1- ETA 14-0375 (WARRINGTON)
2- CERTIFICATE OF CONFORMITY OF FPC (WARRINGTON)
3- CLASSIFICATION REPORT A1 CSI/0238C/11/RF (CSI)
4- TEST REPORT RINA MED205314CS NON-COMBUSTIBILE MATERIAL FOR MARINE EQUIPMENT (RINA)
5- TEST REPORT FOR LEED N° 13-3621 DEL 10/10/2013 (LABO CONSULT)
6- TEST REPORT N° 315705 FREEZE - THAW
7- TEST REPORT N° 297767 HEAT - RAIN
8- TEST REPORT N° 315704 SOAK - DRY
9- TEST REPORT N° 299803 WATER IMPERMEABILITY
10- TEST REPORT N° 315972 WATER VAPOUR TRASMISSION
11- TEST REPORT N° 317123 SHEAR LOAD RESISTANCE OF MECHANICAL FASTENING SYSTEM
12- TEST REPORT N° 315708 PULL-THROUGH RESISTANCE OF MECHANICAL FASTENERS
13- TEST REPORT N° 315710 RESISTANCE TO ECCENTRIC VERTICAL LOAD
14- TEST REPORT N° 315706 RESISTANCE TO SOFT BODY IMPACT
15- TEST REPORT N° 315707 RESISTANCE TO HARD BODY IMPACT
16- TEST REPORT N° 315354 TENSILE STRENGTH PERPENDICULAR TO THE PLANE
17- TEST REPORT N° 315353 TENSILE STRENGTH PARALLEL TO THE PLANE
18- TEST REPORT N° 315963 TENSILE STRENGTH PARALLEL TO THE PLANE
19- TEST REPORT N° 316280 DIMENSIONAL CHANGES ASSOCIATED TO MOISTURE VARIATION
20- TEST REPORT N°315703 MECHANICAL BENDING PROPERTIES (MOE/MOR)
21- TEST REPORT N° CSI-DC-TTS-14-1 THERMAL CONDUCTIVITY (CSI)

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European Technical Assessment ETA 14/0375 of 14/11/14

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011:	
Trade name of the construction product	**AQUAFIRE®**
Product family to which the construction product belongs	Fire Protective Board
Manufacturer	**BIFIRE S. r. l. Via Carducci, 8 20123 MILANO (MI) Italy**
Manufacturing plant(s)	F/006
This European Technical Assessment contains	30 pages including 2 Annex(es) which form an integral part of this assessment.
	Annex(es) 1-2 Contain(s) confidential information and is/are not included in the European Technical Assessment when that assessment is publicly available.
This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of	ETAG 018-part 4, edition 2012, used as European Assessment Document (EAD)

General Comments

1. This European Technical Assessment is issued by Warrington Certification Limited on the basis of ETAG 018 Fire Protective Products Part 1: General June 2013, and Part 4: protective products, Fire protective board, slab and mat products and kits. Used as European Assessment Document (EAD).

2. This European Technical Assessment is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1.

SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical Description of the Product

(Detailed information and data are given in Annexes)

AQUAFIRE® is a fibre reinforced lightweight cement based board with polystyrene bead fillers and glass fibre reinforcement mesh. The product is designed for installation in the following environmental conditions:

Internal and semi exposed use – ETAG 018-4 Type Y

Assembled systems require additional components, as stated in Annex 2 of this ETA. Those ancillary components are not covered by this ETA and cannot be CE marked from this ETA.

1.1 Dimensions and density

Dimensions and density of the product are detailed below in Table 2

Table 2: Dimensions and density	
Density (dried at 105°C) : 960 kg/m^3 ±15%	
Length (mm)	**Tolerances**
2000	± 5
Width (mm)	
1200	± 3.6
Thickness (mm)	
12.5	± 1.2

2 Specification Of The Intended Use In Accordance With The Relevant EAD

2.1 Intended Use

The intended use of AQUAFIRE® is identified in Table 1 below:

Table 1 - Intended Use		
Protection of	**ETAG 018-1 Reference**	**Assessment within the scope of this evaluation report**
Horizontal membrane protection	Type 1	No
Vertical membrane protection	Type 2	Yes
Loadbearing concrete elements	Type 3	No
Loadbearing steel elements	Type 4	No
Loadbearing flat concrete profiled sheet composite elements	Type 5	Yes
Loadbearing concrete filled hollow steel columns	Type 6	No
Loadbearing timber elements	Type 7	No
Fire separating elements with no loadbearing requirements	Type 8	Yes
Technical services assemblies in buildings	Type 9	No
Uses not covered by Types 1-9	Type 10	No

Table 1 shows the possible intended uses of the product. Not all possible uses have been assessed within the framework of this ETA with regards to fire resistance performance. Annex 2 provides details of the use for which fire resistance evaluation has been carried out. This ETA covers assemblies installed in accordance with the provisions given in Annex 2.

Working life

The provisions made in this ETA are based on an assumed intended working life of the fire protective product for the intended use of 25 years, provided that it is subject to appropriate use and maintenance in accordance with this ETA.

The indications given on the intended working life cannot be interpreted as a guarantee given by the producer, but are to be used as a means for selecting the appropriate product in relation to the expected economically reasonable working life of the works.

2.2 Use Category

Internal and semi exposed use – ETAG 018-4 Type Y

3 Performance Of The Product And References To The Methods Used For Its Assessment

The assessment of fitness for use has been made in accordance with EOTA ETAG 018 Part 4: 2012-01-11 (used as European Assessment Document, EAD)

ETAG Clause No.	ETA Clause No.	Characteristic
5.2.2	3.2.1	**ER2: Safety in case of fire**
5.2.2.1	3.2.1.1	- Reaction to fire
5.2.2.2	3.2.1.2	- Resistance to fire
5.2.3	3.2.2	**ER3: Hygiene, Health and the Environment**
5.2.3.1	3.2.2.1	- Water permeability
5.2.3.2	3.2.2.2	- Release of dangerous substances
5.2.4	3.2.3	**ER4: Safety in use**
5.2.4.1	3.2.3.1	- Flexural strength
5.2.4.2	3.2.3.2	- Dimensional stability
5.2.5	3.2.4	**ER5: Protection against noise**
5.2.6	3.2.5	**ER6: Energy, Economy and Heat Retention**
5.2.6.1	3.2.5.1	- Thermal resistance
5.2.6.2	3.2.5.2	- Water vapour transmission coefficient

5.2.7	3.2.6	**Related aspects of durability, serviceability and identification**
5.2.7.1.2 5.2.7.1.2.2 5.2.7.1.2.3 5.2.7.1.2.4 5.2.7.1.3	3.2.6.1 3.2.6.1.1 3.2.6.1.2 3.2.6.1.3 3.2.6.2 3.2.6.2.1 3.2.6.2.2 3.2.6.2.3 3.2.6.2.4 3.2.6.2.5	- Complete durability assessment - Resistance to soak/dry - Resistance to freeze/thaw - Resistance to heat/rain - Basic durability assessment - Flexural strength - Dimensional stability - Tensile strength (perpendicular) - Tensile strength (parallel) - Compressive strength
ETAG Clause No.	**ETA Clause No.**	**Characteristic**
5.2.7.2	3.2.7	**Identification**

3.2 Characteristics and methods

3.2.1 Safety in case of fire

3.2.1.1 Reaction to Fire

The fire protective board product is classified as Class A1 according to EN 13501-1.

3.2.1.2 Resistance to Fire

The resistance to fire performance, tested to EN 1364-1, EN 1365-2 and classified according to EN 13501-2, of assemblies incorporating the fire protective board product are presented in Annex 2.0.

3.2.2 Hygiene, Health and the Environment

3.2.2.1 Water permeability

Testing in accordance with clause 7.3.3 of EN 12467: 2007 has been conducted on samples of AQUAFIRE® board. The findings of the testing concluded that the AQUAFIRE® board samples tested met the requirements for Category A.

3.2.2.2 Release of dangerous substances

Bifire s.r.l. has provided a declaration that AQUAFIRE® board does not contain any Substances of Very High Concern (SVHC's) of the candidate list June 2013 intentionally added, with regards to REACH Regulation 1907/2006.

In addition to the specific sections relating to dangerous substances contained within this ETA, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the CPR, these requirements need also be complied with, when and where they apply.

3.2.3 Safety in Use

3.2.3.1 Flexural Strength

In accordance with EN 12467, the boards have a Modulus of Rupture (MOR) of 5.8 MPa.

3.2.3.2 Dimensional Stability

According to tests conducted in accordance with EN 318, the AQUAFIRE® boards are dimensionally stable.

3.2.4 Protection Against Noise

No performance determined.

3.2.5 Energy, Economy and Heat Retention

3.2.5.1 Thermal Resistance

Thermal resistance of the product has been determined in accordance with EN 12667.

Thermal conductivity of the board sample at 10 ºC and 20 ºC was recorded as 0.20 W m^{-1} K^{-1}.

3.2.5.2 Water Vapour Transmission Co-efficient

The product has been tested in accordance with EN 12572 to determine its water vapour transmission co-efficient.

According to the results of the testing, the product has a mean diffusion resistance factor of 31 μ.

3.2.6 Related Aspects of Durability, Serviceability and Identification

3.2.6.1 Durability assessment

3.2.6.1.1 Resistance to soak/dry

In accordance with EN 12467 the boards have an R_L value of 0.84 and therefore have adequate resistance to soak/dry.

3.2.6.1.2 Resistance to freeze/thaw

In accordance with EN 12467 the boards have an R_L value of 0.86 and therefore have adequate resistance to freeze/thaw.

3.2.6.1.3 Resistance to heat/rain

In accordance with EN 12467 the boards have achieved a Category A and are therefore deemed to have adequate resistance to heat/rain.

3.2.6.2 Basic durability assessment

3.2.6.2.1 Flexural strength

See section 3.2.3.1.

3.2.6.2.2 Dimensional stability

See section 3.2.3.2.

3.2.6.2.3 Tensile strength perpendicular

In accordance with EN 319, the AQUAFIRE® board product has been tested to determine its tensile strength perpendicular to the plane of the board and has a mean perpendicular tensile strength of 0.99 MPa.

3.2.6.2.4 Tensile strength parallel

In accordance with EN 789, the AQUAFIRE® board product has been tested to determine its tensile strength parallel to the plane of the board and has a mean parallel tensile strength of 1.427 MPa.

3.2.6.2.5 Compressive strength

The manufacturer has declared a compressive strength for the product of greater than 6.7 MPa.

These values are guidance values and do not reflect a statistical evaluation, nor a minimum guaranteed value.

3.2.6.3 Durability Assessment

The working life of AQUAFIRE® board is 25 years for the intended use Y (internal and semi exposed use).

3.2.7 Identification

3.2.7.1 Product Properties

The identification of the product was carried out according to the criteria indicated in 5.2.7.2 of ETAG 018-4 and all results were within specified tolerances.

Additional components used in test assemblies are specified in the installation provisions of the fire resistance tests described in Annex 2 of the ETA.

For any additional components referred to in this ETA specifically (by trade name), the composition of the product (if manufactured by the ETA holder) or its properties/characteristics (if supplied to the ETA holder) are laid down in the confidential ETA file held by Warrington Certification Limited. The ETA holder shall inform the Approval Body if any of this information is no longer correct.

For any additional components referred to in this ETA generally (by minimum requirements), compliance with these minimum requirements has been verified with the framework of approval testing.

In the intended end use conditions, assemblies in which the AQUAFIRE® fire protective board is used should meet all works related requirements (e.g. related to safety in use).

4 Assessment And Verification Of Constancy Of Performance (Hereinafter AVCP) System Applied, With References To Its Legal base

According to the decision 1999/454/EC of the European Commission the system of assessment and verification of constancy of performance (see Annex V to the Regulation (EU) No 305/2011) given in the following table apply:

Products	Intended uses	Level or Class	System
Fire Protective Products	Fire protective board, slab and mat products and kits	Any	System 1

5 Technical Details Necessary For The Implementation Of The AVCP System, As Provided For In The Applicable EAD.

Tasks for the Manufacturer

Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall ensure that the product is in conformity with this European technical assessment.

The manufacturer may only use constituent materials stated in the technical documentation of this European technical assessment.

The factory production control shall be in accordance with the Control Plan of 12.09.14 relating to the European technical assessment ETA 14/0375 which is part of the technical documentation of this European technical assessment. The "Control Plan" is laid down in the context of the factory production control system operated by the manufacturer and deposited at Warrington Certification Limited.

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the Control Plan.

Other tasks of manufacturer

Additional information

The manufacturer shall provide a technical data sheet and an installation instruction with the following minimum information:

a) Technical data sheet:

- Field of application:

b) Installation instruction:

- Steps to be followed
- Procedure in case of retrofitting.

Tasks of approved bodies

The approved body shall perform the

- initial type-testing of the product,
- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control,

In accordance with the provisions laid down in the "Control Plan" of 12.09.14 relating to the European Technical Assessment 14/0375.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the product stating the conformity with the provisions of this European technical assessment.

In cases where the provisions of the European technical assessment and its "Control Plan" are no longer fulfilled, the certification body shall withdraw the certificate of conformity and inform the Warrington Certification Limited without delay.

Signatories


Responsible Officer D. Forshaw* - Principal Certification Engineer


Approved A. Kearns* - Technical Manager

* For and on behalf of Warrington Certification Limited.

ANNEX 1 - References

ETAG 018	Fire Protective Products Part 1: General (edition 2004, amended April 2013) Part 4: Fire protective board, slab and mat products and kits (Version December 2011)
EN 13501-1: 2002	Fire classification of construction products and building elements- Part 1: Classification using test data from reaction to fire tests.
EN 13501-2:2009	Fire classification of construction products and building elements- Part 2: Classification using test data from fire resistance tests, excluding ventilation services.
EN 1364-1: 1999	Fire resistance tests for non-loadbearing elements - Part 1 : Walls
EN 1365-2: 2000	Fire resistance tests for loadbearing elements - Part 2 : Floors and roofs
EN ISO 1182: 2010	Reaction to fire tests for building products – Non-combustibility test
EN ISO 1716: 2010	Reaction to fire tests for building products – Determination of the heat of combustion
EN 12467: 2012	Fibre cement flat sheets – Product specification and test methods
EN 318: 2003	Wood based panels – determination of dimensional changes associated with relative humidity
EN 319: 1994	Particleboards and fibreboards. Determination of tensile strength perpendicular to the plane of the board
EN 789: 2005	Timber structures. Test methods. Determination of mechanical properties of wood based panels
EN ISO 12572: 2006	Hygrothermal performance of building materials and products. Determination of water vapour transmission properties
EN 12667: 2001	Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Products of high and medium thermal resistance

ANNEX 2 – Fire resistance performances and assembly methods for uses covered by this ETA

Annex 2.0 – Overview of fire resistance performances for AQUAFIRE® board assemblies

The fire protective assemblies in Table A2.0.1 have been assessed within the framework of this ETA. Assemblies installed according to the provisions given in this Annex are covered by this ETA.

Table A.2.0.1

Assembly assessed within the framework of this ETA	Classification according to EN 13501-2	Test standard	Intended use type according to ETAG 018-4	Installation details	Date of addition to this ETA
Vertical non-loadbearing partition 'AQUAFIRE EI60 PARTITION'	**EI 60 E 120**	EN 1364-1	Type 2	Annex 2.1	September 2014
Vertical non-loadbearing partition 'LIGHTWEIGHT PARTITION FORMED BY A DOUBLE LAYER OF AQUAFIRE BOARD'	**EI 180**	EN 1364-1	Type 2	Annex 2.2	September 2014
Horizontal loadbearing element 'LATTICE GIRDER PLATE FLOOR UPGRADED WITH AQUAFIRE'	**REI 180**	EN 1365-2	Type 5	Annex 2.3	September 2014
Vertical non-loadbearing masonry wall, plastered on both faces and clad with a single layer of AQUAFIRE board on its exposed face	**EI 120**	EN 1364-1	Type 8	Annex 2.4	September 2014

A.2.0.1 General installation requirements

Handling, cutting and machining: The boards shall be cut with a sharp knife or bladed tool. When cutting or machining boards dust results and it should be extracted by a vacuum cleaner to avoid inhalation.

A safety data sheet is available from the manufacturer on request.

Joints: Joints must be staggered between layers and opposite faces. A gap of 3-4 mm should be left between adjacent boards, these gaps may be required to be taped and filled, dependent on assembly type; see individual assemblies in the following sections for further details.

Fastening: Fixing of boards and fastener type shall be as per the requirements detailed in the individual assembly types in the following parts of Annex A. When fixing around the perimeter of boards, the fasteners shall be positioned nominally 15 mm from the edge.

Assembly: The boards shall be installed as specified in the assemblies detailed in the following parts of Annex 2.

Annex 2.1 – Specification of AQUAFIRE® board assemblies (intended type 2) 'AQUAFIRE EI60 PARTITION'

A.2.1.1 Classification

The AQUAFIRE® board assembly described in this annex has been tested in accordance with EN 1364-1 and classified in accordance with EN 13501-2 as follows:

Fire resistance classification: EI 60

Fire resistance classification: E 120

A.2.1.2 Installation requirements

The general installation provisions given in A.2.0.1 of this ETA shall be taken into account.

A.2.1.3 Assembly

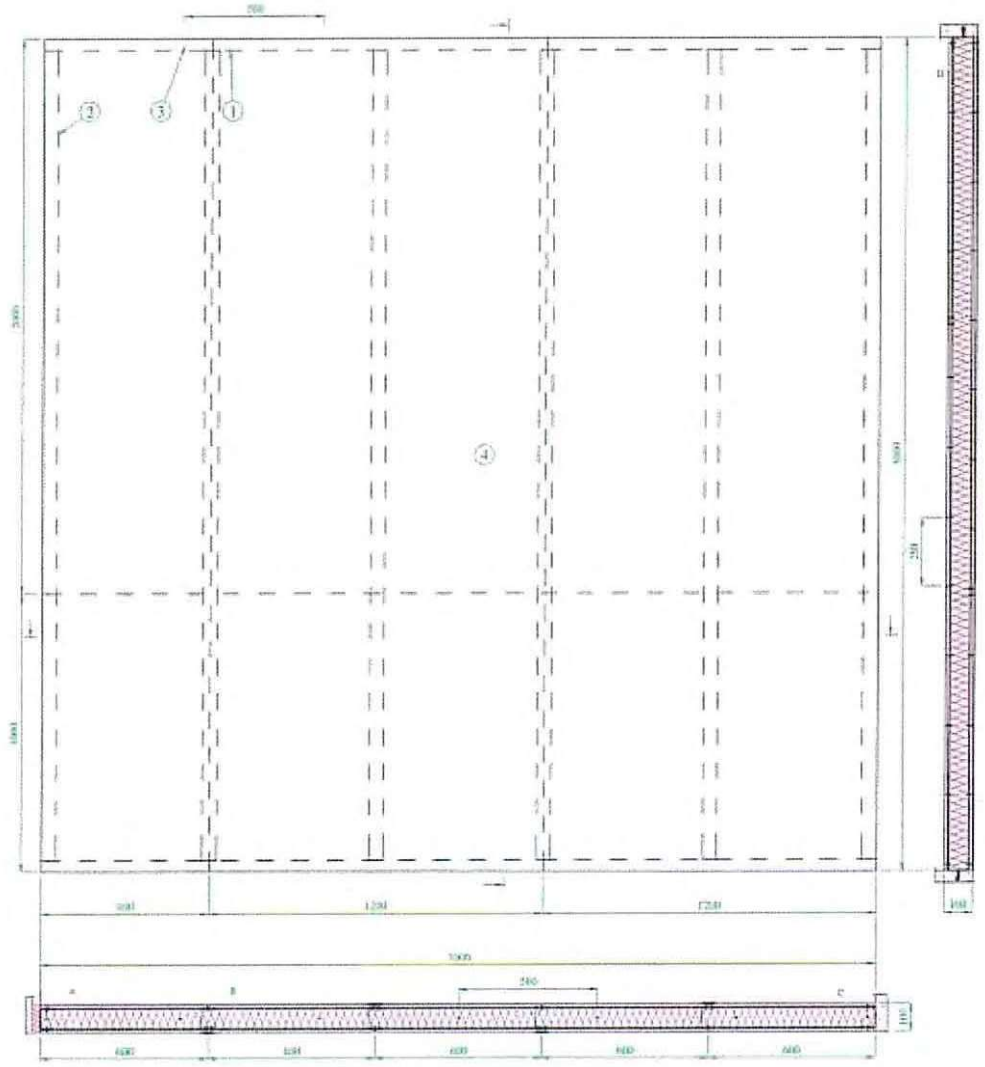
Assemblies shall be as detailed in the following section. Components shall be as specified below in Table A.2.1.1 and as shown in Figures A.2.1.2. and A.2.1.3. Note the figures show the tested assembly and are for general reference purposes only.

