

ACQUA / FUOCO
TWO ELEMENTS
ONE SOLUTION



AquaFire[®]
TECNOLOGIA ITALIANA
TEST AND CERTIFICATIONS



La follia sta nel fare sempre la stessa cosa aspettandosi
risultati diversi. - Albert Einstein.

*Insanity: doing the same thing over and over again and
expecting different results. - Albert Einstein.*



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TEST AND CERTIFICATIONS



- 1- ETA 21-0834 (WARRINGTON - ELEMENT)
- 2- CERTIFICATE OF CONFORMITY OF FPC (WARRINGTON)
- 3- CONSTANCY OF PERFORMANCE
- 4- CLASSIFICATION REPORT A1 CSI/0238C/11/RF (CSI)
- 5- TEST REPORT RINA MED205314CS NON-COMBUSTIBILE MATERIAL FOR MARINE EQUIPMENT (RINA)
- 6- TEST REPORT FOR LEED N° 13-3621 DEL 10/10/2013 (LABO CONSULT)
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- 26- TEST REPORT N° 355334 LARGE MISSILE IMPACT TAS 201-203-94
- 27- TEST REPORT N° 349982 RESISTANCE TO BURGLARY
- 28- RAPPORTO DI PROVA N° 20190509 EPD-BIFIRE AQUAFIRE

 Element Materials Technology Rotterdam B.V. Zekeringstraat 33 1014 BV Amsterdam Netherlands Tel: +31 (0) 20-55633555 www.element.com	 Designated according to Article 29 of Regulation (EU) No 305/2011	Member of  www.eota.eu
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European Technical Assessment

ETA-21/0834
of 01/04/2022

General Part

Technical Assessment Body Issuing the European Technical Assessment:	Element Materials Technology Rotterdam B.V.
Trade Name of the Construction Product:	AQUAFIRE®
Product Family to Which the Construction Product Belongs:	Fire Protective Board
Manufacturer:	BIFIRE SRL Via Laboratori Autobianchi 1 20832 – Desio (MB) Italy
Manufacturing Plant(s):	F/006
This European Technical Assessment Contains:	13 pages including 1 Annex which form an integral part of this assessment.
This European Technical Assessment is Issued in Accordance with Regulation (EU) No 305/2011, On the Basis Of:	EAD 350142-00-1106 Fire Protective Products: Fire protective board, slab and mat products and kits
This Version Replaces:	

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full. However, partial reproduction may be made, with the written consent of the issuing Technical Assessment Body. Any partial reproduction has to be identified as such.

1. Technical Description of the Product

AQUAFIRE® is a fibre reinforced lightweight cement based board with polystyrene bead fillers and glass fibre reinforcement mesh.

In accordance with EAD 35014-00-1106, AQUAFIRE® has been considered and assessed as a fire protective board only option.

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.

According to the manufacturer's declaration, the product specification does not contain any Substances of Very High Concern (SVHC's) of the candidate list, with regards to REACH Regulation 1907/2006.

In addition to the specific clauses relating to dangerous substances contained in this European technical assessment, 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 Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

2. Specification of the Intended Use(s) in Accordance with the Applicable European Assessment Document (hereinafter EAD)

It is intended to protect the following types of elements according to EAD 35014-00-1106:

Type 8: Fire protective products that contribute to the fire resistance of fire separating elements with no loadbearing requirements

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

The resistance to fire performance, tested to EN 1364-1 and classified according to EN 13501-2, of assemblies incorporating the fire protective board product are:

Assembly assessed within the framework of this ETA	Classification according to EN 13501-2	Intended use type EAD 35014-00-1106	Installation details
Vertical non-loadbearing masonry wall, plastered on both faces and clad with a single layer of AQUAFIRE board on its exposed face	EI 120	Type 8	Annex 2.1

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.

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.

3. Performance of the Product and References to the Methods Used for its Assessment

Product: Fire Protective Board		Intended use: Type 8: Fire protective products that contribute to the fire resistance of fire separating elements with no loadbearing requirements
Assessment method	Essential characteristic	Product performance
BASIC WORKS REQUIREMENT 2: SAFETY IN CASE OF FIRE		
EN 13501-1	Reaction to fire	Class A1
EN 13501-2	Fire resistance	EI 120: Type 8
EAD 350142-00-1106	Durability	Type Y durability for 25 years
EN 12467	Extended durability	Resistance to soak/dry, R_L value of 0.84 Resistance to freeze/thaw, R_L value of 0.86 Resistance to heat/rain, Category A
EN 319	Basic durability assessment	Tensile strength perpendicular, 0.99 MPa
EN 789	Basic durability assessment	Tensile strength parallel, 1.427 MPa Average compressive strength, 3.98MPa
EN 12467	Water permeability	Category A
EN 12467	Flexural Strength	Modulus of Rupture (MOR) of 5.8 MPa
BASIC WORKS REQUIREMENT 3: HYGIENE, HEALTH AND THE ENVIRONMENT		
Manufacturer's declaration	Content, emission and or release of dangerous substances	Product specification doesn't contain Substances of Very High Concern (SVHC's) of the candidate list, with regards to REACH Regulation 1907/2006
EN 12467	Water permeability	Category A
BASIC WORKS REQUIREMENT 4: SAFETY AND ACCESSIBILITY IN USE		
EN 12467	Flexural Strength	Modulus of Rupture (MOR) of 5.8 MPa
EN 318	Dimensional Stability	Dimensionally stable.

4. Assessment and Verification of Constancy of Performance (hereinafter AVCP) System Applied, with reference to its Legal Base

According to the decision 1999/454/EC of the European Commission Decision of date 22 June 1999 on the procedure for attesting the conformity of construction products pursuant to Article 20(2) of Council Directive 89/106/EEC as regards fire stopping, fire sealing and fire protective products, 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 (including coatings)	Fire protection of steel elements	Any	1

5. Technical Details Necessary for the Implementation of the AVCP System, as Provided for in the Applicable EAD

The manufacturer shall exercise permanent internal control, record and evaluate the results of factory production in accordance with the provisions laid down in the "Control Plan" related to this European Technical Assessment. 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. The production control system shall ensure that the product is in conformity with this European Technical Assessment.

The manufacturer may only use verified by Technical Assessment Body initial/raw/constituent materials stated in the technical documentations related to this European Technical Assessment.

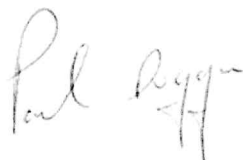
The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

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 Constancy and inform the relevant authorities e.g. NANDO, EOTA.

The Table 11 in EAD 350142-00-1106 presents an example of the properties that shall be controlled and minimum frequencies of control. The exact test method and threshold have been laid down in the factory production control plan, operated by the manufacturer and deposited at Element Materials Technology Rotterdam B.V.

Issued in Amsterdam, Netherlands on 01/04/2022

By



Paul Duggan

Deputy TAB Manager

ANNEX 1 - References

EAD 350142-00-1106	Fire Protective Products: Fire protective board, slab and mat products and kits
EN 13501-1: 2018	Fire classification of construction products and building elements- Part 1: Classification using test data from reaction to fire tests.
EN 13501-2:2016	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 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 EAD 350142-00-1106	Installation details	Date of addition to this ETA
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.

A.2.1 non-loadbearing masonry wall, plastered on both faces and clad with a single layer of AQUAFIRE board on its exposed face

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 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

