175	IBS	Assessment method – for commenting	0 – last §	Main face = exposed surface PLUS part with fire source; means that test rig will be max. 6m in heigt = will be ok	The rig will be 6 m plus the height of the combustion chamber. The rig shall be at least 6 m above the lintel of the combustion chamber
176	DBI	Assessment method – for commenting	0 – last §	It is not clear, if 6 m is total height of the main face, or if it is 6000 mm above the lintel , see 2.1	The rig will be 6 m plus the height of the combustion chamber. The rig shall be at

					least 6 m above the lintel of the combustion chamber
177	VTT	Assessment method – for commenting	0	About "Also the width varies, from 1.8 m up to 4,85m" 5m (or more, with no upper limit).	Checked and changed
178	IBS	Assessment method – for commenting	0 – last §	From an austrian view it would not be necessary testing large scale resprectively using huge wood crib like 500kg; it is to consider basicly "safety aim" and concept of national building authorities interest; in austria concept of national standard testing based in KOTTOFF research, poining out that flashover will happen as fast as no fire rescue can avoid flashover INTO FIRST LAYER ABOVE ignition / burning level in building. So concept of testing is to check out, whether system of facade is able to AVOID FLAME SPREAD into the second layer/floor above ingnition / burning level. Therefore in our opinion it is not necessary to enlarge stest rig as well as wooden crib	The project was defined by EC including two exposures. The aim here is, if possible, that if you perform the large exposure test, it would also cover the medium exposure test.
179	VKF	Assessment method – for commenting	0-last §	The inclusion of a window induces a very important increase regarding number of necessary tests and therefore also regarding costs. Do not include window details.	The intention is to find a method which enables test of façade systems with and without detailing around openings in one single test. It is not known at present which cases (with or without opening details) is the worst; therefore both are used at present. An possible option is to combine both in the same test, and then the design of the test set-up must be so that both the opening details as well as the façade face will be exposed at the same time with the same heat exposure. This will be part of the round robin project.
180	IBS	Assessment method – for commenting	1	About fire exposures: See comment above; why not trying to harmonize into ONE testing scenario ? Manufactureres of countries basicly accepting medium scale have to test large scale when they want to sell their product	The project was defined by EC including two exposures. The aim here is, if possible, that if you perform the large exposure test, it would also cover the medium exposure test.

				into whole internal market; so TWO testing scenarios and different national requirements does not meet CPR-basics ”reduce the burden of manufacuteres”	
181	IBS	Assessment method – for commenting	1	Regarding ” The medium fire exposure test as given in DIN 4102-20 represents a fire that not has reached flashover.” Not fully correct; see comment above as well as KOTTOFs research results and furthermore concept of DIN/ÖN testing standard	The DIN 4102-20 is based on a flash-over scenario, but the method has been down-scaled. The DIN method has thus virtually removed one storey from the test set-up, and only focus on the part located two storeys above the fire room, i.e. the top of the flames.
182	VKF	Assessment method – for commenting	1	About the different exposure scenarii: This may be misleading, as flashover may lead to different conditions depending on a number of factors. Countries should decide on their own which exposure they want to use and what scenario they represent.	The project was defined by EC including two exposures. The aim here is, if possible, that if you perform the large exposure test, it would also cover the medium exposure test. The DIN 4102-20 is based on a flash-over scenario, but the method has been down-scaled. The DIN method has thus virtually removed one storey from the test set-up, and only focus on the part located two storeys above the fire room, i.e. the top of the flames.
183	ZAG	Assessment method – for commenting	1	two fire scenarios – before and after flashover - can lead to confusion with classification Fire either spreads over the façade or it does not when the worst scenario is present, which is flames coming out of the building through the window. Classification may include time period in which fire is transferred to another floor, requirements of which may be different for different building purposes (fire load). All other classifications can cause confusion.	The DIN 4102-20 is based on a flash-over scenario, but the method has been down-scaled. The DIN method has thus virtually removed one storey from the test set-up, and only focus on the part located two storeys above the fire room, i.e. the top of the flames. It will depend in each regulation on how many floor levels are accepted to be lost above the origin of the fire. Usually, it is only one.
184	ZAG	Assessment method – for commenting	1	Before flashover flames do not come out from the building and have no effect on the façade so there is no need of testing such scenario. Fire can start at the façade	It is not proven than external fire is less critical than internal fire. It will depend on the characteristics of each kind of fire. For instance the external fire defined in

				(burning of trash box or vehicle), but such fire is less critical as fully developed fire from inside the building and it is very unlikely to involve window just above the fire	German method is more critical than the internal fire.
185	ZAG	Assessment method – for commenting	1	The terms “external walls” are unclear and need better definition	Agree, terms and definitions need to be rewritten and clarified.
186	ZAG	Assessment method – for commenting	1	About the two fire load scenarios: Legal aspect: DIN 4102.20 and BS 8414 are national standards over which CEN or EOTA have no power. Therefor it has to be cited with the publising date (provided it is availabel even if withdrawn) or the content needs to be integrated in the final document.	See revised text.
187	University Ulster	Assessment method – for commenting	1-last §	Reference of German standard should be provided if available	See revised text.
188	AFITI	Assessment method – for commenting	2.1-1st §	It could be appropriate to include an specific clause for test specimen	The table of content has been changed slightly.
189	AFITI	Assessment method – for commenting	2.1-2nd §	We think is more appropriate to use the same term "test specimen" instead “test rig”over the document	Test rig and test specimen are two different entities. This is now clearly defined.
190	IBS	Assessment method – for commenting	2.1 – 2nd§	Add that these dimensions apply to the rig before the facade system is installed. If that’s the case.	The dimensions are clearly defined now.
191	DBI	Assessment method – for commenting	2.1 – 2nd§	Must’nt it be a minimum heigt of 5m instead of 6 m above the lintel ? see text above, section where ”main face” of test rig is explained ...	Checked and changed
192	VKF	Assessment method – for commenting	2.1 – 3rd §	Do not include window details.	The intention is to find a method which enables test of façade systems with and without detailing around openings in one single test. It is not known at present which cases (with or without opening details) is the worst; therefore both are used at present. An possible option is to combine both in the same test, and then

					the design of the test set-up must be so that both the opening details as well as the façade face will be exposed at the same time with the same heat exposure. This will be part of the round robin project.
193	DBI	Assessment method – for commenting	2.1 – 3rd §	It is not clear why it is necessary to test both with and without the windows.	The intention is to find a method which enables test of façade systems with and without detailing around openings in one single test. It is not known at present which cases (with or without opening details) is the worst; therefore both are used at present. An possible option is to combine both in the same test, and then the design of the test set-up must be so that both the opening details as well as the façade face will be exposed at the same time with the same heat exposure. This will be part of the round robin project.
194	DBI	Assessment method – for commenting	2.1 – 3rd §	About windows details, In this case, additional requirements regarding the width of the window / the combustion chamber need to be specified. The use of the combustion chamber with its actual size (100 mm DIN 4102, 2000 mm BS 8414) might be used to account for different window width. A window width of 1000 mm seems not to express the actual architecture practice. The exposed area, where flames may enter a ventilated cavity above the lintel due to different window width may play a role, as well as structural parameter, like exposure to supporting facade structure.	The intention is not to test windows, but the mounting of the façade system where there are openings. The “window” has been renamed to secondary opening.
195	AFITI	Assessment method – for commenting	2.2-title	We think is more appropriate to use the term "supporting construction" instead of test apparatus	See revised text.
196	ZAG	Assessment method – for commenting	2.2 - 2nd§	“the facade will be directly fixed on the steel structure”	See revised text.

				The fixation should reflect real conditions, which should be mentioned here. –"	
197	IBS	Assessment method – for commenting	2.2 - 2nd§	Which kind of ”curtain walling” do you think of ? (in our opinion every kind of ”curtain walling” is covered by 1364-3/-4 resp. EN13830)	See revised text.
198	IBS	Assessment method – for commenting	2.2 -	In our opinion it should be a ”harmonized” structure of testing rig, e.g. steel structure AND concrete blocks for EVERY kind of specimen/system to be tested; who will pay for erecting and dis-mounting of structure of rig when testing different specimen/systems ? ... otherwise TWO kind of testing rig would to be erected thinking in an economical way ...	It would be up to the lab to see how they will treat this. The lightweight concrete wall can be used several times, so there is no need to demolish that.
199	ZAG	Assessment method – for commenting	2.2 – 4th§	Replace overall density with apparent density	Has been corrected.
200	ZAG	Assessment method – for commenting	2.2 – 4th§	“650 +/- 200 kG:” Does the tolerance have to be so broad? In this range mechanical, thermal... properties vary quite a bit. Although it may have no impact on the test results it’s better to narrow it down a bit.	The definitions and values used in the DIN and BS methods have been used. It may be needed to change the tolerances, and this will be further studied in the round robin program.
201	ZAG	Assessment method – for commenting	2.3	BS (being a national standard) should not be made ”mandatory” or at least cited with the publication details	See revised text.
202	ZAG	Assessment method – for commenting	2.4	About “nations standards” National standards in an EU method are not acceptable to be directly cited. It’s OK for the draft, but in final version ir raises legal issues (copyright, control over the document with changes, withdrawals etc.). This issue shold be addressed in general.	See revised text.
203	DBI	Assessment method – for commenting	2.4	About “nations standards” Reference to national standards should be avoided in the final version.	See revised text.

204	VKF	Assessment method – for commenting	2. 4 last §	The test standard shall not include national specifications. Define just one configuration for the medium and one for the large exposure scenario.	See revised text.
205	ZAG	Assessment method – for commenting	2.4 last §	"Whatever the thickness:" Inconsistent: thickness is fixed to 200 mm.	The distance from the surface of the wing (after the specimen has been mounted) to the edge of the combustion chamber shall be the same, irrespectively of the thickness of the test specimen.
206	DBI	Assessment method – for commenting	2.5.1	Regarfin thermocouples, Specifiy type and accuracy: Ex. As giving in EN1363-1 §4.5.1.2 and §4.5.1.4 Specify the maximium needed operating temperature.	Type of thermocouples has been defined.
207	DBI	Assessment method – for commenting	2.5.1	The terms "vertical" and "horisontal" can be misunderstood. Especially "horisontal" since the facade system is 3-dimensional.	A number of drawings have been added in order to avoid misinterpretations.
208	ZAG	Assessment method – for commenting	2.5.1- 1st §	Replace depth by thickness	See revised text.
209	ZAG	Assessment method – for commenting	2.5.1- 1st §	It may not be possible, without damaging the test specimen beyond the minor damage. E.g. glass cladding, ceramic cladding etc. Also in some cases (facades, that are not flat) the external ebdge may not be defined to +- 5 mm, therefor a reference external edge should be established.	There is a long time experience of drilling through the specimen, without any problems that the test specimen has been damaged. Therefore we do not see any problems to use this technique. A clear description on how to fix the thermocouples will be given.
210	VKF	Assessment method – for commenting	2.5.1	External thermocouples are not to be drilled through the construction. This leads to damage on the very important external finish.	There is a long time experience of drilling through the specimen, without any problems that the test specimen has been damaged. Therefore we do not see any problems to use this technique. A clear description on how to fix the thermocouples will be given.

211	DBI	Assessment method – for commenting	2.5.1- Last §	It should be guaranteed that the thermocouples stay in place during the test.	There is a long time experience of drilling through the specimen, without any problems that the test specimen has been damaged. Therefore we do not see any problems to use this technique. A clear description on how to fix the thermocouples will be given.
212	IBS	Assessment method – for commenting	Figure 4	Huge ! number of TC’s ... approx. 140TC’s ... try to reduce !	See revised text. The number of thermocouples has been reduced since the smouldering has been removed from the method.
213	DBI	Assessment method – for commenting	Figure 4	Why are no thermocouples shown on the vertical center line of the combustion chamber opening?	See revised text. The thermocouples on the vertical lines are used for assessing horizontal fire spread, therefore no vertical line is applied in the center.
214	University Ulster	Assessment method – for commenting	Figure 4	Dimensions should be shown in the Figure	Dimensions have been added.
215	ZAG	Assessment method – for commenting	2.5.2- last §	Text specifies 12 thermocouples while on the figures there are 10 TCs on a line (or the wording is unclear).	This has been changed.
216	ZAG	Assessment method – for commenting	2.5.3- 1st §	Regarding camera proposal, it has to be elaborated in much more details. The problems: reflection, convective cooling, emissivity, not suitable for ventiladed facades etc...	Smouldering is no more included in the proposed assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.
217	DBI	Assessment method – for commenting	2.5.3	About infrared camera, Reference measurements could be needed	Smouldering is no more included in the proposed assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.
218	IBS	Assessment method – for commenting	2.5.3	MUST BE Optional measurement! Smouldering is not part of national requirements in every Member States ... Costs ? ”perforation” of testing specimen ?	Smouldering is no more included in the proposed assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where

					the smouldering fire was left out and dealt with in EN 16733.
219	IBS	Assessment method – for commenting	Figure 5	There seems to be too many thermocouples. A larger distance between the thermocouples, as well as avoiding thermocouples beneath the expected plume area on the surface might be applicable.	Smouldering is no more included in the proposed assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.
220	ZAG	Assessment method – for commenting	2.6	Does “plate thermomerter in front the combustion chamber” mean in the plume ?	Not in the plume, but some distance from it.
221	ZAG	Assessment method – for commenting	2.6	Regarding “Mass loss rate of the crib in the combustion chamber”, What about the PCS of wood, used? Once the test has started, little can be done, if the values are not as expectd...	The mass loss measurement can give indications on the combustion of the wood crib. There are still some questions that need to be handled within the round robin in order to ensure that good enough repeatability and reproducibility is obtained. Therefore the mass loss measurement can give important information, at least in this stage.
222	DBI	Assessment method – for commenting	2.6	What about in-depth measurements inside the substrate in the combustion chamber? Define and measure air supply rate?	The air supply is defined. Measurements within the combustion chamber may also be done during the round robin, but in the final method we cannot see that it would give any valuable information. What is important is the heat exposure to the test specimen, not the heat in the combustion chamber.
223	AFITI	Assessment method – for commenting	2.7	In our opinion this document (in general), is no very clear in relation with the time periods: burning time, observation time, total duration of the test,... We don't have DIN and EN standard, may be this is the reason because it is confused to us the duration of the periods... According to Progress report, table 9: DIN 4102-2: 20 min burning time, and 40 min observation time	Since the ITT specified the DIN and BS methods, we have decided not to change anything regarding the heat exposure to the test specimen at this stage. Further information will be available after the round robin project.

				BS 8414: 30 min burning time, and 30 min observation time	
224	DBI	Assessment method – for commenting	2.7	The two testing procedures seem too different. It makes it almost impossible to relate them to each other and to consider them as part of the same testing regime.	It was already decided in the ITT that the DIN and BS methods should be used as a start.
225	Efectis Nederland	Assessment method – for commenting	2.7	Regarding the fuel source, I am sure you are aware that a wood crib has a poor reproducibility of fire load (it varies quite a bit). Perhaps in the round robin the weight loss of the crib could be measured to make an estimation of the RHR. Additionally if the wood crib is used as fuel source I think it would be wise to emphasize that the crib has to be conditioned for at least two weeks (like other specimens) and the moisture content should be determined before execution of the fire test. However maybe the above is already covered in the BS or DIN standard.	Alternative fire sources will be introduced in the method, and compared in the next step of the project, the round-robin. The selection will be done after the round-robin.
226	IBS	Assessment method – for commenting	2.7.1	About "extinguishment of the wood crib " How to handle ? Maybe construct a "sledge" wood crib fixed on, moving behind testing specimen after time of fire exposure ?	This has been specified.
227	AFITI	Assessment method – for commenting	2.7.2	About" 60 min after ignition": We suppose it is neccesary the assessment of smouldering; please, specify.	Smouldering is no more included in the proposed assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.
228	ZAG	Assessment method – for commenting	2.7.2-last §	Which temperature measurements are relveant for this decision: in the materials, external, in-front of the chamber,...?	All temperature measurements, except the Line 1 which only is used for determining the start of test.
229	Efectis Nederland	Assessment method – for commenting	2.8	I don't see anything about testing outside the facilities of the laboratory, however with such big rigs I could imagine this would be interesting for manufacturers.	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.

				Maybe review the assessment method from this point of view to see if it would be, in the future, possible to carry out the test outside of a normal laboratory.	
230	DBI	Assessment method – for commenting	2.8	It should not be allowed to run the tests outside. There is a clear environmental aspect of being able to treat the smoke produced during the test. In some Member States it may be allowed to run the tests outside whereas in others it’s not. But a EU test should not encourage air pollution that can be avoided or reduced by well-known technology. Besides the environmental aspects there is also the difficulties in controlling the air velocity, temperature, humidity etc.	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
231	ZAG	Assessment method – for commenting	2.8	Concerning “the wind speed in the vicinity of the specimen is less than 3 m s^1 during 15 min” When? Just prior the test. During the test (how is that measureable?), after the test? Please, specify in more detail.	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
232	DBI	Assessment method – for commenting	2.8	Concerning “the wind speed in the vicinity of the specimen is less than 3 m s^1 during 15 min” Before or during the test? It needs to be proven that a wind speed of 3 m/s doen’t affect the test significantly. Add Precision of measuring equipment: Plate thermometers ±15 K (EN 1363-1 §4.6) Temperature measurement ±10 K (EN 1363-1 §4.6) Wind speed ± 0.1 m/s Should the log interval be minimum 30 s due to the criteria given in chapter 4.	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.