Table A.2.1.1

Item		Description
1. Head and base track		
Manufacturer and product reference	:	Gyproc, Gyprofile
General description	:	Galvanised steel channel section track in accordance with EN 14195: 2005
Dimensions	:	75 x 40 mm
Thickness		0.6 mm
2. Partition stud		
Manufacturer and product reference	:	Gyproc, Gyprofile
General description	:	Galvanised steel channel section stud in accordance with EN 14195: 2005
Dimensions	:	50 x 75 x 45 mm
Thickness		0.6 mm
Spacing	:	600 mm

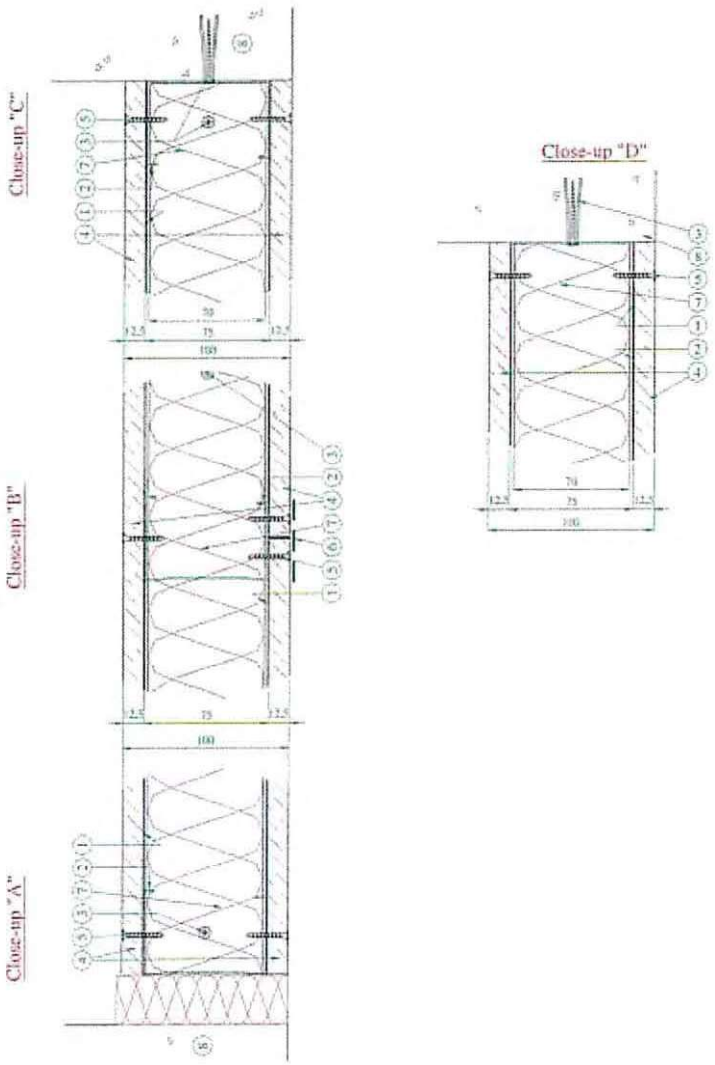
Item		Description
3. Perimeter fixings	:	
Description	:	All steel expanding masonry fixings, 9 mm diameter. Fixed through head and base track and outer vertical studs at 500 mm nominal centres.
4. Cladding boards		
Manufacturer and product reference	:	Bifire s.r.l. AQUAFIRE®
General description	:	Fibre-reinforced lightweight cement based board. Single layer of boards fitted to each face of the framework, joints between board on opposite sides of the assembly were staggered
Dimensions	:	2000 x 1200 mm
Thickness	:	12.5 mm
5. Board fixings		
Supplier and reference	:	Bifire s.r.l. 'vite Aquafire Star'
General description	:	4.2 mm diameter by 40 mm long steel self-tapping drywall screw
Fixing centres	:	Nominally 250 mm vertical centres at board vertical edges and mid-width of board into internal studs/channels.
6. Joint filler and tape		
Supplier and reference	:	Bifire s.r.l. 'Finish' filler and AQUAFIRE tape
Material	:	Cement based premixed single component finish and alkali resistant fibre glass jointing tape nominally 75 mm wide
Application	:	To all board joints
7. Core insulation		
Manufacturer	:	Rockwool
Reference	:	Rockwool Acoustic 225, rock fibre slab
Size	:	1200 x 600 mm
Thickness	:	70 mm
Nominal density	:	70 kg/m^3
Fitting	:	Installed in the cavities formed between vertical studs and cladding boards
8. Supporting construction		
General	:	Suitable standard concrete or masonry supporting construction having fire resistance at least equal to that of the detailed partition assembly

Figure A.2.1.2 Schematic drawing of partition assembly



Do not scale. All dimensions are in mm

Figure A.2.1.3 Sectional views of partition assembly



Do not scale. All dimensions are in mm

Annex 2.2 – Specification of AQUAFIRE® board assemblies (intended type 2) 'LIGHTWEIGHT PARTITION FORMED BY A DOUBLE LAYER OF AQUAFIRE BOARD'

A.2.2.1 Classification

The AQUAFIRE® board assembly described in this annex has been tested in accordance with EN 1364-1 and classified in accordance with EN 13501-2 as follows:

Fire resistance classification: EI 180

A.2.2.2 Installation requirements

The general installation provisions given in A.2.0.1 of this ETA shall be taken into account.

A.2.2.3 Assembly

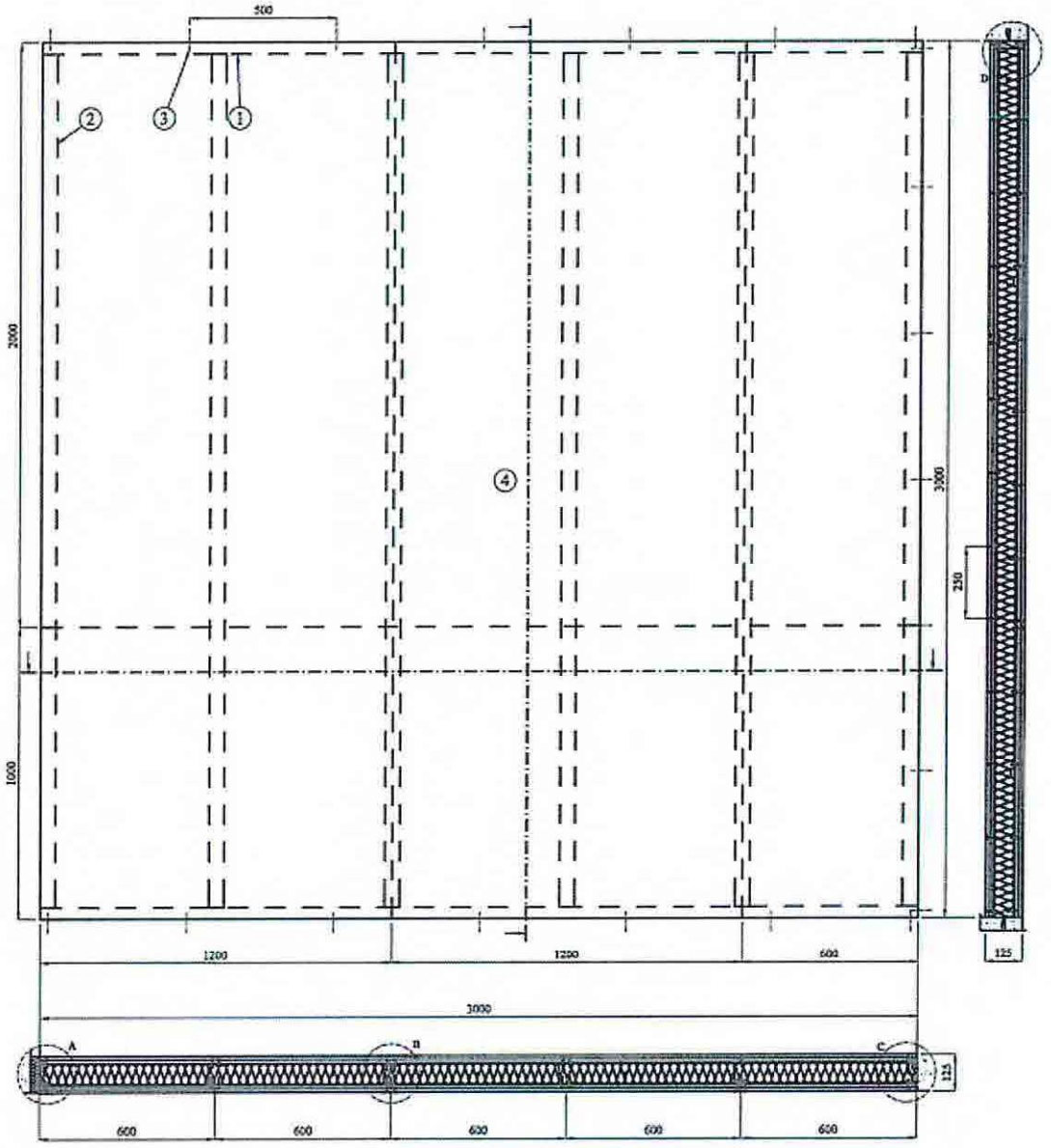
Assemblies shall be as detailed in the following section. Components shall be as specified below in Table A.2.2.1 and as shown in Figures A.2.2.2. and A.2.2.3. Note the figures show the tested assembly and are for general reference purposes only.

Table A.2.2.1

Item		Description
1. Head and base track		
Manufacturer and product reference	:	Gyproc, Gyprofile
General description	:	Galvanised steel channel section track in accordance with EN 14195: 2005
Dimensions	:	75 x 40 mm
Thickness		0.6 mm
2. Partition stud		
Manufacturer and product reference	:	Gyproc, Gyprofile
General description	:	Galvanised steel channel section stud in accordance with EN 14195: 2005
Dimensions	:	50 x 75 x 45 mm
Thickness		0.6 mm
Spacing	:	600 mm

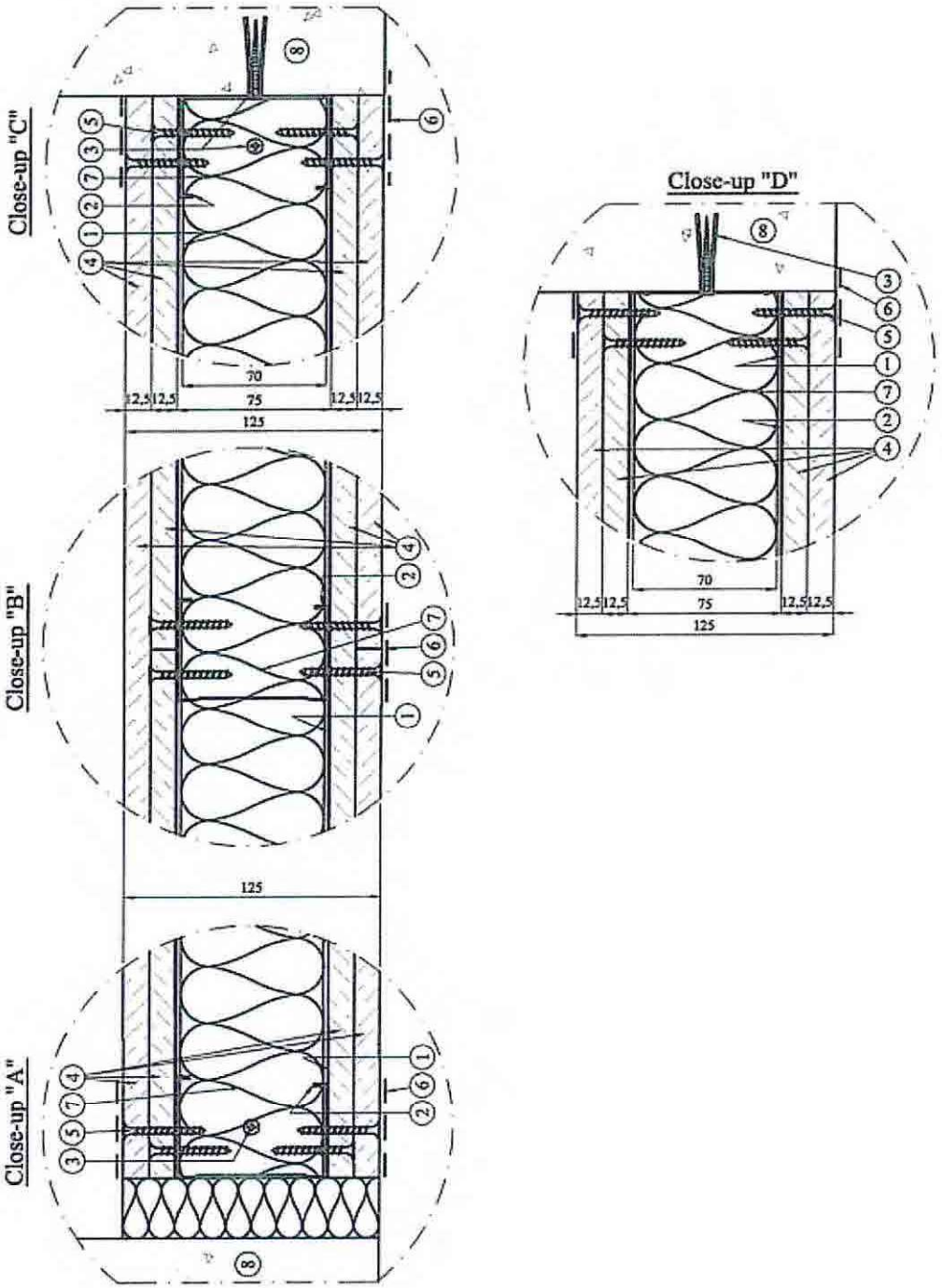
Item		Description
3. Perimeter fixings	:	
Description	:	All steel expanding masonry fixings, 9 mm diameter. Fixed through head and base track and outer vertical studs at 500 mm nominal centres.
4. Cladding boards		
Manufacturer and product reference	:	Bifire s.r.l. AQUAFIRE®
General description	:	Fibre-reinforced lightweight cement based board. Double layer of boards fitted to each face of the framework, joints between board layers were staggered and reversed on opposing sides of the assembly
Dimensions	:	2000 x 1200 mm
Thickness	:	12.5 mm
5. Board fixings		
Supplier and reference	:	Bifire s.r.l. 'vite Aquafire Star'
General description	:	4.2 mm diameter by 40 mm long steel self-tapping drywall screw
Fixing centres	:	Nominally 250 mm vertical centres at board vertical edges and mid-width of board into internal studs/channels.
6. Joint filler and tape		
Supplier and reference	:	Bifire s.r.l. 'Finish' filler and AQUAFIRE tape
Material	:	Cement based premixed single component finish and alkali resistant fibre glass jointing tape nominally 75 mm wide
Application	:	To all board joints in the outer layer of boards on each face and to the perimeter edges of the partition to the outer layer of boards on each face
7. Core insulation		
Manufacturer	:	Rockwool
Reference	:	Rockwool Acoustic 225, rock fibre slab
Size	:	1200 x 600 mm
Thickness	:	70 mm
Nominal density	:	70 kg/m^3
Fitting	:	Installed in the cavities formed between vertical studs and cladding boards
8. Supporting construction		
General	:	Suitable standard concrete or masonry supporting construction having fire resistance at least equal to that of the detailed partition assembly

Figure A.2.2.2 Schematic drawing of partition assembly



Do not scale. All dimensions are in mm

Figure A.2.2.3 Sectional views of partition assembly



Do not scale. All dimensions are in mm

Annex 2.3 – Specification of AQUAFIRE® board assemblies (intended type 5) 'LATTICE GIRDER PLATE FLOOR UPGRADED WITH AQUAFIRE'

A.2.3.1 Classification

The AQUAFIRE® board assembly described in this annex has been tested in accordance with EN 1365-2 and classified in accordance with EN 13501-2 as follows:

Fire resistance classification: REI 180

A.2.3.2 Installation requirements

The general installation provisions given in A.2.0.1 of this ETA shall be taken into account.

A.2.3.3 Assembly

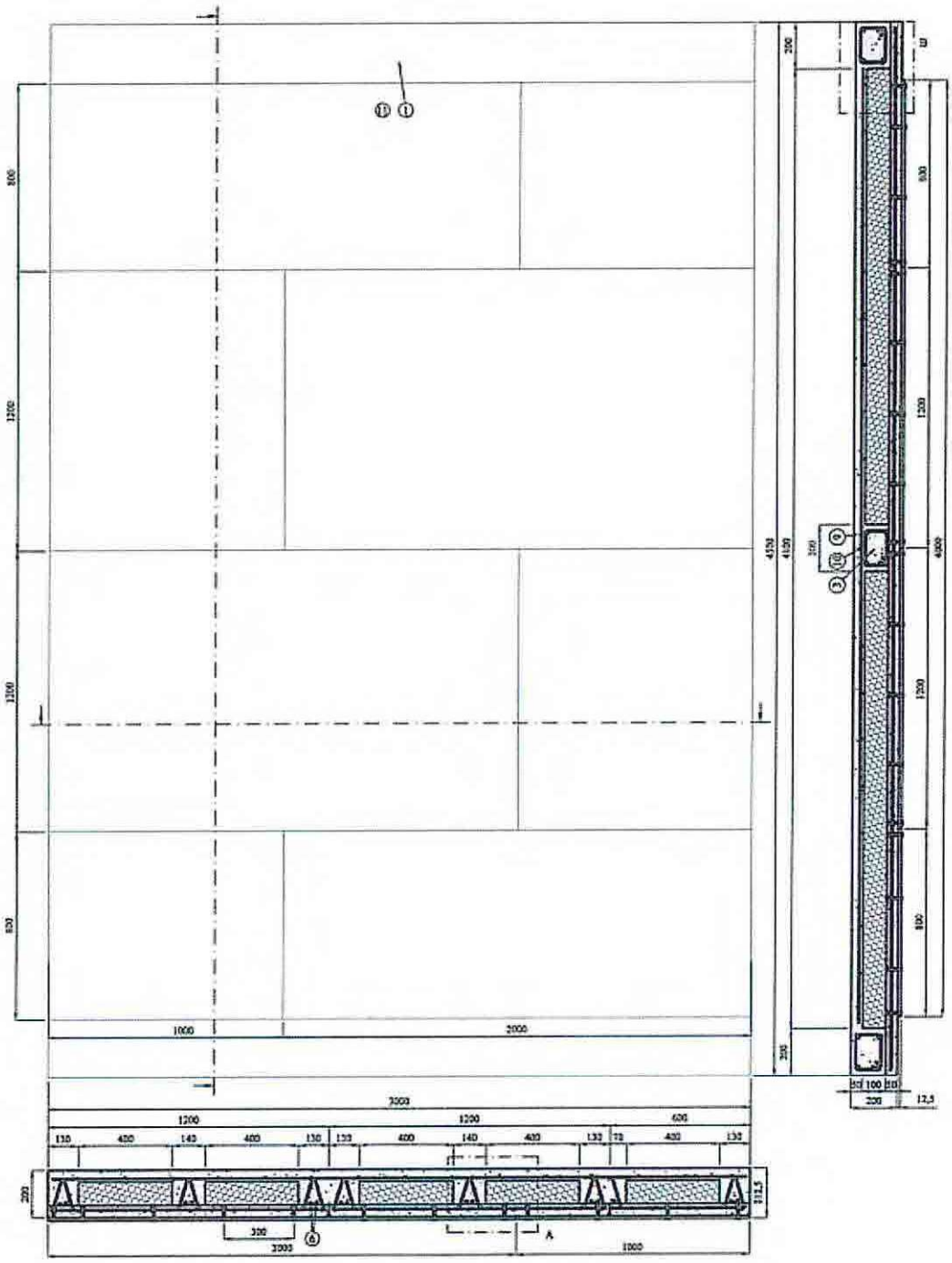
Assemblies shall be as detailed in the following section. Components shall be as specified below in Table A.2.3.1 and as shown in Figures A.2.3.2. and A.2.3.3. Note the figures show the tested assembly and are for general reference purposes only.

Table A.2.3.1

Item		Description
1. Precast base slab		
Concrete grade	:	C30/37
Dimensions	:	4500 x 1200 mm
Thickness		50 mm
2. Reinforcement mesh		
Reference	:	Arc welded B450A steel mesh, nominal wire diameter 5mm, nominal mesh aperture size 250 x 190 mm
Positioning	:	25 mm from base of slab
3. Top slab, longitudinal ribs and edge beams	:	
Description	:	Top slab: cast in place nominal thickness 50 mm Longitudinal ribs: nominal 140 mm wide for central rib and 130 mm for the outer ribs, cast in-situ Edge beams: nominal size 200 x 150 mm All cast using C25/30 concrete

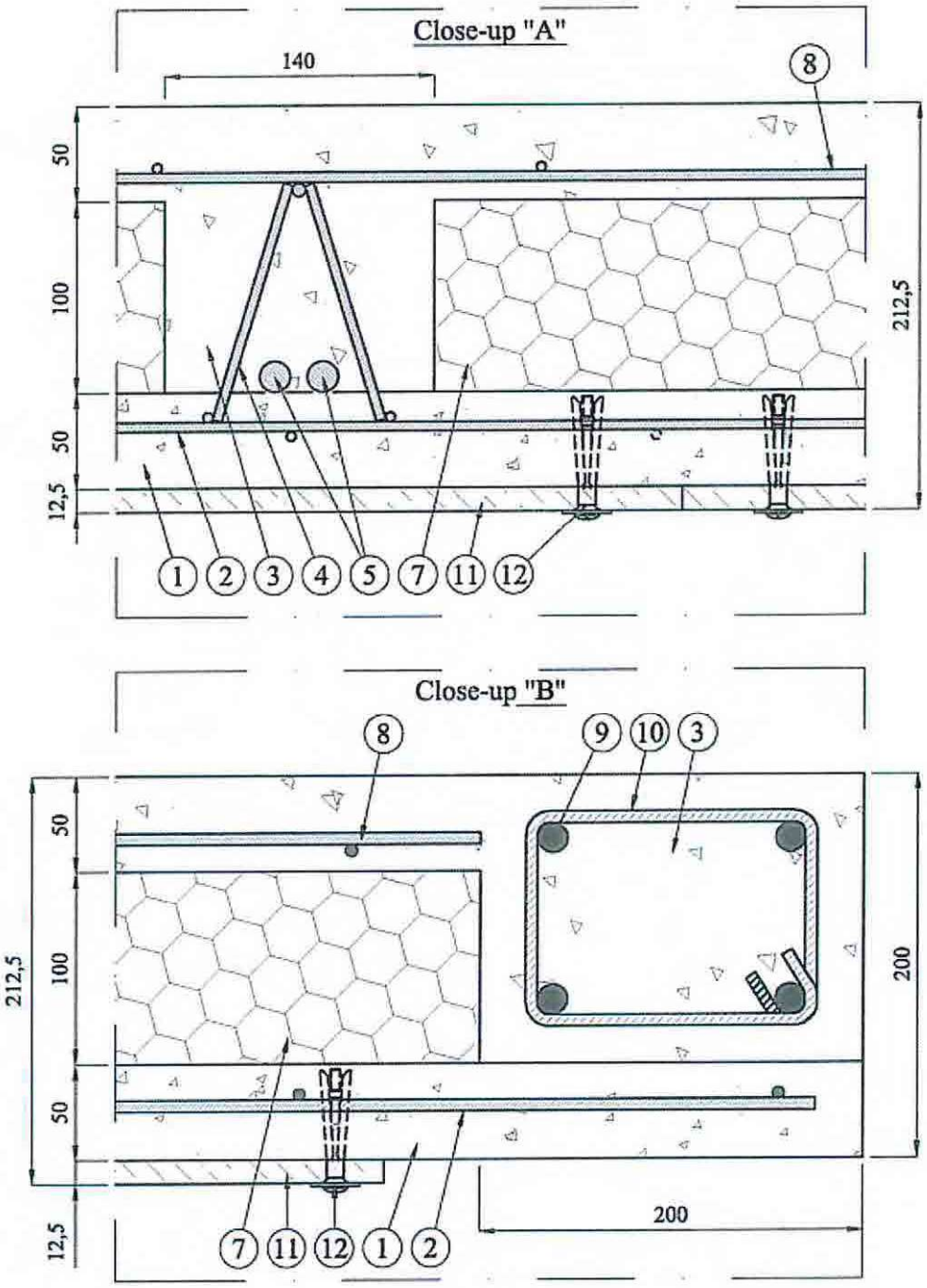
Item		Description
4. Lattice girder		
General description	:	B450A steel lattice girder, nominal height 125 mm laid on bottom slab's arc welded mesh and formed by two lower steel bars nominally 5 mm diameter each and an upper steel bar nominally 7 mm diameter, joined together by steel connecting plates formed from 5 mm nominal diameter steel bar.
Length	:	3000 mm
5. Lattice girder reinforcement bars		
General description	:	Two B450A steel bars, nominal diameter 16 mm each for the middle rib, placed on top of the bottom slabs
6. Lattice girder reinforcement bars		
General description	:	Two B450A steel bars, nominal diameter 14 mm each for the outer ribs, placed on top of the bottom slabs
7. Void formers		
General description	:	Weight reducing polystyrene blocks installed between ribs
Size	:	400 mm wide x 100 mm high
8. Reinforcement Mesh		
General description	:	Arc welded B450A steel mesh, nominal wire diameter 5mm, nominal mesh aperture size 200 x 200 mm
Positioning	:	30 mm from upper face of slab
9. Cross rib and edge beam reinforcement		
General description	:	Four B450A steel bars, nominal diameter 12 mm each
Positioning	:	Cross rib at mid-length and edge beams at each end of the assembly
10. Edge beam connecting plates		
General description	:	B450A steel connecting plates formed from nominal 8 mm diameter steel bars
11. Floor protection		
Manufacturer	:	Bifire s.r.l.
Product	:	AQUAFIRE®
Dimensions (individual board)	:	2000 x 1200 mm
Thickness		12.5 mm
Fitting method	:	Directly fixed to the underside of the floor assembly at nominal 300 mm centres
12. Floor protection fixings		
Manufacturer	:	FISHER
Product	:	SBS 9/4 metal expansion anchors
Size	:	9 mm nominal diameter by 60 mm long

Figure A.2.3.2 Schematic drawing of floor assembly



Do not scale. All dimensions are in mm

Figure A.2.2.3 Sectional views of floor assembly



Do not scale. All dimensions are in mm

Annex 2.4 – Specification of AQUAFIRE® board assemblies (intended type 8) Vertical non-loadbearing masonry wall, plastered on both faces and clad with a single layer of AQUAFIRE board on its exposed face

A.2.4.1 Classification

The AQUAFIRE® board assembly described in this annex has been tested in accordance with EN 1364-1 and classified in accordance with EN 13501-2 as follows:

Fire resistance classification: EI 120

A.2.4.2 Installation requirements

The general installation provisions given in A.2.0.1 of this ETA shall be taken into account.