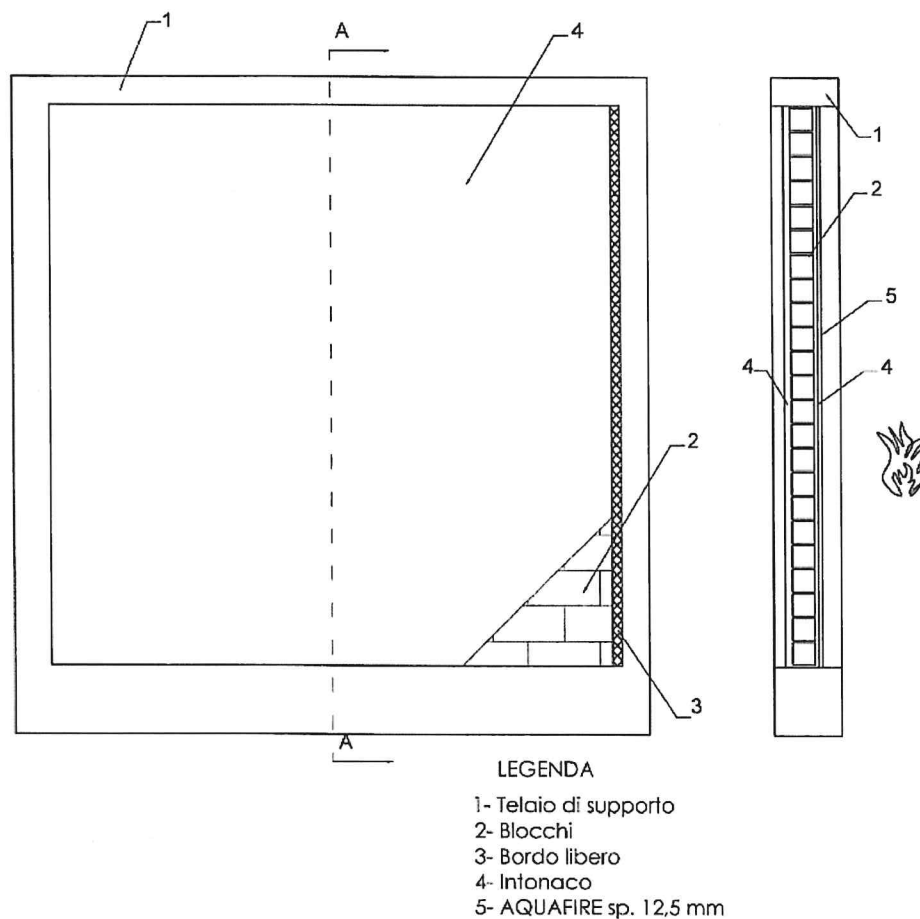
Assemblies shall be as detailed in the following section. Components shall be as specified below in Table A.2.4.1 and as shown in Figures A.2.4.2. to A.2.4.5. Note the figures show the tested assembly and are for general reference purposes only.

Table A.2.4.1

<u>Item</u>	<u>Description</u>
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

<u>Item</u>	<u>Description</u>
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.2.1.1 Schematic drawing of wall assembly and vertical section



Do not scale. All dimensions are in mm

Figure A.2.1.2 Details of clay brick units

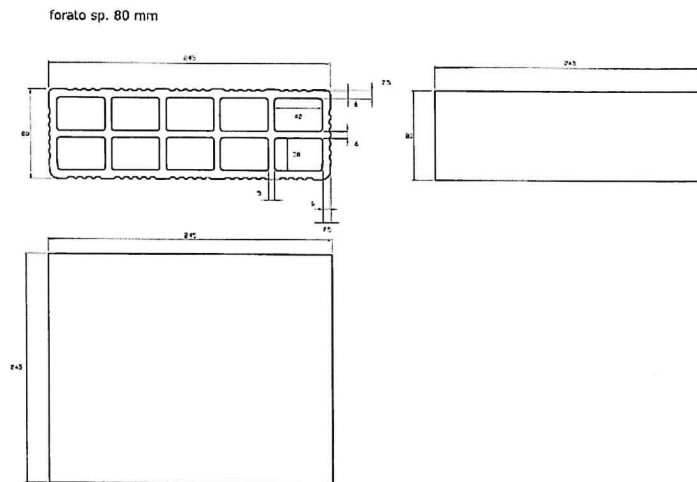
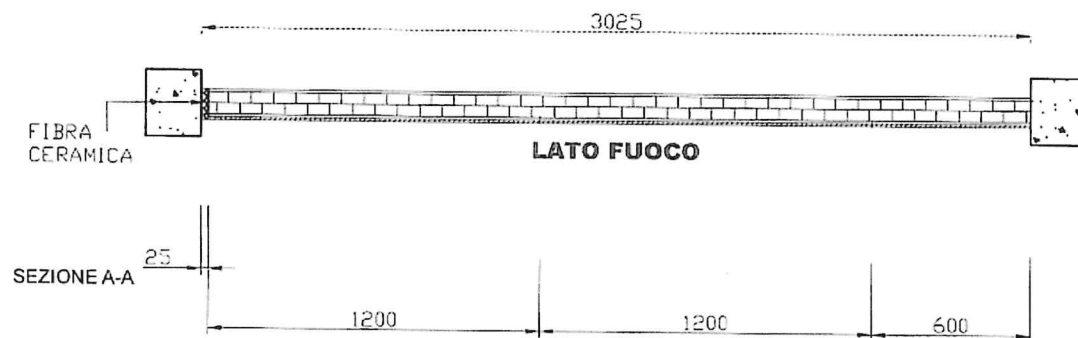
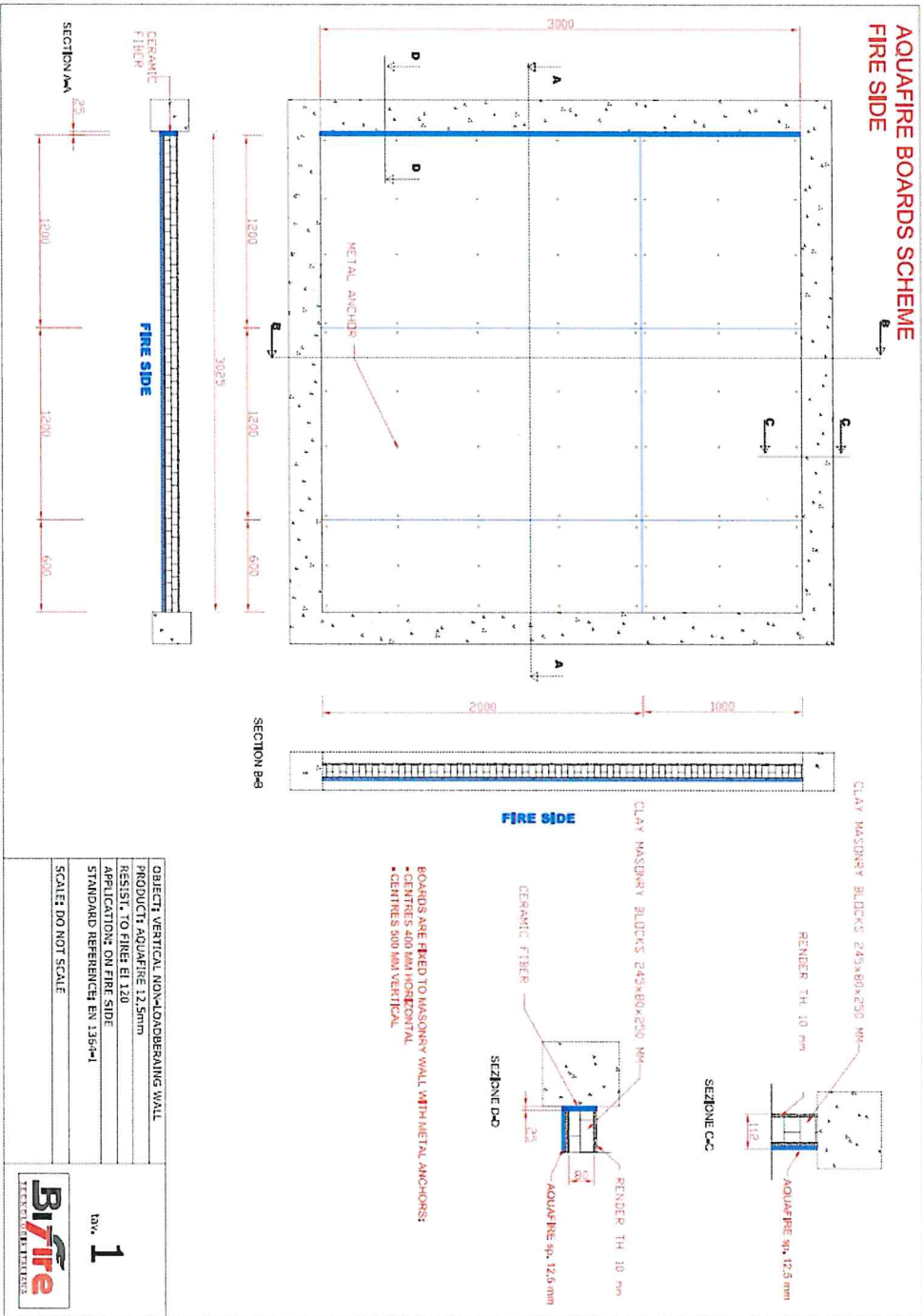


Figure A.2.1.3 Horizontal section through assembly



Do not scale. All dimensions are in mm

Figure A.2.1.4 Schematic drawing of wall assembly and board protection layout to exposed face with sections



Do not scale. All dimensions are in mm

CSI SpA
Certificazione e Testing

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Reg. Imprese 352168/8620/18
C.F./RIVA 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. 04AS/1 - Rev. B

Data / Date 28.12.2011

CSI SpA.
Viale Lombardia 20
20021 BOLLATE (MI)

Società a socio unico soggetto
ad attività di direzione
e coordinamento di IMQ SpA