233	AFITI	Assessment method – for commenting	2.8	Concerning "the wind speed in the vicinity of the specimen is less than 3 m s^1 during 15 min" It could be appropriated to specify it is a medium value (then It could forbidden peaks of xx m/s), maximum, ... Prior the test? During the test? During the burning of the timber crib? We have to take in account that 15 min could be the total part of the burning phase or just a part depend on the duration...	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
234	AFITI	Assessment method – for commenting	2.8	Concerning "The test shall not be performed if it is raining or snowing": In our opinion the relative humidity could be quite important	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
235	ZAG	Assessment method – for commenting	2.8	Global air velocity and wind direction on test field should be measured (at approx. 2 m height) from 15 min before the test until 60 min after wood ignition (the test would be much more reproducible if done within a sufficient large room, of course)	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
236	RISE FR	Assessment method – for commenting	2.8	3m/s is quite strong wind in a fire test, and may affect the result….	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
237	IBS	Assessment method – for commenting	2.8	In our opinion this is contra-productive according to EA-requirements of reproducability and repeatability. Enviromental condidtion have to be under control of accred. Testing lab, so testing rig to be dimensioned for indoor use !!!	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
238	VKF	Assessment method – for commenting	2.8	Tests shall not be performed outside depending on weather conditions. This leads to too much variation between test results.	This will be defined, but it will be decided after the round robin when more information is available on the effects of the ambient conditions.
239	DBI	Assessment method – for commenting	2.9	Add at the top of this section: In general the test specimen shall be constructed and verified as described in EN 1363-1 §6.3, §6.4 and §6.5.	This has been updated, and a clearer description is now given.

240	IBS	Assessment method – for commenting	2.9 – 2nd §	About "external wall assembly", Definition ? Which kind of "facade-system" ?	Definitions are now included, and the text has been updated.
241	DBI	Assessment method – for commenting	2.9	About "Starter tracks", This terms needs a definition. See comment on window detailing above. The construction of the window lintel and vertical posts should be specified in detail to guarantee a representation of the standard mounting and installation situation. E.g. via the heat conduction within the substrate the test could be influenced.	Definitions have been added. Also the mounting around secondary opening has been revised and clarified.
242	DBI	Assessment method – for commenting	2.10	Add at the top of this section: The test specimen shall be conditioned in accordance with EN 1363-1	Not completely feasible since EN 1363-1 only covers material installed within building.
243	IBS	Assessment method – for commenting	2.10-1st &2nd §	See comment above. Conditioning must be under control of testing lab (indoor)	The text on conditioning has been revised.
244	DBI	Assessment method – for commenting	2.10-1st §	Cured does not equal dry. It should be sufficient to wait until the moisture content has stabilised as suggested below.	The text on conditioning has been revised.
245	AFITI	Assessment method – for commenting	2.10	In real conditions, the facade are exposed to environmental conditions that could affect the behaviour of the facade, could it include some ageing?	Ageing has not been included. It is of course an important aspect, but generally when type testing is done it is normally on new products.
246	RISE FR	Assessment method – for commenting	2.10	What is the size of the small-size mock-up ?	The size of the mock-up test is now defined.
247	IBS	Assessment method – for commenting	2.10	About the small-size mock-up: Costs ? Sizes ? Necessity ?	This mock up is used to estimate the moisture stabilization of the sample and to determine material characteristics
248	RISE FR	Assessment method – for commenting	2.10	What is meant by "exchanges with the environment ?	May need to be revised, and the chapter on the mock-up has been revised.
249	RISE FR	Assessment method – for commenting	2.10	Which material characteristics shall be determined ?	Hygroscopic materials where moisture may affect the fire performance.

250	IBS	Assessment method – for commenting	2.10-last§	About "ambient conditions": See comment above (internal conditioning!)	The text has been rewritten.
251	DBI	Assessment method – for commenting	2.10-last§	Should the terms" moisture stabilization" be interpreted as a change less than 0.1 % (dry weight)	That is correct.
252	DBI	Assessment method – for commenting	2.11	"change of flaming" is too subjective The requirement "any change in the mechanical behavior of the cladding system shall be recorded" needs elaboration How is it possible to record "any fire penetrations through fire stops incorporated within the cladding system"? It's happening inside the facade system, probably hidden behind the external finish	These observations shall be presented in the report for the client to use. There are no performance criteria based on these observations so it is mainly to give the client an overview on what happened during the test.
253	RISE FR	Assessment method – for commenting	2.12	"whether it is fire damage or damage due to the influence of heat but not smoke damage" This may be difficult to interpret, and has to be defined in detail	Agree, it may be difficult to clearly define what have happened during the test. Although, these observations are mainly information to the client, and it is not used for the determination of the fire performance.
254	DBI	Assessment method – for commenting	2.12	Are there any triviality limits for " damage, including spalling, melting, deformation and delamination"? Should it only be qualitative observations or must is include quantitative records? In the latter case, more guidance is needed. Charring and burn away should be added to the damage phenomena.	Agree, it may be difficult to clearly define what have happened during the test. Although, these observations are mainly information to the client, and it is not used for the determination of the fire performance. It is only qualitative observations.
255	Efectis Nederland	Assessment method – for commenting	2.12	Regarding 2.12 Post test inspection, I think it would be wise to describe which parameters should be used to describe the flame spread / damage (area, length, depth, color?)	These observations are mainly information to the client, and it is not used for the determination of the fire performance. It is only qualitative observations.
256	IBS	Assessment method – for commenting	3	NO;Calibration with inert test specimen was withdrwan years ago e.g. with EN1363-3 ... Calibration of measuring system will meet reuqirements of EA -> how to fulfill statistic	Since there still are details that need to be studied within the round robin, any calibration routines are not yet available since it depends on the outcome of the round robin.

				requirements when testing a "system" ??? … preferable calibrate thermo couples etc.	
257	AFITI	Assessment method – for commenting	4-1st §	"over a period of 30s": Consecutive ? (same question for 2nd §) What is meant by frame ? Start time = after burning period? For medium exposure test, the observation time is, at least, 40 min. Then, do we have to ignore the last 25 min? For large fire exposure, the observation time is, at least, 30 min. Then, do we have to ignore the last 15 min?	The text has been revised.
258	DBI	Assessment method – for commenting	4-1st §	Why 500K temperature rise? A justification for the choice would be nice to have in the background documentation for the assessment method.	The criteria to be used shall be based on scientific evidence, and not on what is written in old standards.
259	VKF	Assessment method – for commenting	4-1st §	600 K would be appropriate than 500 K	The criteria to be used shall be based on scientific evidence, and not on what is written in old standards.
260	AFITI	Assessment method – for commenting	4	Regarding smouldering, The maximum test duration is 15 h only for medium fire exposure, what about fire large exposure??	Smouldering is no more included in the proposed assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.
261	RISE FR	Assessment method – for commenting	4	Regarding smouldering, no criterion is given here, what should it be? E.g. if no smouldering is observed after 15 h?	Smouldering is no more included in the proposed assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.
262	Efectis Nederland	Assessment method – for commenting	4	Regarding the smouldering fire or falling parts, could it be considered to make these procedures supplementary/optional. I don't think that for all applications in buildings an assessment of these criteria is required. Considering the elaborate registration method for falling parts and/or the use of a	Smouldering is no more included in the proposed assessment method since a European method for smouldering, EN 16733, already exist. This problem is the same as for external fire of roofs, where the smouldering fire was left out and dealt with in EN 16733.

				infra red camera for smouldering I think test could be more accessible and affordable if the assessment of falling parts and smouldering is upon request of the manufacturer.	The method and assessment criteria will be improved. It will be possible to check this visually or to use more complex methods. An example will be given in an informative annex.
263	RISE FR	Assessment method – for commenting	4	Regarding falling parts : What is meant by "In the possession of the area" ? Why is introduce the word specific here? What is meant by "More dense mesh is recommended"	The method and assessment criteria will be improved. It will be possible to check this visually or to use more complex methods. An example will be given in an informative annex.
264	DBI	Assessment method – for commenting	4	Regarding falling parts : Is this only of the surface (i.e. one layer), or all the way through? For example, what happens if there was a construction with several layers that were peeling off one after another? What if the surface is hidden by smoke?	The method and assessment criteria will be improved. It will be possible to check this visually or to use more complex methods. An example will be given in an informative annex.
265	AFITI	Assessment method – for commenting	4	Regarding falling parts : Take note if the particles are burning or not	The method and assessment criteria will be improved. It will be possible to check this visually or to use more complex methods. An example will be given in an informative annex.
266	AFITI	Assessment method – for commenting	4	Regarding falling parts : In our opinion is quite difficult to evaluate in that way, because the detachment of material could be partial in each area	The method and assessment criteria will be improved. It will be possible to check this visually or to use more complex methods. An example will be given in an informative annex.
267	DBI	Assessment method – for commenting	4	Add § test report Test report In addition to the items required by EN1363-1, the following shall also be included in the test report a reference that the test was carried out in accordance with ENXXXXX the measured wind speeds all measured temperatures	A specific chapter on test report has been introduced.

268	IBS	Assessment method – for commenting	5	Could the DIAP be part of the RR ? Respectively collect experiences from experts during current project (maybe ”generic parametres” to be defined) ?!	The field of application will at this stage only include some examples.
269	Efectis Nederland	Assessment method – for commenting	5	understand that the DIAP is only an example. However I think it is incorrect to allow the height of the construction to be increased without additional conditions (such as distance of fixing centres).	The field of application will at this stage only include some examples.
270	VKF	Assessment method – for commenting	5 – 2nd § - 4e alinea	Why can the width be increased only if the specimen was tested on the large exposure scenario? Most facades tend to be larger (wider) than the tested width of 3500 mm. Both thests need to represent facades of any width. Of course provided joints were tested and provided distance of fixing centres is not increased.	The field of application will at this stage only include some examples.
271	IBS	Assessment method – for commenting	6	May produce a table based on results of this project, showing more or less äquivalent test results to different testing procedures (because theire basicly compareable) Harmonized procedure is required, to allow reproduceable and repeatable evaluation of historical data (see example for EN16034, SH02-Taks group)	The use of historical data will be possible on a national level, but not for CE-marking. The possibility to retest and compare the current national test method with the new European method in the frame of the round-robin project can be discussed with EC.
272	DBI	Assessment method – for commenting	7	All façade systems will most likely include window detailing. If the project group think that the window configuration is needed to fully assess the façade system, then the window detailing should not be a sub option. If the project group think that the no-window test is also needed to assess the unhindered fire spread along the façade, then both configurations (with and without window) should always be required to get a classification. But if the project group think that the test with a window is always more harsh than the non-window test, then the assessment	The intention is to find a method which enables test of façade systems with and without detailing around openings in one single test. It is not known at present which cases (with or without opening details) is the worst; therefore both are used at present. An possible option is to combine both in the same test, and then the design of the test set-up must be so that both the opening details as well as the façade face will be exposed at the same time with the same heat exposure. This will be part of the round robin project.

				method should only include the window configuration.	
273	AFITI	Assessment method – for commenting	7	Progress report, clause 5.1.6 proposes to include the exposure time. That report, clause 5.1.2, specifies 3 posibilities for exposure time: 15 min, 30 min or 45 min. This document fixes (as we understand it) exposure time depende of the type of the test (20 min for the medium test and 30 min for the large one). We suppose this is the reason because the time is not included in the classification	Only the times used in DIN and BS methods are now proposed, since there was a general comment to simplify the classification system, and have as few classes as possible.
274	DBI	Assessment method – for commenting	7	Regarding windows detailing: It should be considered whether the classification is only valid for the tested window widths and narrower.	It is not a test of windows or other components to be installed on the façade. In the test will an opening be included, so the façade detailing around openings can be assessed.
275	IBS	Assessment method – for commenting	7	Whats about concept of SBI-classification ?	The reaction to fire classification is already used in many Member States for facades, and will be so also in the future. The present methodology will mainly be used for facades on high risk buildings.
276	IBS	Assessment method – for commenting	7 – 2nd §	Would LFw satisfy LF?	A simpler classification system has been introduced. In the proposed test method detailing around an opening shall always be assessed.
277	ZAG	Assessment method – for commenting	7	About class F: Seems awkward for the following reasons: . falling parts are ”d” in SBI classes, F (standalone) is also a class in SBI classification. Considering that in some countries ”SBI” RtF classification is used for facades, F (as standalone letter) should be avoided (in spite it clerly has a different meaning here)	A simpler classification system has been introduced.
278	RISE FR	Assessment method – for commenting	4-3rd §	Maybe use another letter than F, since it i salready used for Fire. Maybe small “f”? or	A simpler classification system has been introduced.

				"fp"? This would be on the same line as in the Euroclass system	
279	AFITI	Assessment method – for commenting	4-3rd §	Regarding F class, we propose to use lowercase letter, as Euroclasses for complementary information. Moreover, we propose to put 0, 1 and 2 as Reaction Euroclasess for, respectively, no falling parts, falling no-flaming parts and falling flaming parts.	A simpler classification system has been introduced.
280	RISE FR	Assessment method – for commenting	4-3rd §	I suggest using a small s. S may, however be confused with smoke as used in the Euroclass system.	A simpler classification system has been introduced.
281	AFITI	Assessment method – for commenting	4-3rd §	We propose to use lowercase letter for S, as Euroclasses for complementary information.	A simpler classification system has been introduced.
282	RISE FR	Assessment method – for commenting	4-4th §	About LFw-FS, This system seems very complicated….	A simpler classification system has been introduced.
283	DBI	Assessment method – for commenting	4-4th §	About MF-S class: To support recognisability throughout the building industry, it should be considered to always include the observation labels regardless if the criteria wasn't met. Inspired by the reaction to fire classes for smoke and droplets.	A simpler classification system has been introduced.
284	DBI	Assessment method – for commenting	4-4th §	About LFw-F,S and LF-F,S classes: There is a great risk that non-fire test experts will get confused if there can be two different facade test classifications assigned to a certain facade system. And after all non-fire test experts compose the majority of the building industry.	A simpler classification system has been introduced.
285	ZAG	Assessment method – for commenting	7	Introducing of two classifications can (will) be confusing	A simpler classification system has been introduced.
286	ZAG	Assessment method – for commenting	7	Perhaps another classification can be introduced as critical heat flux to certain façade which can start a fire as a consequence of fire on neighbour building – perhaps façade outer face measuring with	This has not been introduced.

				cone calorimeter and additional classification (letter) in the whole classification is an option?	
287	Polish Ministry	Draft final report	Ge	Concerning the Consultation on the need to maintain the medium scale assessment method within the European Approach to assess fire performance of facades Polish experts inform that the technical regulations include requirement regarding fire spread through facades which is evaluated on the base of medium scale assessment method. For this reason the medium scale assessment method should be included in a European Approach to assess the fire performance of facades.	Noted
288	Polish Ministry	Draft final report	Ge	Concerning the Consultation on the need to maintain the medium scale assessment method within the European Approach to assess fire performance of facades Polish experts inform that the technical regulations include requirement regarding fire spread through facades which is evaluated on the base of medium scale assessment method. For this reason the medium scale assessment method should be included in a European Approach to assess the fire performance of facades.	Noted
289	Danish Transport, Constructio n and Housing Authority	Draft final report	ge	Regarding the consultation on the need to maintain the medium scale assessment method within the European Approach to assess fire performance of facades, which was sent out prior to the AGF meeting on 8 December 2017 Denmark has the following considerations. In case of an agreement on a common test method for the fire performance of facades, which takes into account different levels of exposure (i.e. different sizes of fire as	Noted

				seems to be included in the proposed method) Denmark would no longer see the need for a medium scale test method for facades.	
290	EU Commission	Draft final report	Ge	The proposed assessment approach introduces significant changes to ”the preferred Option” (described in the Terms of Reference). In the AGF meeting of 8/12/2017 it was clarified that the contractor’s proposal (e.g. the introduction of new position for window openings and for thermocouples) would, almost certainly, compromise the possibility of manufacturers which have already tested their products in accordance with BS 8414 and/or DIN 4102-20 to use their historic test data. The important facility for many manufacturers to use the already available test data has been an important reason in the choice of “the preferred option” discussed with Member States and industry in the Standing Committee on Construction before the start of the contract. Therefore the Final Report must concentrate to keep the test methods BS 8414 / DIN 4102-20 and to introduce certain extensions to accommodate falling parts, typical facades in a vertical line as in the French LEPIR 2 test and the assessment of fire barriers	It is correct that the changes from the original BS 8414 and DIN 4102-20 methods may have an effect on the results, and thus on how historic data can be used. This was already foreseen when the midterm report was presented, and the interpretation of the contractors was that changes such as secondary openings were acceptable and appreciated by many Member States. The comment above that a new position of window openings will affect the use of historic data is difficult to understand since the new position would go in the direction that the proposed method is more like the original and thus will have less effect on the use of historic data, compared to the proposal made in June. For all Member States not using the BS 8414 or DIN 4102-20 methods it must be evaluated how historical data can be used, and the same is the case for the Member States using these methods as soon as any deviation is made from the BS 8414 and DIN 4102-20 methods. Since deviations are proposed, such as secondary openings, the use of historical data must be evaluated. It is proposed in the draft Final Report that each Member State should be invited to compare the national test method to the proposed one (the Member State or other should pay for these additional tests). The secondary opening has been moved away from the center line of the

					combustion chamber in order to have a substantial part of the test specimen as in the original methods, but allowing to examine the behavior of the system detailing around openings, thus this proposal is closer to the BS 8414 and DIN 4102-20 methods compared to the proposal in June. A second option has been included in the final report where the DIN and BS methods are kept as they are, and with optional measures for falling parts/burning debris and secondary opening.
291	EU Commissio n	Draft final report	Ge	23. The Report would certainly benefit from some changes in its structure to make the reading easier and the structure simpler (e.g. in clause 0.6 of page 147 instead of "… in the appropriate section of the proposed methodology" introduce the number of the section so the reader of the report to find the information.	Reference to pages introduced
292	DIBt	Draft final report	Ge	It should be stated clearly in the document that the proposed test approach shall be used in addition to the classification system acc. to EN 13501-1 but not instead. For example ETICS covered by the coming European product standard shall always be tested and classified acc. to EN 13501-1. And only in certain cases the fire performance test can be done in addition to that classification.	See section 0 of the main report.
293	FINLAN esko.k.mik kola	Draft final report	Ge	Finland does not regulate facades based on medium nor on large fire exposure test. This is also valid for the new regulations coming into force 1.1.2018. The principles of fire safety regulation concerning façade structures are given below:	Noted