A.2.4.3 Assembly

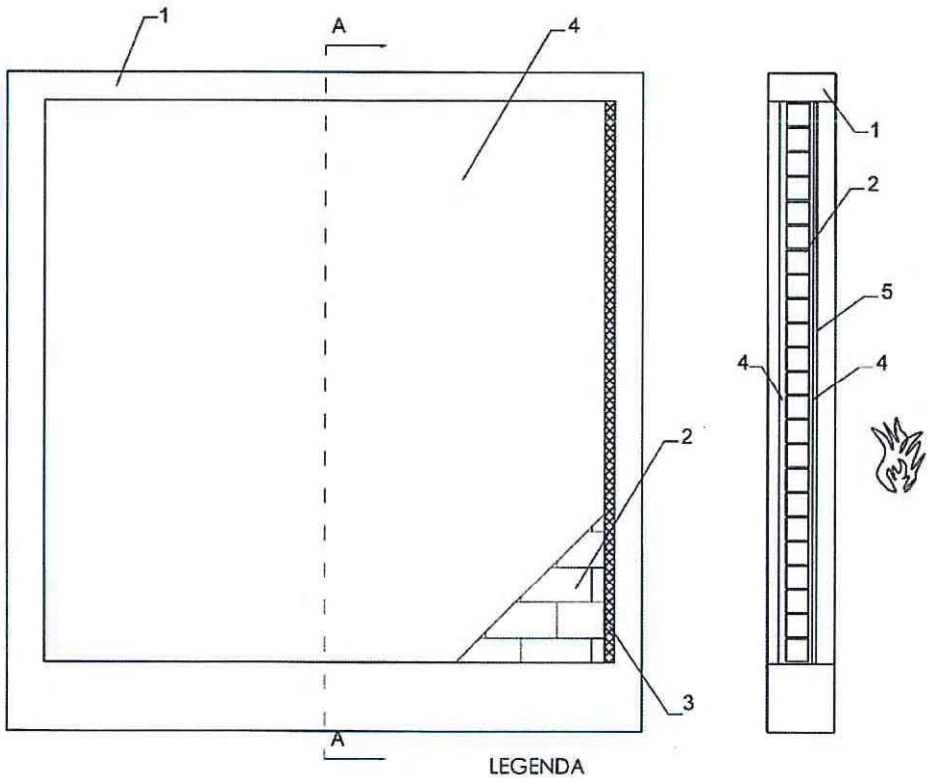
Assemblies shall be as detailed in the following section. Components shall be as specified below in Table A.2.4.1 and as shown in Figures A.2.4.2. to A.2.4.5. Note the figures show the tested assembly and are for general reference purposes only.

Table A.2.4.1

Item		Description
1. Masonry blocks (EN 771-1: 2011)		
Type	:	Low density
Material	:	Clay masonry
Category	:	II
Dimensions	:	245 x 80 x 250 mm
Percentage of holes	:	65%
Direction of holes	:	Horizontal
Minimum thickness of web	:	5 mm
Minimum thickness of shell	:	6 mm
2. Mortar		
Class	:	M5 according to EN 998-2: 2010
3. Render		
Class	:	CSIII according to EN 998-1: 2010
Thickness	:	Nominal 10 mm on each face of the masonry wall

Item		Description
4. Cladding board	:	
Manufacturer	:	Bifire s.r.l.
Product	:	AQUAFIRE®
Dimensions (individual board)	:	2000 x 1200 mm
Thickness		12.5 mm
Fitting method	:	Directly fixed to the exposed face of the wall assembly at nominal 400 mm horizontal and 500 mm vertical centres
5. Cladding fixings		
Manufacturer	:	FISHER
Product	:	SBS 9/4 steel screw anchors
Size	:	9 mm nominal diameter by 60 mm long

Figure A.2.4.2 Schematic drawing of wall assembly and vertical section



LEGENDA

1- Telaio di supporto
2- Blocchi
3- Bordo libero
4- Intonaco
5- AQUAFIRE sp. 12,5 mm

Do not scale. All dimensions are in mm

Figure A.2.4.3 Details of clay brick units

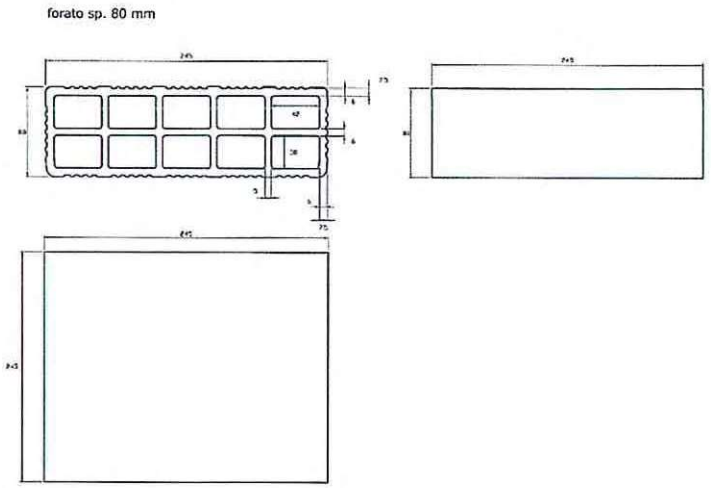
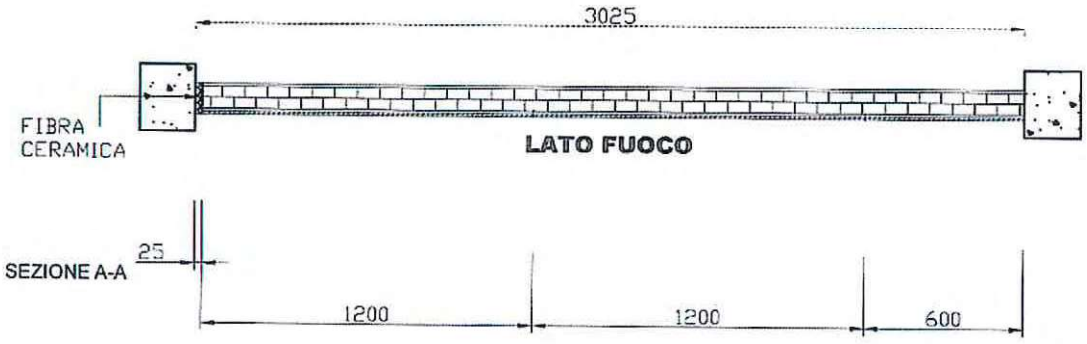
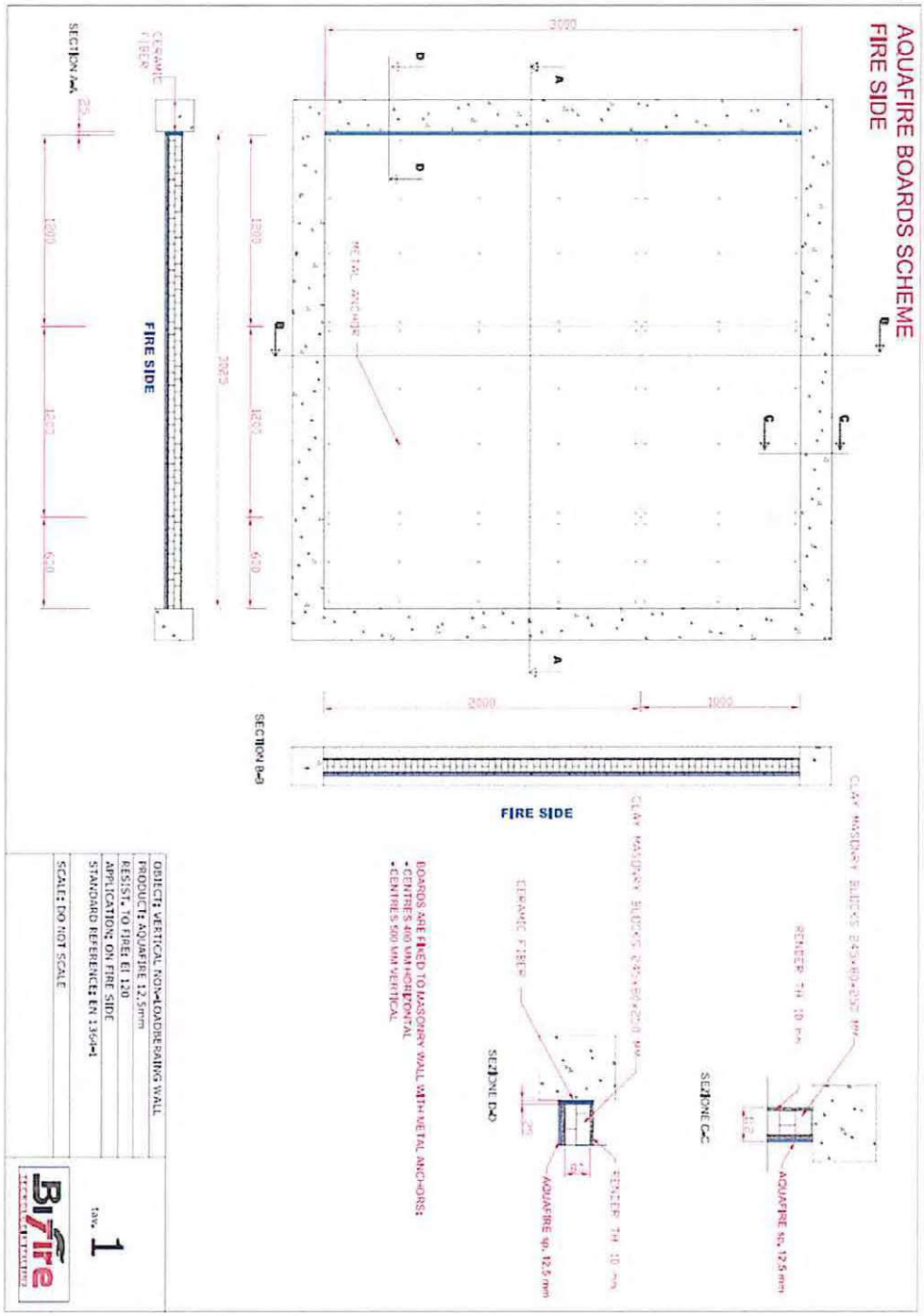


Figure A.2.4.4 Horizontal section through assembly



Do not scale. All dimensions are in mm

Figure A.2.4.5 Schematic drawing of wall assembly and board protection layout to exposed face with sections



Do not scale. All dimensions are in mm

Warrington Certification Ltd
Holmesfield Road
Warrington
WA1 2DS
United Kingdom

T : +44 (0) 1925 646 669
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W : www.exova.com
W:: www.warringtonfire.net

Notified Body: 1121
Warrington Certification Limited, Holmesfield Road, Warrington,WA1 2DS, Great Britain

Certificate of Conformity of the Factory Production Control

This Certificate applies to the construction product

"AQUAFIRE"
Fibre Cement Board

produced by or for

BiFire S.R.L
Via Lavoratori Autobianchi 1
20832 Desio (MB)
Italy

and produced in the manufacturing plant

BiFire S.R.L
Via Lavoratori Autobianchi 1
20832 Desio (MB)
Italy

This certificate attests that, after completion of a successful audit inspection, Warrington Certification Ltd are satisfied that the Quality Management Systems and Processes in operation, at the above manufacturing address, are fully in compliance with the Factory Production Control requirements for the construction product concerned.

This certificate was first issued on 17/04/2014 and will remain valid, until the below date, as long as the manufacturing conditions in the plant and the factory production control itself are not modified significantly.

Signed:

Issue Date: 17th April 2014

Valid to: 14th November 2015

CSI SpA
Certificazione e Testing

Sede legale - Uffici - Laboratori:
20021 Bollate - MI - I
Viale Lombardia 20
Tel. +39 02 383301
Fax +39 02 3503940
www.csi-spa.com

R.E.A. 1466310
Reg. Imprese 352168/8620/18
C.F./P.IVA IT11360160151
Cap. Sociale euro 1.040.000

RAPPORTO DI CLASSIFICAZIONE
CLASSIFICATION REPORT
CSI/0238c/11/RF

Rapporto di classificazione di reazione al fuoco del prodotto

Reaction to fire classification report of product ..... : **AQUAFIRE**

Descrizione
Description ..... : **Vedi pag. 2 / see page 2**

Per conto di
On behalf of ..... : **BIFIRE S.r.l.**

Indirizzo
Address ..... : **Via Carducci, 8**
20123 Milano

Norma tecnica: **EN 13501-1 - Classificazione al fuoco di prodotti ed elementi da costruzione - Parte 1: Classificazione sulla base dei dati di prova derivati da prove di reazione al fuoco**
Technical standard: ***EN 13501-1 Fire classification of construction products and building elements - Part 1: Classification using test data from reaction to fire tests***

Mod. 04AS1/1 - Rev. 8

Data / *Date* 28.12.2011

C S I S.p.A.
Viale Lombardia n. 20
20021 BOLLATE (MI)

1. DATI GENERALI / *GENERAL DATA* :

Identificazione delle norme di riferimento / *Standard reference identification*:

- **EN 13501-1 - Classificazione al fuoco di prodotti ed elementi da costruzione - Parte 1: Classificazione sulla base dei dati di prova derivati da prove di reazione al fuoco**
- ***EN 13501-1 Fire classification of construction products and building elements - Part 1: Classification using test data from reaction to fire tests.***
- **EN ISO 1182 Prove di reazione al fuoco prodotti edilizi - Prova di *non* combustibilità**
- ***EN ISO 1182 Reaction to fire tests for building products - Non combustibility test.***
- **EN ISO 1716 Prove di reazione al fuoco prodotti edilizi - determinazione del potere calorifico superiore**
- ***EN ISO 1716 Reaction to fire tests for building products - Determination of the gross calorific value.***

2. IDENTIFICAZIONE DELLE PROCEDURE / *PROCEDURES IDENTIFICATION*

- Procedura normalizzata / *Standard procedure* : ..... : **SI / *YES***
- Controllo calcoli e trasferimento dati / *Calculation and data transfer check* ..... : **SI / *YES***

3. DETTAGLI DEL PRODOTTO CLASSIFICATO / *DETAILS OF CLASSIFIED PRODUCT*

3.1 Natura e impiego / *Nature and end use application* :

Il prodotto **AQUAFIRE** è definito come un materiale incombustibile. La sua classificazione è sua classificazione è valida per le seguenti condizioni di impiego:
The product **AQUAFIRE** *is defined as a non combustible product. Its classification is valid for the following end use application(s):*

- Qualsiasi
- *Any*

3.2 Descrizione / *Description*:

Il prodotto **AQUAFIRE** è compiutamente descritto nella scheda tecnica allegata al presente rapporto di classificazione.
The product **AQUAFIRE** *is fully described in the data sheet attached to this classification report.*

4. DICHIARAZIONI / *DECLARATIONS*

- Questo rapporto di classificazione definisce la classificazione assegnata al prodotto indicato in copertina secondo le procedure stabilite nella norma EN 13501-1
- *This classification report defines the classification assigned to the product mentioned on the cover in accordance with the procedures given in EN 13501-1.*
- I risultati di prova contenuti nel presente rapporto di classificazione si riferiscono esclusivamente al campione provato
- *Test results contained in this classification report relate only to the specimens tested.*
- Il presente rapporto di classificazione non può essere riprodotto parzialmente senza l'autorizzazione del Responsabile di Laboratorio
  The classification report shall not be reproduced except in full without the written approval of the Managing Director.

CSI S.p.A. Viale Lombardia n. 38

5. RAPPORTI DI PROVA E RISULTATI DI PROVA IN SUPPORTO DI QUESTA CLASSIFICAZIONE
TEST REPORTS AND TEST RESULTS IN SUPPORT OF THIS CLASSIFICATION

5.1 Rapporti di prova / *test reports*

Nome del laboratorio / *Name of laboratory*	Nome del Committente / *Name of sponsor*	Numero di Identificazione del rapporto di prova / *Test report ref. No.*	Metodo di prova / *test method*
CSI S.p.A.	BIFIRE S.r.l.	CSI/0238a/11/RF	EN ISO 1182
CSI S.p.A.	BIFIRE S.r.l.	CSI/0238b/11/RF	EN ISO 1716

5.2 Risultati di prova per prodotti da costruzione esclusi i pavimenti
Test results for construction products except floorings

Metodo di prova *Test method*	Parametro *Parameter*	Numero di prove *Number of tests*	Risultati / *Results*	
			Parametri continui media / *Continuous parameter average [m]*	Parametri di conformità / *Compliance parameter*
EN ISO 1182				
	ΔT [°C] (1)	5	1,2	(-)
	Δm [%] (1)		11,7	(-)
	t_f [s] (1)		0	(-)
EN ISO 1716				
	PCS [MJ/kg]	3	0,15	(-)

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20021 BOLLATE (MI)

6. CLASSIFICAZIONE E CAMPO DIRETTO DI APPLICAZIONE
CLASSIFICATION AND DIRECT FIELD OF APPLICATION

6.1 Riferimenti e campo diretto di applicazione / *Reference and direct field of application*

Questa classificazione è stata condotta conformemente alla clausola 8.3 della EN 13501-1:2009.
This classification has been carried out in accordance with clause 8.3 of EN 13501-1: 2009.

6.2 Classificazione / *Classification*

Il prodotto **AQUAFIRE** in relazione al suo comportamento alla reazione al fuoco è classificato:
The product **AQUAFIRE** *in relation to its fire reaction behaviour is classified.*

A1

La classificazione aggiuntiva in relazione allo sviluppo di fumo è:
The additional classification in relation to smoke production is:

-

La classificazione aggiuntiva in relazione alle gocce/particelle accese è:
The additional classification in relation to flaming droplets/particles is:

-

Il formato per la classificazione di reazione al fuoco per i prodotti da costruzione eccetto i pavimenti è la seguente:
The format of the reaction to fire classification for construction products except flooring is:

Comportamento al fuoco *Fire behaviour*		Sviluppo di fumo *Smoke production*			Parti infiammate *Flaming droplets*	
A1	-	-	-	-	-	-

6.3 Campo di applicazione / *Field of application*

Questa classificazione è valida per le seguenti condizioni di impiego /
This classification is valid for the following end use conditions:

– Qualsiasi
Any

CSI S.p.A.
Viale Lombardia n. 20
20021 BOLLATE (MI)

7. LIMITAZIONI / *LIMITATIONS*

7.1 Avvertimento / *Warning*

Questo documento non rappresenta un'approvazione di tipo od una certificazione del prodotto
This document does not represent type approval or certification of the product.

DATA Date	IL Resp. Divisione Costruzioni Division Head	Il Direttore del Laboratorio Managing Director
28/12/2011	Ing. P. Mele	Ing. R. Gatti

CSI S.p.A.
Viale Lombardia n. 20
20021 BOLLATE (MI)

EC TYPE EXAMINATION (MODULE B)

CERTIFICATE Nr. MED205314CS

This is to certify, *that RINA, specified as Notified Body N° 0474 by the Italian "Ministero delle Infrastrutture e dei Trasporti Direzione Generale per la navigazione ed il Trasporto Marittimo ed Interno" on 25 November 1998, did undertake the relevant type approval procedures for the equipment identified below which was found to be in compliance with the Fire Protection requirements of Marine Equipment Directive (MED) 96/98/EC as modified by Directive 2012/32/EU*

MED Item N°	**A.1/3.13**
Description	**Non-combustible materials**
Type	**AQUAFIRE®**
Applicant	**BIFIRE S.R.L.** VIA LAVORATORI DELL'AUTOBIANCHI, 1 20832 DESIO (MB) ITALY
Testing standards	**IMO Res. MSC.307(88)-(2010 FTP Code)**
Reference standards	**Chap. II-2 and X of SOLAS 74 Convention, as amended, RINA Rules for the certification of Marine Equipment**

Issued at GENOA on
August 26, 2014

This Certificate is valid until
August 25, 2019

This Certificate consists of this sheet plus an attachment

[redacted]

Massimo Dinale
RINA Services S.p.A.

RINA Services S.p.A.
Via Corsica, 12 - 16128 Genova
Tel +39 010 53851
Fax +39 010 5351000

Milano, October 10th, 2013

Esteemed
BIFIRE S.r.l.
Via Lavoratori dell'Autobianchi, 1
20832 Desio MB

TESTING REPORT N°13-3621

Contract n°	N° 592-13	Sampling date	09-17-13
Sample	Panel	Receivment date	09-18-13
Sample number	**13-3316**	Starting test date	09-19-13
		Ending test date	09-30-13
Sampling	Carried out by the client		
Description	"Aquafire" sample		

The sample tested has shown the following results:

PARAMETER	M.U.	VALUE	TESTING METHOD
Asbestos (PCOM)	P/A	Absent	NIOSH 9002 1994

P/A= Presence/Abscence
PCOM= Phase Contrast Optical Microscopy

The laboratory applies quality management procedure compliant to UNI CEI EN ISO/IEC 17025:2005 regulation.
The results contained in this test report only referto the sample tested.
This test report may only be reproduced in full.