Solo la copia completa di questo Rapporto di Classificazione permette un normale impiego dei risultati /
Only the full copy of this classification report allows a normal use of results



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 9-20141
11/11

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CSI
CERTIFICAZIONE E TESTING

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

Data / Date 28.12.2011

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

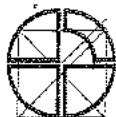
Test results for construction products except floorings

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_r [s] (1)		0	(-)
EN ISO 1716	PCS [MJ/kg]	3	0,15	(-)

Mod. 04/01/02 - Rev. 9

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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 <i>Fire behaviour</i>	Sviluppo di fumo <i>Smoke production</i>	Parti infiammate <i>Flaming droplets</i>
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. 29
20021 BOLLATE (MI)

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CSI
CERTIFICAZIONE E TESTING

RAPPORTO DI CLASSIFICAZIONE/ CLASSIFICATION REPORT CSI/0238c/11/RF
Data / Date 28.12.2011

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

28/12/2011

IL Resp. Divisione Costruzioni
Division Head

Ing. P. Mele

Il Direttore del Laboratorio
Managing Director

Ing. R. Gatti

CSI SpA
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

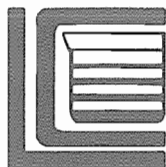
This Certificate is valid until
August 25, 2019

This Certificate consists of this sheet plus an attachment



Massimo Dinale

RINA Services S.p.A.



LABO CONSULT S.r.l.

STUDI E MONITORAGGI SULL'AMBIENTE ANALISI CHIMICHE E MERCEOLOGICHE AUDIT AMBIENTALI

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/Absence

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 refer to 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

SEDE LEGALE E AMMINISTRATIVA: VIA DON MINZONI, 9 20158 MILANO TEL. 02 39.32.16.86 R.A. FAX 02 39.32.17.52

Cap. Soc. € 10.920,00 int. vers. C.C.I.A.A. Milano N. 1001867 Reg. Soc. Comm. Trib. Milano N. 185464 Cod. Fisc. e P. IVA N. 04363550155

TEST AND CERTIFICATIONS

**LABO CONSULT S.r.l.**

STUDI E MONITORAGGI SULL'AMBIENTE ANALISI CHIMICHE E MERCEOLOGICHE AUDIT AMBIENTALI

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 refer to 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 Ferra

SEDE LEGALE E AMMINISTRATIVA: VIA DON MINZONI, 9 20158 MILANO TEL. 02 39.32.16.66 P.A. FAX 02 39.32.17.52

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TEST AND CERTIFICATIONS

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.

Comp. AV
Revis. PB

This test report consists of 6 sheets.
This document is the English translation of the test report No. 315705 dated 09/05/2014 issued in Italian; in case of dispute the only valid version is the Italian one. Date of translation: 13/06/2014.

Sheet
1 of 6

TEST AND CERTIFICATIONS

CAUTION: This document relates only to the sample of material tested and shall not be reproduced except in full without Istituto Giordano's written approval.

The boards have the following specifications:

- density = $960 \text{ kg/m}^3 \pm 15 \%$;
- width = $(1200 \pm 3,6) \text{ mm}$;
- length = $(2000 \pm 5,0) \text{ mm}$;
- thickness = $(12,5 \pm 1,2) \text{ mm}$.

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 $l_s = 10 \text{ mm}$;
- 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 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.

- 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	$(23 \pm 2) ^\circ C$
Relative humidity	$(50 \pm 5) \%$

Test results

Lot	Direction of test	Test piece	Condition- ing	Measured thickness “e”	Breaking load “F”	Modulus of rupture “MOR _{fci} ”	Modulus of elasticity “MOE”
[No.]		[No.]		[mm]	[N]	[MPa]	[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.

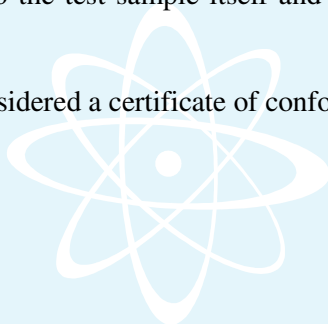
Findings

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)



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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This test report consists of 5 sheets.
This document is the English translation of the test report No. 297767 dated 11/09/2012 issued in Italian.
Date of translation: 05/12/2013.

Sheet
1 of 5

TEST AND CERTIFICATIONS

CAUTION: This document relates only to the sample of material tested and shall not be reproduced except in full without Istituto Giordano's written approval.

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 $\pm$ 1 %
Length	2000 mm $\pm$ 1 %
Thickness	12,5 mm $\pm$ 1 %
Density	960 kg/m ³ $\pm$ 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 m².

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 $(+60 \pm 2)$ °C;

(*) according to that stated by the Customer.

- light radiation apparatus fitted with Osram Ultra-Vitalux 300 W lamps such as to guarantee a total irradiance level of $(900 \pm 100) \text{ W/m}^2$;
- 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 $(60 \pm 5) ^\circ\text{C}$.

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)	$2:50 \pm 0:05$
Pause	$0:10 \pm 0:01$
Radiant heat (black body temperature = $60 \pm 5 ^\circ\text{C}$)	$2:50 \pm 0:05$
Pause	$0:10 \pm 0:01$
Total cycle	$6:00 \pm 0:12$

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

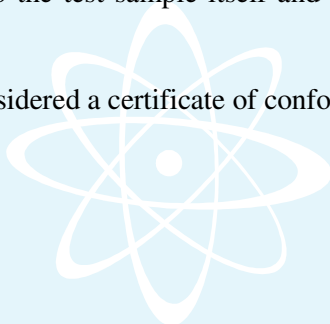
Findings

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

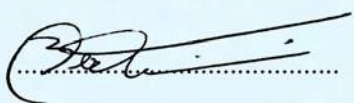
Category A

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

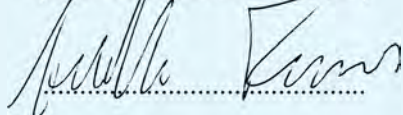
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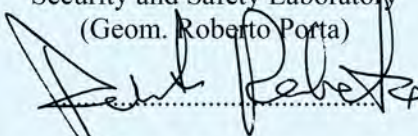
Test Technician
(Dott. Ing. Paolo Bertini)



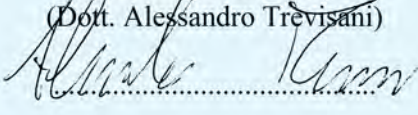
Test Technician
(Dott. Alessandro Trevisani)



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



Head of Wood Technology / Con-
ditioning Laboratory
(Dott. Alessandro Trevisani)



Managing Director
(Dott. Ing. Vincenzo Iommi)



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.

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Revis. PB

This test report consists of 6 sheets.
This document is the English translation of the test report No. 315704 dated 09/05/2014 issued in Italian; in case of dispute the only valid version is the Italian one. Date of translation: 13/06/2014.

Sheet
1 of 6

TEST AND CERTIFICATIONS

CAUTION: This document relates only to the sample of material tested and shall not be reproduced except in full without Istituto Giordano's written approval.

The boards have the following specifications:

- density = $960 \text{ kg/m}^3 \pm 15 \%$;
- width = $(1200 \pm 3,6) \text{ mm}$;
- length = $(2000 \pm 5,0) \text{ mm}$;
- thickness = $(12,5 \pm 1,2) \text{ mm}$.

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 $250 \times 100 \text{ mm}$ 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);

- 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.

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

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	$(23 \pm 2) ^\circ\text{C}$
Relative humidity	$(50 \pm 5) \%$

Test results

Lot	Direction of test	Test piece	Conditioning	Measured thickness “e”	Breaking load “F”	Modulus of rupture “MOR _{fc} ”	Modulus of elasticity “MOE”
[No.]		[No.]		[mm]	[N]	[MPa]	[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.

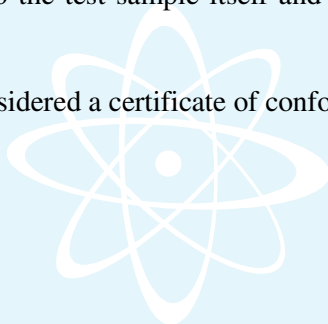
Findings

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)



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.

Comp. AV
Revis. PB

This test report consists of 5 sheets.
This document is the English translation of the test report No. 299803 dated 12/11/2012 issued in Italian.
Date of translation: 05/12/2013.

Sheet
1 of 5

TEST AND CERTIFICATIONS

CAUTION: This document relates only to the sample of material tested and shall not be reproduced except in full without Istituto Giordano's written approval.

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.