				o Reaction to fire classes in relation to different heights and uses of buildings are defined + protective means if e.g. combustible thermal insulation materials are used o As an additional option (which is not a requirement) the fire performance of the external wall structure may also be demonstrated by a full-scale test ▪ Guidance related to this full-scale test says: Fire exposure to the outer surface in the test method is to be known and corresponding to real fires, and test specimen size needs to be sufficient to enable potential mechanical damage to occur.	
294	EUMPES	Draft final report	Ge	To avoid barriers to trade and limit the testing burden Member States should commit to accept the new tests, and to refrain from additional national requirements. A modified classification system should enable Member States to define national fire safety requirements for different building types and uses, referring to classes according to EN 13501. A solution would be to amend EN 13501, the classification standard for fire performance, providing reference to the new test methods. Manufacturers then can declare the fire performance of façades in compliance with the Construction Products Regulation (CPR), displayed in the DoP and the CE mark. Designers and applicants can easily identify if the product is in conformity with the respective national regulation.	The objective with the present project is to propose a methodology for assessing facades. How and where the final classification system is presented is outside the scope of the present project.
295	EAE	Draft final report	Ge	However, we have identified some necessary amendments, and do believe that some general decisions and actions	Noted

				have to be taken prior to performing Round Robin tests.	
296	EAE	Draft final report	Ge	An open question is, how the fire performance of façade claddings will be declared in compliance to the Construction Products Regulation (CPR). The solution might be to use EN 13501 as a classification standard. Then EN 13501 should be amended accordingly, providing reference to the new test methods. These tests will be additional to existing ones (e.g. small burner, SBI). The classification and interpretation of test results should be left to EN 13501. Here additional classes should be incorporated. The modified classification system should comply with national safety requirements enabling Member States to define their requirements for different building types and uses giving reference to classes according to EN 13501. If manufacturers declare the performance of their product accordingly (displayed in the DoP and the CE mark), designers and applicants can easily identify if the product is in conformity with the respective national regulation. This would mean, that the classification in the new test standard could be significantly reduced. The test report should include all necessary information required for the classification according to EN 13501. Relevant technical specifications for construction products (kits) should include reference to these standards and information about worst case rules to limit test efforts.	The location and classification levels fall outside the scope of this project. It is possible to add classes not directly linked to the assessment method, e.g. for smoke. Regarding: "the classification in the new test standard could be significantly reduced" It will depend on the track selected among the possible alternatives specified in the updated final report
297	EU Commissio n	Draft final report	1	Some of the respondents in the enquiry mentioned in Table 1 are not representing the fire regulatory authorities in certain Member States (e.g. Greece). The contractor needs to be absolutely certain	For most Member States we have used sub-contractors to handle the communication with the national regulators. We have clearly explained that they must control with the

				that any answers received to the enquiry represent the views of the competent authorities and not the views of academics of fire labs.	regulatory authorities that their answers are correct and representing the actual Member State. Furthermore, the draft Final Report has been sent to AGF and if there are any deviations (the sub-contractors have not done their job) it would be detected now since all responses and answers are given in the draft Final Report.
298	EU Commission	Draft final report	1	Furthermore it is very important to distinguish between what is required by Member States regulations and what is included in the test methods developed or used in certain countries. It is not certain that all test methods are obligatory in the regulatory provisions of the corresponding countries.	This has been covered in the initial enquiry by asking what the regulation states and the results are tabulated in Appendix C of the report.
299	EU Commission	Draft final report	1	The regulatory provisions of each Member State must have been notified (at draft stage) by the Member State to the Commission and to the other Member States using the procedure of Directive 98/34/EC. The list of the regulatory provisions which is expected to be drawn up should contain the reference of the notification under 98/34/EC. The database of these notifications is kept in the TRIS (http://ec.europa.eu/growth/tools-databases/tris/en/search/).	Noted
300	EU Commission	Draft final report	1	The comprehensive list of these products (required in Task 1) should be presented in a separate Annex.	Regulatory requirements are typically set as performance requirements and do not generally address specific materials or systems to enable changes in construction industry to be accommodated without the need to alter regulatory requirements.

301	EU Commission	Draft final report	1.1.1	Regarding the term "façade" in 1.1.1, it should be noted that, the purpose of the development of the European assessment approach is to allow testing all façade kits (e.g. ETICS, claddings, panel systems) which are now submitted to obligatory testing according to current national rules of the Member States.	This covers all exterior walls.
302	DIBt	Draft final report	1.1.1	The proposed definition of "façade" seems to be too simple. It doesn't really reflect the wide range of different types of facades. Furthermore it could lead to misunderstanding, that the proposed approach shall be used always to test the fire performance of complete external wall constructions. However, in most cases only the fire performance (mainly the contribution to fire spread) of external wall cladding systems is tested. We are therefore of the opinion that a more detailed definition of "façade" is needed considering the wide range of various types of facades.	The definition used was proposed to the Member States during the enquiry (Appendix A, question 2), and it was accepted by a majority of the Member States without change (Appendix B presents the feedback from all Member States on this question). The scope of the proposed classification and test method contains this definition but will also be reviewed to ensure that full wall build ups are not tested unless required to do so based on system design.
303	EAE	Draft final report	Scope	Facade systems Should be replaced by "façade claddings". DIN 4102-20 is not appropriate for testing of walls, and not suitable for the assessment of all façade systems. Non-loadbearing walls require separate testing, in order to check the fire spread through junctions. In the two tests proposed the junctions do not suffer from sufficiently high stress to test and measure all necessary performances. U.K.: Is the BS test intended to assess wall constructions? Is there sufficient experience?	The scope of the proposed classification and test method contains this definition but will also be reviewed to ensure that full wall build ups are not tested unless required to do so based on system design. BS 8414-2 is designed to assess full wall construction details.

304	EU Commission	Draft final report	4	The analysis of regulatory provisions going beyond the "preferred option" (foreseen in Task 4 of the contract) is not covered in the current draft Final Report.	It is included in Annex C, but it can certainly be improved and summarized in the main text of Task 4. A table is introduced in Chapter 4.
305	EU Commission	Draft final report	4	Also under Task 4, we would expect the contractor to propose specific work from the BS 8414 (e.g. to propose testing of typical facades with windows in a vertical line as in the French LEPIR 2 test). This should also be reflected into the proposed product classification (Task 5) with additional cases (i.e. a façade with windows / façade without windows).	This was proposed in June, but the comment on that proposal was that it leads to a too complicated classification system. Therefore the secondary opening has been proposed as mandatory, and moved somewhat to the side in order to get a simpler classification system, and a test more closely to the original BS 8414 and DIN 4102-20 methods. Regarding classification the use of different classes on the "windows" were presented at midterm, and the main comments achieved on this was that the classification system should be made simpler, and use as few classes as possible.
306	EU Commission	Draft final report	5.1.4	The Final Report (regarding falling parts in page 19) would need to clarify how the Finnish requirements of pieces no larger than 0.1 m2 are supposed to be accommodated (e.g. by sub-class?).	The requirement used in Hungary on 5 kg and 0.4 m2 is very liberal. There are different options, use different classes on falling parts or make the requirement stricter, e.g. 1 kg and 0.1 m2 as the requirements in Sweden.
307	Polish Ministry	Draft final report	5.1.6	Regarding proposed classification system (5.1.6, table 10 with comment), we would like to indicate that applying hierarchy of importance of the classes and assumption that the large scale class covers middle scale class has no justification before obtaining the results of comparative tests which were mentioned and predicted in the report (7.2).	It will depend on the track selected (Alternative method or proposed method) among the possible alternatives specified in the updated final report. Keeping DIN and BS (Proposed method) as they are does not allow to conclude without further testing Converging to only one common test rig with 2 different fire exposures may lead to such conclusion since the method

					would be built with this intention and forms the basis of the Alternative method scenario approach.
308	EU Commission	Draft final report	5.2	Taking into account point 1 above the contractor must re-examine the proposed classification system (classification criteria/values) to allow the maximum use of historical data.	To retain the use of historic data the parameters recorded and associated methodologies used to determine these characteristics must remain unchanged or the relationship between the techniques used and their impact on these characteristics of the proposed amendments clearly understood. Task 4 in the main body of the report has been revised to address this comment.
309	EU Commission	Draft final report	5.2	The use of historic data under (at least regarding products tested in the past with the BS 8414 and DIN 4102-20) needs to be examined in detail under the current contract, because the possibility for manufacturers to use historic data has been one of the main reasons to choose these two methods.	Task 4 in the main body of the report has been revised to address this comment.
310	EU Commission	Draft final report	5.2	The proposed inclusion of the national comparative tests as part of the round robin testing was not foreseen in the Terms of Reference of the contract and the budgetary provisions of the EC services have not foreseen such expenditure. Therefore this verification should be undertaken outside the next phase of the study (i.e. the round robin programme for the finalization of the European assessment approach). An indicative expense for one MS applying the large scale test should at least be provided.	The proposal is that during the round robin the Member States can be invited to participate, on their own cost, to make comparative test on the same systems used in the round robin to evaluate whether historical data can be used or not. This would also allow the Member States to assess the safety level of the proposed method.
311	EU Commission	Draft final report	5.2	The last sentence of 5.2 is rather incomprehensible and need to be clarified. Before the CE marking the acceptance of available test data from other test methods	Has been corrected

				is a matter under the responsibility of Member States' authorities.	
312	EU Commission	Draft final report	6	A further result of the contractor's approach is that the proposal does not at this stage have the precision and content expected by the ToR in order to be immediately introduced in harmonized standards. The contractor therefore considers necessary to verify the robustness of the proposed significant changes to the test method which was not foreseen by the contract specifications for the round robin phase.	Since modifications are necessary and that certain details, such as environmental conditions, must be prescribed in detail there is still scientific work that must be done, i.e. the acceptable level of wind speed must be defined even if the test will be carried out indoors. Other details that must be verified is how high up the rig must be placed in order to avoid that the heat from the combustion chamber affects burning droplets/debris. At the meeting 8/12/2017 a distance of 2 m was suggested, but this needs to be verified and optimized
313	EU Commission	Draft final report	7.1	The proposed Technical Terms of Reference for the round robin programme (ant the cost) would need to be amended to take into account changes requested in point 1 above. This should not pose particular problems to the contractor as the details for the test methods are well known.	It is difficult right now to propose anything on the further studies and round robin since there are two different options. It must be decided which option to continue working on before the program can be established.
314	EU Commission	Draft final report	7.2	The round robin programme as it has been proposed is not a round robin, but rather a research exercise to develop an unfinished test method. A number of details for the intended test have not been determined.	Agree. The proposed work needed in the second phase can be improved. It is also stated in Task 4 that we should propose additional technical work in order to ensure satisfaction of regulatory needs. The round robin shall only be carried out when the theoretical work and the pre-normative research has reach such state that we are confident that the method is good enough to pass a round robin successfully. It is difficult to go into any details on the next phase of the project (further studies

					and round robin) before we know which methodology to proceed with.
315	EU Commission	Draft final report	7.2	The proposed Technical Terms of Reference for the round robin programme (ant the cost) would need to be amended to take into account changes requested in point 1 above. This should not pose particular problems to the contractor as the details for the test methods are well known.	Agree. Although, it is difficult to go into any details on the next phase of the project (further studies and round robin) before we know which methodology to proceed with.
316	Danish Transport, Construction and Housing Authority	Draft final report	7.2	Regarding round robin (task 3) We support an experimental round robin performed on an inert facade to ensure repeatability and reproducibility of the test setup. However, a more detailed description of the assessments that the round robin will address would be helpful. The suggestion of a theoretical round robin also seems to be a good idea. It is not clear how an experimental round robin on one additional facade, which is expected to fail, will be sufficient to ensure repeatability and reproducibility of test results of a larger range of possible designs of facade systems. Different facade systems may have different failure modes. How is this assessed by one setup?	Agree. Although, it is difficult to go into any details on the next phase of the project (further studies and round robin) before we know which methodology to proceed with.
317	EAE	Draft final report	7.2	The proposed round is not a Round Robin, as it is intended to use it as a research exercise of a not finalized test method. A number of details have not been determined yet. This is not acceptable. A Round Robin is normally done to prove repeatability and reproducibility of a finally detailed and existing test method.	Agree. Although, it is difficult to go into any details on the next phase of the project (further studies and round robin) before we know which methodology to proceed with.

318	DIBt	Draft final report	7.2	Calibration tests on the naked test rig with the two proposed fire sources and also with alternative fire sources (e. g. gas burner – cf. statement no. 83 of the consortium on page 99 of annex F of the draft report) should be part of the round robin investigations to receive more data on the heat exposures (temperatures, flame heights, heat flux etc.) and more information on repeatability and reproducibility. Furthermore the influence of various exhaust systems should be investigated within these tests. Please add such calibration tests to the tasks of the round robin investigations	Agree. Although, it is difficult to go into any details on the next phase of the project (further studies and round robin) before we know which methodology to proceed with.
319	FINLAND esko.k.mik kola	Draft final report	7.2	Fire exposure in the test: Heat fluxes on the façade surface (at least on two heights) should be measured o This is important in the planned Round Robin to define how reproducible the initial test conditions are	Agree. Although, it is difficult to go into any details on the next phase of the project (further studies and round robin) before we know which methodology to proceed with. To decide whether through heat flux gauges or/and through plate thermometers. But probably only for exercise with inert facade
320	EUMEPS	Draft final report	7.2	j. The report describes the next phase as a Round Robin phase. In fact the first two stages as described are closer to a test development process, where the third phase really is a Round Robin. k. After finalisation of phase 2, after assessing and comparing the test results, regulators at Member State level have to be asked, if the results and the proposed method and classification system meet their national safety requirements, without a need for additional national	Agree. Although, it is difficult to go into any details on the next phase of the project (further studies and round robin) before we know which methodology to proceed with. k. Agreed. Keep in mind that regulator could compare and check the safety level only if façade systems already tested nationally are retested with the European method

				requirements, and if and how historical data can be used.	
321	Polish Ministry	Draft final report	7.2.5	Analyzing the report (7.2.5, table 12, task 2), the possibility of proceeding façade tests outdoors is not excluded. In opinion of our experts only the examination of the facades made in controlled, laboratory conditions will ensure the required repeatability and reproducibility of the results due to environmental conditions.	The idea of the consortium was to wait for RR testing in order to collect data and compare outside testing with inside testing before concluding.
322	EU Commissio n	Draft final report	10	Smouldering is currently one of the criteria in the German method and needs to be also included in the European assessment approach (for the medium scale test only). However the assessment time would need to be limited to 6 hours (as foreseen also in EN 16733).	Assessment of smouldering can be incorporated as an option, but also this would increase the number of classes in the classification.
323	EU Commissio n	Draft final report	10	Smoke production rate has been indicated by some of AGF participants as relevant for the test method and should be addressed as an essential performance characteristic (maybe by reference to the existing reaction to fire classification of the components of the façade).	Smoke is treated by the Euroclass system, and the contractors cannot see how to introduce smoke measurements in the proposal since there is no information on what to examine and which criterion to be used for the assessment. Furthermore there are no Member States that require smoke measurements when using the medium or large scale tests. There are requirements but they are covered through the already existing EN 13501-1 classification. If the Euroclass is enough, the problem is than already solved. The regulators can thus require a specific Euroclass and if needed the appropriate façade class.
324	FINLAN esko.k.mik kola	Draft final report	10	Fire exposure and criteria - Only one test method, the large fire exposure method is strongly preferred with following comments and conditions: o Fire	In one hand it is requested to keep only large fire exposure and in the other hand to modulate the classification in order to

				exposure to the façade is the same from a flashover room fire whether the building is low, medium or high rise o Fire requirements for facades in low rise building are not as demanding as for higher rise buildings o Not only pass/fail criteria at one hour, because this kind of criteria can be valid only for the high fire performance level o Criteria shall be of more continuous type (= criteria fulfilled until certain times, e.g. 15 min, 30 min, 45 min, 60 min as in fire resistance classification) so that the different performance levels can be chosen to fit national requirement levels - Criteria proposals (temperature rise limits, criteria for falling parts, times until which criteria are met) shall be made only after the planned Round Robin exercise - Continuous smouldering combustion will be declared in DoP's. This declared property should also be applicable to façade products without measuring it in large scale façade test. Similarly, smoke production is determined using the SBI method instead of measuring it in large scale facade test.	grade and adapt it to different cases of building heights. Keeping the medium fire exposure is helpful for the grading and will anyway depend on the choice of Member States. These criteria are until now proposals of the consortium based on either criteria existing in the national test methods or requirements coming from national regulations. The criteria coming from test methods can be adapted from RR results Due to the lack of unanimous opinion by Member States regarding the way (either through SBI or directly within the façade test) to assess the smouldering, such measurement will be proposed as an option in the façade test method
325	EAE	Draft final report	10.5 Future work	Before round robin starts Different types of façade systems need to be tested Borderline systems are needed to verify pass fail criteria (worst case) Reference sample should be defined Calibration tests are necessary.	Agree. Although, it is difficult to go into any details on the next phase of the project (further studies and round robin) before we know which methodology to proceed with.