Chief Scientific Officer
Ordine interprovinciale Chimici della Lombardia n°1107
Dr. Giuseppe Belvedere

Laboratory General Manager
Dr. Claudio Ferri

Milano, November 8th, 2013

Esteemed
BIFIRE S.r.l.
Via Lavoratori dell'Autobianchi, 1
20832 Desio MB

TEST REPORT N°13-3959

Contract n°	N° 657-13	Sampling date	18-10-13
Sample	Panel	Receivment date	18-10-13
Sample number	**13-3732**	Starting test date	21-10-13
		Ending test date	05-11-13
Sampling	Carried out by the client		
Description	"Aquafire" sample		

The sample tested has shown the following results:

PARAMETER	M.U.	VALUE	TESTING METHOD
Formaldehyde	µg/Kg	not detectable (<10)	NIOSH 2539 1994

The laboratory applies quality management procedure compliant to UNI CEI EN ISO/IEC 17025:2005 regulation.
The results contained in this test report only referto the sample tested.
This test report may only be reproduced in full.

Chief Scientific Officer
Ordine Interprovinciale Chimici della Lombardia n°1107
Dr. Giuseppe Belvedere

Laboratory General Manager
Dr. Claudio Ferri

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PEC: ist-giordano@legalmail.it
Cod. Fisc./Part. IVA: 00 549 540 409 - Cap. Soc. € 1.500.000 i.v.
R.E.A. c/o C.C.I.A.A. (RN) 156766
Registro Imprese di Rimini n. 00 549 540 409

TEST REPORT No. 315705

Place and date of issue: Bellaria-Igea Marina - Italy, 09/05/2014

Customer: BIFIRE S.r.l.- Via Carducci, 8 - 20123 MILANO (MI) - Italy

Date test requested: 20/01/2014

Order number and date: 61981, 21/01/2014

Date sample received: 20/01/2014 and 02/04/2014

Test date: from 29/01/2014 to 23/04/2014

Purpose of test: freeze-thaw cycling of fibre-cement flat sheets in accordance with clause 7.4.1 of standard UNI EN 12467:2012

Test site: Istituto Giordano S.p.A. - Via Erbosa, 72 - 47043 Gatteo (FC) - Italy

Sample origin: sampled by Istituto Giordano in accordance with the procedure specified in sample report dated 14/01/2014 and supplied by the Customer

Identification of sample received: No. 2014/0109

Sample name*

The test sample is called “AQUAFIRE”.

Description of sample*

The test sample comprises untreated fibre-reinforced lightweight cement boards and 10 test pieces of size 250 × 100 mm and thickness 12,5 mm that the Customer arranged to cut from sheets of the same type in accordance with the requirements of standard UNI EN 12467:2012.

(*) according to that stated by the Customer.

The boards have the following specifications:

– density = 960 kg/m³ ± 15 %;
– width = (1200 ± 3,6) mm;
– length = (2000 ± 5,0) mm;
– thickness = (12,5 ± 1,2) mm.

5 of these test pieces were cut in the machine direction “M” and 5 at right angles to the machine “T”.

The lot of test pieces was supplied by the Customer after performing the freeze-thaw conditioning cycles specified by standard UNI EN 12467:2012.

Normative References

The test was carried out in accordance with the requirements of standard UNI EN 12467:2012 dated 11/10/2012 “Fibre-cement flat sheets - Product specification and test methods”, in particular:

– requirements in accordance with clauses 5.2.2 “Category A” and 5.5.2 of standard UNI EN 12467:2012;
– test method specified by subclause 7.4.1 “Freeze-thaw” of standard UNI EN 12467:2012.

Test apparatus

The following equipment was used to carry out the test:

– IG 10000 digital force gauge manufactured by Istituto Giordano S.p.A., speed range 0,05-300 mm/min, clear span between support columns of 640 mm and effective travel 2000 mm (apparatus in-house identification code FT161);
– AEP load cell, capacity 10 kN (apparatus in-house identification code EDI073);
– steel test frame complying with clause 7.3.2.2.1 with radius of supports and loading bar of 10 mm and span between the supports l_s = 10 mm;
– Mitutoyo Corporation digital calliper gauge with 10 micron resolution (apparatus in-house identification code EDI066).

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Test method

The test pieces were split into two lots of which:

– the first comprising test pieces obtained in the laboratory from untreated boards of type “M” and “T” and designated for testing in the untreated condition;

– the second comprising Customer-supplied test pieces of type “M” and “T” designated for testing after freeze-thaw conditioning.

The specimens from both lots were immersed in water for 24 h at ambient temperature 23 ± 2 °C.

The specimens from both lots then underwent the bending strength test in accordance with subclause 7.3.2.3 of standard UNI EN 12467:2012. The rate of loading was set to 30 mm/min such that breakage occurs within 10 s and 30 s.

Cylindrical supports were used of radius 10 mm arranged so that the span between the centres of the supports “l_S” is 200 mm.

The following were calculated for each test piece:

– modulus of rupture MOR, in MPa, in accordance with clause 7.3.2.4 “Expression and interpretation of results” of standard UNI EN 12467:2012, as given by the following formula.

$$MOR=\frac{3F\cdot l_S}{2\cdot b\cdot e^2}$$

where: F = breaking load, in N;

l_S = span between the axes of supports, in mm;

b = width of the test piece, in mm;

e = thickness of the test piece, in mm;

– modulus of elasticity MOE, in MPa, in accordance with clause 7.3.2.4.2 of standard UNI EN 12467:2012, as given by the following formula.

$$E=\frac{(F_2-F_1)\cdot l_S^3}{4\cdot b\cdot e^3\cdot (f_2-f_1)}$$

where: l_S = span between the axes of supports, in mm;

F_1 and F_2 = loads, taken from two points within the linear section of the plot, below the limit of proportionality;

b = width of the test piece, in mm;

e = thickness of the test piece, in mm;

f_1 and f_2 = deflections corresponding to the load selected, in mm.

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– individual ratio, MR_i in accordance with clause 7.4.1.4 of standard UNI EN 12467:2012, calculated as follows:

$$MR_i = \frac{MOR_{fi}}{MOR_{fci}}$$

where: MOR_{fi} = modulus of rupture of the specimen from the i^{th} pair after freeze-thaw cycling (second lot);

MOR_{fci} = modulus of rupture of the specimen from the i^{th} pair tested for reference (first lot).

Finally, the average, R, and standard deviation, s, of the individual ratio, MR_i, were calculated along with the lower estimation, R_L, of the mean of the ratios at 95% confidence level as follows:

$$R_L = R - 0{,}58 \cdot s$$

comparing the result with the requirements of clause 5.5.2 of standard UNI EN 12467:2012.

Environmental conditions during test

Ambient temperature	(23 ± 2) °C
Relative humidity	(50 ± 5) %

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Test results

Lot [No.]	Direction of test	Test piece [No.]	Condition-ing	Measured thickness "e" [mm]	Breaking load "F" [N]	Modulus of rupture "MOR_{fci}" [MPa]	Modulus of elasticity "MOE" [MPa]
1	M	1	none	12,3	326	6,4	501
		2		12,1	193	6,0	515
		3		12,5	301	5,8	635
		4		12,1	300	6,2	481
		5		12,2	273	5,5	546
	T	1		12,2	292	5,9	1646
		2		12,4	272	5,4	1413
		3		12,3	252	5,0	1451
		4		12,2	270	5,4	1506
		5		12,3	305	6,0	1736
Mean				**12,3**	**288**	**5,8**	**1043**
Standard deviation				**0,1**	**37**	**0,4**	**544**
2	M	1	freeze-thaw	12,2	297	6,0	1087
		2		12,6	305	5,8	1245
		3		12,6	302	5,7	1235
		4		12,3	321	6,3	1611
		5		12,5	293	5,7	1456
	T	1		12,2	301	6,0	1712
		2		12,4	298	5,8	1588
		3		12,4	287	5,6	1870
		4		12,4	292	5,7	1428
		5		12,4	321	6,3	1234
Mean				**12,4**	**302**	**5,9**	**1447**
Standard deviation				**0,1**	**11**	**0,3**	**249**

R (average MR_i)	0,98
s (standard deviation of MR_i)	0,21
R_L (lower estimation of MR_i)	0,86*

(*) In accordance with subclause 5.5.2 of standard UNI EN 12467:2012, the ratio R_L shall be not less than 0,75.

ISTITUTO GIORDANO

Findings

On the basis of the test performed, the results obtained and the provisions of subclauses 5.5.2 and 7.4.1 of standard UNI EN 12467:2012, as regards the freeze-thaw cycling test, the test sample, comprising fibre-cement flat sheets called "AQUAFIRE" submitted by the company BIFIRE S.r.l.- Via Carducci, 8 - 20123 MILANO (MI) - Italy, meets the requirements specified for

Category A

The results given refer exclusively to the test sample itself and are only valid under the same conditions in which testing was carried out.
This test report alone shall not be considered a certificate of conformity.

Test Technician:
Dott. Ing. Paolo Bertini

Head of Security and Safety Laboratory:
Dott. Andrea Bruschi

Chief Executive Officer
(Dott. Arch. Sara Lorenza Giordano)

Istituto Giordano S.p.A.
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Registro Imprese di Rimini n. 00 549 540 409

TEST REPORT No. 297767

Place and date of issue: Bellaria-Igea Marina - Italy, 11/09/2012

Customer: BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy

Date test requested: 30/07/2012

Order number and date: 57225, 01/08/2012

Date sample received: 02/08/2012

Test date: from 02/08/2012 to 31/08/2012

Purpose of test: Heat-rain cycling of fibre-cement flat sheets in accordance with subclauses 5.5.3 and 7.4.2 of standard UNI EN 12467:2007

Test site: Istituto Giordano S.p.A. - Blocco 4 - Via Rossini, 2 - 47814 Bellaria-Igea Marina (RN) - Italy and Istituto Giordano S.p.A. - Via Erbosa, 72 - 47043 Gatteo (FC) - Italy

Sample origin: sampled and supplied by the Customer

Identification of sample received: No. 2012/1709

Sample name*

The test sample is called “AQUAFIRE”.

(*) according to that stated by the Customer.

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Description of sample*

The test sample comprises lightweight silicate fibre-cement flat sheets whose characteristics are specified in the table here below.

Width	1200 mm ± 1 %
Length	2000 mm ± 1 %
Thickness	12,5 mm ± 1 %
Density	960 kg/m^3 ± 15 %

Normative References

The test was carried out in accordance with the requirements of standard UNI EN 12467:2007 dated 25/01/2007 "Lastre piane di fibrocemento - Specifica di prodotto e metodi di prova" *("Fibre-cement flat sheets - Product specification and test methods")*, in particular:

– requirements in accordance with subclauses 5.2.2 "Category A" and 5.5.3 of standard UNI EN 12467:2007;
– test method specified by clause 7.4.2 "Heat-rain" of standard UNI EN 12467:2007.

Description of specimens

2 specimens of size 2000 × 1200 mm and 2000 × 600 mm were cut from the sample and laid horizontally in order to create a test area when joined of 3,5 m^2.

Test apparatus

The following equipment was used to carry out the test:

– temperature and humidity chamber (apparatus in-house identification code FT152) with temperature range of (–20 ± 2) °C to (+60 ± 2) °C;

(*) according to that stated by the Customer.

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– light radiation apparatus fitted with Osram Ultra-Vitalux 300 W lamps such as to guarantee a total irradiance level of (900 ± 100) W/m²;
– water spray system complete with flow meter, capable of providing complete wetting on the board face with an output of approximately 1 l/min/m^2.

Test method

The boards were joined and installed in the centre of the climate chamber in order to have ambient temperature on one side of the boards and the temperatures set by the radiant heat and rain cycles on the other.
In accordance with the Customer's instructions, the side with the rough surface is exposed to radiation.
The black body temperature is considered and regulated during radiant heating at (60 ± 5) °C.
In accordance with table 11 of the reference standard, the specimen underwent the following heat-rain cycle:

Steps	**Duration** [h:min]
Water spray (1 l/min/m^2)	2:50 ± 0:05
Pause	0:10 ± 0:01
Radiant heat (black body temperature = 60 ± 5 °C)	2:50 ± 0:05
Pause	0:10 ± 0:01
Total cycle	**6:00 ± 0:12**

50 cycles for category A were carried out as requested by subclause 5.5.3 of standard UNI EN 12467:2007.

As requested by subclause 5.5.3 of standard UNI EN 12467:2007, after testing it was verified that any visible cracks, delamination, warping and bowing or other defects in the boards were not of such a degree as to affect their performance in use. Subsequently, the water impermeability test was carried out in accordance with 5.4.4 and 7.3.3 of the reference standard.

Test results

Upon completion of the test in accordance with 5.5.3 of standard UNI EN 12467:2007, no visible cracks, delamination, warping and bowing or other defects in the sheets were noted of such a degree as to affect their performance in use.

In accordance with 5.4.4 and 7.3.3 of standard UNI EN 12467:2007, no formation of drops of water occurred during the impermeability test.

Photo of specimen during the impermeability test

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Findings

On the basis of the test performed, the results obtained and the provisions of subclauses 5.5.3 and 7.4.2 of standard UNI EN 12467:2007, as regards the heat-rain cycling test, the test sample, comprising fibre-cement flat sheets called “AQUAFIRE” submitted by the company BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy, meets the requirements specified for

Category A

The results given refer exclusively to the test sample itself and are only valid under the same conditions in which testing was carried out.
This test report alone shall not be considered a certificate of conformity.

Test Technician
(Dott. Ing. Paolo Bertini)

Head of
Security and Safety Laboratory
(Geom. Roberto Porta)

Test Technician
(Dott. Alessandro Trevisani)

Head of Wood Technology / Conditioning Laboratory
(Dott. Alessandro Trevisani)

Managing Director
(Dott. Ing. Vincenzo Iommi)

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Registro Imprese di Rimini n. 00 549 540 409

TEST REPORT No. 315704

Place and date of issue: Bellaria-Igea Marina - Italy, 09/05/2014

Customer: BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy

Date test requested: 20/01/2014

Order number and date: 61981, 21/01/2014

Date sample received: 20/01/2014 and 02/04/2014

Test date: from 29/01/2014 to 23/04/2014

Purpose of test: soak-dry testing of fibre-cement flat sheets in accordance with subclause 7.3.6 of standard UNI EN 12467:2012

Test site: Istituto Giordano S.p.A. - Via Erbosa, 72 - 47043 Gatteo (FC) - Italy

Sample origin: sampled by Istituto Giordano in accordance with the procedure specified in sample report dated 14/01/2014 and supplied by the Customer

Identification of sample received: No. 2014/0109

Sample name*

The test sample is called “AQUAFIRE”.

Description of specimen*

The test sample comprises untreated fibre-reinforced lightweight cement boards and 10 test pieces of size 250 × 100 mm and thickness 12,5 mm that the Customer arranged to cut from sheets of the same type in accordance with the requirements of standard UNI EN 12467:2012.

(*) according to that stated by the Customer.

The boards have the following specifications:

– density = 960 kg/m³ ± 15 %;
– width = (1200 ± 3,6) mm;
– length = (2000 ± 5,0) mm;
– thickness = (12,5 ± 1,2) mm.

5 of these test pieces were cut in the machine direction “M” and 5 at right angles to the machine “T”.

The lot of test pieces was supplied by the Customer after performing the soak-dry conditioning cycles specified by standard UNI EN 12467:2012.

Normative References

The test was carried out in accordance with the requirements of standard UNI EN 12467:2012 dated 11/10/2012 “Fibre-cement flat sheets - Product specification and test methods”, in particular:

– requirements in accordance with clauses 5.2.2 “Category A” and 5.5.5 of standard UNI EN 12467:2012;
– test method specified by subclause 7.3.6 “Soak-dry” of standard UNI EN 12467:2012.

Description of test pieces

In accordance with standard UNI EN 12467:2012, 10 test pieces were cut from the untreated board of size 250 × 100 mm and original product thickness.

5 of the ten test pieces were cut in the machine direction “M” and 5 at right angles to the machine “T”.

Test apparatus

The following equipment was used to carry out the test:

– IG 10000 digital force gauge manufactured by Istituto Giordano S.p.A., speed range 0,05-300 mm/min, clear span between support columns of 640 mm and effective travel 2000 mm (apparatus in-house identification code FT161);
– AEP load cell, capacity 10 kN (apparatus in-house identification code EDI073);

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– steel test frame complying with clause 7.3.2.2.1 with radius of supports and loading bar of 10 mm and span between the supports l_s = 10 mm;
– Mitutoyo Corporation digital calliper gauge with 10 micron resolution (apparatus in-house identification code EDI066).

Test method

The test pieces were split into two lots of which:
– the first comprising test pieces obtained in the laboratory from untreated boards of type “M” and “T” and designated for testing in the untreated condition;
– the second comprising Customer-supplied test pieces of type “M” and “T” designated for testing after soak-dry conditioning.

The specimens from both lots were immersed in water for 24 h at ambient temperature (23 ± 2) °C.

The specimens from both lots then underwent the bending strength test in accordance with subclause 7.3.2.3 of standard UNI EN 12467:2012. The rate of loading was set to 30 mm/min such that breakage occurs within 10 s and 30 s.

Cylindrical supports were used of radius 10 mm arranged so that the span between the centres of the supports “l_S” is 200 mm.

The following were calculated:
– modulus of rupture MOR, in MPa, in accordance with clause 7.3.2.4 “Expression and interpretation of results” of standard UNI EN 12467:2012, as given by the following formula.

$$MOR=\frac{3F\cdot l_S}{2\cdot b\cdot e^2}$$

where: F = breaking load, in N;
l_S = span between the axes of supports, in mm;
b = width of the test piece, in mm;
e = thickness of the test piece, in mm;

– modulus of elasticity MOE, in MPa, in accordance with clause 7.3.2.4.2 of standard UNI EN 12467:2012, as given by the following formula.

$$E=\frac{(F_2-F_1)\cdot l_S^3}{4\cdot b\cdot e^3\cdot(f_2-f_1)}$$

where: l_S = span between the axes of supports, in mm;

F_1 and F_2 = loads, taken from two points within the linear section of the plot, below the limit of proportionality;

b = width of the test piece, in mm;

e = thickness of the test piece, in mm;

f_1 and f_2 = deflections corresponding to the load selected, in mm.

– individual ratio, MR_i in accordance with clause 7.3.6.4 of standard UNI EN 12467:2012, calculated as follows:

$$MR_i = \frac{MOR_{fi}}{MOR_{fci}}$$

where: MOR_{fi} = modulus of rupture of the i^{th} specimen after the soak-dry cycles (second lot);

MOR_{fci} = modulus of rupture of the specimen from the i^{th} pair tested for reference (first lot).

Finally, the average, R, and standard deviation, s, of the individual ratio, MR_i, were calculated along with the lower estimation, R_L, of the mean of the ratios at 95% confidence level as follows:

$$R_L = R - 0{,}58 \cdot s$$

comparing the result with the requirements of clause 5.5.5 of standard UNI EN 12467:2012.

Environmental conditions during test

Ambient temperature	(23 ± 2) °C
Relative humidity	(50 ± 5) %

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Test results

Lot [No.]	Direction of test	Test piece [No.]	Condition-ing	Measured thickness "e" [mm]	Breaking load "F" [N]	Modulus of rupture "MOR_{fci}" [MPa]	Modulus of elasticity "MOE" [MPa]
1	M	1	none	12,3	326	6,4	501
		2		12,1	193	6,0	515
		3		12,5	301	5,8	635
		4		12,1	300	6,2	481
		5		12,2	273	5,5	546
	T	1		12,2	292	5,9	1646
		2		12,4	272	5,4	1413
		3		12,3	252	5,0	1451
		4		12,2	270	5,4	1506
		5		12,3	305	6,0	1736
Mean				**12,3**	**288**	**5,8**	**1043**
Standard deviation				**0,1**	**37**	**0,4**	**544**
2	M	1	soak-dry	12,2	278	5,6	961
		2		12,3	315	6,2	837
		3		12,2	303	6,1	1132
		4		12,6	295	5,6	1098
		5		12,6	329	6,2	1183
	T	1		12,4	288	5,7	910
		2		12,4	260	5,1	799
		3		12,1	278	5,7	838
		4		12,2	295	5,9	1062
		5		12,6	333	6,3	963
Mean				**12,4**	**297**	**5,8**	**978**
Standard deviation				**0,2**	**23**	**0,4**	**135**

R (average MR_i)	1,03
s (standard deviation of MR_i)	0,05
R_L (lower estimation of MR_i)	1,00*

(*) In accordance with subclause 5.5.5 of standard UNI EN 12467:2012, the ratio R_L shall be not less than 0,75.

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Findings

On the basis of the test performed, the results obtained and the provisions of subclauses 5.5.5 and 7.3.6 of standard UNI EN 12467:2012, as regards the soak-dry cycling test, the test sample, comprising fibre-cement flat sheets called “AQUAFIRE” submitted by the company BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy, meets the requirements specified for

Category A

The results given refer exclusively to the test sample itself and are only valid under the same conditions in which testing was carried out.
This test report alone shall not be considered a certificate of conformity.

Test Technician:
Dott. Ing. Paolo Bertini

Head of Security and Safety Laboratory:
Dott. Andrea Bruschi

Chief Executive Officer
(Dott. Arch. Sara Lorenza Giordano)

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TEST REPORT No. 299803

Place and date of issue: Bellaria-Igea Marina - Italy, 12/11/2012

Customer: BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy

Date test requested: 30/07/2012

Order number and date: 57225, 01/08/2012

Date sample received: 02/08/2012

Test date: from 30/08/2012 to 31/08/2012

Purpose of test: Water impermeability of fibre-cement flat sheets in accordance with clause 7.3.3 of standard UNI EN 12467:2007

Test site: Istituto Giordano S.p.A. - Via Erbosa, 72 - 47043 Gatteo (FC) - Italy

Sample origin: sampled and supplied by the Customer

Identification of sample received: No. 2012/1709

Sample name*

The test sample is called “AQUAFIRE”.

(*) according to that stated by the Customer.

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Description of sample*

The test sample comprises lightweight silicate cement board whose characteristics are given in the following Customer-supplied technical data sheet.

TECHNICAL DATA SHEET

PRODUCT DESCRIPTION	
Manufacturer	Bifire S.r.l.
General	Lightweight silicate cement board
Type of material	anisotropic
Production system	Mix of cement and aggregates
Bulk process	Curing
Component assembly	Mixing, kneading, impregnation and extrusion
Installation	Screwed to supporting framework
Use	Building

TECHNICAL SPECIFICATIONS			
Description	**Unit**	**Value**	**Tolerances**
Density	[kg/m^3]	960	± 15 %
Width	[mm]	1200	± 1 %
Length	[mm]	2000	± 1 %
Thickness	[mm]	12,5	± 1,0 mm

(*) according to that stated by the Customer.

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Normative References

The test was carried out in accordance with the requirements of standard UNI EN 12467:2007 dated 25/01/2007 "Lastre piane di fibrocemento - Specifica di prodotto e metodi di prova" *("Fibre-cement flat sheets - Product specification and test methods")*, in particular:

– requirements in accordance with clauses 5.2.2 "Category A" and 5.4.4 of standard UNI EN 12467:2007;
– test method specified by clause 7.3.3 "Water impermeability" of standard UNI EN 12467:2007.

Description of specimens

The customer arranged to cut 3 specimens from the sample, size 600 × 500 mm and thickness 12,5 mm, in accordance with the requirements of clause 7.3.3.1.