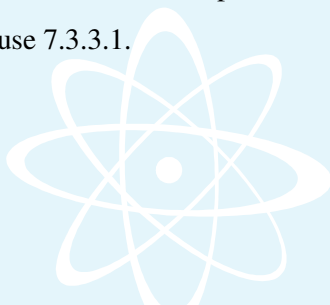
Normative References

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.

Environmental conditions during test

Ambient temperature	$(23 \pm 2) ^\circ\text{C}$
Relative humidity	$(50 \pm 5) \%$

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

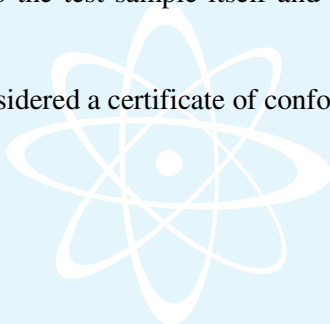
Findings

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.

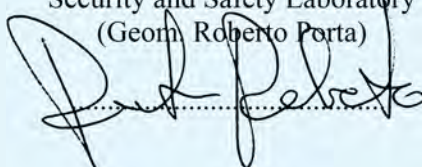
This test report alone shall not be considered a certificate of conformity.



Test Technician
(Dott. Ing. Paolo Bertini)



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



Managing Director
(Dott. Ing. Vincenzo Iommi)



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

Purpose of test:

12572:2006 di materiali e prodotti da costruzione

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.

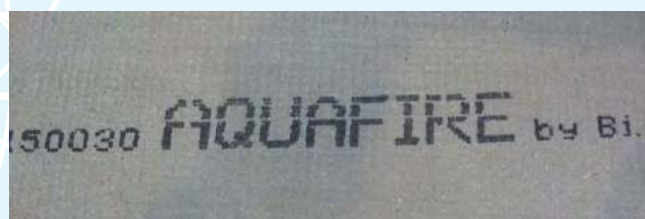
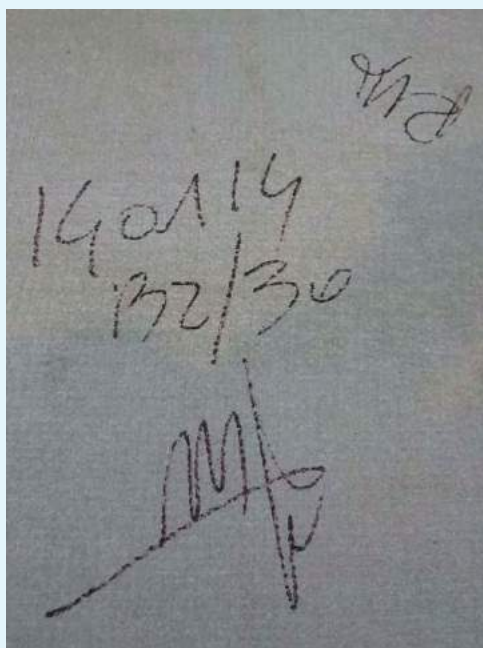
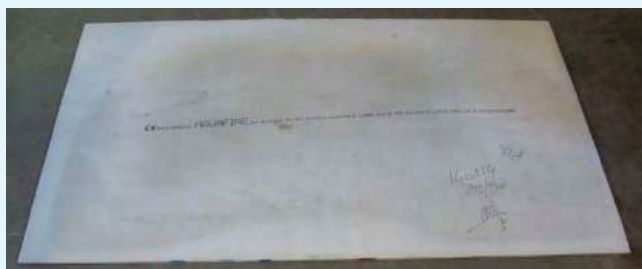
(*) Secondo le dichiarazioni del Committente.

According to information supplied by the Customer.



LAB N° 0021

Comp. AV Revis. PR	Il presente rapporto di prova è composto da n. 5 fogli ed è emesso in formato bilingue (italiano e inglese); in caso di dubbio, è valida la versione in lingua italiana. <i>This test report is made up of 5 sheets and it is issued in a bilingual format (Italian and English); in case of doubt, please refer to the Italian version.</i>	Foglio / Sheet 1 / 5
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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".

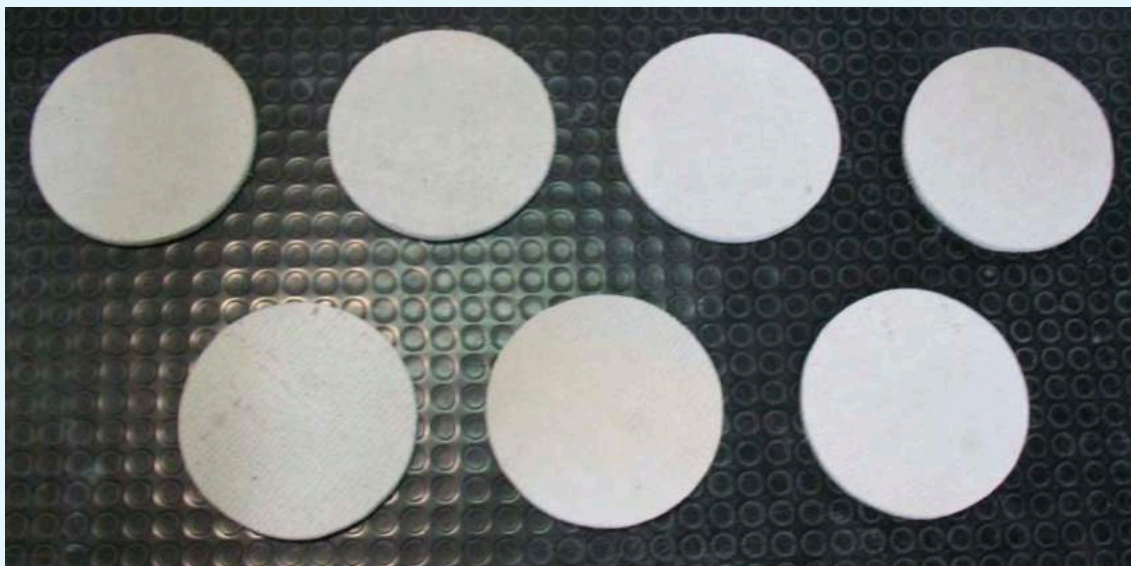
The test was carried out in accordance with the requirements of standard UNI EN ISO 12572:2006 dated 12/10/2006 "Hygrothermal performance of building materials and products. Determination of water vapour transmission properties".

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.

Condizioni di prova.Test conditions.

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

Caratteristiche delle provette.Specimens properties.**Condizioni di prova:***Set of conditions:*

C: 23 - 50/93

		Provetta <i>Specimen</i>				
		n. 1	n. 2	n. 3	n. 4	n. 5
Spessore <i>Thickness</i>	[mm]	11,90	12,00	11,95	11,98	12,13
Superficie della provetta <i>Specimens area</i>	[mm ²]	32700	32510	32430	32240	32160
Superficie di misura <i>Exposed area</i>	[mm ²]	277780	27720	27740	27690	27740
Massa volumica dopo il condizionamento <i>Density after conditioning</i>	[kg/m ³]	11207	1124	1118	1171	1162

Risultati della prova.Test results.

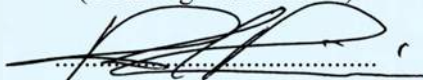
Condizioni di prova <i>Set of conditions</i>	Provetta <i>Specimen</i>	Velocità di trasmissione del vapore <i>Water vapour transmission rate</i>	Permeanza <i>Permeance</i>	Resistenza <i>Resistance</i>	Permeabilità al vapore <i>Water vapour permeability</i>	Fattore di resistenza alla diffusione <i>Diffusion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

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

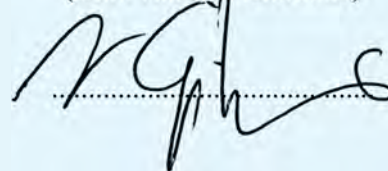
Il Responsabile
Tecnico di Prova
Test Technician
(Dott. Ing. Paolo Ricci)



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)



TEST AND CERTIFICATIONS



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R.E.A. c/o C.C.I.A.A. (RN) 156766

Registro Imprese di Rimini n. 00 549 540 409

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".

Comp. AV
Revis. PB

This test report consists of 5 sheets.

This document is the English translation of the test report No. 317123 dated 07/07/2014 issued in Italian; in case of dispute the only valid version is the Italian one. Date of translation: 07/07/2014.

Sheet
1 of 5

TEST AND CERTIFICATIONS

CAUTION: This document relates only to the sample or material tested and shall not be reproduced except in full without Istituto Giordano's written approval.

Description of sample*

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

- density = $960 \text{ kg/m}^3 \pm 15 \%$;
- width = $(1200 \pm 3,6) \text{ mm}$;
- length = $(2000 \pm 5,0) \text{ mm}$;
- thickness = $(12,5 \pm 1,2) \text{ mm}$.