				Test method has to be detailed	
326	CZ	Draft final report	11 & final report § 10.2.2	There is a discrepancy between the proposal for falling parts in chapter 10.2.2 and the official proposal in the Annex H, chapter 11. The chapter 10.2.2 states that the maximum weight is 5 kg and the maximum area is 0,4 m2. Contrary to that the Annex H, chapter 11 states that the maximum area is 0,2 m2. Unify the proposal and the official proposal in the Annex H. We advise assessing the maximum weight of the falling parts/droplets. Parts smaller than 5 kg can injure or kill a person.	Corrected
327	EU Commission	Draft final report	Annex H 6.3	The proposal does not refer to the possibility to evaluate devices designed to stop fire spread between levels. This matter should be examined under the current contract.	It is clearly stated that the test specimen shall be built as in practice, chapter 6.3 of Annex E and G. If fire stops shall be used, they must be present in the test specimen at the proper locations, e.g. at the lintel of the combustion chamber and at the lower edge of the secondary opening. It is possible to give more examples on details to be included such as fire stops.
328	EU Commission	Draft final report	Annex H	12. The solution described in point 1 above must also be included in details in the proposed assessment method (Appendix H of the draft Final Report).	Two options are now presented, one on the methodology proposed by the consortium, and one option based on the current BS and DIN methods.
329	EU Commission	Draft final report	Annex H 4.4	16. The combustion chamber position could interfere in the assessment of the burning particles and/or droplets because the fire could ignite debris falling from the façade. Some experts suggest solving this issue by lifting the test specimen from the ground level. The combustion chamber could be	The intention is to determine how to assess burning droplets/particles during the next stage. This will firstly be done by using CFD calculations to see how much radiation shield is needed, and how this can be accomplished (how high up the combustion chamber must be moved, or if other types of shield can be

				the same for both tests including dimensions and forced ventilation.	used). Regarding the size of the combustion chamber a change of the dimensions and ventilation dramatically would change the heat exposure to the test specimen, and thus the use of historical data can be affected.
330	EU Commission	Draft final report	Annex H 5	13. As several participants in the AGF meeting of 8/12/2017 commented to carry the test outside would be very problematic due to existing legal safety requirements for outdoor fires and the unavoidable serious problems in repeatability and the reproducibility. Tests would therefore need to be undertaken indoors.	It is necessary to scientifically define the tolerances of the environmental conditions in order to get good enough repeatability and reproducibility. Since this still is a white spot on the map we have been quite liberal in the writing. It most probable will be required to make the tests indoors, but even so it is important to define the conditions to be kept. Since large amounts of smoke is produced during a test, ventilation is required (if the test hall not is extremely large) which introduces draughts and winds around the test set-up.
331	Europ Alu 2	Draft final report	Annex H	All comments from European Aluminium are made on Appendix H – Assessment of fire performance of facades Green highlighted comments relate, either partly or fully, to European Aluminium's same comment. Independently from the development of the test method, for several external cladding systems which can be used the test method is going beyond the principles of the CPR. It is a valuable method that European Aluminium fully supports technically but should not be considered in the future as 'essential characteristic' for some harmonised technical specifications. Justifications to this remark can be found underneath and decision from the side of	Noted

				the European Commission should be taken after examining all these areas as a whole.	
332	Swedish National Board of Housing, Building and Planning	Draft final report	Annex H	The opinion of the Swedish experts is that the proposal can be supported in general and that the proposal has improved in many important aspects since the draft report.	Noted
333	Eurima	Draft final report	Annex H	Regarding the ongoing assessment of tire performance of façades , Eurima acknowledges that the proposed document and method were improved compared to previous versions, especially on continuous glowing combustion and the use of historical data	Noted
334	Eurima	Draft final report	Annex H	The study is based on present methods - not real fire scenarios. Eurima still holds the view that this method should be an opportunity to introduce a high-quality test method that will reflect the real safety risks related to façades. We therefore recommend to be in line with the principles outlined in the Guidance Paper G which refers to façades and to define a reference scenario.	Noted The present work is based on the ITT from EC, which specified that the work shall be based on the present BS and DIN methods.
335	Eurima 2	Draft final report	Annex H	We would like to remind the Commission and contractors that, defining a reference scenario is important to be able to define the test criteria. We would like to recommend the contractors to be in line with the principles outlined in the Guidance Paper G which refers to façades;	Noted The present work is based on the ITT from EC, which specified that the work shall be based on the present BS and DIN methods.
336	Eurima 2	Draft final report	Annex H	Following our letter of 7.12.2017 and after the Advisory Group meeting of last Friday 8.12.2017, Eurima would like to make some additional comments regarding the	Noted

				ongoing assessment of tire performance of façades. We would like to thank the Commission for its efforts towards developing this common approach to assess the tire performance of façades and we are of the opinion that all regulators should try to find compromises within this European approach for the common interest.	
337	Danish Transport, Construction and Housing Authority	Draft final report	Annex H	It seems as though the two proposed test methods contain a number of similarities between to two test rigs. It should be considered to only have one test rig, where the layout of the combustion chamber could be altered depending on the chosen fire exposure. This could make it more feasible for the fire laboratories to perform fire tests for both fire exposures, whereas the proposed two test rigs may limit some laboratories from performing both tests.	This is now described more clearly in the alternative methodology (Annex G). The only difference between the medium fire exposure and large fire exposure test rig is the combustion chamber. It is thus possible to have one test rig where both fire exposures can be assessed.
338	CZ	Draft final report	Annex H	In case of not accepting the intermediate-scale test method according to ISO 13785-1, we do not agree with deleting the medium fire exposure test method. Accepting only one test method would increase the requirements out of proportion and almost all the facade systems and test results would be obsolete. The test method according to BS 8414-1 is used for application to high rise buildings (over 18 m) and a test method according to DIN 4102-20 is used for application on buildings with height in the range from 7 to 22 m. The medium fire exposure test is sufficient for building with fire height up to 22,5 m.	Noted

				Keep the medium fire exposure test method.	
339	FINLAND esko.k.mik kola	Draft final report	Annex H	Ventilated facades – details for testing shall be defined (e.g. depth of the void, cavity barriers/where to install, etc.)	Do not agree. It must be the client that defines the system to be tested, i.e. if fire barriers shall be included or not, the position of these, and the design of the fire barriers. It has been more detailed in the assessment method.
340	CPE	Draft final report	Annex H	Regulatory use of the results of this test method are unclear. Harmonisation is welcomed but due to the subsidiarity principle the assessment is only valid to fulfil National regulations or in the case the system is sold as a kit within a European market approach (CPR). These points should be clarified in the report and considered in any action of the European Commission.	Noted This is outside the scope of the present project.
341	CPE	Draft final report	Annex H	The round robin proposal is too limited to be representative due to the wide variety of systems covered by the test method. It should be based on a final version of the test where the impact of the changes in the new method is well understood and documented. Construction Products Europe's experts did not reach consensus on the need to have a European approach to the use of historical data. Some of them accept this approach while others consider it is a way to hide barriers to trade behind unjustified scientific reasons.	Noted Since the next step depends on the choices made outside the consortium, and different options are available, it is at this stage not possible to suggest the work needed in the next step.
342	CPE	Draft final report	Annex H	Smoke production rate is relevant information for the test method and should be addressed in future developments.	Noted Smoke can be addressed through the Euroclass of the used materials, EN

					13501-1. This has been further explained in the report.
343	CPE	Draft final report	Annex H	The removal of the medium size test from the method is a question for regulators and not manufacturers and should be supported and justified by evidence	Noted
344	Europ Alu 2	Draft final report	Annex H	The title is misleading as it is quite common for the reader of a technical specification to consider that 'façade' can also cover 'curtain wallings'. As correctly mentioned in the scope, 'curtain wallings' are not covered by the scope because they have their own assessment methods. Even in clause 3 of the proposal the definition of 'façade' has not been properly defined by the consultants because it is used so widely that can possibly produce confusion to the market. The best way forward is to use the wording that has wisely been defined in Clause 3 for 'external cladding systems' and as a result name the project: Assessment of fire performance of external cladding systems.	Noted The aim is that the method should cover much more than external cladding systems, which is prescribed in the ITT. It is clearly written that curtain walling is outside the scope of the presented methodology.
345	EU Commission 2	Draft final report	Annex H 0.1	The large scale test would also need to contain the verification of continuous glowing combustion (the application of EN 16733 for the products components is not accepted by Germany who is the only Member State which has requirements for this aspect). Germany agrees that the time necessary need not go beyond 6 hours.	Smouldering is only assessed with the DIN method, and not with the BS method, and there is no demand for smouldering from the MS using the large fire exposure. Furthermore, it is not advisable to decrease the time for measurements of smouldering without any scientific background.
346	EAE	Draft final report	Annex H 0.1	DIN 4102-20 requires assessment of smouldering. Material testing according to EN 16733 is not sufficient. The combination	A solution (Proposed method) is presented where the original DIN method is applied. The methodology for

				of different products and system buildup may lead to smouldering even if the material alone passes EN 16733. Needs to be introduced in case there are national requirements	measurements of smouldering used in the current DIN method can easily be adopted also for the medium fire exposure test in Alternative method.
347	Eurima	Draft final report	Annex H 0.1	We appreciate that EN 16733 is recommended to be used to evaluate the propensity for continuous smouldering combustion, as it will be part of DoPs of the applicable façade products. There is no reason for an additional evaluation of this characteristic in the test evaluation or in the proposed classification.	Noted See previous answer where such assessment is required.
348	Eurima 2	Draft final report	Annex H 0.1	We appreciate that EN 16733 is recommended to be used to evaluate the propensity for continuous smouldering combustion, as it will be part of the DoPs of the applicable façade products. As we agreed to use results of the SBI for smoke, smouldering should also be considered using a smaller test when the latter is enough representative. There is no reason for an additional evaluation of this characteristic in the test evaluation or in the proposed classification;	Noted See previous answer where such assessment is required.
349	EU Commissio n 2	Draft final report	Annex H 0.2	Regarding smoke production it is clear that the study contractor is expected to verify if and how Member States currently verify this performance aspect and make the necessary proposal. If thois aspect is today verified by applying the Euro-classification tests to the façade components then this should also suffice for the European approach.	It is proposed that the Euroclass declaration is enough to cover the smoke production declaration. This has been clarified in the report.
350	DIBt	Draft final report	Annex H 0.6	The surface of the test specimens should not be damaged by drilling holes for mounting of thermocouples. The German test experiences acc. to DIN 4102-20	Both ways of fixing thermocouples will be described in the test method allowing to assess/compare them at the RR step.

				clearly show that damages of the surface of the tested facades (e. g. renderings of ETICS) can have a very significant effect on fire performance of façade systems. Please change the proposal accordingly. Thermocouples in front of the surface of the façade shall be fixed with appropriate fixing dives without damaging the specimen surface. Thermocouples suspended from the ceiling in front of the specimen (e. g. fixed on steel wire ropes) have proven to be a simple and practical method which marginally affects the test results.	
351	DIBt	Draft final report	Annex H 0.7	Due to the German building requirements we absolutely disagree to the conclusion of the consortium that smouldering combustion shall not be part of the fire performance assessment of facades. Glowing and smouldering combustion processes form an integral part of fire spread within a façade and they are therefore relevant for the fire performance assessment with regard to the legal fire safety requirements in Germany. The advice to the existing test method of EN 16733 doesn't give a sufficient reason to rule out smouldering from the faced fire performance assessment, because EN 16733 describes a small-scale test for single products with restricted dimensions of the test specimens and under a much lower fire exposure than in the façade tests. Even in the external fire performance tests acc. to TS 1187 (approach 1) of roof systems the characteristic Glowing / Smouldering is part of the assessment. We therefore strongly request to consider again smouldering combustion as part of the fire performance assessment of facades	A solution (Proposed method) is presented where the original DIN method is applied. The methodology for measurements of smouldering used in the current DIN method can easily be adopted also for the medium fire exposure test in Alternative method.

				– at least within tests with the medium fire exposure level. However, the duration of the monitoring time needed can be discussed (e. g. 6 hours as maximum – analogously to EN 16733).	
352	EU commission 2	Draft final report	Annex H 0.9	Regarding the large scale method: 1. Industry and the EC services consider necessary for manufacturers to be able to rely on the historic data as much as possible. Therefore the BS 8414 test would need to be maintained as much as possible. The test should be complemented with additional aspects to allow the verification of the additional regulated performance aspects. Please, note that the manufacturer (taking into account the provisions in the Member States he intends his product to be used) would chose which additional aspects should be verified in the test. If, for example, he only targets markets which regulate on the basis of the BS 8414 then the test method without any additional options should be enough. If he targets markets of Member States which regulate on falling parts but not on continuous glowing combustion, then the test would need also to verify the falling parts and does not need to go into the verification of the continuous glowing combustion performance. B. Regarding the medium scale method: The method should be kept as much as possible close to DIN 4102-20 to allow manufacturers to use historic data. This should be rather an easy case because the DIN method features are a common denominator for the 3 countries which	Such approach was not considered initially by the consortium and will be proposed as alternative approach in the next version of draft final report. A methodology (Proposed method) has been included in the report where the DIN and BS methods are kept in their original shape, and additional optional measurements/assessment have been included, as well as a draft classification system.

				regulate today on the basis of the medium test.	
353	Europ Alu	Draft final report	Annex H 0.9	This aspect is a bit questionable. It really depends how the European Commission will proceed alter receiving this proposaL: Option A: Offer this text to CEN for consideration by CEN/TC 127 Option B: Offer this text to EOTA for onsideration and development of a test method Option C: Issue with a legislative action (like in other instances) a text using fast track procedures I am pretty sure that EC will choose option C for several reasons, with first and foremost to act fast after the accident in Grenfell. If this will happen, we need to address already the historical data in the document. Several industries, in this case I am not just having in mind just aluminium, have done significant investments on this subject. As a result, it would be good if you can correlate the different National tests that are already available with the 4 proposed classifications that you have efficiently concluded. Then automatically you know the issued test report under which scenario falls (LS1 to LS 4).	Noted The consortium cannot speak for EU Commission Without any test performed with the new European test method, especially on façade systems already tested at national level, it is very difficult almost impossible to correlate. Such action can only be performed after the RR step, provided such tests are included at the RR step
354	Europ Alu 2	Draft final report	Annex H 0.9	A pragmatic solution in regards to the usage of historical data should be provided with the finalization of the project and not at later stage on national level;	Task 4 in the main body of the report has been revised to address this comment.
355	Europ Alu	Draft final report	Annex H 0.10	Regarding "There have been many comments on the previously proposed classification system. It is too many classes and it is complicated"	Noted

				Just to thank you for recognising it and taking good actions with the new proposal that is realistic	
356	IBS	Draft final report	Annex H 1	About fire exposures: See comment above; why not trying to harmonize into ONE testing scenario ? Manufactureres of countries basicly accepting medium scale have to test large scale when they want to sell their product into whole internal market; so TWO testing scenarios and different national requirements does not meet CPR-basics ”reduce the burden of manufacuteres”	The project was defined by EC including two exposures. The aim here is, if possible, that if you perform the large exposure test, it would also cover the medium exposure test.
357	Europ Alu 2	Draft final report	Annex H 1 First paragraph – last sentence	Full support on the content of the given sentence in regards to curtain walling. Let’s not forget that during 8 December’s meeting nobody from the meeting of Ad hoc Group on Fire opposed to what European Aluminium expressed. Different position within the scope is required (end of scope) and improvement in the wording. Following the principles of technical specification rules, the exclusions are placed on the bottom of the scope, so please move it in the bottom as you have more valuable details for the test to give to the reader for the method as such. Rephrase of the sentence is required, using as basis the following wording: Curtain walling kits are not covered by this assessment method as dedicated methods for this product family i.e. EN 1363-3 and EN 1363-4 are available.	The exclusion is only here to explain that the façade test does not replace the fire resistance test in EN 1364-3/4. But the fire spread risk shall be assessed which is not the case of such EN test, for instance for a Timber curtain walling
358	Europ Alu 2	Draft final report	Annex H 1	The ‘products and systems’ described in the bullet point is only reflecting examples of	Noted

			Second paragraph	the external cladding materials that are used. The message which is given to the reader is that the sponsor of this test has to be the producer of the external cladding material which is not correct. It is well known that the producer of the external cladding material is only making available on the market materials produced from his production line and not others that are also required to be applied on the building envelope. From the moment you insist to keep examples, you need to describe different types of insulation, sub framing solutions, weather membranes etc. As discussed during the meeting, manufacturers placing ETICS can only have such requirement for their products. For other types of claddings applied on buildings in a non-series manner, where the construction is more complicated and expensive the manufacturer should not declare a value under the principles of the CPR for a solution that is type tested and has no relevance to what was applied in reality. Definitely the test method should be used on other purposes but there is no other harmonised technical specification of relevance.	This seems to be a question addressed to the EU Commission
359	Europ Alu 2	Draft final report	Annex H 1 Last 4 paragraphs (3	This description is correct but does not fit to the scope of a technical specification. Move this wording in between clauses 0 and 0.1 as it is providing background information of the project intention.	Noted, no action taken.

			paragraphs + Note)		
360	CPE	Draft final report	Annex H 1	There is no information about the applicability of the method to products and systems. The inclusion of an indicative list and the reference to the non-exclusion of other products and systems is generic. It is not clear if the application of the method to other products or systems will deliver right results. The list of systems/products should be deleted from the scope. The possibility to use the test method depends firstly on the definition of façade (see next point). The list could be developed only when the definition of façade is clear and evidence that the test method is applicable exists. The exclusion of curtain walling from the scope should be explicit.	The present work is to propose a testing and assessment methodology, which is as broad as possible. The CE-marking will not be based on this methodology but on eventual future harmonised product standards or EOTA documents, where the scope will be defined.
361	EUMEPS	Draft final report	Annex H 1	The scope of the test should be limited to the most applied types of facades. Full validation to all possible façade type variations would not be possible within the budgetary indications provided by the authors. Maybe at a later stage the scope of the methods developed could be expanded to further areas.	The method shall be application for all façade systems. For the variations, either historical data or new test shall be used until a direct field and/or extended field of application is available
362	EAE	Draft final report	Annex H 1	b. The scope of the test should be limited to facade claddings.	The method shall be application for all façade systems. For the variations, either historical data or new test shall be used until a direct field and/or extended field of application is available
363	Eurima	Draft final report	Annex H 1	The main idea of testing fire-spread through a façade should be to prevent the fire- spread from one fire-compartment to another via the façade. We question why	Some more clarification in the document, chapter 1.

				this is excluded from the method: "This method cannot assess the risk of tire re-entry into the compartments above the combustion chamber. "	
364	DIBt	Draft final report	Annex H 3	From German point of view it is not sufficient to express the size if burned areas and charred areas only in square metres. The length (height above the combustion chamber) and width of these areas should also be given, because these values give more information with regard to fire spread than the size of the areas in question alone. For "Smouldering" the definition as used in EN 16733 should be taken over, because that definition also covers "Glowing" (with visible light).	Fire spread is defined in terms of the temperature criteria on the different levels. In revised document damaged area should be described in terms of size, location and type. This is however only to be noted and not a part of the assessment.
365	Europ Alu 2	Draft final report	Annex H 3 Facade	What is the advantage to call it façade rather than 'tested system' or even better 'tested specimen'? As already mentioned, the term 'façade' is already misleading in the title. Let's not forget that we are developing a test method, and that has to be distinguished from the applied product on the building. Remove the definition of 'façade' completely and use one of the recommended proposals in the text.	Façade is defined in chap 3 as the "tested system". Albeit the lack of definition, the term is widely used.
366	Europ Alu 2	Draft final report	Annex H 3 Level 1 - 4	We see no advantage to define heights which are different to the ones that are given in BS 8414 and DIN 4102-20. The idea of the project call from the EC was to remain as close as possible to the two methods. That will secure that in the future industry will have no reason to double test the same test specimen for European and	In the proposed method the reason behind using the same (and changed) rig and set-up is to aim for maximum use of the test results, and also from an economic point, the labs only have to have one rig for façade tests.