Test apparatus

The following equipment was used to carry out the test:

– Mitutoyo Corporation digital calliper gauge with 10 micron resolution (apparatus in-house identification code EDI066);
– digital chronometer.

Test method

A suitable frame was sealed on top of the specimen in order to leave a clear test area of 550 × 450 mm. The frame was filled with water to a height of 20 mm above the face of the sheet. This arrangement was placed in an environment chamber with controlled temperature and humidity so that the underside can be viewed without moving the specimen during the test. The duration of the test was 24 h.

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Environmental conditions during test

Ambient temperature	(23 ± 2) °C
Relative humidity	(50 ± 5) %

Test results

Specimen [No.]	Height of water above specimen [mm]	Duration of test [h]	Effect
1	20	24	no traces of moisture or drops of water
2	20	24	no traces of moisture or drops of water
3	20	24	no traces of moisture or drops of water

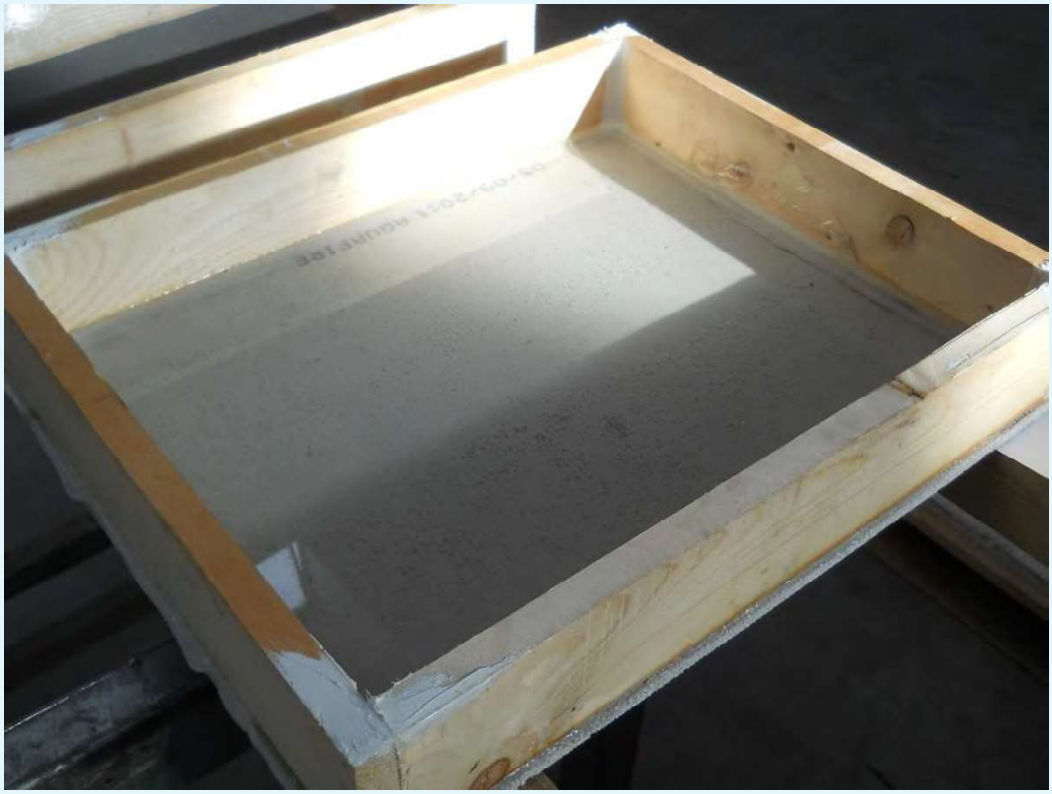

Photo of a specimen during testing

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Findings

On the basis of the test performed, the results obtained and the provisions of subclauses 5.4.4 and 7.3.3 of standard UNI EN 12467:2007, as regards the water impermeability test, the test sample, comprising fibre-cement flat sheets called "AQUAFIRE" submitted by the company BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy, meets the requirements specified for

Category A

The results given refer exclusively to the test sample itself and are only valid under the same conditions in which testing was carried out.
This test report alone shall not be considered a certificate of conformity.

Test Technician	Head of	Managing Director
(Dott. Ing. Paolo Bertini)	Security and Safety Laboratory	(Dott. Ing. Vincenzo Iommi)
	(Geom. Roberto Porta)	

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RAPPORTO DI PROVA N. 315972

TEST REPORT No. 315972

Luogo e data di emissione: Bellaria-Igea Marina - Italia, 20/05/2014
Place and date of issue:

Committente: BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italia
Customer:

Data della richiesta della prova: 23/01/2014
Date test requested:

Numero e data della commessa: 61981, 23/01/2014
Order number and date:

Data del ricevimento del campione: 20/01/2014
Date sample received:

Data dell'esecuzione della prova: dal*/from* 31/01/2014 al*/to* 24/02/2014
Test date:

Oggetto della prova: proprietà di trasmissione del vapore d'acqua secondo la norma UNI EN ISO 12572:2006 di materiali e prodotti da costruzione
Purpose of test: *water vapour transmission properties of building materials and products in accordance with standard UNI EN ISO 12572:2006*

Luogo della prova: Istituto Giordano S.p.A. - Blocco 1 - Via Rossini, 2 - 47814 Bellaria-Igea Marina (RN) - Italia
Place of test:

Provenienza del campione: campionato da Istituto Giordano secondo le procedure definite nel verbale di prelievo del 14/01/2014 e fornito dal Committente
Sample origin: *sampled by Istituto Giordano in accordance with the procedure specified in sample report dated 14/01/2014 and supplied by the Customer*

Identificazione del campione in accettazione: 2014/0109
Identification of sample received:

Denominazione del campione*.

Sample name.*

Il campione sottoposto a prova è denominato "AQUAFIRE".
The test sample is called "AQUAFIRE".

Descrizione del campione*.

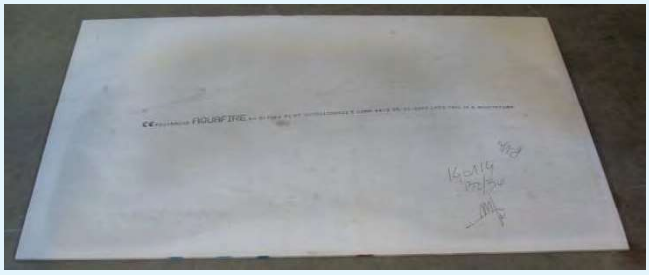
Description of sample.*

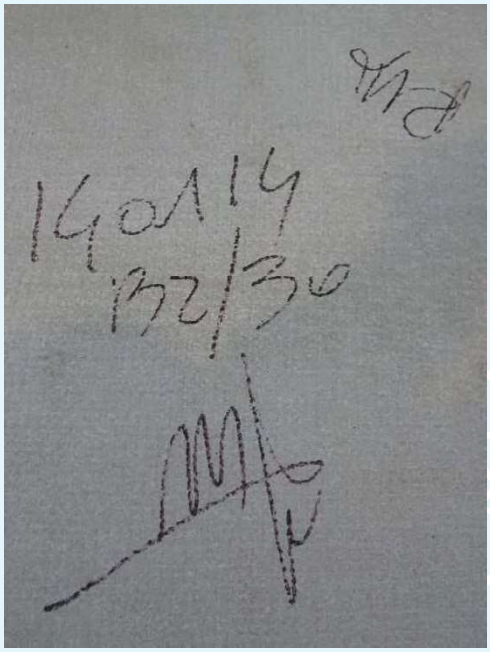
Il campione in esame è costituito da una lastra in cemento alleggerito fibrorinforzato, avente spessore nominale 12,5 mm.
The test sample consists of No. 2 slabs made of lightweight fiber-reinforced concrete, with a nominal thickness of 12,5 mm.

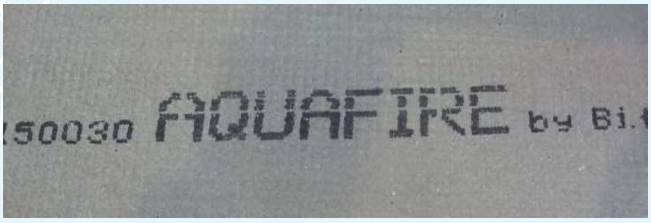
(*) Secondo le dichiarazioni del Committente.
According to information supplied by the Customer.

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
LAB N° 0021

LAB N° 0021







Fotografie del campione.
Photos of test sample.

Riferimenti normativi.

Normative references.

La prova è stata eseguita secondo le prescrizioni della norma UNI EN ISO 12572:2006 del 12/10/2006 "Prestazione igrotermica dei materiali e dei prodotti per edilizia. Determinazione delle proprietà di trasmissione del vapore d'acqua", utilizzando la procedura interna di dettaglio PP001 revisione 21 del 12/02/2014 "Determinazione delle proprietà di trasmissione del vapore acqueo".

The test was carried out in accordance with the requirements of standard UNI EN ISO 12572:2006 dated 12/10/2006 "Hygrothermal performance of building materials and products. Determination of water vapour transmission properties".

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ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO

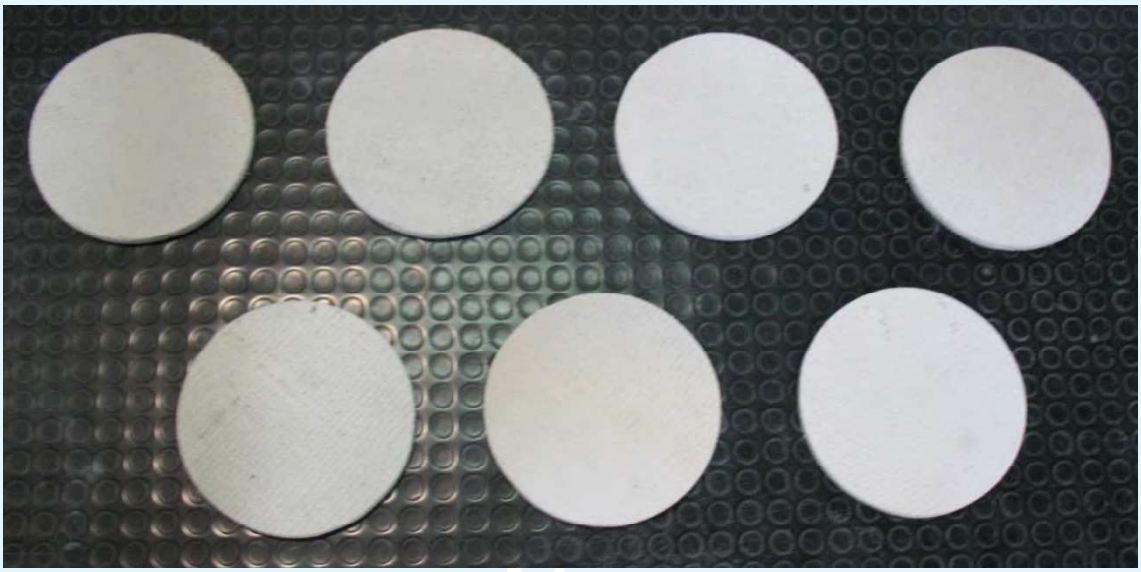
LAB N° 0021

Descrizione delle provette.

Specimen description.

Dal campione in esame sono state ricavate, mediante taglio, n. 5 (+ 2 di riferimento) provette cilindriche di diametro nominale 200 mm.

No. 5 specimens (+ 2 dummies specimens) of diameter 200 mm have been made from the sample under examination by cutting.



Fotografia delle provette.

Photo of the specimens

Condizionamento delle provette.

Specimen conditioning.

Prima della prova le provette sono state sottoposte a un condizionamento a temperatura di 23 °C e U.R. del 50 %, per 24 h.

The specimens were conditioned for 24 h at a temperature of 23 °C and 50 % of relative humidity.

Modalità della prova.

Test methods.

Le provette sono state installate sull'apertura dei recipienti di prova contenenti del sale essiccante al fine di mantenere l'umidità relativa all'interno del 0 %.

Le provette sono state inserite all'interno di una camera climatica alla temperatura di 23 °C ed al 50 % di umidità relativa.

The specimens were fitted on the opening of the test cups containing desiccant salt in order to maintain a relative humidity inside the cups of 0 %.

The specimens were placed inside a climatic chamber at a temperature of 23 °C and 50 % relative humidity.

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ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0021

Condizioni di prova.

Test conditions.

Pressione atmosferica *Atmospheric pressure*	1013 mbar	
Temperatura *Temperature*	23 °C	
Condizioni di prova *Set of conditions*	C: 23 - 50/93	
Umidità relativa e pressione di vapore all'interno del contenitore *Relative humidity and vapour pressure inside test cup*	94 %	2639 Pa
Umidità relativa e pressione di vapore nell'ambiente climatizzato *Relative humidity and vapour pressure in climatic chamber*	50 %	1404 Pa

Caratteristiche delle provette.

Specimens properties.

Condizioni di prova: *Set of conditions:* C: 23 - 50/93		**Provetta** *Specimen*				
		n. 1	**n. 2**	**n. 3**	**n. 4**	**n. 5**
Spessore *Thickness*	[mm]	11,90	12,00	11,95	11,98	12,13
Superficie della provetta *Specimens area*	[mm²]	32700	32510	32430	32240	32160
Superficie di misura *Exposed area*	[mm²]	277780	27720	27740	27690	27740
Massa volumica dopo il condizionamento *Density after conditioning*	[kg/m³]	11207	1124	1118	1171	1162

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ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0021

Risultati della prova.

Test results.

Condizioni di prova *Set of conditions*	**Provetta** *Specimen* [n.]	**Velocità di trasmissione del vapore** *Water vapour transmission rate* **g** [kg/(s·m²)]	**Permeanza** *Permeance* **W** [kg/(m²·s·Pa)]	**Resistenza** *Resistance* **Z** [m²·s·Pa/kg]	**Permeabilità al vapore** *Water vapour permeability* **δ** [kg/(m·s·Pa)]	**Fattore di resistenza alla diffusione** *Diffusion resistance factor* **μ** [-]	**Spessore d'aria equivalente** *Equivalent air layer thickness* **S_d** [m]
C: 23 - 50/93	1	$6{,}01\cdot10^{-7}$	$5{,}12\cdot10^{-10}$	$1{,}95\cdot10^{9}$	$6{,}09\cdot10^{-12}$	32,0	0,381
	2	$6{,}59\cdot10^{-7}$	$5{,}65\cdot10^{-10}$	$1{,}77\cdot10^{9}$	$6{,}77\cdot10^{-12}$	28,8	0,345
	3	$6{,}11\cdot10^{-7}$	$5{,}21\cdot10^{-10}$	$1{,}92\cdot10^{9}$	$6{,}22\cdot10^{-12}$	31,4	0,375
	4	$5{,}99\cdot10^{-7}$	$5{,}10\cdot10^{-10}$	$1{,}96\cdot10^{9}$	$6{,}11\cdot10^{-12}$	31,9	0,383
	5	$6{,}32\cdot10^{-7}$	$5{,}40\cdot10^{-10}$	$1{,}85\cdot10^{9}$	$6{,}54\cdot10^{-12}$	29,8	0,361

Condizioni di prova *Set of conditions*		C: 23 - 50/93
Valore medio della velocità di trasmissione del vapore "g" *Mean water vapour transmission rate*	[kg/(s·m²)]	$6{,}2\cdot10^{-7}$
Valore medio della permeanza "W" *Mean permeance*	[kg/(m²·s·Pa)]	$5{,}3\cdot10^{-10}$
Valore medio della resistenza "Z" *Mean resistance*	[m²·s·Pa/kg]	$1{,}9\cdot10^{9}$
Valore medio del fattore di resistenza alla diffusione "μ" *Mean diffusion resistance factor*	[-]	31
Valore medio dello spessore d'aria equivalente "S_d" *Mean equivalent air layer thickness*	[m]	0,37
Valore medio della permeabilità al vapore "δ" e relativa incertezza estesa *Mean water vapour permeability "δ" and relative expanded uncertainty*	[kg/(m·s·Pa)]	**$(6{,}4\cdot10^{-12} \pm 0{,}7\cdot10^{-12})$**
Livello di fiducia "p" dell'incertezza estesa *Expanded uncertainty confidence level "p"*	[%]	95
Fattore di copertura "kp" dell'incertezza estesa *Expanded uncertainty coverage factor "k_p"*	[-]	2,00

Nota: l'incertezza estesa della permeabilità al vapore "δ" comprende anche la dispersione dei valori di permeabilità al vapore misurati sulle provette.

Note: the expanded uncertainty of the water vapour permeability "δ" also includes the dispersion of the values of water vapour permeability measured on test specimens.

Il Responsabile Tecnico di Prova
Test Technician
(Dott. Ing. Paolo Ricci)

Il Responsabile del Laboratorio di Fisica Tecnica
Head of Applied Physics Laboratory
(Dott. Ing. Vincenzo Iommi)

L'Amministratore Delegato
Chief Executive Officer
(Dott. Nazario Giordano)

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TEST REPORT No. 317123

This test report cancels and replaces test report No. 315709 dated 09/05/2014 issued by Istituto Giordano

Place and date of issue: Bellaria-Igea Marina - Italy, 07/07/2014

Customer: BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy

Date test requested: 17/03/2014

Order number and date: 62576, 18/03/2014

Date sample received: 14/04/2014

Test date: 16/04/2014

Purpose of test: determination of the shear load resistance of a screw installed through a fibre-cement flat sheet in accordance with clause 5.1.4.1.2 of guideline ETAG 018-4:2011

Test site: Istituto Giordano S.p.A. - Via Erbosa, 72 - 47043 Gatteo (FC) - Italy

Sample origin: sampled by Istituto Giordano in accordance with the procedure specified in sample report dated 14/01/2014 and supplied by the Customer

Identification of sample received: No. 2014/0768

Sample name*

The test sample is called “AQUAFIRE”.

ISTITUTO GIORDANO

Description of sample*

The test sample comprises fibre-reinforced lightweight cement boards with the following specifications:

- density = 960 kg/m³ ± 15 %;
- width = (1200 ± 3,6) mm;
- length = (2000 ± 5,0) mm;
- thickness = (12,5 ± 1,2) mm.

Description of test pieces

5 test pieces were cut transversely from the sample of size 150 x 50 mm and original product thickness.

Normative References

The test was carried out according to the method specified in ETAG 018-4:2011 dated 01/12/2011 “Guideline for European technical approval of fire protective products - Part 4: Fire protective board, slab and mat products and kits”.

Test apparatus

The following equipment was used to carry out the test:

- Istituto Giordano S.p.A. IG 10000 digital force gauge, speed range 0,05-300 mm/min or load rate 9-300 N/s, clear span between support columns of 640 mm and effective travel 2000 mm (apparatus in-house identification code FT161);
- AEP load cell, capacity 2 kN (apparatus in-house identification code FT480);
- Borletti digital calliper gauge with 10 micron resolution (apparatus in-house identification code EDI066).

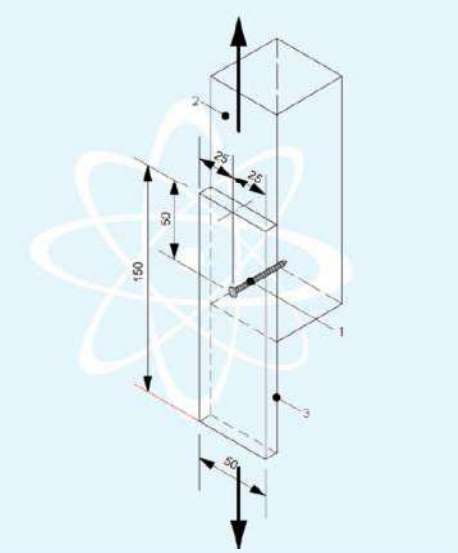
(*) according to that stated by the Customer.

ISTITUTO GIORDANO

Test method

The test was carried out in accordance with 5.1.4.1.2 “Shear load resistance of mechanical fastening systems” of guideline ETAG 018-4:2011.

Each test piece is held tightly in the testing machine. A screw, head diameter 10 mm and body diameter 4 mm, is installed in accordance with the manufacturer's specifications and subjected to a shear load with a tensioning speed of 0,5 mm/min. The test continues until the screw has been pulled completely from the test piece, the maximum shear load being recorded.



Test assembly layout

Environmental conditions during test

Ambient temperature	(23 ± 2) °C
Relative humidity	(50 ± 5) %

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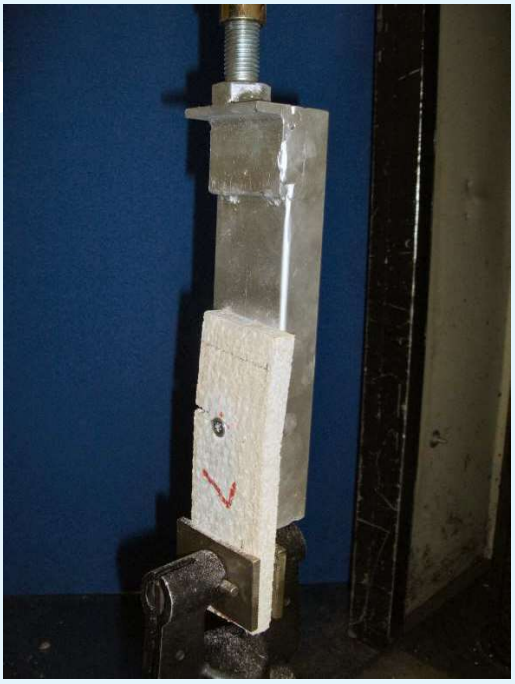
Test results

Test piece [No.]	Maximum withdrawal force [N]	[kg]	Mode of failure
1	721	73,5	board shear failure
2	965	98,4	board shear failure
3	778	79,3	board shear failure
4	797	81,2	board shear failure
5	939	95,7	board shear failure
Mean	**840**	**85,6**	**//**
Standard deviation	**106**	**10,8**	**//**

Photo of a test piece during testing



Example of failure

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Findings

On the basis of the tests performed and the results obtained, the test sample, comprising fibre-reinforced lightweight cement board called “AQUAFIRE” submitted by BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy, meets the shear load resistance requirements for mechanical fasteners given in the following table.

Test	Test standard	Mode of failure	Mean failure load [N]
shear load resistance	clause 5.1.4.1.2 ETAG 018-4:2011	board shear failure	840

The results given refer exclusively to the test sample itself and are only valid under the same conditions in which testing was carried out.

This test report alone shall not be considered a certificate of conformity.

Test Technician:
Dott. Ing. Paolo Bertini

Head of Security and Safety Laboratory:
Dott. Andrea Bruschi

Chief Executive Officer
(Dott. Arch. Sara Lorenza Giordano)

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TEST REPORT No. 315708

Place and date of issue: Bellaria-Igea Marina - Italy, 09/05/2014

Customer: BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy

Date test requested: 17/03/2014

Order number and date: 62576, 18/03/2014

Date sample received: 14/04/2014

Test date: 16/04/2014

Purpose of test: determination of the pull-through resistance of a screw from a fibre-cement flat sheet in accordance with clause 5.1.4.1.1 of guideline ETAG 018-4:2011

Test site: Istituto Giordano S.p.A. - Via Erbosa, 72 - 47043 Gatteo (FC) - Italy

Sample origin: sampled by Istituto Giordano in accordance with the procedure specified in sample report dated 14/01/2014 and supplied by the Customer

Identification of sample received: No. 2014/0768

Sample name*

The test sample is called “AQUAFIRE”.