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:

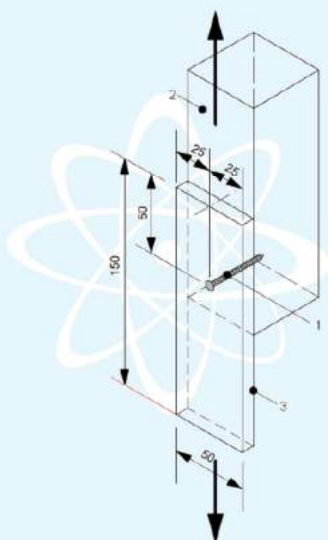
- Istituto Giordano S.p.A. IG 10000 digital force gauge, speed range 0,05-300 mm/min or load rate 9-300 N/s, clear span between support columns of 640 mm and effective travel 2000 mm (apparatus in-house identification code FT161);
- AEP load cell, capacity 2 kN (apparatus in-house identification code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

(*) according to that stated by the Customer.

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) %

Test results

Test piece [No.]	Maximum withdrawal force		Mode of failure
	[N]	[kg]	
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

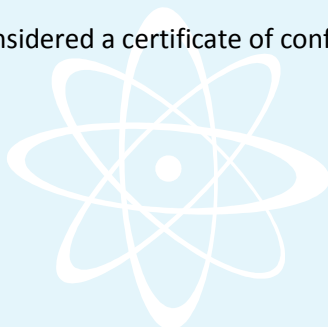
Findings

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)



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 = $960 \text{ kg/m}^3 \pm 15 \%$;

(*) according to that stated by the Customer.

Comp. AV
Revis. PB

This test report consists of 5 sheets.
This document is the English translation of the test report No. 315708 dated 09/05/2014 issued in Italian; in case of dispute the only valid version is the Italian one. Date of translation: 16/06/2014.

Sheet
1 of 5

TEST AND CERTIFICATIONS

CAUTION: This document relates only to the sample of material tested and shall not be reproduced except in full without Istituto Giordano's written approval.

- width = $(1200 \pm 3,6)$ mm;
- length = $(2000 \pm 5,0)$ mm;
- thickness = $(12,5 \pm 1,2)$ 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

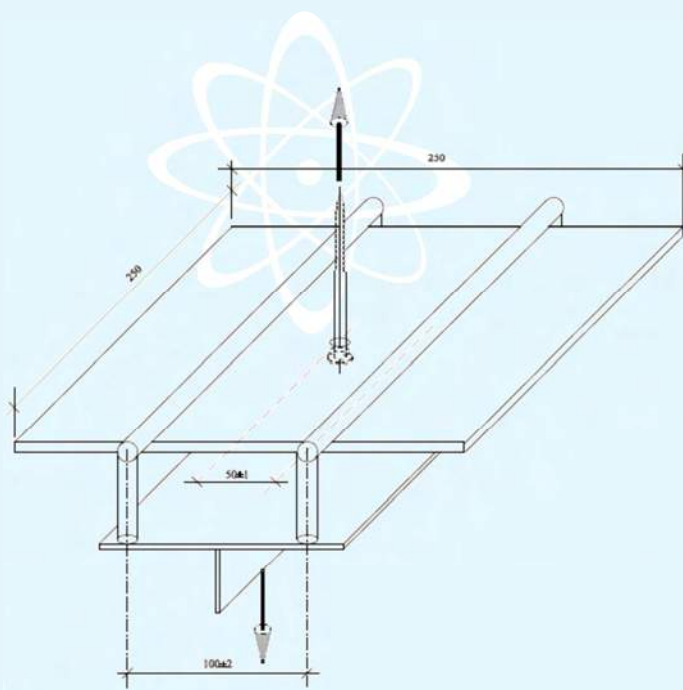
The following equipment was used to carry out the test:

- 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).

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	$(23 \pm 2) ^\circ\text{C}$
Relative humidity	$(50 \pm 5) \%$

Test results

Test piece	Conditioning	Maximum pull-through re- sistance		Mode of failure
[No.]		[N]	[kg]	
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

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
(Dott. Arch. Sara Lorenza Giordano)



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 = $960 \text{ kg/m}^3 \pm 15 \%$;

(*) according to that stated by the Customer.

Comp. AV
Revis. PB

This test report consists of 5 sheets.
This document is the English translation of the test report No. 315710 dated 09/05/2014 issued in Italian; in case of dispute the only valid version is the Italian one. Date of translation: 18/06/2014.

Sheet
1 of 5

TEST AND CERTIFICATIONS

CAUTION: This document relates only to the sample of material tested and shall not be reproduced except in full without Istituto Giordano's written approval.

- width = $(1200 \pm 3,6)$ mm;
- length = $(2000 \pm 5,0)$ mm;
- thickness = $(12,5 \pm 1,2)$ 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

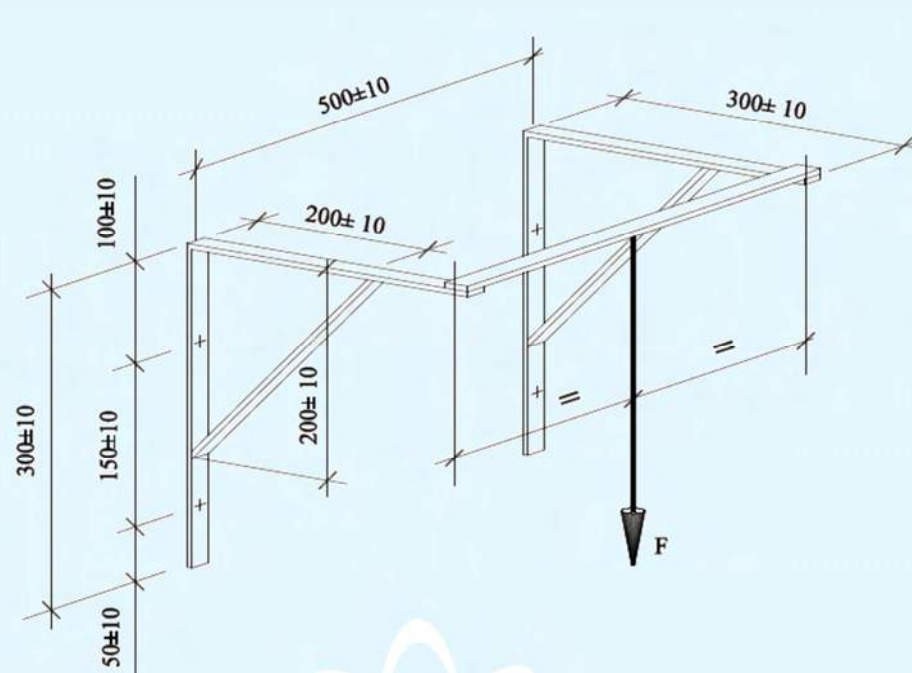
The following equipment was used to carry out the test:

- 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	$(23 \pm 2) ^\circ\text{C}$
Relative humidity	$(50 \pm 5) \%$

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**

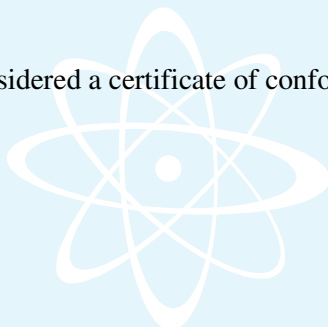
Findings

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.

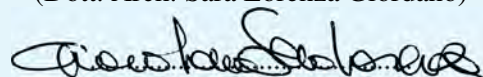
This test report alone shall not be considered a certificate of conformity.



Test Technician:
Dott. Ing. Paolo Bertini

Head of Security and Safety Laboratory:
Dott. Andrea Bruschi

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



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 = $960 \text{ kg/m}^3 \pm 15 \%$;

(*) according to that stated by the Customer.

Comp. AV
Revis. PB

This test report consists of 4 sheets.
This document is the English translation of the test report No. 315706 dated 09/05/2014 issued in Italian; in case of dispute the only valid version is the Italian one. Date of translation: 13/06/2014.

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1 of 4

TEST AND CERTIFICATIONS

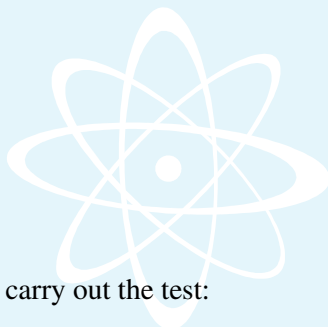
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- width = $(1200 \pm 3,6)$ mm;
- length = $(2000 \pm 5,0)$ mm;
- thickness = $(12,5 \pm 1,2)$ mm.