				Member State level as mentioned during 8th December's meeting. Amend the levels by setting them in the same levels as given in the two tests that are considered basis for the development of this technical specification. In case comment is rejected, project consultants have to provide clear justifications against such an issue.	
367	Europ Alu 2	Draft final report	Annex H 3 Non-ventilated systems	This definition is not correct. In UK it is common practice to produce ventilated claddings with sealed joints. A characteristic example is the building of BSI in London. https://www.google.gr/maps/@51.4923775,-0.2753316,3a,22.2y,169.7h,88.68t/data=!3m6!1e1!3m4!1shGSd51GTU-hp_Yc4wzT1xw!2e0!7i13312!8i6656?hl=en Make necessary correction to the definition.	The word is removed
368	Europ Alu 2	Draft final report	Annex H 3 Entire	The technical specification does not function as 'vocabulary for tests of external cladding systems. It is important to examine which terms are really used in the technical specification and remove the ones which are not given anywhere. Example 1: while searching (CTRL + F) the term 'non-ventilated' (see previous remark), we see that it appears only once in the entire document (in this table). Example 2: Same applies for 'ventilated systems', which cover both ventilated and non-ventilated claddings.	Corrected

				Then we can reasonably question the added value to collect terms that are not used on the technical specification. Reassess all terms, definitions, symbols and designations and Remove the ones which are not of use in the document.	
369	CPE	Draft final report	Annex H 3	A clear definition of façade is missing. The title of the test method refers to an unclear concept. This fact together with the open scope creates uncertainty on the potential application of the test. The definition of cavity barrier is missing.	We have defined façade as the system to be tested since no common definition occurs.
370	EAE	Draft final report	Annex H 3 Damaged area	Definition is not detailed sufficiently Describe in detail what is meant my "damaged area"	Damaged area is no longer used as a term.
371	EAE	Draft final report	Annex H 3 Charred area	Charred but not combusted is not sufficiently defined Define "charred area" in detail	We have a new definition for charred material.
372	EAE	Draft final report	Annex H 3 Falling parts/droplet s	Should not be covered in the same definition. As different views are known, observations should be reported in detail in the test report without a classification. Define "charred area" in detail • Separate both topics • detailed information about observations to be given in the test report	Falling parts are redefined and the corresponding chapters rewritten.
373	EAE	Draft final report	Annex H 3 Fire barrier	Resists is the wrong word Replace by inhibit	Corrected
374	EAE	Draft final report	Annex H 3	Wrong definition Replace by fire spread which	This has been changed. Flame spread is defined according to the temperature

			Flame spread	incudes - Temperature - Damage - Visible flames	criterion. Damages and visible flames are discussed without.
375	EAE	Draft final report	Annex H 3	• Further definitions have to be included • Definitions should be used consistently and comply with the terms and definitions of the CPR (as far as possible)	Changes have been done.
376	CZ	Draft final report	Annex H 4.1 1st §	The size of test specimens for both proposed test methods corresponds to a large-scale fire test according to EN ISO 13943. An intermediate-scale test is missing in this proposal and according to practical experiences, we consider it as necessary for construction detail testing. We still believe that the best solution would be to work together with ISO in correlation with Vienna agreement on improving and updating ISO 13785-1 and ISO 13785-2.	This is outside the scope of the present project. The aim here is to propose an assessment methodology for façade systems, not a screening test nor a method for component testing (although it can be done with the present proposals).
377	Europ Alu	Draft final report	Annex H 4.1 4th paragraph	Usage of term 'glazed elements' That is called curtain walling (please read the definition of Curtain Walling in EN 13830) and for curtain walls we have a descript on that mentions that are out of the scope because there are particular provisions developed on European level and applicable for more than 10 years. In case there is a curtain walling not tested according to the relevant European Norms, there should be recommended to ask from those manufacturers test/assess the performance of those products according to those EN 1363-3 or -4 and not according to a technical specification that has not been developed for those products.	It is not necessary that a glazed element always is a part of a curtain wall, and therefore it is included.

				Definition of Curtain Walling in EN 13830:2015: part of the building envelope made of a framework usually consisting of horizontal and vertical profiles, connected together and anchored to the supporting structure of the building, and containing fixed and/or openable infills, which provides ail the required functions of an internal or external wall or part thereof, but does not contribute to the load bearing or the stability of the structure of the building. Curtain walling is designed as a self-supporting construction which transmits dead-loads, imposed loads, environmental loads (wind, snow,etc) and seismic load to the main building structure. I am underlining the 'framework' because with this definition 'point fixed glazing' is not covered. If you are having something like this in mind you need to be more precise.	
378	Europ Alu 2	Draft final report	Annex H 4.1 4th paragraph	Usage of term ‘glazed elements’ That is frequently considered as curtain walling (please read the definition of Curtain Walling in EN 13830) and for curtain walls we have a description in the scope that highlights that are out of the scope because there are particular provisions developed on European level and applicable for more than 10 years. In case there is a curtain walling not tested according to the relevant European Norms, there should be recommended to ask from those manufacturers test/assess the performance of those products according to those EN 1363-3 or -4 and not according to	See previous comment

				a technical specification that has not been developed particularly for those products. Note: The argumentation on this aspect is completely in line with the argumentation used from project consultants during the 8th December in regards to smouldering 'from the moment that a particular test method is available, we should not reproduce similar method with this document on smouldering' Remove reference to 'glazed elements'.	
379	DIBt	Draft final report	Annex H 4.1	Why the test rig for the medium fire exposure scenario must have a height of 6 m above lintel of the combustion chamber? The fire load is 8-times lower than that for the large fire exposure scenario, but the difference in height is just 1 m. For the medium fire exposure scenario at least 4.5 m height of the test rig should be enough.	The reason is coming from the initial intention to develop only one single rig to perform both large and medium exposure tests. In the Proposed method the dimension of test rigs will be kept as they are.
380	CPE	Draft final report	Annex H 4.1	The reference to glazed elements could be misleading as they are mainly used in curtain walling (out of the scope).	It is not necessary that a glazed element always is a part of a curtain wall, and therefore it is included.
381	CPE	Draft final report	Annex H 4.1	For non-loadbearing external wall systems, the structural frame could be replaced by self-supporting masonry construction. In case of application to the masonry infill it should be sealed with a mineral base coat to guarantee air/smoke tightness of the joints.	It has been changed in the text that the masonry needs to be air tight.
382	CPE	Draft final report	Annex H 4.1	The description of the main face and wing should include that they are mounted at 90º.	Included in the report
383	CPE	Draft final report	Annex H 4.1	The test does not explicitly include the possibility to evaluate devices designed to stop fire spread between levels.	This is described in chapter 6.2.

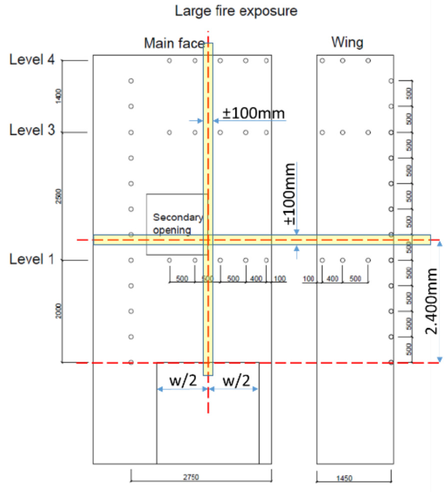
384	EAE	Draft final report	Annex H 4.1	The increased height of the test rig for the medium scale fire load test (from 5,5 m acc. to DIN 4102-20 to 7,0 m acc. to Appendix H) requires assessments, whether this amendment leads to the same results as known from a 5,5 m medium scale test. After assessing and comparing the test results achieved using 5,5 m and 7,0 m rigs, regulators at Member State level have to be asked, if the results meet their national safety requirements, and if and how historical data may be used in this case.	The reason is coming from the initial intention to develop only one single rig to perform both large and medium exposure tests. Furthermore, an increase of the height either does not impact the result or potentially makes the test more conservative. In the Proposed method the dimension of test rigs will be kept as they are.
385	EAE	Draft final report	Annex H 4.1	There is no experience with testing the medium fire at the same rig as the large-scale fire. As temperature, streaming and radiating conditions are completely different from well-known tests, a scientific research has to be started, if this is the aim.	See previous answer
386	EAE	Draft final report	Annex H 4.1	Is the DIN 4102-20 test performed on the large wall acceptable? Prior to Round Robin a test should be performed, evaluating the effects of such modification in order to ensure the use of historical data.	See previous answer
387	EU commission 2	Draft final report	Annex H 4.2	The large test would however need (at least at this stage of development) to include 2 options to be representative of the current regulatory views: without openings as used in the BS 8414 test, and with openings placed in a vertical line above the fire chamber (because the horizontal displacement of the openings is	Such approach was not considered initially by the consortium and will be proposed in the final report. Two options are now included, the consortium proposal and one option where the BS and DIN methods are directly used.

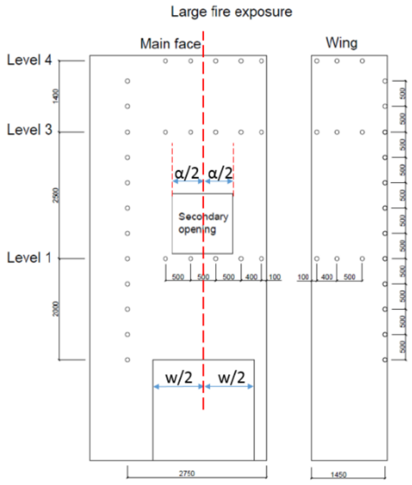
				not accepted by Member States which apply a test rig with openings).	
388	EU commission 2	Draft final report	Annex H 4.2	Regarding details around windows the test is expected to test the facades as intended to be built by the product manufacturer. So the test would need to test the real façade as the manufacturer intends to be in the final form.	Noted, and clarified in the text.
389	CPE	Draft final report	Annex H 4.2	It is not clear if the secondary opening is optional. The two possibilities are: • The secondary opening is required, then it should be explained in the method; • The secondary opening is optional, then the classification should be amended to reflect this construction. The possibility to use window frames introduces uncertainty in the measurement. If the possibility to install a window frame is introduced, it should be standardised and it should not contribute to fire propagation (e.g. choose basic steel frame geometry). Some Construction Products Europe's experts disagree with the position and size of the secondary opening arguing that it is not representative of a real case scenario.	It shall be clearly described in both assessment approaches. Some façade systems are in contact with the window frame. Testing without any frame will not allow to test the representative installation. See annex C. Offset position was lead by the intention to cover both application with and without window opening in only one single test. But due to all recurrent comment on its position it could be possible to correct this position In the Proposed method, both opening (combustion chamber and secondary opening) will be aligned
390	Eurima	Draft final report	Annex H 4.2	As generally there are no buildings without windows, the inclusion of windows in the façade system is justified and the measurement of the heat flux in the window above is also relevant to evaluate. However, the window position should be directly above the combustion chamber so that the flame impingement represents real-life situations. An excentric position is not used in any of the existing test methods	The aim with the proposed method is to cover both the detailing around openings as well as a façade surface without opening. Therefore, the secondary openings have been placed eccentric. This would minimize the amount of testing needed. It is important to remember that this is a test method used for classification of systems, and thus it shall show how the

				and there is no experience with this setup. Installing windows in the insulation layer has become the preferred option, so mounting should be done accordingly in test specimen.	system works when exposed to fire, and not necessarily look like a conventional building.
391	FINLAND esko.k.mikkola	Draft final report	Annex H 4.2	Window opening - details (size of window, location of window, edge details) must be defined in a representative way taking into account 'side effects' of the opening (e.g. the opening may behave as a fire barrier for certain products)	This has been clarified.
392	CZ	Draft final report	Annex H 4.2	The asymmetrical placement of the secondary opening is not suitable for assessing the fire performance. It is not used in any existing method and it is not very common in practice. Modern buildings have bigger windows than 1200 × 1200 mm and the distance between two windows is usually less than 2100 mm. The aim of testing of fire performance of facades should be to stop the fire spread from one fire compartment to the other. Move the secondary opening above the opening of the combustion chamber and to reduce the distance between the opening to 1300 mm.	A change has been made on the location of the secondary opening. It has been moved down, but it is still eccentrically to the combustion chamber. The eccentricity is used in order to get all information needed in one test, i.e. minimize the amount of testing needed. This will be further studied in the next stage of the project.
393	DIBt	Draft final report	Annex H 4.2	The need to consider a secondary opening on the main face should be checked carefully within the round robin test. From German experiences the existent of a secondary opening above the combustion chamber can be a barrier and interrupt fire spread inside or on the surface of the façade. Furthermore it is difficult to laid down appropriate EXAP rules with regard to	The aim with the proposed method is to cover both the detailing around openings as well as a façade surface without opening. Therefore, the secondary openings have been placed eccentric. This would minimize the amount of testing needed. It is important to remember that this is a test method used for classification of systems, and thus it shall show how the

				this opening (e. g. position, size, materials of the frame a. s. o.). Therefore – if possible – the secondary opening should not be mandatory, at least for the medium fire exposure.	system works when exposed to fire, and not necessarily look like a conventional building.
394	EAE	Draft final report	Annex H 4.2	To perform the test with a second window in the test rig might be acceptable, if this remains an option. In case of performing the test with a second opening, comparative tests should assess correlation with Lepir 2 test as performed in France in order to keep the safety level, and to allow for using existing test results in France.	It will be an option acc. to the Proposed method For the correlation, facades solution already tested at national level were proposed in the frame of the RR for such reason.
395	EAE	Draft final report	Annex H 4.2	This is a product test (kit = cladding system) and not a test for the assessment building construction. Window details of the cladding may already be tested above the fire source (e.g. lintel details). One should consider that windows will be open in case of fire (at least after a while), causing different fluid streaming. The described "sample window" does not represent a real window opening. If a second opening will be included, this should be an optional configuration, to comply with requirements of those MS with such requirements. However, comparative tests will be required to show correlation to existing tests.	Such approach was not considered initially by the consortium and will be proposed in the final report. Two options are now included, the alternative proposal and one option where the BS and DIN methods are directly used (proposed method). The aim with the (Alternative method) is to cover both the detailing around openings as well as a façade surface without opening. Therefore, the secondary openings have been placed eccentric. This would minimize the amount of testing needed. It is important to remember that this is a test method used for classification of systems, and thus it shall show how the system works when exposed to fire, and not necessarily look like a conventional building.
396	Europ Alu	Draft final report	Annex H 4.2	That is not acceptable. It must be decided what the intention of this test is:	Such approach was not considered initially by the consortium and will be proposed in the final report.

				Option A: Assess the performance of the External cladding system? The window details should be avoided as there is no end in the solutions that have to be tested (different type of framing members and compositions of glazing). Option B: If you want to assess the performance of the design of a specific building maybe that is OK but need to be addressed properly. As already mentioned on our letter sent to RISE last July, anyway the test method is going far beyond the principles of the CPR as there are so many details that are hidden behind a test configuration that will hardly be used as such in an actual project when a manufacturer is intending to test the system for the general product certification before making available product to the market. Please bear in mind our comment for Annex C over here to find a more sustainable solution	Two options are now included, the consortium proposal and one option where the BS and DIN methods are directly used. The aim with the alternative method is to cover both the detailing around openings as well as a façade surface without opening. Therefore, the secondary openings have been placed eccentric. This would minimize the amount of testing needed. It is important to remember that this is a test method used for classification of systems, and thus it shall show how the system works when exposed to fire, and not necessarily look like a conventional building.
397	Europ Alu 2	Draft final report	Annex H 4.2 entire	It is important to point out that it is not clear whether there is a necessity to include a window (called Secondary opening in Figure 2) in the test specimen as the most critical part on a window is the top part where flames are reaching the above level. With the combustion chamber we already simulate this detail, as a result we question the necessity to introduce a second one at higher levels. Let’s not forget that the test method is intending to assess the performance of the cladding and not those particularities that are producing several restrictions as the	Such approach was not considered initially by the consortium and will be proposed in the final report. Two options are now included, the consortium proposal and one option where the BS and DIN methods are directly used. The aim with the alternative methodis to cover both the detailing around openings as well as a façade surface without opening. Therefore, the secondary openings have been placed eccentric. This would minimize the amount of testing needed.