Description of sample*

The test sample comprises fibre-reinforced lightweight cement board with the following specifications:

– density = 960 kg/m³ ± 15 %;

(*) according to that stated by the Customer.

- width = (1200 ± 3,6) mm;
- length = (2000 ± 5,0) mm;
- thickness = (12,5 ± 1,2) mm.

Description of test pieces

10 test pieces were cut from the sample of size 250 × 250 mm and original product thickness.

Normative References

The test was carried out according to the method specified in ETAG 018-4:2011 dated 01/12/2011 "Guideline for European technical approval of fire protective products - Part 4: Fire protective board, slab and mat products and kits".

Test apparatus

The following equipment was used to carry out the test:

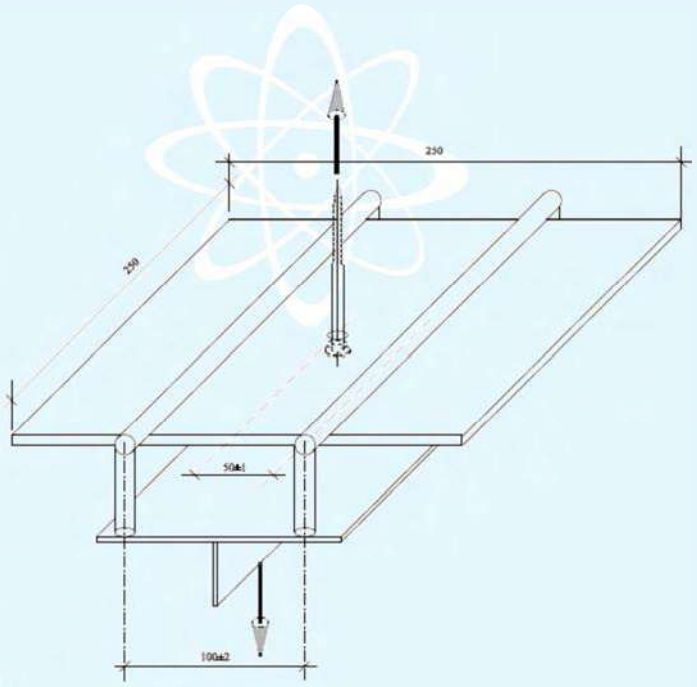
- Istituto Giordano S.p.A. IG 10000 digital force gauge, speed range 0,05-300 mm/min or load rate 9-300 N/s, clear span between support columns of 640 mm and effective travel 2000 mm (apparatus in-house identification code FT161);
- AEP load cell, capacity 2 kN (apparatus in-house identification code FT480);
- Borletti digital calliper gauge with 10 micron resolution (apparatus in-house identification code EDI066).

ISTITUTO GIORDANO

Test method

The test was carried out in accordance with 5.1.4.1.1 “Pull-through resistance of mechanical fasteners” of guideline ETAG 018-4:2011.

Each test piece is held tightly in the testing machine. A screw, head diameter 10 mm and body diameter 4 mm, is installed in accordance with the manufacturer's specifications and subjected to a tensile force having a constant crosshead speed of 20 mm/min. The test continues until the screw has been pulled completely through the test piece, the maximum pull-through resistance being recorded. The test is then repeated on test pieces immersed in water at a temperature of 20 °C for 1 h in accordance with clause 5.1.4.1.1.2 “After immersion in water” of guideline ETAG 018-4:2011.



Test apparatus layout

Environmental conditions during test

Ambient temperature	(23 ± 2) °C
Relative humidity	(50 ± 5) %

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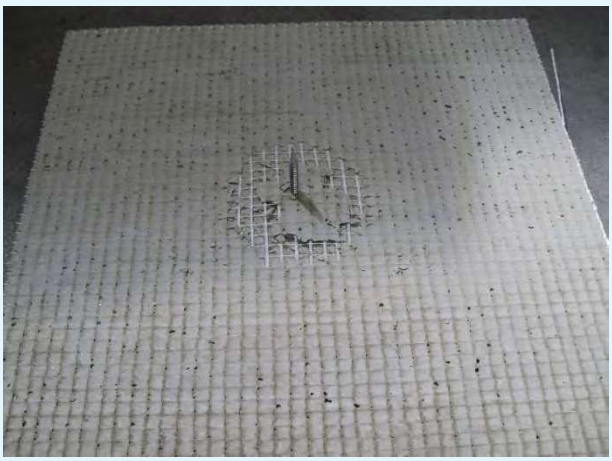
Test results

Test piece [No.]	Conditioning	Maximum pull-through resistance [N]	[kg]	Mode of failure
1	none	771	78,6	screw pulled completely from board
2		829	84,5	screw pulled completely from board
3		858	87,5	screw pulled completely from board
4		851	86,7	screw pulled completely from board
5		704	71,8	screw pulled completely from board
Mean		**803**	**81,8**	//
Standard deviation		**65**	**6,6**	//
6	immersion in water at 20 °C for 1 h	567	57,8	screw pulled completely from board
7		423	43,1	screw pulled completely from board
8		586	59,7	screw pulled completely from board
9		365	37,2	screw pulled completely from board
10		468	47,7	screw pulled completely from board
Mean		**482**	**49,1**	//
Standard deviation		**94**	**9,6**	//

Photo of a test piece during testing



Example of failure with pull-out of screw

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Findings

On the basis of the tests performed and the results obtained, the test sample, comprising fibre-reinforced lightweight cement board called "AQUAFIRE" submitted by BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy, meets the pull-through resistance requirements for mechanical fasteners given in the following table.

Test	Test standard	Test conditions	Mode of failure	Mean failure load [N]
Screw pull-through resistance	clause 5.1.4.1.1 ETAG 018-4:2011	dry	screw pulled completely from board	803
		after immersion in water for 1 h	screw pulled completely from board	482

The results given refer exclusively to the test sample itself and are only valid under the same conditions in which testing was carried out.

This test report alone shall not be considered a certificate of conformity.

Test Technician:
Dott. Ing. Paolo Bertini

Head of Security and Safety Laboratory:
Dott. Andrea Bruschi

Chief Executive Officer
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TEST REPORT No. 315710

Place and date of issue: Bellaria-Igea Marina - Italy, 09/05/2014

Customer: BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy

Date test requested: 17/03/2014

Order number and date: 62576, 18/03/2014

Date sample received: 14/04/2014

Test date: 15/04/2014

Purpose of test: resistance to functional failure from eccentric vertical load of a fibre-cement flat sheet in accordance with clause 5.1.4.2.3 of guideline ETAG 018-4:2011

Test site: Istituto Giordano S.p.A. - Via Erbosa, 72 - 47043 Gatteo (FC) - Italy

Sample origin: sampled by Istituto Giordano in accordance with the procedure specified in sample report dated 14/01/2014 and supplied by the Customer

Identification of sample received: No. 2014/0768

Sample name*

The test sample is called “AQUAFIRE”.

Description of sample*

The test sample comprises fibre-reinforced lightweight cement boards with the following specifications:

– density = 960 kg/m³ ± 15 %;

(*) according to that stated by the Customer.

ISTITUTO GIORDANO

– width = (1200 ± 3,6) mm;
– length = (2000 ± 5,0) mm;
– thickness = (12,5 ± 1,2) mm.

Normative References

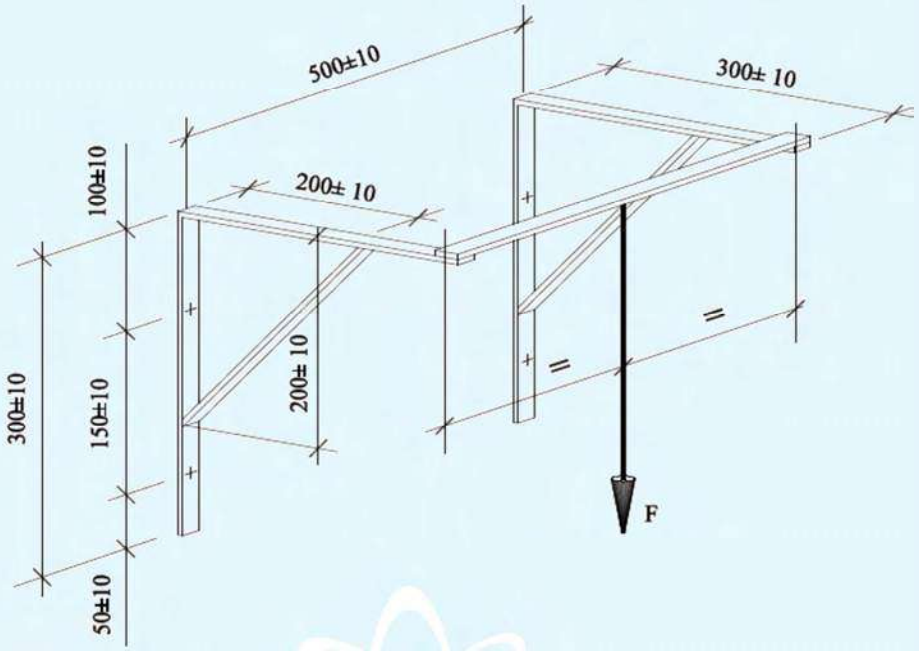
The test was carried out according to the method specified in ETAG 018-4:2011 dated 01/12/2011 “Guideline for European technical approval of fire protective products - Part 4: Fire protective board, slab and mat products and kits”.

Test apparatus

The following equipment was used to carry out the test:
– calibrated iron ballast, weight 5 kg and 10 kg;
– test rig (apparatus in-house identification code EDI011);
– Sola Tri-Matic 5 m/19 mm metric tape measure (apparatus in-house identification code AV044);
– Bosch DLE 50 Professional laser rangefinder (apparatus in-house identification code AV114);
– Borletti digital calliper gauge with 10 micron resolution (apparatus in-house identification code EDI066);
– complementary accessories.

Test method

The test was carried out in accordance with clause 5.1.4.2.3 “Resistance to functional failure from eccentric vertical load” of guideline ETAG 018-4:2011.
The board is securely fixed to a steel frame and the load test assembly is screwed to the board. A ballast of steel disks is used to subject the test piece to a set of three gradually-increasing loads, each lasting 24 h. The test continues until the system collapses, the maximum load being recorded.



Eccentric load test assembly

Environmental conditions during test

Ambient temperature	(23 ± 2) °C
Relative humidity	(50 ± 5) %

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Test results

Load step [No.]	Applied load [kg]	Duration [h]	Result
1	20	24	Compliant, no effect
2	30	24	Compliant, no effect
3	35	24	Board cracked, fixing screw failure

Photo of sample during test

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Findings

On the basis of the tests performed and the results obtained, the test sample, comprising fibre-reinforced lightweight cement board called "AQUAFIRE" submitted by BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy, meets the resistance to withdrawal requirements for mechanical fasteners given in the following table.

Test	Test standard	Requirement	Applied load [kg]
eccentric vertical load	clause 5.1.4.2.3 ETAG 018-4:2011	clause 5.1.4.2.3 ETAG 018-4:2011	30

The results given refer exclusively to the test sample itself and are only valid under the same conditions in which testing was carried out.

This test report alone shall not be considered a certificate of conformity.

Test Technician:
Dott. Ing. Paolo Bertini

Head of Security and Safety Laboratory:
Dott. Andrea Bruschi

Chief Executive Officer
(Dott. Arch. Sara Lorenza Giordano)

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TEST REPORT No. 315706

Place and date of issue: Bellaria-Igea Marina - Italy, 09/05/2014

Customer: BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy

Date test requested: 23/01/2014

Order number and date: 61981, 23/01/2014

Date sample received: 14/04/2014

Test date: 15/04/2014

Purpose of test: resistance to soft body impact of a fibre-cement flat sheet in accordance with clause 5.1.4.2.1 of guideline ETAG 018-4:2011

Test site: Istituto Giordano S.p.A. - Via Erbosa, 72 - 47043 Gatteo (FC) - Italy

Sample origin: sampled by Istituto Giordano in accordance with the procedure specified in sample report dated 14/01/2014 and supplied by the Customer

Identification of sample received: No. 2014/0768

Sample name*

The test sample is called “AQUAFIRE”.

Description of sample*

The test sample comprises a untreated fibre-reinforced lightweight cement board, with the following specifications:

– density = 960 kg/m³ ± 15 %;

(*) according to that stated by the Customer.

ISTITUTO GIORDANO

- width = (1200 ± 3,6) mm;
- length = (2000 ± 5,0) mm;
- thickness = (12,5 ± 1,2) mm.

Normative References

The test was carried out in accordance with the following documents:

- ETAG 018-4:2011 dated 01/12/2011 "Guideline for European technical approval of fire protective products - Part 4: Fire protective board, slab and mat products and kits";
- EOTA TR 001:2003 dated February 2003 "Determination of impact resistance of panels and panel assemblies".

Test apparatus

The following equipment was used to carry out the test:

- test rig (apparatus in-house identification code EDI011);
- soft body impactor comprising spherical bag filled with glass spheres, mass 50 kg (apparatus in-house identification code EDI062);
- metric ruler (apparatus in-house identification code EDI083);
- Mitutoyo Corporation digital tape measure (apparatus in-house identification code: FT364);
- digital assay balance (apparatus in-house identification code RZF135).

Test method

The test was carried out in accordance with clause 5.1.4.2.1 "Resistance to functional failure from soft body impact load - 50 kg bag" della guida ETAG 018-4:2011.

The test was carried out by striking the sample at the midpoint between two studs. Residual deflection was measured 5 min after each impact.

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Environmental conditions during test

Ambient temperature	(20 ± 3) °C
Relative humidity	(50 ± 15) %

Test results

Photo of sample during test

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Impact [No.]	Mass [kg]	Impact energy [J]	Drop height [m]	Residual deflection [mm]	Result
1	50	60	0,122	1,0	no damage
2	50	100	0,204	4,1	no damage
3	50	120	0,245	2,2	no damage
4	50	130	0,265	2,1	no damage
5	50	200	0,408	19,7	stud bent
6	50	300	0,612	//	no collapse, no penetration or projection
7	50	400	0,815	//	no collapse, no penetration or projection
8	50	500	1,019	//	collapse of board

Findings

On the basis of the tests performed and the results obtained, the test sample, comprising a fibre-reinforced lightweight cement board called "AQUAFIRE" submitted by BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILA-NO (MI) - Italy, meets the resistance to soft body impact requirements given in the following table.

Test	Test reference	Requirement	Conditions	Energy [J]
soft body impact	clause 5.1.4.2.1 ETAG 018-4:2011	clause 2 EOTA TR 001:2003	serviceability	<130
			safety in use	<400

The results given refer exclusively to the test sample itself and are only valid under the same conditions in which testing was carried out.

This test report alone shall not be considered a certificate of conformity.

Test Technician:
Dott. Ing. Paolo Bertini

Head of Security and Safety Laboratory:
Dott. Andrea Bruschi

Chief Executive Officer
(Dott. Arch. Sara Lorenza Giordano)

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TEST REPORT No. 315707

Place and date of issue: Bellaria-Igea Marina - Italy, 09/05/2014

Customer: BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy

Date test requested: 23/01/2014

Order number and date: 61981, 23/01/2014

Date sample received: 14/04/2014

Test date: 16/04/2014

Purpose of test: resistance to hard body impact of a fibre-cement flat sheet in accordance with clause 5.1.4.2.2 of guideline ETAG 018-4:2011

Test site: Istituto Giordano S.p.A. - Via Erbosa, 72 - 47043 Gatteo (FC) - Italy

Sample origin: sampled by Istituto Giordano in accordance with the procedure specified in sample report dated 14/01/2014 and supplied by the Customer

Identification of sample received: No. 2014/0768

Sample name*

The test sample is called “AQUAFIRE”.

Description of sample*

The test sample comprises a untreated fibre-reinforced lightweight cement board, with the following specifications:

– density = 960 kg/m³ ± 15 %;

(*) according to that stated by the Customer.

- width = (1200 ± 3,6) mm;
- length = (2000 ± 5,0) mm;
- thickness = (12,5 ± 1,2) mm.

Normative References

The test was carried out in accordance with the following documents:

- ETAG 018-4:2011 dated 01/12/2011 “Guideline for European technical approval of fire protective products - Part 4: Fire protective board, slab and mat products and kits”;
- EOTA TR 001:2003 dated February 2003 “Determination of impact resistance of panels and panel assemblies”.

Test apparatus

The following equipment was used to carry out the test:

- steel ball impactor, mass 0,5 kg (apparatus in-house identification code EDI013);
- Borletti digital calliper gauge with 10 micron resolution (apparatus in-house identification code EDI066);
- Mitutoyo digital gauge (apparatus in-house identification code EDI004);
- Mitutoyo Corporation digital tape measure (apparatus in-house identification code: FT364);
- digital assay balance (apparatus in-house identification code RZF135).

Test method

The test was carried out in accordance with clause 5.1.4.2.2 “Resistance to functional failure from hard body impact load - 0,5 kg steel ball” of guideline ETAG 018-4:2011.

The test was carried out by the striking the centre of the horizontally-positioned sample.

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Environmental conditions during test

Ambient temperature	(20 ± 3) °C
Relative humidity	(50 ± 15) %

Test results

Impact [No.]	Mass [kg]	Impact energy [J]	Drop height [m]	Indentation diameter [mm]	Indentation depth [mm]	Result
1	0,5	1,30	265	0,0	0,0	no visible damage
2	0,5	2,50	510	10,3	0,31	visible indentation
3	0,5	3,75	765	15,2	0,87	no collapse, penetration or projection
4	0,5	6,00*	1223	13,6	1,06	no collapse, penetration or projection

(*) Maximum energy level specified by the standard

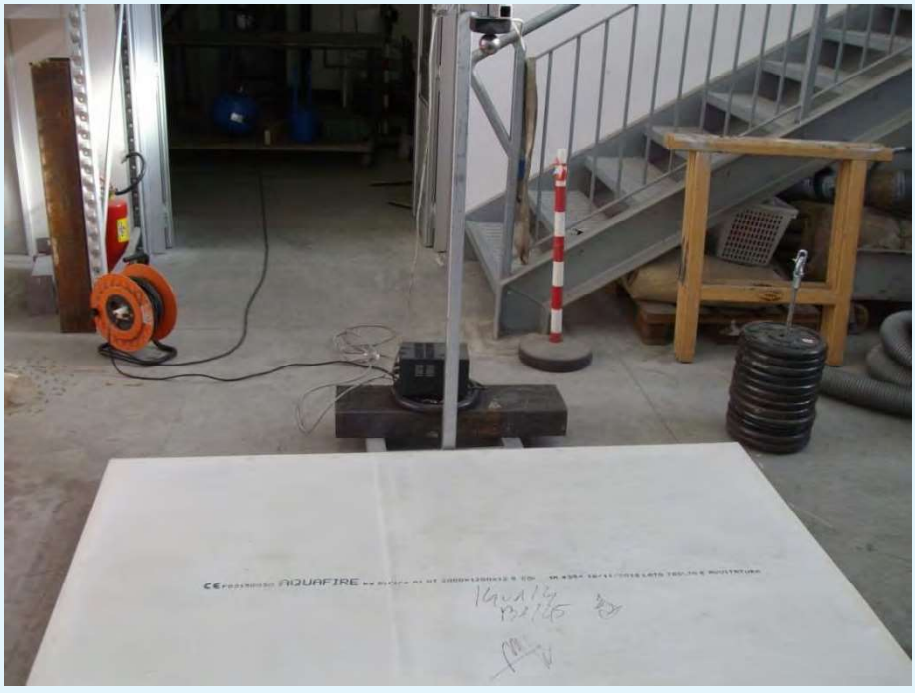

Photo of sample during test

ISTITUTO GIORDANO

Findings

On the basis of the tests performed and the results obtained, the test sample, comprising a fibre-reinforced lightweight cement board called “AQUAFIRE” submitted by BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy, meets the resistance to hard body impact requirements given in the following table.

Test	Test reference	Requirement	Conditions	Energy [J]
0,5 kg hard body impact	clause 5.1.4.2.2 ETAG 018-4:2011	clause 3 EOTA TR 001:2003	serviceability	<1,3
			safety in use	<6,0

The results given refer exclusively to the test sample itself and are only valid under the same conditions in which testing was carried out.

This test report alone shall not be considered a certificate of conformity.

Test Technician:
Dott. Ing. Paolo Bertini

Head of Security and Safety Laboratory:
Dott. Andrea Bruschi

Chief Executive Officer
(Dott. Arch. Sara Lorenza Giordano)

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Registro Imprese di Rimini n. 00 549 540 409

TEST REPORT No. 315354

Place and date of issue: Bellaria-Igea Marina - Italy, 29/04/2014

Customer: BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy

Date test requested: 23/01/2014

Order number and date: 61981, 23/01/2014

Date sample received: 20/01/2014

Test date: 22/04/2014

Purpose of test: determination of tensile strength perpendicular to the plane of fibre-reinforced lightweight cement board in accordance with standard UNI EN 319:1994

Test site: Istituto Giordano S.p.A. - Blocco 1 - Via Rossini, 2 - 47814 Bellaria-Igea Marina (RN) - Italy

Sample origin: sampled by Istituto Giordano in accordance with the procedure specified in sample report dated 14/01/2014 and supplied by the Customer

Identification of sample received: No. 2014/0109

Sample name*

The test sample is called “AQUAFIRE”.

(*) according to that stated by the Customer.

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Description of sample*

The test sample comprises fibre-reinforced lightweight cement boards, nominal thickness 12,5 mm, taken from the following batches:

1) Batch 4354 dated 18/11/2013 - 140114 B1/from 1 to 50;
2) Batch 4473 dated 25/11/2013 - 140114 B2/from 1 to 50;
3) Batch 4534 dated 27/11/2013 - 140114 B3/from 1 to 50;
4) Batch 4602 dated 02/12/2013 - 140114 B4/from 1 to 50.

Description of test pieces

8 test pieces of nominal size 50 × 50 mm and the original thickness were cut from the sample.
Sampling took place in accordance with clause 5.2 of the standard. After cutting, the test pieces were bonded to special steel plates using KERAKOLL KERABUID ECO EPOBOND adhesive. Each test piece was assigned a letter ranging from A to H.