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.

Environmental conditions during test

Ambient temperature	$(20 \pm 3) ^\circ\text{C}$
Relative humidity	$(50 \pm 15) \%$

Test results**Photo of sample during test**

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 MILANO (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)



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 = $960 \text{ kg/m}^3 \pm 15 \%$;

(*) according to that stated by the Customer.

Comp. AV
Revis. PB

This test report consists of 4 sheets.
This document is the English translation of the test report No. 315707 dated 09/05/2014 issued in Italian; in case of dispute the only valid version is the Italian one. Date of translation: 13/06/2014.

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TEST AND CERTIFICATIONS

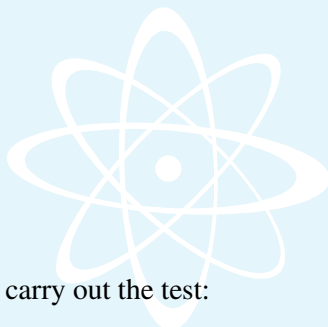
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- width = $(1200 \pm 3,6)$ mm;
- length = $(2000 \pm 5,0)$ mm;
- thickness = $(12,5 \pm 1,2)$ mm.

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.

Environmental conditions during test

Ambient temperature	$(20 \pm 3) ^\circ\text{C}$
Relative humidity	$(50 \pm 15) \%$

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

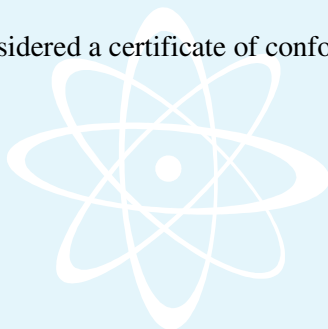
Findings

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)



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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This test report consists of 5 sheets.
This document is the English translation of the test report No. 315354 dated 29/04/2014 issued in Italian; in case of dispute the only valid version is the Italian one. Date of translation: 13/06/2014.

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TEST AND CERTIFICATIONS

CAUTION: This document relates only to the sample of material tested and shall not be reproduced except in full without Istituto Giordano's written approval.

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.

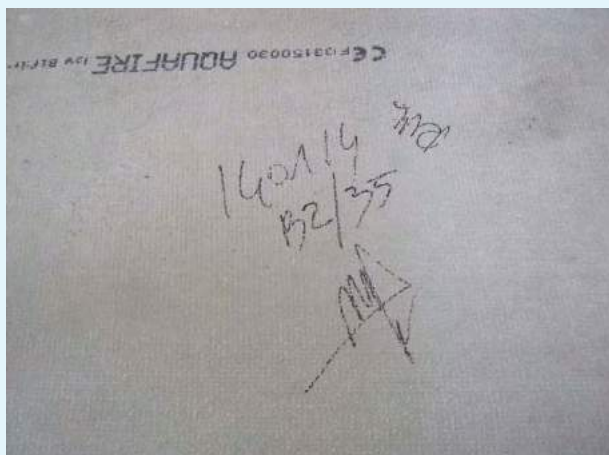


Photo of board and a test piece

(*) according to that stated by the Customer.

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.



Photo of a test piece during testing

Environmental conditions during test

Ambient temperature	$(18 \pm 2) ^\circ\text{C}$
Relative humidity	$(48 \pm 5) \%$

Test results

Test piece	Length	Width	Maximum force	Tensile strength
[No.]	a [mm]	b [mm]	F _{max} [N]	f _{t1} [N/mm ²]
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.

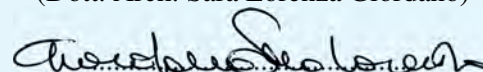


After-test photo of a test piece

Test Technician:
Dott. Alessandro Trevisani

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

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



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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Revis. AT

This test report consists of 5 sheets.
This document is the English translation of the test report No. 315353 dated 29/04/2014 issued in Italian; in case of dispute the only valid version is the Italian one. Date of translation: 13/06/2014.

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1 of 5

TEST AND CERTIFICATIONS

CAUTION: This document relates only to the sample of material tested and shall not be reproduced except in full without Istituto Giordano's written approval.

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.

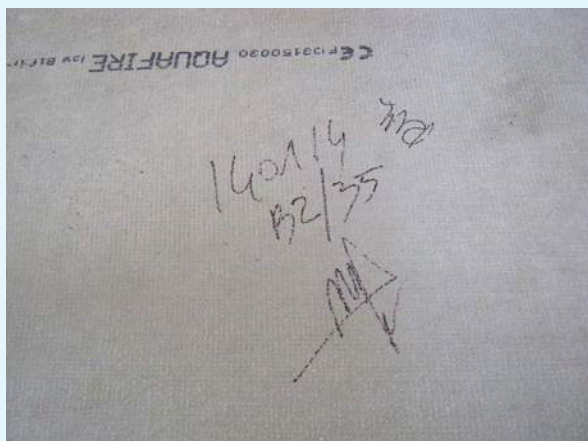


Photo of board and some test pieces

(*) according to that stated by the Customer.

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 $(20 \pm 2) ^\circ\text{C}$ and relative humidity $(65 \pm 5) \%$ (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.

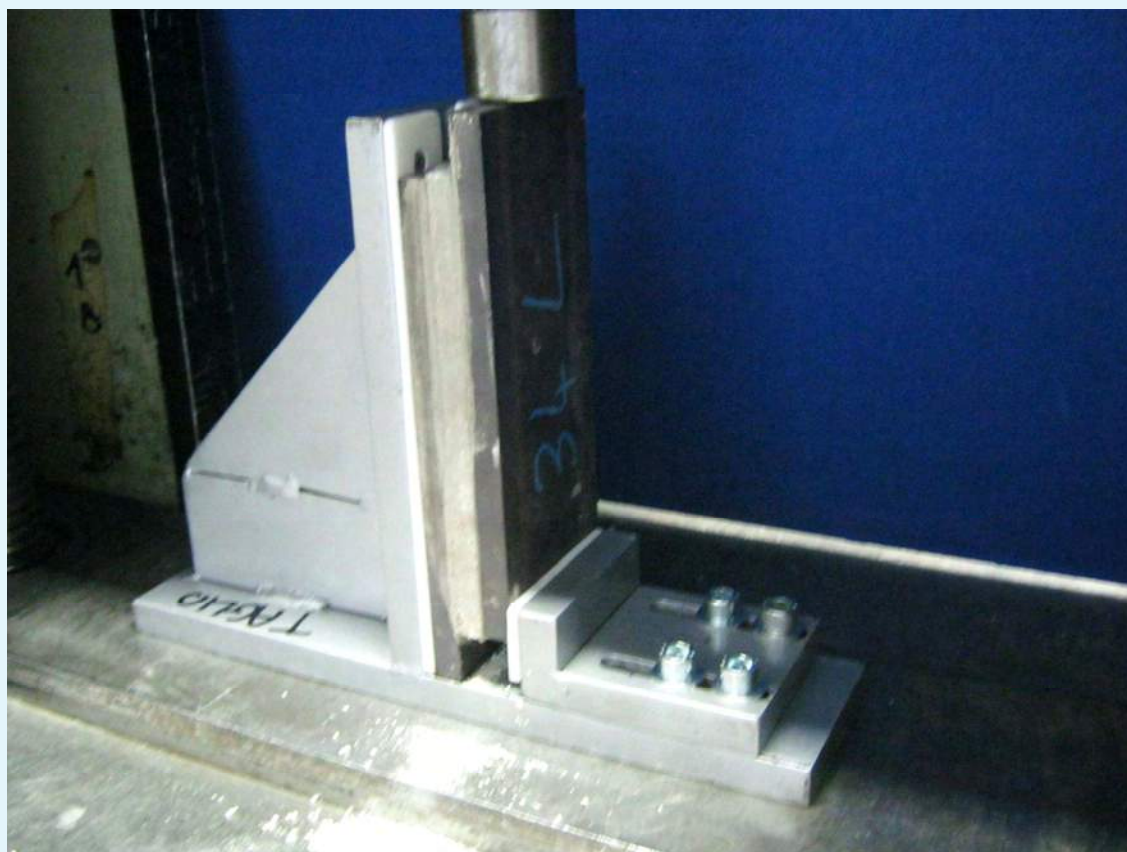


Photo of a test piece during testing

Conditions during test

Ambient temperature	$(20 \pm 5) ^\circ\text{C}$
Relative humidity	$(50 \pm 10) \%$

Test results

Test piece	Direction	Length	Width	Maximum load	Planar shear strength
[No.]		l [mm]	b [mm]	$F_{\max}$ [N]	f_r [N/mm ²]
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)



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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This test report consists of 5 sheets.
This document is the English translation of the test report No. 315963 dated 20/05/2014 issued in Italian; in case of dispute the only valid version is the Italian one. Date of translation: 13/06/2014.