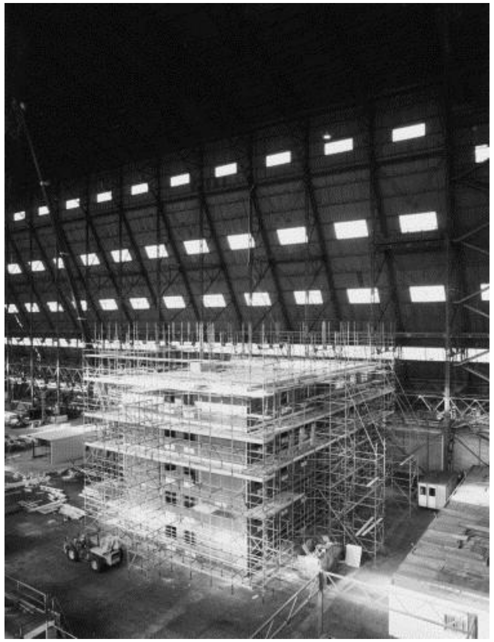
				geometry of the remaining cladding has to be limited to the remaining space. In addition, detail of the 'secondary opening' is functioning as a fire barrier, which means that it is not allowing the flames to reach the top of the cladding and record as high as possible temperatures in the second level of thermocouples. Remove from the proposal the secondary opening  Figure 9. Positions of thermocouples to be used in the large fire exposure test.	It is important to remember that this is a test method used for classification of systems, and thus it shall show how the system works when exposed to fire, and not necessarily look like a conventional building.
398	Europ Alu 2	Draft final report	Annex H 4.2 entire	In case it is decided to retain the window: Our experience says that the flames have the tendency to tilt to the direction of the wing in corner tests; In common practice (majority of buildings) windows in different floors are installed in the same plain (one above the other). As a result, we are of the opinion that the secondary window is not positioned in the	The aim with the proposed method is to cover both the detailing around openings as well as a façade surface without opening. Therefore the secondary openings have been placed eccentric. This would minimize the amount of testing needed. It is important to remember that this is a test method used for classification of systems, and thus it shall show how the

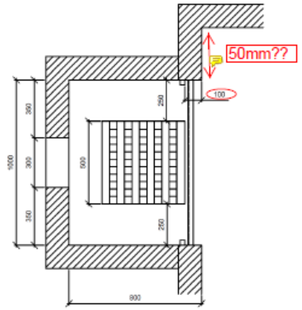
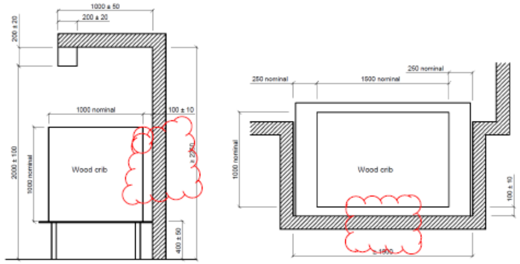
				right place and has to be placed in the centreline above the combustion chamber. Move the window to the right as shown in the picture below. 	system works when exposed to fire, and not necessarily look like a conventional building.
399	Europ Alu 2	Draft final report	Annex H 4.2 1st paragraph, second sentence	In case it is decided to retain the window: That is not correct approach. It must be decided what the intention of this test is: - Option A: Assess the performance of the external cladding system? Then window details should be avoided as there is no end in the solutions that have to be tested (see examples of Annex C of this technical specification). - Option B: If you want to assess the performance of the design of a specific building maybe that could be understood, but need to be addressed properly. As already mentioned on our letter sent to the project leader last July and to the European Commission last November, the	The aim with the proposed method is to cover both the detailing around openings as well as a façade surface without opening. Therefore the secondary openings have been placed eccentric. This would minimize the amount of testing needed. It is important to remember that this is a test method used for classification of systems, and thus it shall show how the system works when exposed to fire, and not necessarily look like a conventional building.

				test method is going far beyond the principles of the CPR as there are so many details that are hidden behind a test configuration that will hardly be used as such in an actual project when a manufacturer is intending to test the system for the general product certification before making available product to the market. Please bear in mind our comment for Annex C over here to find a more sustainable solution. As the intention is to assess the performance of the cladding, it is recommended to define a particular window detailing that could be tested by all manufacturers and that can pass all others. If not, as the consultants respected the strong objection of the audience on the initial classification proposal (more than 40 different alternative combinations) and made this very efficient proposal on clause 14, we invite you consider a similar approach using as basis Annex C and mention when tested which type of window mounting is covering other types of window mounting.	
400	Eumeps	Draft final report	Annex H 4.2	If detailing around the openings are included, then it must be clarified that this does not include the detailing of connections to e.g. windows and doors but only the opening of the façade itself. If detailing of connecting products in all its variation would be included the number of tests would be enormous.	See annex C
401	Europ Alu	Draft final report	Annex H 4.4	This size cannot be produced with some products (e.g. aluminium cassette).We do not see an added value of differentiating	The intention is to keep the BS and DIN methods as they are as far as possible.

			Table 1 Distance of fire load chamber	this dimension between Medium and Large fire exposure.	
402	Europ Alu 2	Draft final report	Annex H 4.4 Table 1 Distance of fire load chamber	On Medium fire exposure it is impossible to produce 50±10mm in width of external cladding product. We see no advantage of differentiating this size in comparison to the Large scale fire test. If the intention of the EC and the test labs is to use the same rig for both large and medium fire exposure that should be fixed in the same size anyway. Please harmonise this value considering the value given for the large fire exposure test 250±10mm.	The intention is to keep the BS and DIN methods as they are as far as possible.
403	Europ Alu 2	Draft final report	Annex H 4.4 Table 1 Height of fire load base above …	First of all we see no advantage to differentiate the height for the two tests (Medium and Large exposure). There are no obvious technical justifications to our point of view to have them different. In addition, we need to repeat that if the intention of the EC and the test labs is to use the same rig for both large and medium fire exposure that should be fixed in the same size anyway; According to the opinion of European Aluminium, the height is directly linked to the assessment of the falling parts (classifications LS 1 and LS 3). There are particular reasons for which we are of the opinion that the distance between the base of the combustion chamber and the ground of the laboratory should be significantly larger (e.g. 2000mm) as this way:	It is not possible to have the same height for the medium and large fire exposure tests since the height of the combustion chambers are different. It is true that some type of screen may be needed between the combustion chamber and the material falling down from the test specimen to avoid ignition due to radiation from the combustion chamber. This needs to be studied in the next phase of the programme. For the uplift. 2 m is probably too much, the test rig would then be 10 m high. CFD calculation could help to determine the smallest needed uplift distance.

				Observation of size as well as of burning particles and/or burning droplets will be difficult; It could be influenced by radiation originating from the combustion chamber that may cause self-ignition, while that will not happen in the unlike event of a fire which occurs on any floor of a building; Harmonise height and as discussed and supported during the 8th December meeting uplift the cladding by a height of e.g. 2.000mm to secure that falling parts will be easily recorded and that they will not be exposed to the severe levels of radiation due to the combustion chamber.	
404	Europ Alu 2	Draft final report	Annex H 4.4 Table 1 Depth of fire load chamber	We do not see an advantage to have this value differentiated between the two test methods. This is the reason why we invite you to fix the same value. If the intention of the EC and the test labs is to use the same rig for both large and medium fire exposure that should be fixed in the same size anyway. Harmonise the depth of the chamber.	This would be a major change of the test method, and it will certainly affect the heat exposure to the test specimen, and historical data would be difficult to use.
405	Europ Alu 2	Draft final report	Annex H 4.4 Table 1 Opening for forced ventilation	To the European Aluminium point of view there is a necessity to introduce in large fire exposure similar descriptions of forced ventilation on the combustion chamber as in the Medium fire exposure scenario. Our experience from BS 8414 series of tests (BRE has 4 chambers within the laboratory) is that the temperature curves are influenced in tests with similar configuration due to the air circulation on the lab.	This would be a major change of the test method, and it will certainly affect the heat exposure to the test specimen.

				If we want to reduce uncertainties, we need to respect the same principles as in the medium fire exposure by adding from the rear ventilation. Otherwise the test laboratory need to be with enormous size like the former hangar of Cardington (picture below) that was used for fire tests, where the air ventilation system will not influence the tests as much as it happens in smaller volumes (Test lab of BRE or RISE). Specify forced ventilation in Large fire exposure scenario with principles similar to the ones of the medium fire exposure one. Fire tests' performance repeatability should be proven with the round robin tests in case no back forced ventilation is not specified. 	

406	Europ Alu 2	Draft final report	Annex H 4.4 Figure 4	As already mentioned in Table 1 the distance from the chamber to the wind on medium fire exposure cannot be 50±10mm. Even in the drawing that has been drafted the distance is significantly larger: Revise it 250±10mm as in the large fire exposure scenario.  ïre exposure with wood crib as fuel.	The intention is to keep the BS and DIN methods as they are as far as possible.
407	Europ Alu 2	Draft final report	Annex H 4.4 Figure 5	As mentioned in Table 1 please add opening in the rear side of the combustion chamber following similar principles to the medium fire exposure scenario: Add opening & forced ventilation in the rear side of the combustion chamber.  Figure 5. Combustion chamber for the large fire exposure.	This would be a major change of the test method, and it will certainly affect the heat exposure to the test specimen.

408	CPE	Draft final report	Annex H 4.4	The distance of fire load chamber opening from internal corner for the medium fire exposure is too short. It is difficult to build a piece of façade of 50 ± 10 mm for all kind of materials. The same distance of the large fire exposure could be used. The combustion chamber position could interfere in the assessment of the burning particles and/or droplets because the fire could ignite debris falling from the façade. Some experts suggest solving this issue by lifting the test specimen from the ground level. Combustion chamber could be the same for both tests including dimensions and forced ventilation. Reasons to keep different combustion chambers should be provided or the same mounting should be used.	This would be a major change of the test method, and it will certainly affect the heat exposure to the test specimen.
409	EAE	Draft final report	Annex H 4.4	Drawings and text regarding the position of wood crib are not congruent. Align text and drawings.	Corrected
410	Danish Transport, Construction and Housing Authority	Draft final report	Annex H 4.5	Regarding fuel type We agree on the proposed use of wood as burning item for the proposed test methods. We also agree on the fact, that it is very important to have focus on the repeatability and reproducibility of the burning item which will be analysed in the coming phase (task 2). This is, of course due to the importance of ensuring repeatability and reproducibility on the thermal exposure of the facade. For that reason it is important to consider how to ensure this prior to conducting the round robin. We have also noticed in the draft for at test standard in appendix H that the wood, which is used for the cribs in the medium and that large fire exposure,	We agree with the comment. A better definition of the fuel source will probably be needed, but at present more studies are needed, and they are planned for the second stage of the project. Presently the aim of this project has been to use the BS and DIN methods as a basis, and make as few adjustments as possible, and still have a method that covers all MS regulations. Therefore no changes have been made on the fuel and combustion chamber.

				differs in density between the two fires. The reason for this is not clear, and should be substantiated.	
411	EUMEPS	Draft final report	Annex H 4.5	The preferred heat source for the test would be a wood crib, identical to the ones used and clearly described in the DIN and the BS test. A lot of practical experience is available with these configurations. Taking into account a gas burner as an alternative would require an intensive, expensive and time consuming supporting scientific program.	We agree with the comment. A better definition of the fuel source will probably be needed, but at present more studies are needed, and they are planned for the second stage of the project. Presently the aim of this project has been to use the BS and DIN methods as a basis, and make as few adjustments as possible, and still have a method that covers all MS regulations. Therefore no changes have been made on the fuel and combustion chamber.
412	CPE	Draft final report	Annex H 4.5	Experts disagree on the repeatability of wood cribs performance. The possibility to use gas burners should be considered.	We agree with the comment. A better definition of the fuel source will probably be needed, but at present more studies are needed, and they are planned for the second stage of the project. Presently the aim of this project has been to use the BS and DIN methods as a basis, and make as few adjustments as possible, and still have a method that covers all MS regulations. Therefore no changes have been made on the fuel and combustion chamber.
413	Swedish National Board of Housing, Building and Planning	Draft final report	Annex H 4.5	Fire exposure The use of wood as fire load does not have a very good repeatability and is hard to handle in the same way in different Member States and test facilities. The actual load varies depending for example on the species, density and moisture content of the wood. Other factors affecting the heat release rate if wood cribs are used as fire load are ventilation and weather conditions. The round robin tests could be	We agree with the comment. A better definition of the fuel source will probably be needed, but at present more studies are needed, and they are planned for the second stage of the project. Presently the aim of this project has been to use the BS and DIN methods as a basis, and make as few adjustments as possible, and still have a method that covers all MS regulations. Therefore no changes

				used to establish the fire load from the combustion chamber to enable use of alternative fuels in the future, e.g. gas burners.	have been made on the fuel and combustion chamber.
414	CPE	Draft final report	Annex H 4.5	The description of the crib construction is not detailed enough. Clarification on the need to nail the layers, the kind of solid platform, etc. are required. Justification on the need to have different ignition procedures for the tow test scales should be provided or a single approach should be chosen. The tolerance for the density of wood is too big.	We agree with the comment. A better definition of the fuel source will probably be needed, but at present more studies are needed, and they are planned for the second stage of the project. Presently the aim of this project has been to use the BS and DIN methods as a basis, and make as few adjustments as possible, and still have a method that covers all MS regulations. Therefore no changes have been made on the fuel and combustion chamber.
415	CZ	Draft final report	Annex H 4.5	Different dimensions of the cross-section of wood sticks creating wood cribs as fuel for both of the proposed test methods. Unify the dimensions of the wood sticks cross-sections to 40 × 40 ± 2 mm.	We agree with the comment. A better definition of the fuel source will probably be needed, but at present more studies are needed, and they are planned for the second stage of the project. Presently the aim of this project has been to use the BS and DIN methods as a basis, and make as few adjustments as possible, and still have a method that covers all MS regulations. Therefore no changes have been made on the fuel and combustion chamber.
416	CZ	Draft final report	Annex H 4.5	The non-uniform way of ignition for both of the proposed test methods. Unify the mean of ignition for both test methods.	We agree with the comment. A better definition of the fuel source will probably be needed, but at present more studies are needed, and they are planned for the second stage of the project. Presently the aim of this project has been to use the BS and DIN methods as a basis, and make as few adjustments as possible, and still have a method that covers all MS regulations. Therefore no changes

					have been made on the fuel and combustion chamber.
417	CZ	Draft final report	Annex H 4.5	The extinguishing of the wood crib could have a negative influence on the test specimen. We propose not to extinguish the cribs but let them self-extinguish.	The aim of this project has been to use the BS and DIN methods as a basis, and make as few adjustments as possible, and still have a method that covers all MS regulations. Therefore no changes have been made on the extinguishing of the wood crib.
418	EAE	Draft final report	Annex H 4.5	Two levels of fire load (medium and large scale) are necessary to meet today's different national requirements.	Noted
419	EAE	Draft final report	Annex H 4.5	A scientific research has to be started, as the proposed medium and large scaled fire load differs significantly from DIN 4102-20 and BS 8414 test setups.	Noted
420	DIBt	Draft final report	Annex H 4.5.1	The use of the gas burner according to DIN 4102-20 test method should be possible alternatively to the wood crib (or better it shall be used instead of a wooden crib). The gas flow is not so high that there will be problems with icing. The big advantage of a gas burner is the reproducibility, the handling is easier (just switch of or on the gas flow) and an additional ventilation from the backside of the combustion chamber is not necessary. When extinguishing the fire there is no need to be careful in contrast to the use of the wooden crib. Furthermore there is no need to determine the mass loss rate.	The aim of this project has been to use the BS and DIN methods as a basis, and make as few adjustments as possible, and still have a method that covers all MS regulations. Therefore no changes have been made on the fuel and combustion chamber.
421	FINLAN esko.k.mik kola	Draft final report	Annex H 4.5	Only one test method, the large fire exposure method is strongly preferred with following comments and conditions: o Fire exposure to the façade is the same from a flashover room fire whether the building is low, medium or high rise	The objective has been to use the DIN and BS standards and introduce eventual additions to these methods, so they would cover the requirements in the MS. It is only Hungary that are using different times and it may be possible that only one exposure time is enough. If more

				o Fire requirements for facades in low rise building are not as demanding as for higher rise buildings o Not only pass/fail criteria at one hour, because this kind of criteria can be valid only for the high fire performance level o Criteria shall be of more continuous type (= criteria fulfilled until certain times, e.g. 15 min, 30 min, 45 min, 60 min as in fire resistance classification) so that the different performance levels can be chosen to fit national requirement levels	alternatives are introduced, the classification system will be more complex.
422	Europ Alu 2	Draft final report	Annex H 4.5 Entire (4.5.1 & 4.5.2)	We need to be realists and try to standardise as much as possible the fuel source for the two scenarios: • Why different types of timber should be used in the two methods? In the end the manufacturer will be the one who will have to pay for the preparation of the necessary storage area for the different species. Will the staff in the test laboratory be in the position to recognise which quality has to be used in each test? • Similar remark applies for the geometry of the sticks. What is the advantage to have in the medium test 40x40mm2 and in the large one 50x50mm2? • Why there should be deviation in density limits? • Why the moisture content can be between 10-15% in large fire exposure test while in the medium one provisions according to EN 13238 have to be considered?	Agree that it would be very good to have one definition of the fuel. Although, if we are to keep the BS and DIN methods as close as possible. This is one topic that needs to be studied in the next phase.