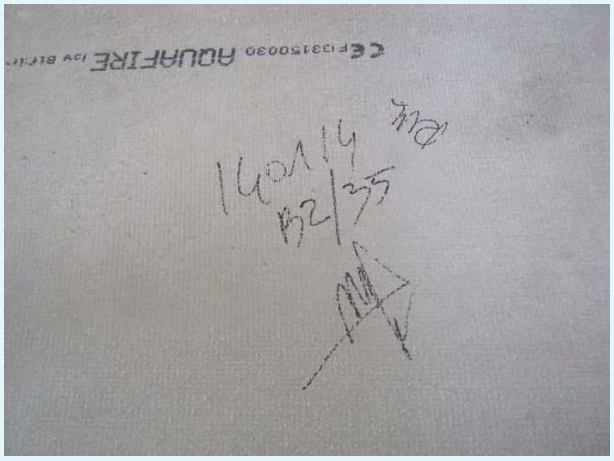

Photo of board and a test piece

(*) according to that stated by the Customer.

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Normative References

The test was carried out according to the requirements of standard UNI EN 319:1994 dated 31/07/1994 “Particleboards and fibreboards. Determination of tensile strength perpendicular to the plane of the board”.

Test apparatus

The following equipment was used to carry out the test:

– digital calliper gauge with 10 micron resolution (in-house identification code LG023);
– digital force gauge (in-house identification code TDL016) with 10 000 N load cell (in-house identification code TDL029).

Test method

Conditioning of test pieces

The test pieces were conditioned to constant mass for at least 48 h at a temperature of (20 ± 2) °C and relative humidity of (65 ± 5) %.

Test method

The test was carried out with force gauge rate of cross-head movement of 3 mm/min so that the maximum load is reached within (60 ± 30) s as specified by clause 6.1 of the reference standard.
After stabilising with the conditioning described above, the test pieces are loaded at a constant rate until rupture occurs.
Tensile strength perpendicular to the plane of the test piece is calculated according to the following formula:

$$f_{t1} = \frac{F_{max}}{a \cdot b}$$

where: f_{t1} = tensile strength perpendicular to the plane, expressed in N/mm²;
F_{max} = breaking load, in N;
a, b = length and width of the test piece, in mm.

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Photo of a test piece during testing

Environmental conditions during test

Ambient temperature	(18 ± 2) °C
Relative humidity	(48 ± 5) %

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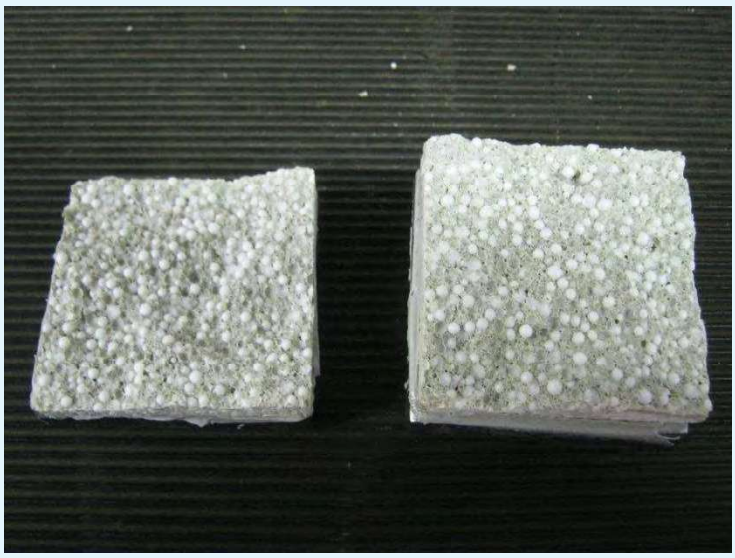
Test results

Test piece [No.]	Length a [mm]	Width b [mm]	Maximum force F_{max} [N]	Tensile strength f_{t1} [N/mm²]
A	50,20	50,49	2585	1,02
B	50,55	49,92	2412	0,96
C	50,75	50,29	2351	0,92
D	50,96	50,71	2687	1,04
E	50,48	50,30	2599	1,02
F	50,39	51,02	2368	0,92
G	50,48	50,40	2741	1,08
H	51,03	50,77	2516	0,97
Mean	**50,61**	**50,49**	**2532**	**0,99**
Standard deviation	**0,29**	**0,34**	**146**	**0,06**

Note: in no case was the test piece detached from the rigid plates.



After-test photo of a test piece

Test Technician:
Dott. Alessandro Trevisani

Head of Wood Technology/Conditioning Laboratory:
Dott. Alessandro Trevisani

Chief Executive Officer
(Dott. Arch. Sara Lorenza Giordano)

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Registro Imprese di Rimini n. 00 549 540 409

TEST REPORT No. 315353

Place and date of issue: Bellaria-Igea Marina - Italy, 29/04/2014

Customer: BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy

Date test requested: 23/01/2014

Order number and date: 61981, 23/01/2014

Date sample received: 20/01/2014

Test date: 15/04/2014

Purpose of test: determination of planar shear properties of fibre-reinforced lightweight cement board in accordance with clause 11 of standard UNI EN 789:2005

Test site: Istituto Giordano S.p.A. - Via Erbosa, 72 - 47043 Gatteo (FC) - Italy

Sample origin: sampled by Istituto Giordano in accordance with the procedure specified in sample report dated 14/01/2014 and supplied by the Customer

Identification of sample received: No. 2014/0109

Sample name*

The test sample is called “AQUAFIRE”.

(*) according to that stated by the Customer.

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Description of sample*

The test sample comprises fibre-reinforced lightweight cement boards, nominal thickness 12,5 mm, taken from the following batches:

1) Batch 4354 dated 18-11-2013 - 140114 B1/from 1 to 50;
2) Batch 4473 dated 25-11-2013 - 140114 B2/from 1 to 50;
3) Batch 4534 dated 27-11-2013 - 140114 B3/from 1 to 50;
4) Batch 4602 dated 02-12-2013 - 140114 B4/from 1 to 50.

Description of test pieces

8 test pieces of nominal size 100 × 255 mm and the original thickness were cut from the sample.
Sampling was carried out in accordance with the schedule specified in clause 5.2 of the standard using test pieces numbered from 33 to 40. After cutting, the test pieces were bonded to special steel plates using MAPEI Keraflex maxi s1 adhesive following application of Eco Prim T primer diluted 1:1.

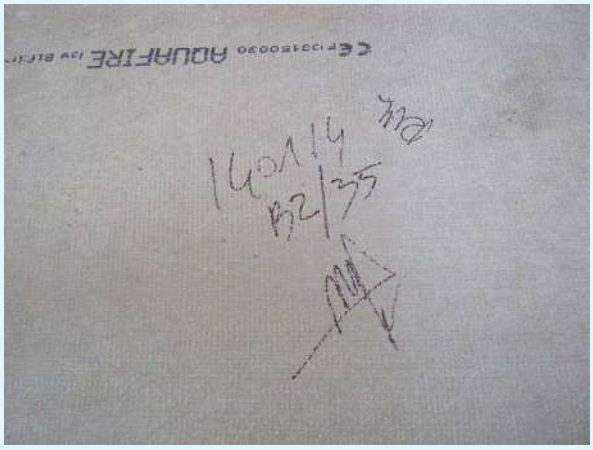

Photo of board and some test pieces

(*) according to that stated by the Customer.

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Normative References

The test was carried out according to the requirements of clause 11 of standard UNI EN 789:2005 dated 01/05/2005 “Timber structures - Test methods - Determination of mechanical properties of wood based panels”.

Test apparatus

The following equipment was used to carry out the test:

– temperature and humidity chamber with a temperature of (20 ± 2) °C and relative humidity (65 ± 5) % (in-house identification code TDL001);
– force gauge with 10 000 N load cell (in-house identification codes FT161 and FT193);
– digital calliper gauge with 10 micron resolution (in-house identification code FT334).

Test method

The test pieces were first conditioned to constant mass in the temperature/humidity chamber for at least 24 h.
The test was carried out in accordance with clause 11.4.1 of the reference standard with force gauge rate of cross-head movement of 2 mm/min.
The planar shear strength “f_r” (in N/mm²) of each test piece is calculated from the following formula:

$$f_r = \frac{F_{max}}{lb}$$

where: l = length of the test specimen, in mm;
b = width of the test specimen, in mm;
F_{max} = maximum load, in newtons.

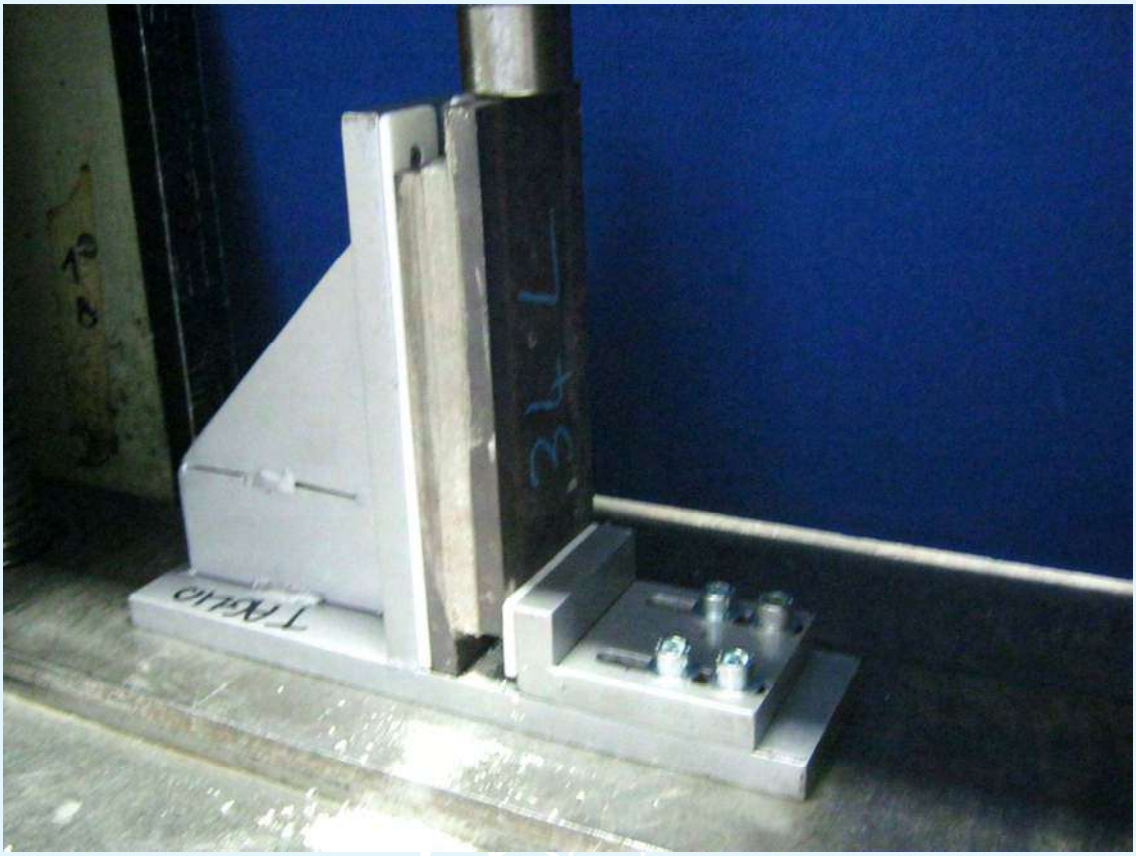

Photo of a test piece during testing

Conditions during test

Ambient temperature	(20 ± 5) °C
Relative humidity	(50 ± 10) %

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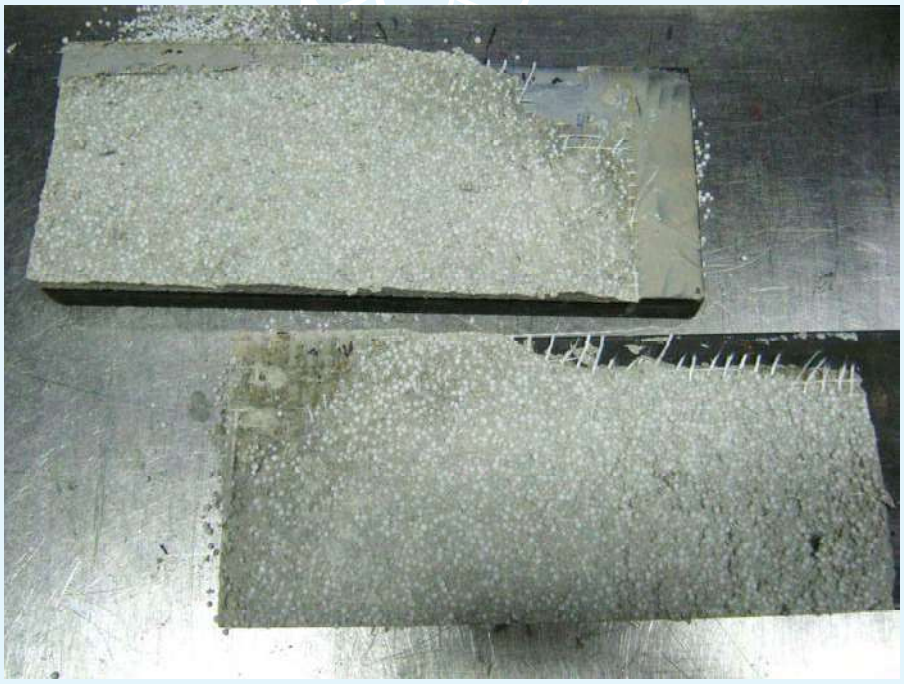
Test results

Test piece [No.]	Direction	Length l [mm]	Width b [mm]	Maximum load F_{max} [N]	Planar shear strength f_r [N/mm²]
33	L	225,00	101,05	26385	1,160
34	L	225,00	100,42	25347	1,122
35	L	225,00	100,46	20846	0,922
36	L	225,00	100,72	28307	1,249
37	T	225,00	100,63	22784	1,006
38	T	225,00	100,29	20787	0,921
39	T	225,00	100,22	20157	0,894
40	T	225,00	100,51	26543	1,174
Mean	/	**225,00**	**100,54**	**23895**	**1,056**



After-test photo of a test piece

Test Technician:
Dott. Alessandro Trevisani

Head of Wood Technology/Conditioning Laboratory:
Dott. Alessandro Trevisani

Chief Executive Officer
(Dott. Arch. Sara Lorenza Giordano)

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TEST REPORT No. 315963

Place and date of issue: Bellaria-Igea Marina - Italy, 20/05/2014

Customer: BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy

Date test requested: 16/04/2014

Order number and date: 61981, 23/01/2014

Date sample received: 20/01/2014

Test date: 15/04/2014

Purpose of test: determination of planar shear properties of fibre-reinforced lightweight cement board in accordance with clause 11 of standard UNI EN 789:2005

Test site: Istituto Giordano S.p.A. - Via Erbosa, 72 - 47043 Gatteo (FC) - Italy

Sample origin: sampled by Istituto Giordano in accordance with the procedure specified in sample report dated 14/04/2014 and supplied by the Customer

Identification of sample received: No. 2014/0109

Sample name*

The test sample is called “AQUAFIRE”.

(*) according to that stated by the Customer.

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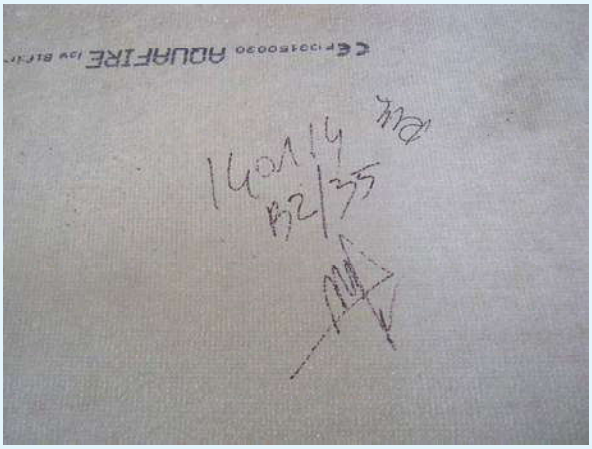
Description of sample*

The test sample comprises fibre-reinforced lightweight cement boards, nominal thickness 12,5 mm, taken from the following batches:

1) Batch 4354 dated 18-11-2013 - 140114 B1/from 1 to 50;
2) Batch 4473 dated 25-11-2013 - 140114 B2/from 1 to 50;
3) Batch 4534 dated 27/11/2013 - 140114 B3/from 1 to 50;
4) Batch 4602 dated 02/12/2013 - 140114 B4/from 1 to 50.

Description of test pieces

8 test pieces of nominal size 100 × 255 mm and the original thickness were cut from the sample.
Sampling was carried out in accordance with the schedule specified in clause 5.2 of the standard using test pieces numbered from 33 to 40. After cutting, the test pieces were bonded to special steel plates using Kerakoll KERABUID ECO EPOBOND adhesive.



Close-up of a board belonging to the sample

(*) according to that stated by the Customer.

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Normative References

The test was carried out according to the requirements of clause 11 of standard UNI EN 789:2005 dated 01/05/2005 “Timber structures - Test methods - Determination of mechanical properties of wood based panels”.

Test apparatus

The following equipment was used to carry out the test:

– temperature and humidity chamber with a temperature of (20 ± 2) °C and relative humidity (65 ± 5) % (in-house identification code TDL001);
– force gauge with 10 000 N load cell (in-house identification codes FT161 + FT193);
– digital calliper gauge with 10 micron resolution (in-house identification code FT334).

Test method

The test pieces were first conditioned to constant mass in the temperature/humidity chamber for at least 24 h.
The test was carried out in accordance with clause 11.4.1 of the reference standard with force gauge rate of cross-head movement of 2 mm/min.
The planar shear strength “f_r” (in N/mm²) of each test piece is calculated from the following formula:

$$f_r = \frac{F_{max}}{lb}$$

where: l = length of the test specimen, in mm;
b = width of the test piece, in mm;
F_{max} = maximum load, in newtons.

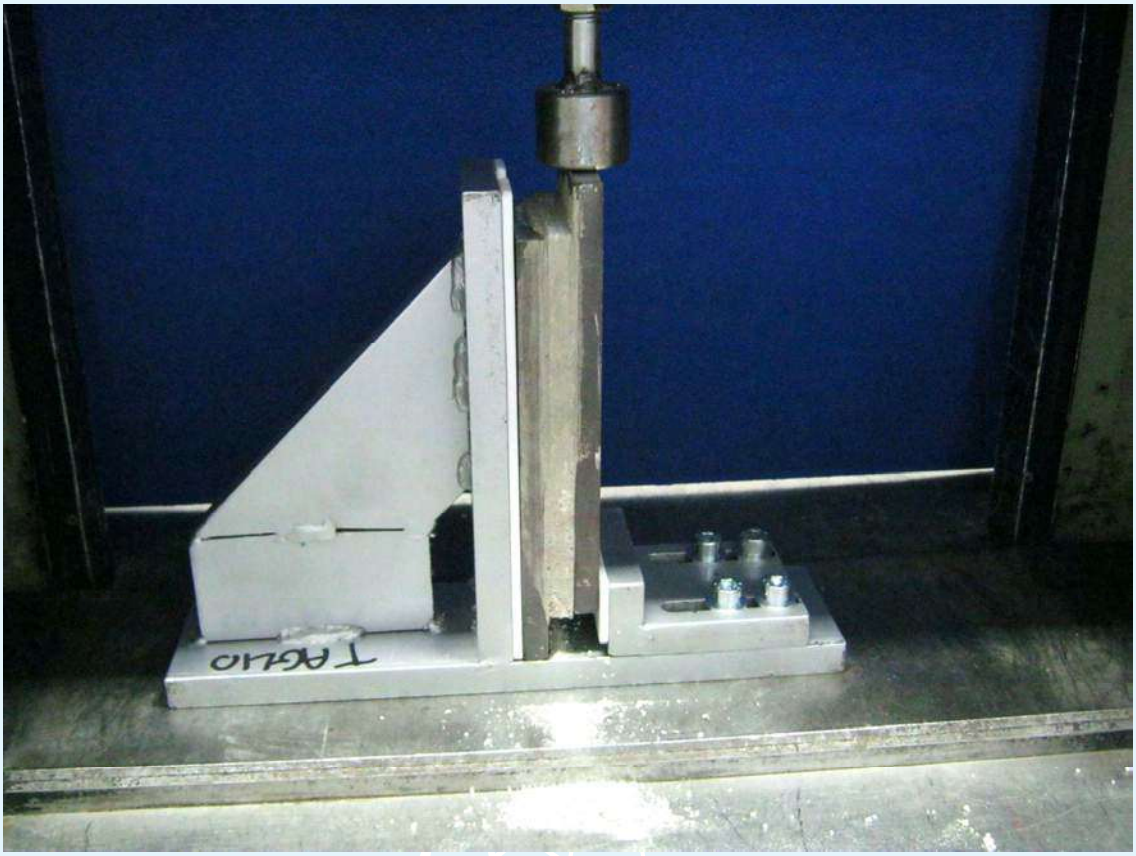

Photo of a test piece during testing

Conditions during test

Ambient temperature	(20 ± 5) °C
Relative humidity	(50 ± 10) %

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Test results

Test piece [No.]	Direction	Length l [mm]	Width b [mm]	Maximum load F_{max} [N]	Planar shear strength f_r [N/mm²]
33	L	225	100	30317	1,3474
34	L	225	100	32498	1,4444
35	L	225	100	31109	1,3826
36	L	225	100	30783	1,3681
37	T	225	100	26960	1,1982
38	T	225	100	33758	1,5004
39	T	225	100	38524	1,7122
40	T	225	100	32916	1,4629
Mean	/	**225**	**100**	**32108**	**1,4270**

After-test photo of a test piece

Test Technician:
Dott. Alessandro Trevisani

Head of Wood Technology/Conditioning Laboratory:
Dott. Alessandro Trevisani

Chief Executive Officer
(Dott. Arch. Sara Lorenza Giordano)

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TEST REPORT No. 316280

Place and date of issue: Bellaria-Igea Marina - Italy, 30/05/2014

Customer: BIFIRE S.r.l. - Via Carducci, 8 - 20123 MILANO (MI) - Italy

Date test requested: 18/03/2014

Order number and date: 61981, 23/01/2014

Date sample received: 20/01/2014

Test date: from 18/03/2014 to 27/05/2014

Purpose of test: determination of dimensional changes associated with changes in relative humidity of fibre-reinforced lightweight cement board with reference to standard UNI EN 318:2003

Test site: Istituto Giordano S.p.A. - Blocco 4 - Via San Mauro, 8 - 47814 Bellaria-Igea Marina (RN) - Italy

Sample origin: sampled by Istituto Giordano in accordance with the procedure specified in sample report dated 14/01/2014 and supplied by the Customer

Identification of sample received: No. 2014/0109

Sample name*

The test sample is called “AQUAFIRE”.

(*) according to that stated by the Customer.

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Description of sample*

The test sample comprises fibre-reinforced lightweight cement boards, nominal thickness 12,5 mm, taken from the following batches:

1) Batch 4354 dated 18-11-2013 - 140114 B1/from 1 to 50;
2) Batch 4473 dated 25-11-2013 - 140114 B2/from 1 to 50;
3) Batch 4534 dated 27/11/2013 - 140114 B3/from 1 to 50;
4) Batch 4602 dated 02/12/2013 - 140114 B4/from 1 to 50.

Normative References

The test was carried out in accordance with the requirements of standard UNI EN 318:2003 dated 01/03/2003 "Wood-based panels - Determination of dimensional changes associated with changes in relative humidity".