Sheet
1 of 5

TEST AND CERTIFICATIONS

CAUTION: This document relates only to the sample of material tested and shall not be reproduced except in full without Istituto Giordano's written approval.

Description of sample*

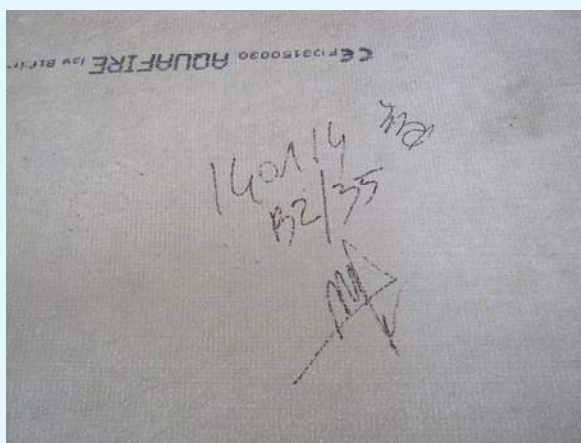
The test sample comprises fibre-reinforced lightweight cement boards, nominal thickness 12,5 mm, taken from the following batches:

- 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.

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.

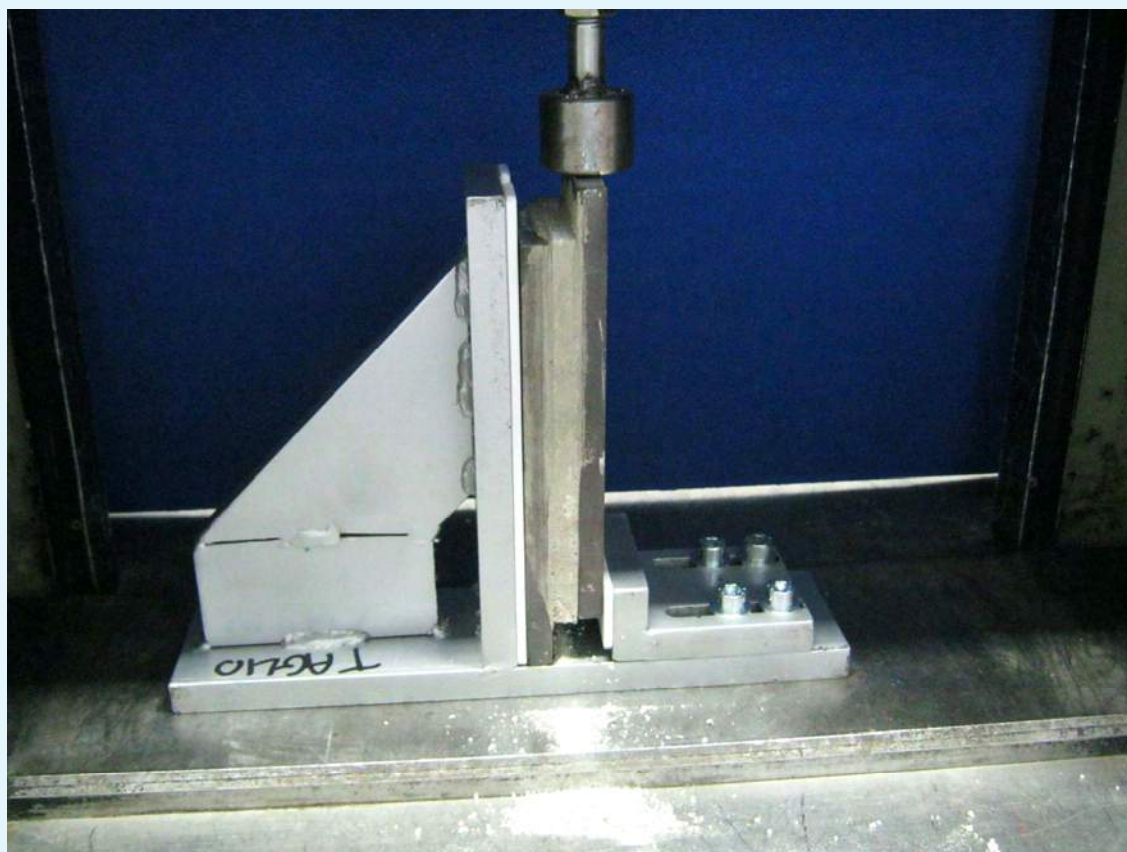


Photo of a test piece during testing

Conditions during test

Ambient temperature	$(20 \pm 5) ^\circ\text{C}$
Relative humidity	$(50 \pm 10) \%$

Test results

Test piece	Direction	Length	Width	Maximum load	Planar shear strength
[No.]		l [mm]	b [mm]	F_{max} [N]	f_r [N/mm ²]
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)



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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This test report consists of 7 sheets.
This document is the English translation of the test report No. 316280 dated 30/05/2014 issued in Italian; in case of dispute the only valid version is the Italian one. Date of translation: 30/06/2014.

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TEST AND CERTIFICATIONS

CAUTION: This document relates only to the sample of material tested and shall not be reproduced except in full without Istituto Giordano's written approval.

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.

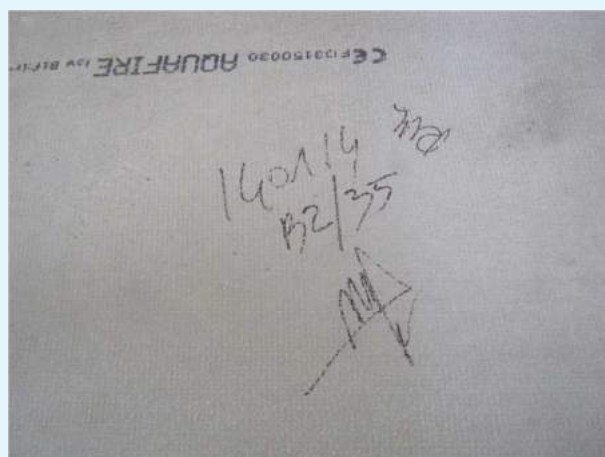


Photo of a test piece and close-up of a sample batch ID

(*) according to that stated by the Customer.

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:

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

- using set II results:

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

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

- **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.



Test results

Set I, measurement after step II (20 °C - 65 % RH)				
Test piece	Length	Thickness	Mass	Moisture content
	[mm]	[mm]	[g]	[%]
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	Thickness	Mass	Moisture content
	[mm]	[mm]	[g]	[%]
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

Set I, measurement after step III (20 °C - 85 % RH)				
Test piece	Length	Thickness	Mass	Moisture content
	[mm]	[mm]	[g]	[%]
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	Thickness	Mass	Moisture content
	[mm]	[mm]	[g]	[%]
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

Determination of change in length and thickness

Set 1		
Test piece	Change in length δl_{65-85} [mm/m]	Change in thickness δt_{65-85} [%]
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 δl_{65-30} [mm/m]	Change in thickness δt_{65-30} [%]
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)



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 = $960 \text{ kg/m}^3 \pm 15 \%$;

(*) according to that stated by the Customer.

Comp. AV
Revis. PB

This test report consists of 5 sheets.
This document is the English translation of the test report No. 315703 dated 09/05/2014 issued in Italian; in case of dispute the only valid version is the Italian one. Date of translation: 13/06/2014.

Sheet
1 of 5

TEST AND CERTIFICATIONS

CAUTION: This document relates only to the sample of material tested and shall not be reproduced except in full without Istituto Giordano's written approval.