				As many aspects as possible have to be standardised in both methods.	
423	EUMEPS	Draft final report	Annex H 4.5	EUMEPS supports the proposal by the authors for a basic direction of including two levels of fire load (medium and large fire load). These are necessary to meet today's different national requirements, the medium fire load typically applied for medium height buildings (within reach of locally available firefighting equipment) and the high fire load for high rise or unlimited heights. b. Alignment towards both most applied methods allows for validation of historic test results. c. Note: EUMEPS asks for careful use of words and terminology related to the tests. In some documents there seems to be confusion between scale of the test and the fire load. Both levels foreseen involve the same size of the test rig: really a large scale test! The fire load is the variable factor being a medium fire load or a high fire load.	Noted
424	DIBt	Draft final report	Annex H 4.5.2	If the density of the softwood sticks can vary between 400 and 600 kg/m³, but the number of the sticks is always the same (100 sticks in length direction + 150 sticks in cross direction), the total amount of wood can differ extremely and as consequence the total heat release too. With regard to repeatability and reproducibility it is therefore necessary to laid down a smaller tolerance range for the density of the wood stocks and a value (including an acceptable tolerance) for the total amount of wood used for the crib.	Agree that it would be very good to have one definition of the fuel. Although, if we are to keep the BS and DIN methods as close as possible. This is one topic that needs to be studied in the next phase.

425	DIBt	Draft final report	Annex H 4.6.3	The use of 4 cameras seems to be a bit exaggerated. Please reduce the number of cameras.	4 cameras are needed to cover the whole specimen on both the main face and the wing.
426	DIBt	Draft final report	Annex H 4.6.4	The determination of the loss of mass of the crib is appreciated. However, it should be described in more details, because supply of air to the wood crib from the bottom of the chamber via the open metal frame (carrying the crib – cf. cl. 4.5.1) must be ensured.	This method has not been proven yet and needs to be verified during the next phase of the project. The intention is to get a measurement of the heat exposure to the test specimen.
427	CPE	Draft final report	Annex H 4.6.4	Functioning of the devices measuring mass loss at temperatures up to 1.000ºC should be considered. The introduction of this requirement should be justified.	This method has not been proven yet and needs to be verified during the next phase of the project. The intention is to get a measurement of the heat exposure to the test specimen.
428	EU Commission 2	Draft final report	Annex H 5	The test would need to be done indoors only.	It is necessary to scientifically define the tolerances of the environmental conditions in order to get good enough repeatability and reproducibility. Since this still is a white spot on the map we have been quite liberal in the writing. It most probable will be required to make the tests indoors, but even so it is important to define the conditions to be kept. Since large amounts of smoke is produced during a test, ventilation is required (if the test hall not is extremely large) which introduces draughts and winds around the test set-up. Furthermore if we consider the comment concerning §4.4, even test performed indoor may show that the temperature curves are influenced in tests with similar configuration due to the air circulation on the lab when the lab is not large enough compared to the test rig

429	Danish Transport, Construction and Housing Authority	Draft final report	Annex H 5	Regarding environmental conditions The draft test standard describes environmental conditions related to temperature, wind speed and weather conditions as rain. The temperature range is larger than accepted for e.g. the room fire test given in EN 14390, where the ambient temperature is given to 20 °C ±10 °C. The reason for the larger range is not clear, and does not seem to be a part of the further investigation of the environmental conditions stated in task 2. There should be a validation of the larger temperature range and the influence on the test results. Wind speed is measured before the start of the test, but not during the test. Will measurement of the ambient wind speed during the test be considered in the final programme? Wind speed can change during a 60 minutes fire test, and this may influence the test result. Weather conditions are described as rain, snow or fog. These definitions are not clear and should be clarified. These conditions may also change during a fire test performed on an outside test rig. Will weather changes during a fire test, which is performed outside, lead to the termination of the test?	Narrower tolerances should reduce the possible differences of tests. Further studies on this topic is planned for the next phase of the project.
430	Europ Alu 2	Draft final report	Annex H 5	From the description, it can be understood that running the test outdoor is possible. But is it proper to do so from both environmental point of view and repeatability? With all the respect, we agree to have fixed testing conditions, but the tests have to be done on an internal condition (e.g. RISE test lab, BRE test lab etc) to secure that	See previous answer

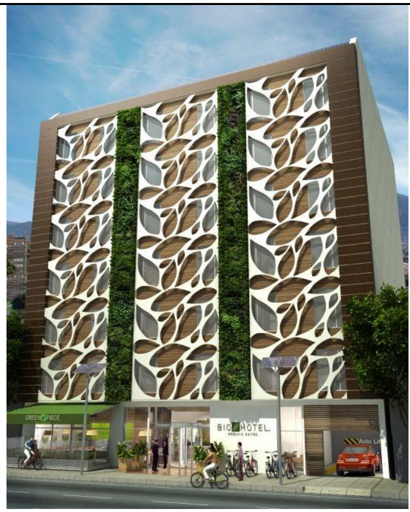
				smoke will not impact the environment & the results of the test will not be questioned at later stages by anyone. Not to forget that the test has a 1hour duration and the weather conditions may vary in such a duration even if the first 30 minutes are of highest importance. Testing outdoors: Apart from all the rest, we must keep in mind that with the climate change weather conditions are varying significantly and considering that testing dates are fixed several weeks in advance it is not obvious that the sponsor of the test will make his participation arrangements for a very long period until considering that the weather conditions permit to run the test. Experts from the laboratories, Representatives of the industry as well as the staff of the European Commission is involved in technical specifications for several years and have already agreed on the 8th December meeting that testing in an environment in which conditions may vary is not preferred. In addition to that, the idea to allow both options possible, will produce more problems as in some countries that is not allowed (e.g. remark from Norway on 8th December meeting). Last but not least, during the meeting it was pointed out that some countries would like to test the performance according to their climate conditions. In case this option will be allowed, this decision will go against the principles of the operation of standardisation in the future.	

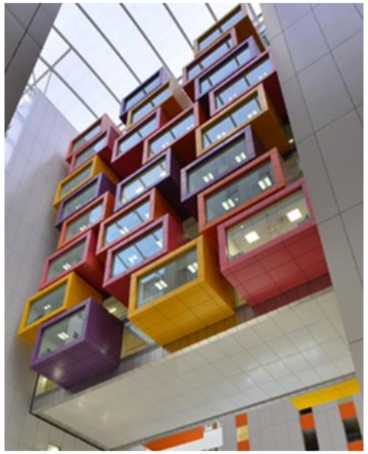
				Tests MUST take place only indoors!	
431	DIBt	Draft final report	Annex H 5	A wind and flow velocity of up to 3 m/s before the test start in front of the specimen surface is too high to ensure repeatable test results. According to our German test experiences a maximum value of 1 m/s is a reasonable measure between repeatability and economy. Furthermore we would like to advise, that when the test rig is built up in a building, than you can test also if it is snowing or raining outside the building. Please change the second para accordingly.	It is necessary to scientifically define the tolerances of the environmental conditions in order to get good enough repeatability and reproducibility. Since this still is a white spot on the map we have been quite liberal in the writing. It most probable will be required to make the tests indoors, but even so it is important to define the conditions to be kept. Since large amounts of smoke is produced during a test, ventilation is required (if the test hall not is extremely large) which introduces draughts and winds around the test set-up. Furthermore if we consider the comment concerning §4.4, even test performed indoor may show that the temperature curves are influenced in tests with similar configuration due to the air circulation on the lab when the lab is not large enough compared to the test rig
432	FINLAND esko.k.mik kola	Draft final report	Annex H 5	Outdoor conditions are not acceptable – tests must be carried out inside with defined temperature and humidity conditions and with defined air velocities around the test rig	See previous answer
433	Swedish National Board of Housing, Building and Planning	Draft final report	Annex H 5	Environmental conditions Fire testing should preferably be carried out indoors to avoid influence of weather conditions. Another reason for indoor testing is the environmental aspect. It seems out of date to develop a test method that is lacking possibilities of emission control.	See previous answer
434	CPE	Draft final report	Annex H 5	The environmental conditions could influence the results, e.g. wind direction.	See previous answer

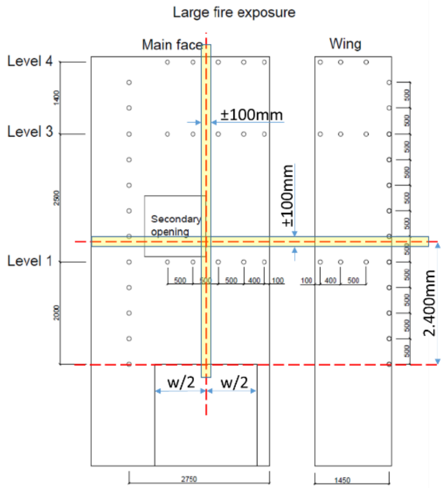
				The limitation to perform the test indoor is needed.	
435	EUMEPS	Draft final report	Annex H 5	Tests shall be performed in an indoor environment. Outdoor testing with varying weather conditions will severely influence test results. In addition some Member States do not allow testing outdoor for environmental considerations. Finally the seasonal conditions would frustrate testing in some Member States for a big part of the year.	See previous answer
436	EAE	Draft final report	Annex H 5	Tests shall be performed in a hall. Outdoor testing with altering weathering conditions may influence test results.	See previous answer
437	EAE	Draft final report	Annex H 5	The test shall be performed in an environment which is not depending from the weather conditions in order to achieve comparability and repeatability. Every test facility has to prove its suitability by calibration tests. Do not allow testing outside. Additionally, the following definitions should be included: - Minimum distance to opposing walls - Minimum distance to roof of enclosure - Definition of position and power of the exhaust	See previous answer
438	Danish Transport, Construction and Housing Authority	Draft final report	Annex H 6.3	Regarding the test specimen The draft test standard states that the test specimen should be mounted according to the manufacturer’s instruction. Some facade systems are non-uniform in their composition of materials and some materials within such a façade system may lead to a larger extend of fire spread. It is not clear how it is ensured, that the most	This is to be covered by the field of application. The field of application tells which changes you can do to the tested system, and then it is up to the client/laboratory to define how to perform the test in order to get the maximum field of application.

				critical design is tested. If a facade has e.g. vertical bands materials, which are more likely to spread a fire, then how should the facade be mounted and how is it ensured that a fixed position of thermocouples, as suggested, will be able to assess that the fire spreads partially over the facade? Many facade systems composed of combustible materials also have some kind of fire barrier positioned at fire compartment boundaries. The test standard can be interpreted in such a way, that a change in the position of the fire barrier in comparison to the top of the opening of the fire chamber may lead to the need for further testing. This should be considered in the field of application in order to keep cost of fire tests at a reasonably level.	
439	CPE	Draft final report	Annex H 6.3	The predefined configuration is not representative of actual installation for some products and forces manufacturers to test non-applicable scenarios.	Noted
440	Europ Alu 2	Draft final report	Annex H 6.3 First 3 paragraphs	We understand the necessity to describe all these aspects. On the other hand side that is the reason why we argue that the test is going beyond the principles of the CPR and that the test should be project related and not product related. Let's not forget that with the exception of ETICS that can be consider as a massive and cost effective solution for retrofitting usual building typologies, when an external cladding is produced, architects are usually willing to design projects in which the appearance is unique and either different construction products are used (e.g. insulation, substructure, anchors, cladding	Noted

				of preference and not of a predesigned system). In addition to that, there are several cladding materials which are combined on building envelopes. Examples: Aluminium cladding & Timber  Metal, timber and ceramics  What about such envelopes?	

				 And now a question: If you test an aluminium cladding (suppose being a flat layer as it is usually tested), can you consider that a configuration which contains projected elements or special geometries of the same material is covered by such test?  	

				  (assume that such design is chosen for an external cladding) Make sure that this specification is not directly linked to the CPR and that the test	

				method in several instances will be used as a step beyond the CPR (project assessment and not product assessment).	
441	Europ Alu 2	Draft final report	Annex H 6.3 Last 2 paragraphs	For metal claddings (similar problems should occur on several other sectors) these dimensions are making the test specimen configuration very specific because we have to respect a series of boundaries, as we have to adjust our sheets and subframes on the space which is left around the window, the combustion chamber and the size of the rig. Reading the last two paragraphs, we recognize that more requirements are introduced to position joints on particular areas/levels.  Figure 9. Positions of thermocouples to be used in the large fire exposure test. Please note European Aluminium members are offering to their clients sheets that have a standard size of 2m x 6m and as a result you cannot know how large the cassette which will be applied on the project will be.	This problem cannot be solved within the present project. This must be dealt with in the field of application or in future product standards.

				Measuring the remaining spaces on the rig, the largest size which can be assessed cannot be larger in dimensions than 2mx3m. We should be more liberal as you are not able any longer to assess the performance of the product for any dimension you may place in the market.	
442	Europ Alu 2	Draft final report	Annex H 6.4 First paragraph, first sentence	For sure we agree and understand why this type of information has to be recorded. On the other hand side we have to keep in mind that this shows that the test is project related and not product related, when you start to describe this type of details on a test report. Make sure that this specification is not directly linked to the CPR and that the test method will be used as a step beyond the CPR (project assessment and not product assessment).	Outside of the scope of the project
443	Europ Alu 2	Draft final report	Annex H 6.4 First paragraph second sentence	not can cannot	Done
444	Europ Alu 2	Draft final report	Annex H 6.4 First paragraph Last sentence	That is the reason why the test must occur indoors. As agreed by the majority of experts during the meeting during 8th December's meeting, forbid the option to run the test externally.	See previous answer about §5
445	Europ Alu 2	Draft final report	Annex H 7	The sentence is placed in a wrong clause and again: We understand the necessity to describe all these aspects. On the other hand side that is the reason why we argue	We do not agree

			Second paragraph	that the test is going beyond the principles of the CPR and that the test should be project related and not product related. Please move this sentence in 6.3 clause	
446	Europ Alu 2	Draft final report	7 Figure 6	Missing forced ventilation detail from the rear side To add forced ventilation from the rear side	There is no ventilation details in the BS method, and it is not intended to be since this would be a major change of the method.
447	Europ Alu 2	Draft final report	8	It is understood that the moisture of particular samples requires time to reach actual conditions. It is not accepted to allow the option for running the tests outdoors as you are not in a position to secure the conditions in which the sample will be exposed during curing and during the test. More detailed remarks have been mentioned earlier. Allow to run the tests only indoors.	See previous answer about §5
448	CPE	Draft final report	8	Limiting the conditioning to 28 days is not properly justified.	Unclear comment. Example or further development of the idea is missing
449	EU commission 2	Draft final report	9	2. The large test would however need (at least at this stage of development) to include 2 options to be representative of the current regulatory views: without openings as used in the BS 8414 test, and with openings placed in a vertical line above the fire chamber (because the horizontal displacement of the openings is not accepted by Member States which apply a test rig with openings). 3. For the first option in point 2 above the thermocouples must be provided, at least, in those positions as foreseen by the BS	Such approach was not considered initially by the consortium and will be proposed in the next version of the final report.

				8414 test. For the second option in point 2 above the thermocouples must be placed as foreseen by the most representative test rig with openings (seems to be LEPIR2).	
450	Danish Transport, Construction and Housing Authority	Draft final report	9	Regarding temperature measurement We agree on the choice of temperature measurements as a means of measuring fire spread. As stated above, however, some facade systems may have a non-uniform composition of materials. How will a fixed position, as suggested, be able to assess fire spread in a non-uniform facade system? For such facades additional thermocouples and/or alternative positions of the thermocouples might need to be introduced.	Noted It will be treated through the field of application.
451	CPE	Draft final report	9	Installation of thermocouples as described in the text can have negative side-effects. Some examples are "pull in" of the thermocouples due to increase in volume of the cladding and weak points in the system due to the holes. The solution provided in the DIN method is mounting the thermocouples in a rack or frame.	Both ways of fixing thermocouples will be described in the test method allowing to assess/compare them at the RR step
452	Europ Alu 2	Draft final report	9	Thermocouples position has to be in the same levels as defined in BS 8414 and DIN 4102-20. More detailed justification is given earlier. Make necessary adjustments to keep the same levels as commented before.	The alternative approach (BS/DIN + options) should meet this wish
453	FINLAND esko.k.mikkola	Draft final report	9	Fire exposure in the test: Heat fluxes on the façade surface (at least on two heights) should be measured o This is important in the planned Round Robin to define how reproducible the initial test conditions are	Agreed. To decide whether through heat flux gauges or/and through plate thermometers.

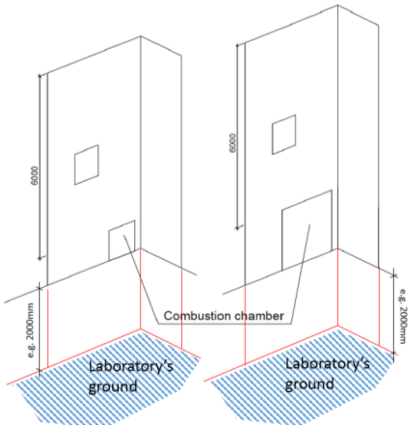
454	EAE	Draft final report	9	Drilling of the TCs through the front of the specimen will in many cases have influence on the fire behavior of the specimen. TCs in front of the specimen have to be mounted from the outside. Only TCs measuring temperatures inside the system, shall to be drilled from the backside of the test specimen and after that they shall be sealed from the backside.	Both ways of fixing thermocouples will be described in the test method allowing to assess/compare them at the RR step
455	EAE	Draft final report	9	The comparison of the fire loads does not fit with the dimensions of the test rigs and the positions of the TCs	Unclear comment. Example or further development of the idea is missing
456	DIBt	Draft final report	9	See comment and proposal above to clause 06 on page 147 – damaging of the specimen surface by drilling holes is not acceptable.	Both ways of fixing thermocouples will be described in the test method allowing to assess/compare them at the RR step
457	EAE	Draft final report	9.1	Medium scale test – level 1 is not needed Remove level 1	For the new assessment method approach, such level is needed to determine the start time For the Proposed method, it may disappear.
458	EUrima 2	Draft final report	9.2	We are not sure that the number and position of the thermocouples used in this test method, to evaluate the horizontal flame spread, is enough. For example, depending on if the test is performed outdoor or indoor, we may have different distributions of the flame spread. We would recommend to adding a visual observation during the round robin to be sure that we are collecting a reliable set of data.	Agreed To be addressed within the RR.
459	DIBt	Draft final report	9.2	According to our comment above to clause 07 concerning the necessity to consider smouldering combustion the number of internal thermocouples foreseen at present are not sufficient. A grid with a higher number of thermocouples is necessary to	This is included in Proposed method, the DIN method is kept as it is. It would be possible to update the Alternative method with the smouldering measurements if needed.

				measure and assess this characteristic. This should be also described in this clause.	
460	DIBt	Draft final report	9.2 Figure 8&9	As shown in these figures the location of the measure points depends on the thickness of the system tested. This requires drilling of new holes for the thermocouples for each new test specimen and it is impractical and expensive. Furthermore the location of the vertical line of thermocouples of 2.75 m from the corner on the main face for the medium exposure seems to be too far away from the combustion chamber. Therefore the distance between the first and the second thermocouple (seen from the inner corner) should be variable (e. g. between 300 and 500 mm) and not always exactly 400 mm as in the drawings. The line of thermocouples should only be located closer to the inner corner of the test rig (e. g .about 2.0 m).	There are now two different options, and the second option is to keep the DIN method as it is. If Alternative method is chosen it would be possible to update that method as well if needed.
461	CPE	Draft final report	9.4	Functioning of the devices measuring mass loss at temperatures up to 1.000ºC should be considered. The introduction of this requirement should be justified.	The mass loss measurement will be examined in the next phase of the project. It has been used previously with good experience in Sweden.
462	Europ Alu 2	Draft final report	10 3rd bullet	With rain the test should not take place. We are against of carrying out the test outdoors. Should be done indoor and not in uncontrolled weather conditions! Allow to run the tests only indoors and record in the test report, indoor conditions only!	See observation made for §5
463	DIBt	Draft final report	10.1	A total test time of 60 minutes as maximum is not sufficient.	Agreed for the smouldering option. It is now included in the Proposed method.