Description of test pieces

The test sample was cut in each panel direction (length = L and width = T) in order to obtain 2 sets of 8 test pieces (4L + 4T). The test pieces are of nominal size 350 × 50 mm and the original thickness.

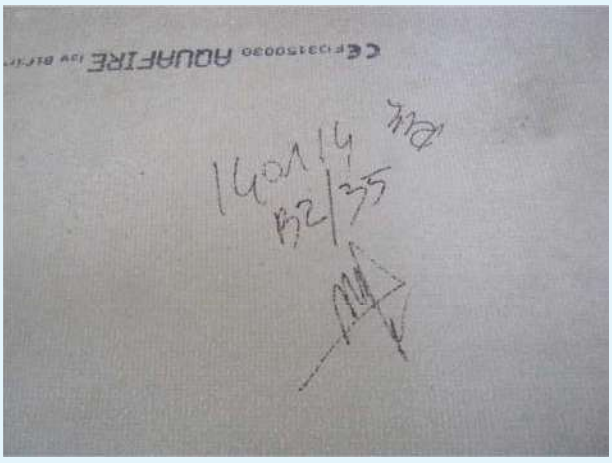

Photo of a test piece and close-up of a sample batch ID

(*) according to that stated by the Customer.

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Test apparatus

The test was performed using the following equipment requested by clause 4 of the reference standard:

– digital calliper gauge with 10 micron resolution (in-house identification code FT334);
– Angelantoni temperature and humidity chamber (in-house identification code FT137);
– digital micrometer (in-house identification code FT363);
– digital balance (in-house identification code TDL006).

Test method

Preliminary treatment

The choice for preliminary treatment was based on the provisions of clause 6.2 of the reference standard with the following conditioning climates:

– "step II" (20 °C - 65 % RH) for both sets;
– "step III" (20 °C - 85 % RH) for set I and (20 °C - 30 % RH) for set II.

The test was then carried out in accordance with subclause 6.3 of the reference standard.

Determination of the moisture content and the change in length and thickness

The following tables, one for each set of test pieces, give details of the measurements carried out and the following calculations:

– **moisture content**: as a percentage, calculated using an in-house method;
– **change in length**: calculated according to the equations:
  – using set I results:

$$\delta l_{65,85} = \frac{l_{85} \quad l_{65}}{l_{65}} \quad 1000$$

  – using set II results:

$$\delta l_{65,30} = \frac{l_{30} \quad l_{65}}{l_{65}} \quad 1000$$

where l_X is the length between measurement points at 20 °C with X% relative humidity;

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– **change in thickness**: calculated as the mean change in thickness for the three measured points according to the equations:
  – using set I results:

$$\delta t_{65,85} = \frac{t_{85} - t_{65}}{t_{65}} \cdot 100$$

  – using set II results:

$$\delta t_{65,30} = \frac{t_{30} - t_{65}}{t_{65}} \cdot 100$$

  where t_X is the thickness recorded at the measurement points at 20 °C with X% relative humidity.

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Test results

Set I, measurement after step II (20 °C - 65 % RH)				
Test piece	**Length** [mm]	**Thickness** [mm]	**Mass** [g]	**Moisture content** [%]
L1	200,78	12,57	242,2	2,8
L2	200,72	12,37	227,3	2,6
L3	200,72	12,41	246,9	2,5
L4	200,75	12,39	257,4	3,4
T1	200,66	12,25	258,0	2,8
T2	200,68	12,35	254,7	4,4
T3	200,63	12,52	259,3	4,7
T4	200,65	12,21	259,7	4,3
Mean	**200,70**	**12,38**	**250,7**	**3,4**

Set II, measurement after step II (20 °C - 65 % RH)				
Test piece	**Length** [mm]	**Thickness** [mm]	**Mass** [g]	**Moisture content** [%]
L1	200,76	12,36	250,9	5,2
L2	200,66	12,45	249,2	4,2
L3	200,78	12,40	228,9	4,9
L4	200,83	12,41	247,3	5,1
T1	200,68	12,39	258,9	5,0
T2	200,64	12,32	256,2	4,9
T3	200,68	12,30	255,6	4,7
T4	200,68	12,45	260,9	5,8
Mean	**200,71**	**12,39**	**251,0**	**5,0**

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Set I, measurement after step III (20 °C - 85 % RH)				
Test piece	**Length** [mm]	**Thickness** [mm]	**Mass** [g]	**Moisture content** [%]
L1	200,82	12,70	246,3	4,5
L2	200,83	12,46	230,8	4,2
L3	200,83	12,53	250,8	4,1
L4	200,90	12,56	258,9	4,0
T1	200,64	12,30	262,4	4,6
T2	200,81	12,47	256,4	5,1
T3	200,71	12,72	261,1	5,5
T4	200,68	12,43	261,8	5,1
Mean	**200,78**	**12,52**	**253,6**	**4,6**

Set II, measurement after step III (20 °C - 30 % RH)				
Test piece	**Length** [mm]	**Thickness** [mm]	**Mass** [g]	**Moisture content** [%]
L1	200,76	12,39	247,6	3,8
L2	200,67	12,56	246,8	3,2
L3	200,74	12,39	226,4	3,7
L4	200,66	12,34	244,5	4,0
T1	200,60	12,18	256,3	4,0
T2	200,49	12,38	253,4	3,8
T3	200,50	12,33	253,2	3,7
T4	200,55	12,40	257,1	4,3
Mean	**200,62**	**12,37**	**248,2**	**3,8**

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Determination of change in length and thickness

Set 1		
Test piece	**Change in length $\delta l_{65\text{-}85}$** [mm/m]	**Change in thickness $\delta t_{65\text{-}85}$** [%]
L1	0,20	1,69
L2	0,55	1,54
L3	0,55	1,58
L4	0,75	0,58
T1	-0,10	1,71
T2	0,65	0,67
T3	0,40	0,69
T4	0,15	0,81
Mean	**0,39**	**1,16**

Set II		
Test piece	**Change in length $\delta l_{65\text{-}30}$** [mm/m]	**Change in thickness $\delta t_{65\text{-}30}$** [%]
L1	0,00	-1,32
L2	0,05	-0,96
L3	-0,20	-1,09
L4	-0,85	-1,13
T1	-0,40	-1,00
T2	-0,75	-1,09
T3	-0,90	-0,94
T4	-0,65	-1,46
Mean	**-0,46**	**-1,12**

Test Technician:
Dott. Alessandro Trevisani

Head of Wood Technology/Conditioning Laboratory:
Dott. Alessandro Trevisani

Chief Executive Officer
(Dott. Arch. Sara Lorenza Giordano)

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Registro Imprese di Rimini n. 00 549 540 409

TEST REPORT No. 315703

Place and date of issue: Bellaria-Igea Marina - Italy, 09/05/2014

Customer: BIFIRE S.r.l.- Via Carducci, 8 - 20123 MILANO (MI) - Italy

Date test requested: 20/01/2014

Order number and date: 61981, 23/01/2014

Date sample received: 20/01/2014

Test date: 29/01/2014

Purpose of test: determination of mechanical bending properties (MOE/MOR) of fibre-cement flat sheets in accordance with clause 7.3.2 of standard UNI EN 12467:2012

Test site: Istituto Giordano S.p.A. - Via Erbosa, 72 - 47043 Gatteo (FC) - Italy

Sample origin: sampled by Istituto Giordano in accordance with the procedure specified in sample report dated 14/01/2014 and supplied by the Customer

Identification of sample received: No. 2014/0109

Sample name*

The test sample is called “AQUAFIRE”.

Description of sample*

The test sample comprises untreated fibre-reinforced lightweight cement boards, with the following specifications:

– density = 960 kg/m³ ± 15 %;

(*) according to that stated by the Customer.

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– width = (1200 ± 3,6) mm;
– length = (2000 ± 5,0) mm;
– thickness = (12,5 ± 1,2) mm.

Description of test pieces

In accordance with standard UNI EN 12467:2012, 10 test pieces were cut from the sample of size 250 × 100 mm and original product thickness.

5 of the ten test pieces were cut in the machine direction “M” and 5 at right angles to the machine “T”.

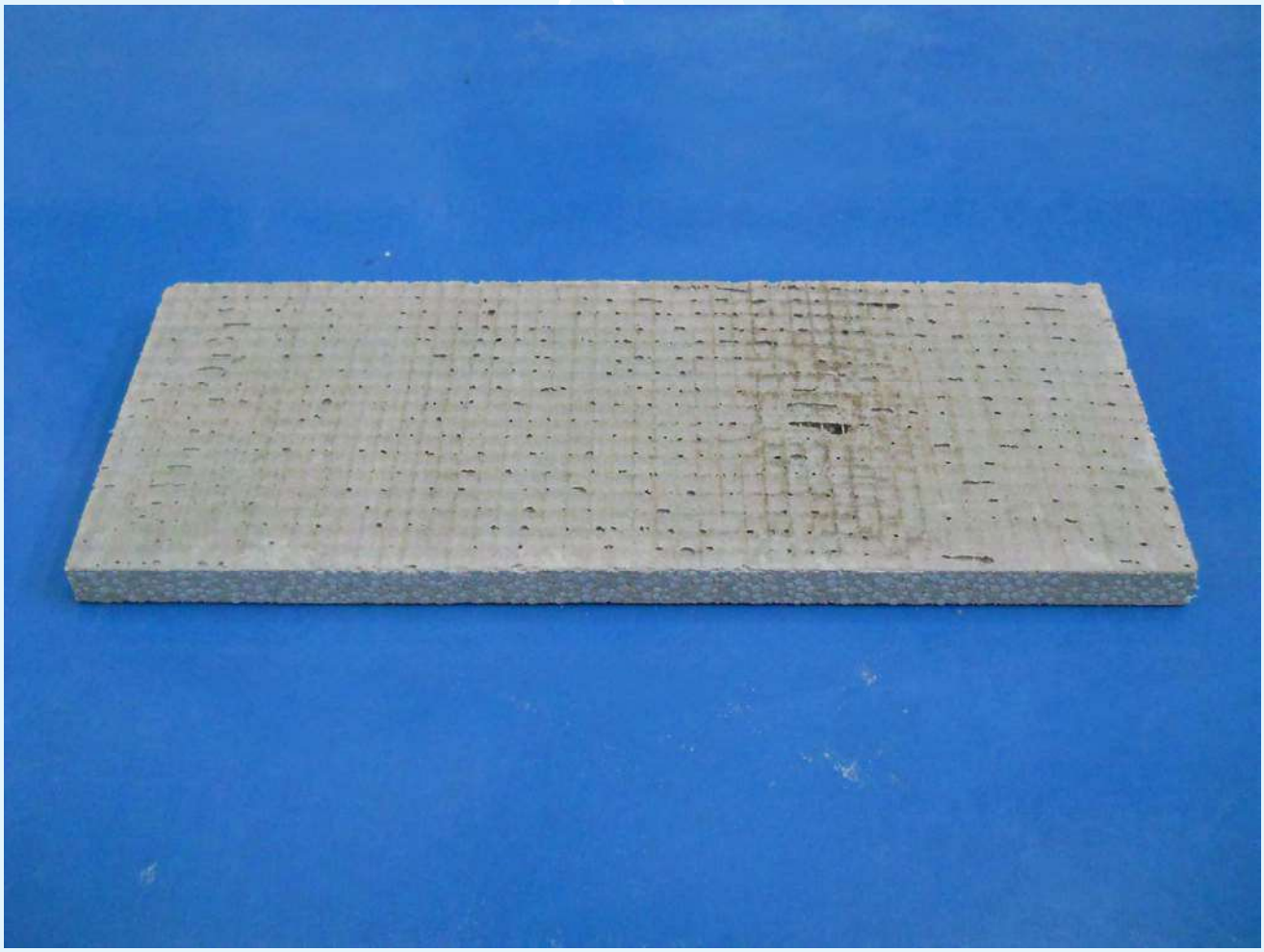

Photo of a test piece

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Normative References

The test was carried out in accordance with the requirements of standard UNI EN 12467:2012 dated 11/10/2012 “Fibre-cement flat sheets - Product specification and test methods”.

Test apparatus

The following equipment was used to carry out the test:

- IG 10000 electronic force gauge manufactured by Istituto Giordano S.p.A., speed range 0,05-300 mm/min, clear span between support columns of 640 mm and effective travel 2000 mm (apparatus in-house identification code FT161);
- AEP load cell, capacity 10 kN (apparatus in-house identification code EDI073);
- steel test frame complying with clause 7.3.2.2.1 with radius of supports and loading bar of 10 mm and span between the supports l_s = 10 mm;
- Mitutoyo Corporation digital calliper gauge with 10 micron resolution (apparatus in-house identification code EDI066).

Test method

The test was carried out in accordance with the requirements of standard UNI EN 12467:2012 and more specifically:

- requirements in accordance with clauses 5.2.2 “Category A” and 5.5.2 of standard UNI EN 12467:2012;
- Test method in accordance with clause 7.3.2 “Mechanical characteristics - Bending strength - Modulus of elasticity (Bending modulus)” of standard UNI EN 12467:2012.

The test pieces were conditioned for at least 7 days under standard laboratory conditions, temperature (23 ± 2) °C and relative humidity (50 ± 5) %.

They were subsequently immersed in water for 24 h at ambient temperature (23 ± 2) °C and then underwent the bending test in accordance with clause 7.3.2.3 of standard UNI EN 12467:2012.

Cylindrical supports were used of radius 10 mm arranged so that the span between the axes of the supports “l_s” is 200 mm.

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The following were calculated for each test piece:

– modulus of rupture MOR, in MPa, in accordance with clause 7.3.2.4.1 of standard UNI EN 12467:2012, as given by the following formula.

$$MOR = \frac{3 \cdot F \cdot l_S}{2 \cdot b \cdot e^2}$$

where: F = breaking load, in N;

l_S = span between the axes of supports, in mm;

b = width of the test piece, in mm;

e = thickness of the test piece, in mm;

– modulus of elasticity MOE, in MPa, in accordance with clause 7.3.2.4.2 of standard UNI EN 12467:2012, as given by the following formula.

$$E = \frac{(F_2 - F_1) \cdot l_S^3}{4 \cdot b \cdot e^3 \cdot (f_2 - f_1)}$$

where: l_S = span between the axes of supports, in mm;

F_1 and F_2 = loads, taken from two points within the linear section of the plot, below the limit of proportionality;

b = width of the test piece, in mm;

e = thickness of the test piece, in mm;

f_1 and f_2 = deflections corresponding to the load selected, in mm.

Environmental conditions during test

Ambient temperature	(23 ± 2) °C
Relative humidity	(50 ± 5) %

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Test results

Direction of test	Test piece [n.]	Measured thickness "e"	Breaking load "F" [N]	Modulus of rupture "MOR_{fci}" [MPa]	Modulus of elasticity "MOE" [MPa]
M	1	12,3	326	6,4	501
	2	12,1	193	6,0	515
	3	12,5	301	5,8	635
	4	12,1	300	6,2	481
	5	12,2	273	5,5	546
T	1	12,2	292	5,9	1646
	2	12,4	272	5,4	1413
	3	12,3	252	5,0	1451
	4	12,2	270	5,4	1506
	5	12,3	305	6,0	1736
Mean		**12,3**	**288**	**5,8**	**1043**
Standard deviation		**0,1**	**37**	**0,4**	**544**

Test Technician:
Dott. Ing. Paolo Bertini

Head of Security and Safety Laboratory:
Dott. Andrea Bruschi

Chief Executive Officer
(Dott. Arch. Sara Lorenza Giordano)

DIVISIONE: **COSTRUZIONI**
DIVISION: ***CONSTRUCTIONS***

LABORATORIO: ***FISICA DELLE COSTRUZIONI***
LABORATORY: ***PHISIC OF CONSTRUCTIONS***

RAPPORTO DI PROVA
(Test Report)

Pag. di/*of* pag. **1/4**

N° **0007\DC\TTS\14**

Data: *Date:* **13/03/2014**

IDENTIFICAZIONE E DESCRIZIONE DEL CAMPIONE:
SPECIMEN DESCRIPTION:

AQUAFIRE

DATI IDENTIFICATIVI DEL CLIENTE:
CLIENT:

BIFIRE S.r.l.
Via Lavoratori dell'Autobianchi, 1
20832 DESIO (MB)

NORMA DI RIFERIMENTO:
REFERENCE STANDARD:

EN 12667:2001
EN 12664:2001

DISTRIBUZIONE ESTERNA:
OUTSIDE DISTRIBUTION:

BIFIRE S.r.l.

DISTRIBUZIONE INTERNA:
INSIDE DISTRIBUTION:

Capo Laboratorio – *Laboratory Head*

ENTE DI ACCREDITAMENTO:
ACCREDITATION BODY:

DATI GENERALI / *GENERAL DATA*

Data ricevimento campioni / *samples supply date*	**11/02/2014**
Data esecuzione prove / *date of test*	**14/02/2014**
Campionamento / *sampling*:	**Campione fornito dal Cliente** *Sample supplied by Client*

Identificazione delle norme di riferimento / *Standard reference identification*

EN 12667: Prestazione termica dei materiali e dei prodotti per edilizia – Determinazione della resistenza termica con il metodo della piastra calda con anello di guardia e con il metodo del termoflussimetro – Prodotti con alta e media resistenza termica – Gennaio 2001.
EN 12667: Thermal performance of building materials and products – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Products of high and medium thermal resistance – January 2001

EN 12664: Prestazione termica dei materiali e dei prodotti per edilizia – Determinazione della resistenza termica con il metodo della piastra calda con anello di guardia e con il metodo del termoflussimetro – Prodotti secchi e umidi con media e bassa resistenza termica – Gennaio 2001.
EN 12664: Thermal performance of building materials and products – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Dry and moist products of medium and low thermal resistance – January 2001

Identificazione dei metodi di prova / *Test method identification*

Misura della resistenza termica *R* con metodo del termoflussimetro secondo metodologia EN 12667, EN 12664 per campioni con media e bassa resistenza termica.
Determination of thermal resistance R by means of heat-flow meter method according to EN 12667, EN 12664 for specimens of medium and low thermal resistance.

Configurazione simmetrica con singolo campione disposto orizzontalmente; superficie calda inferiore.
Single-specimen symmetrical configuration, specimen placed horizontally; bottom hot side.

Identificazione dello strumento / *Instrument identification*	**Lasercomp FOX300**
Calibrazione dello strumento / *Instrument calibration*	**NIST 1450b**
Metodo per ridurre le perdite laterali / *Method to reduce edge heat losses*	**Isolamento / *Insulation***
Condizioni ambientali nel laboratorio / *Environmental conditions in the laboratory*	**22±3 °C, 50±10% UR**
Condizionamento del campione / *Conditioning of specimen*	**22±3 °C, 50±10% UR, t > 24 h**
Procedura normalizzata / *Standard procedure*	**SI /*YES***
Deviazione dai metodi di prova / *Standard procedure deviations*	**SI /*YES***
Controllo calcoli e trasferimenti dati / *Calculation and data transfer check*	**SI /*YES***

DEVIAZIONI / *DEVIATIONS*

Non è stata verificata l'area dei difetti superficiali (par. 6.3.2 EN 12667)
Surface irregularities area has not been checked (par. 6.3.2 EN 12667)

Non sono state determinate le variazioni di spessore, massa e volume durante il condizionamento e la prova (par. 8.1 EN 12667)
Relative mass, thickness and volume changes during conditioning and test have not been determined (par. 8.1 EN 12667)

DICHIARAZIONI

Rapporto di prova iniziale di tipo emesso in qualità di Organismo Notificato n. 0497 ai fini della marcatura CE secondo il Regolamento (UE) N.305/2011
Initial type test report issued as Notified Body n. 0497 for CE marking purposes according to (UE) N.305/2011.

I risultati di prova contenuti nel presente rapporto si riferiscono esclusivamente al campione provato.
Test results contained in this report relate only to specimens tested.

Il presente rapporto non può essere riprodotto parzialmente senza l'autorizzazione del Responsabile di Laboratorio.
The test report shall not be reproduced except in full without the written approval of the Managing Director.

Tranne ove esplicitamente riportato, le caratteristiche dei prodotti sono state ricavate dalle descrizioni del cliente e non sono state verificate dal laboratorio.
Except where stated, characteristics of products were taken from client description and were not verified by the laboratory.

DESCRIZIONE DEL CAMPIONE / *SPECIMEN DESCRIPTION*

AQUAFIRE
Lastra in cemento alleggerito fibrorinforzato spessore 12,5 mm
Fibre-reinforced lightweight cement boards thickness 12,5 mm

RISULTATI SPERIMENTALI / *EXPERIMENTAL RESULTS*

Campione *Specimen*	d 10^{-3} m	ρ_0 kg/m³	t_1 °C	t_2 °C	t_m °C	q_1 W/m²	q_2 W/m²	R m² K W⁻¹	$\mathcal{J}$ W m⁻¹ K⁻¹
Campione 1 *Sample 1*	12.402	983	0,01	20.01	10.01	344,7	323	**0.05991**	**0.2070**
			10.01	30,02	20,01	340,5	317,2	**0.06083**	**0.2039**
Campione 2 *Sample 2*	12.459	931	0,02	20.01	10.01	328.3	323	**0.06140**	**0.2032**
			10.01	30,02	20,01	340.5	317,2	**0.06084**	**0.2048**
Campione 3 *Sample 3*	12.516	949	0,01	20.01	10.01	344,7	323	**0.05992**	**0.2089**
			10.01	30,02	20,01	340,5	317,2	**0.06084**	**0.2057**
Campione 4 *Sample 4*	12.332	927	0,01	20.01	10.01	344,7	323	**0.05991**	**0.2059**
			10.01	30,01	20,01	340.5	317.2	**0.06083**	**0.2027**

Legenda

d =	Spessore del provino (misurato) / *Specimen thickness (measured)*
ρ_0 =	Densità del provino / *Specimen density*
t_1 =	Temperatura media lato freddo / *Average temperature cold side*
t_2 =	Temperatura media lato caldo / *Average temperature hot side*
$t_m = (t_1 + t_2)/2$ =	Temperatura media / *Average temperature*
q_1 =	Flusso di calore lato freddo / *Heat flux cold side*
q_2 =	Flusso di calore lato caldo / *Heat flux hot side*
$q_m = (q_1 + q_2)/2$ =	Flusso di calore medio / *Average heat flux*
$R = (t_2 - t_1)/q_m$ =	Resistenza termica / *Thermal resistance*
$\mathcal{J} = d/R$ =	Fattore di trasferimento del campione/ *Transfer factor of specimen*

Nota / *Note*

Il fattore di trasferimento viene spesso definito *conduttività termica apparente del provino* nelle specifiche condizioni di prova.
The transfer factor is often referred to elsewhere as apparent thermal conductivity of specimen *in the specific test conditions.*

DATA ***Date***	**RESP. DIVISIONE** ***Division Head***	**RESP. DEL CENTRO** ***Managing Director***
13/03/2014	**Paolo Mele**	**Pasqualino Cau**