				A longer observation / monitoring time is needed after the extinguishing of the fire source for consideration of possible smouldering combustion processes (cf. comment above to clause 06) – at least for the medium fire exposure.	It would be possible to update the Alternative method method with the smouldering measurements if needed.
464	EAE	Draft final report	10.1	Testing/observation time Glowing is not covered by this time Replace if necessary	See comment above.
465	Europ Alu 2	Draft final report	10.1.1	Why the -5 description that appears on 10.1.2 is not copied here? It should be harmonised. Please describe the soak fibreboard ignition strips insertion into cribs.	The -5 description is only valid for the large fire exposure, the medium fire exposure crib shall be ignited according to clause 4.5.2 as mentioned in the table.
466	EAE	Draft final report	10.2	Observations during the Test are not defined sufficiently Minimum 2 cameras, at least HW; photos of complete test specimen should be taken every minute	It has been clarified
467	EAE	Draft final report	10.2	Flame height and burnt area are not defined Define in detail the way to measure flame height and burnt area to ensure comparability.	It is defined by the temperature measurements which are the measures used for the fire spread evaluation. The visual observations are not used as failure criteria. Burned area and flame height is mainly information to the client.
468	CZ	Draft final report	11 & final report § 10.2.2	There is a discrepancy between the proposal for falling parts in chapter 10.2.2 and the official proposal in the Annex H, chapter 11. The chapter 10.2.2 states that the maximum weight is 5 kg and the maximum area is 0,4 m2. Contrary to that the Annex H, chapter 11 states that the maximum area is 0,2 m2.	Corrected

				Unify the proposal and the official proposal in the Annex H. We advise assessing the maximum weight of the falling parts/droplets. Parts smaller than 5 kg can injure or kill a person.	
469	EU commisssion 2	Draft final report	11 Falling parts	4. The "falling parts performance" needs to foresee a flexible classification to fit regulatory requirements like: Class 1: no parts larger than 1 kg and 0.1 m2 and Class 2: no parts larger than 5 kg and 0.2 m2.	This is right now not in any regulations. The Class 1 is a measure used in Sweden, but it is not prescribed in the regulation. Some agreement must be achieved before this can be decided.
470	Eurima 2	Draft final report	11	Eurima agrees with the Commission proposal to only declare values and leave the acceptance criteria to Member States. We acknowledge that the discussions today should be focused on the development of the harmonised test method itself	This comment was finally not confirmed after the meeting
471	EAE	Draft final report	11	Falling and burning Particles. This should be separated. Assessment of burning parts is not possible with this set-up. For assessment of burning falling parts, or droplets the test set up has to be changed: non-burning parts may be ignited by the original fire source. The chamber for the fire load would have to lifted up.	To be further investigated in the next stage of the project.
472	DIBt	Draft final report	11	The temperature rise greater than 500 K cannot be the sole criterion for assessing the vertical fire spread. Our German test experiences show that the tip of the flame plume and the location of the thermocouples are not always in the same level. Furthermore there are too less thermocouples to register exactly any flames in the height of the measure line.	It is defined by the temperature measurements which are the measures used for the fire spread evaluation. The visual observations are not used as failure criteria. Burned area and flame height is mainly information to the client.

				Therefore the visual flame height and the height of the burned area must be part of assessing the vertical fire spread	
473	DIBt	Draft final report	11	There are some differences between the proposal in chapter 10.2.2 on page 49 of the report and the criteria given on page 177 concerning falling parts / burning particles. This should be checked. In addition the time limit for continuous burning of falling parts/droplets on the floor seems to be very hard. This is a limit value used in the German small-scale (laboratory) test "Brandschacht". Therefore evaluation of the proposed limit value is necessary within the round robin tests and possibly amendment after that.	Agreed
474	Europ Alu 2	Draft final report	11 Falling parts/burning particles segment 3rd paragraph	'burning particles and/or droplets' is not sufficiently highlighting the nature of the droplets Add 'burning' in front of the 'droplets'.	Corrected
475	Europ Alu 2	Draft final report	11 Falling parts/burning particles segment 3rd paragraph, 2nd sentence	Observation of size as well as duration of burning particles and/or burning droplets is difficult when the ground is so close to the combustion chamber as there is a lot of light and smoke. And what about self-ignition due to the radiation of the heat source? Self-ignition can occur only when the fire is burning the ground floor of a high rise building - Not a usual situation in this unlike event (see for example Grenfell tower where the fire applied at higher levels)... We invite the consortium solve this issue by uplifting the test specimen as much as	Agree, but 2 m is probably too much. CFD calculation could help to determine the smallest needed uplift distance. This will be further studied in the next stage of the project.

				possible and place a kind of barrier against heat flow. Let's not forget that the material which is used in the cladding has already been assessed for Reaction to Fire and can be up to A2 in the case of Aluminium Composite Panels, but when exposed to so high level of radiation and temperature we cannot secure what the consequences will be. Similar remarks have been raised by other sectors with insulation (e.g. combustible) or cladding elements (e.g. timber claddings). Uplift the specimen for a certain height (i.e. 2.000mm) to increase visibility for inspection during the test and reduce impact of fallen parts from increased radiation: 	
476	FINLAND esko.k.mikkola	Draft final report	11	Falling parts needs further consideration (5 kg falling piece can kill a person)	Noted See previous observation

477	Eurima	Draft final report	11	Eurima appreciates that solid materials as falling parts were considered but would recommend considering also burning droplets. As falling parts are part of the proposed classification system, burning droplets (similarly to the SBI test) should make a mandatory part of the classification. We would like also to have more clarity regarding the information concerning the size of falling parts (max. 0,2m2 (page 177) and 0,4m2).	Corrected
478	EAE	Draft final report	11 Falling parts	Falling parts This has to be reported, the criteria fail/not fail is national to decide	See previous observation from EU commission on this topic
479	EAE	Draft final report	11	Criteria of temperature rising: Differ in the countries between 500, 550 and 600 K Proposal: 550 K	Evaluation of the proposed limit value is necessary within the round robin tests and possibly amendment after that.
480	Eurima	Draft final report	11	Although there are no performance criteria, the temperature measurements resemble BS 8414. We have doubts on whether these can correctly evaluate the propensity of the façade to spread tire. Alternative test methods have much different temperature measurements and criteria. The proposed classification system is based on flame spread but it is hard to find the suitable criteria for trame spread from the proposed method. Given temperature rise limit less than 500K is rather high in 5,9m height and it is not sufficient to indicate the real tire spread in the façade. We would like to better understand the origin of this criterion and how/why this temperature has been defined.	Evaluation of the proposed limit value is necessary within the round robin tests and possibly amendment after that

481	Europ Alu 2	Draft final report	11 Façade-floor junction (optional) segment 1st paragraph	It is needed to refer to specific figure. Refer to a particular figure for that (e.g. Figure 6 right detail)	Corrected
482	FINLAND esko.k.mikkola	Draft final report	11	o Not only pass/fail criteria at one hour, because this kind of criteria can be valid only for the high fire performance level o Criteria shall be of more continuous type (= criteria fulfilled until certain times, e.g. 15 min, 30 min, 45 min, 60 min as in fire resistance classification) so that the different performance levels can be chosen to fit national requirement levels - Criteria proposals (temperature rise limits, criteria for falling parts, times until which criteria are met) shall be made only after the planned Round Robin exercise - Continuous smouldering combustion will be declared in DoP's. This declared property should also be applicable to façade products without measuring it in large scale façade test. Similarly, smoke production is determined using the SBI method instead of measuring it in large scale facade test.	Keeping the medium fire exposure is helpful for the grading and will anyway depend on the choice of Member States. These criteria are until now proposals of the consortium based on either criterion existing in the national test methods or requirements coming from national regulations. The criteria coming from test methods can be adapted from RR results Due to the lack of unanimous opinion by Member States regarding the way (either through SBI or directly within the façade test) to assess the smouldering, such measurement will be proposed as an option in the façade test method
483	CPE	Draft final report	11	Proper justification to the extension of the duration in which temperature limits may not be exceeded should be provided. Assessment of lateral flame spread is not based on enough evidence. Radiation of the combustion chamber could have an impact in the measurements at lower level. This performance should be included only if there are regulatory requirements for it.	The duration of the tests and the time limits used are taken directly from the DIN and BS standards. It is true that the lateral flame spread has not been validated. It is used in some countries, i.e. UK, but it is based on visual observations. These measurements need to be validated in the next stage on the project.

				The falling parts criteria presented is not supported by our experts but also difficult to measure in an objective and consistent way. The values provided in the report do not match with the values in the test method. The criteria should be fully revised considering these considerations.	Falling parts and burning debris/droplets have been evaluated for a long time in some countries. The levels to be used must be defined by regulators and is outside the scope of the present project.
484	Europ Alu 2	Draft final report	12 f) 3rd-5th bullet	That is why the test is going beyond the principles of the CPR Make sure that this specification is not directly linked to the CPR or it is not directly linked for all external claddings and that the test method will be used as a step beyond the CPR (project assessment and not product assessment).	Noted
485	DIBt	Draft final report	13	It is too early to define rules for a set of direct field of applications. Therefore the given examples should be deleted, because some of them are questionable. For example joints can help to interrupt the fire spread on the surface of a façade, but on the other side joints may allow fire breaks into (ventilated) cavities and therefore contribute to a greater fire spread. Hence it is not possible to say in general, that the number of joints can increase when tested with joints. All rules for direct and extended application of test results should be discussed later and always with regard to a specific group of similar façade types.	Agreed
486	Europ Alu	Draft final report	13 Last bullet	What about insulation that is rated as Al & A2? We need to write down the obvious to avoid unnecessary discussions afterwards For example:	The report only gives some rough examples on DIAP. This must be dealt with later.

				'For Euroclass Al & A2 insulation,the thickness and density can be changed without necessity to retest the product'. And: 'For Euriclass Al & A2 insulation of one producer can be replaced with an insulation of a different producer'.	
487	Europ Alu 2	Draft final report	13 Last 2 bullets	Replacing insulation of A1 or A2 should be possible as well. Add relevant rules with necessary provisions.	The report only gives some rough examples on DIAP. This must be dealt with later.
488	EAE	Draft final report	13	i. The field of application has to be defined especially for the tested product. It is not acceptable as proposed in the draft. Examples given there seem to be too general).	The report only gives some rough examples on DIAP. This must be dealt with later.
489	EAE	Draft final report	13	Experience for the proposed field of application is missing. To be defined later and as a product specific aspect.	The report only gives some rough examples on DIAP. This must be dealt with later.
490	EAE	Draft final report	14	f. The proposed classification should be changed in order to better comply with existing national requirements. Probably it would even be better to exclude the classification from the test standard and leave the interpretation to EN 13501. EN 13501 could then be used as a classification standard.	Agreed Will be done in a next step. At this stage it shall be visible for comparison with assessment method
491	DIBt	Draft final report	14	The proposed classification system and the statement that results with the large fire exposure always cover the medium fire exposure is questionable and should be therefore checked within the round robin tests. (The "biggest hammer" is not the	For the new method approach, the RR will allow to compare large and medium exposure and to confirm whether the large one is enclosing the medium one

				best tool in any cases. Sometimes a "smaller hammer" is a more effective tool.) Moreover, tests with the large fire exposure would have to consider the characteristic "Smouldering" (cf. various comments above) as precondition that the results are also valid for the medium fire exposure. Therefore it should be stated clearly that the proposed system urgently need conformation within the round robin tests before it can be laid down finally.	
492	Eumpes	Draft final report	14	Smouldering is included in DIN 4102-20 and is a national requirement. Therefore a new method requires assessment of smouldering. Material testing according to EN 16733 is not sufficient. The combination of different products and system build-up may lead to smouldering even if the naked material passes EN 16733	Included in the Proposed method.
493	EUMEPS	Draft final report	14	d. Additional classification for falling parts seems acceptable, however further analysis on definition and criteria would be necessary.	Further studies to be carried out during the next stage of the project
494	EUMEPS	Draft final report	14	e. Other parameters (a.o. : temperature, wind speed, wind direction, positioning of thermocouples, temperature criteria, horizontal flame spread) should be specified and clearly described during further development in such a way that the combination of these parameters is calibrated in such way that an exposure is ensured that is close enough to allow for validation of these historic test results.	Further studies to be carried out during the next stage of the project
495	EUMEPS	Draft final report	14	f. Previous proposals including a far more detailed classification system would result in market fragmentation and increased testing burden, because it is unlikely that	Noted

				Member States would align their requirements.	
496	EUMEPS	Draft final report	14	g. No classification system, falling back on just declaring the values on a number of regulated parameters would be even worse and would even further increase testing burden and would result in technical barriers to trade. This would rather be a harmonisation of testing methods creating a single market for test institutes, than creating a single market for construction products.	Noted
497	EAE	Draft final report	14	This has to be separated, because a number of countries consider only fire spread, but not falling parts or droplets. As the flame spread is the main aim of the result of the test, any other result regarding - Smoke - Falling parts not burlning - Falling parts burning - Dropleds should be given detailed in the report without classification, so that it can be assessed nationally. LS 1 or LS 2	Noted
498	Swedish National Board of Housing, Building and Planning	Draft final report	14	Classifications Sweden supports the proposed new simplified classification system with minor amendments. Falling parts The criterion for falling parts is in the proposal set to a maximum of 5 kg. This was done since the consortium could not	Noted

				find any other criteria in national regulations. However, the criteria in the Swedish building regulations and the test method SP Fire 105 stipulate no major falling parts, such as broken glass or small bits of plaster. This is normally interpreted to no parts heavier than 1 kg. To make this clearer, work to amend SP Fire 105 with a more specific criteria for falling parts is ongoing at RISE in cooperation with Boverket. Our suggestion at this stage is to have two subclasses for falling parts, one for small parts up to 1 kg and one for slightly larger parts up to 5 kg. This is to ensure that Member States that regulate only minor falling parts could use a subclass that will not allow parts of the building considerably heavier than a brick falling on people evacuating or on rescue personnel. To include declared values instead of classes, as discussed in the AGF meeting 2017-12-08, would in our opinion make the system unnecessary complicated and unclear.	
499	Swedish National Board of Housing, Building and Planning	Draft final report	14	Glowing combustion Sweden finds no reason to include glowing (smouldering) combustion in the test method. In the AGF meeting 2017-12-08 Germany stated that it was necessary for their fire departments, so that they could be confident to leave the building after putting out a fire. If this is the reason to have glowing combustion in the test method, it could be argued that it is not any part of the basic work requirements in CPR and could be dealt with in other ways in Germany. As	Noted

				explained by Mr Boström during the AGF meeting, long time observation of the test rig would bring major unnecessary costs for the industry.	
500	Eurima	Draft final report	14	Eurima believes that smoke is a relevant safety criteria in tire that should be addressed in the future.	Noted
501	FINLAND esko.k.mikkola	Draft final report	Annex B	Fire exposure in the test: Heat fluxes on the façade surface (at least on two heights) should be measured o This is important in the planned Round Robin to define how reproducible the initial test conditions are	Agreed. To decide whether through heat flux gauges or/and through plate thermometers.
502	FINLAND esko.k.mikkola	Draft final report	Annex B	Round Robin - Façade products commonly used in different parts of Europe should be chosen for the exercise – this is essential to be able to compare final classification criteria with present national requirement levels - Round Robin results for the first step towards principles of worst case conditions for different types of façade constructions and extended application rules	Agree
503	CPE	Draft final report	Annex B	Functioning of the devices measuring mass loss at temperatures up to 1.000ºC should be considered. The introduction of this requirement should be justified.	This will be examined during the next stage of the project
504	Europ Alu 2	Draft final report	Annex C	It would make sense to find a 'smart' way get certification for the 4 cases without repeating the test 4 times for each case. We invite that you describe with the hierarchical order which is the most onerous method that can be also considered as success for the other methods as well. This should be possible as	All cases will not be necessary to test, it is only the case that is closest to the system to be approved that needs to be tested.

				you have efficiently managed to reduce the certification options with a very smart approach (take i Clause 14). Define which window case is the most onerous that will not require more testing on such detailing for the different product families that can be tested and provide specific guidance which typology is more onerous comparing to the others.	

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