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

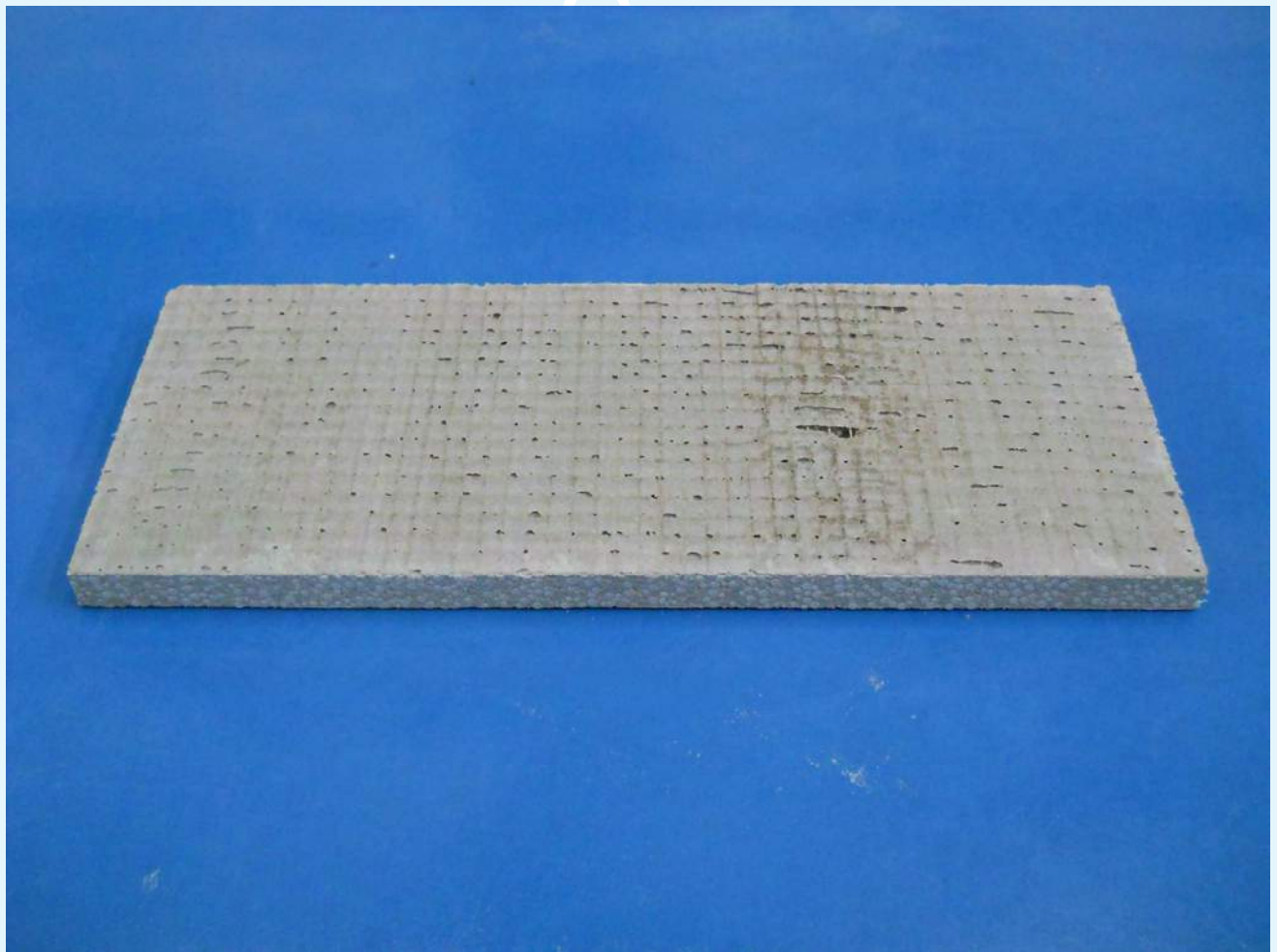


Photo of a test piece

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.

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	$(23 \pm 2) ^\circ\text{C}$
Relative humidity	$(50 \pm 5) \%$

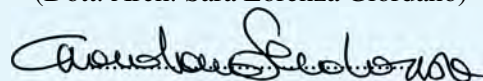
Test results

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 <i>(Test Report)</i>	Pag. di/of 1/4 pag.
N° 0007\DC\TTS\14	Data: 13/03/2014 Date:

IDENTIFICAZIONE E DESCRIZIONE DEL CAMPIONE: <i>SPECIMEN DESCRIPTION:</i>
AQUAFIRE

DATI IDENTIFICATIVI DEL CLIENTE: <i>CLIENT:</i>
BIFIRE S.r.l. Via Lavoratori dell'Autobianchi, 1 20832 DESIO (MB)

NORMA DI RIFERIMENTO: <i>REFERENCE STANDARD:</i>
EN 12667:2001 EN 12664:2001

DISTRIBUZIONE ESTERNA: <i>OUTSIDE DISTRIBUTION:</i>	DISTRIBUZIONE INTERNA: <i>INSIDE DISTRIBUTION:</i>
BIFIRE S.r.l.	Capo Laboratorio – Laboratory Head

ENTE DI ACCREDITAMENTO: <i>ACCREDITATION BODY:</i>

Mod. 37 - Rev. B - Società a Sede Unica soggetta ad attività di direzione e coordinamento di IMQ spa



RAPPORTO DI PROVA (Test Report)

Pag.
di/of 2/4
pag.

N° 0007\DC\TTS\14

Data:
Date: 13/03/2014

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 <i>Specimen</i>	d 10^{-3} m	ρ_0 kg/m ³	t_1 °C	t_2 °C	t_m °C	q_1 W/m ²	q_2 W/m ²	R m ² K W ⁻¹	$\mathcal{F}$ W m ⁻¹ K ⁻¹
Campione 1 <i>Sample 1</i>	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 <i>Sample 2</i>	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 <i>Sample 3</i>	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 <i>Sample 4</i>	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) / <i>Specimen thickness (measured)</i>
$\rho_0 =$	Densità del provino / <i>Specimen density</i>
$t_1 =$	Temperatura media lato freddo / <i>Average temperature cold side</i>
$t_2 =$	Temperatura media lato caldo / <i>Average temperature hot side</i>
$t_m = (t_1 + t_2)/2 =$	Temperatura media / <i>Average temperature</i>
$q_1 =$	Flusso di calore lato freddo / <i>Heat flux cold side</i>
$q_2 =$	Flusso di calore lato caldo / <i>Heat flux hot side</i>
$q_m = (q_1 + q_2)/2 =$	Flusso di calore medio / <i>Average heat flux</i>
$R = (t_2 - t_1)/q_m =$	Resistenza termica / <i>Thermal resistance</i>
$\mathcal{F} = d/R =$	Fattore di trasferimento del campione / <i>Transfer factor of specimen</i>

Nota / Note

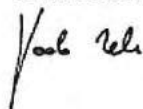
Il fattore di trasferimento viene spesso definito *conduttività termica apparente del provino* nelle specifiche condizioni di prova.
The transfer factor is often referred to elsewhere as apparent thermal conductivity of specimen in the specific test conditions.

DATA
Date

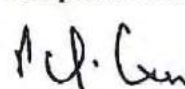
13/03/2014

RESP. DIVISIONE
Division Head

Paolo Mele


RESP. DEL CENTRO
Managing Director

Pasqualino Cau



RAPPORTO DI PROVA N. 340720

TEST REPORT No. 340720

Luogo e data di emissione: Bellaria-Igea Marina - Italia/Italy, 22/03/2017

Place and date of issue:

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

Customer:

Data della richiesta della prova: 23/01/2017

Date testing requested:

Numero e data della commessa: 71959, 23/01/2017

Order number and date:

Data del ricevimento del campione: 23/12/2016

Date sample received:

Data dell'esecuzione della prova: dal 08/02/2017 al 08/03/2017

Date of testing: from 08/02/2017 to 08/03/2017

Oggetto della prova: emissione di composti organici volatili (VOC) con il metodo in camera di prova secondo la norma UNI EN ISO 16000-9:2006

Purpose of testing:

emission of Volatile Organic Compounds (VOC) using testing chamber method according to standard UNI EN ISO 16000-9:2006

Luogo della prova: Istituto Giordano S.p.A. - Blocco 4 - Via San Mauro, 8 - 47814 Bellaria-Igea Marina (RN) - Italia/Italy

Place of testing:

Provenienza del campione: campionato e fornito dal Committente

Origin of sample: sampled and supplied by the Customer

Identificazione del campione in accettazione: n. 2016/2570

Identification of sample received: No. 2016/2570

Denominazione del campione*.

Sample name*.

Il campione sottoposto a prova è denominato "AQUAFIRE".

The test sample is called "AQUAFIRE".

Descrizione del campione*.

Description of the sample*.

Il campione sottoposto a prova è costituito da una lastra in cemento alleggerito fibrorinforzato.

The sample for testing is made up of fiber-reinforced lightweight concrete slab.

(*) secondo le dichiarazioni del Committente.
according to information supplied by the Customer.

Comp. FM Revis. AC	Il presente rapporto di prova è composto da n. 3 fogli ed è emesso in formato bilingue (italiano e inglese); in caso di dubbio, è valida la versione in lingua italiana. <i>This test report is made up of 3 sheets and it is issued in a bilingual format (Italian and English); in case of dispute the only valid version is the Italian one.</i>	Foglio / Sheet 1 / 3
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Riferimenti normativi.

Normative references.

La prova è stata eseguita secondo le prescrizioni della norma UNI EN ISO 16000-9:2006 del 06/07/2006 "Aria in ambienti confinati - Parte 9: Determinazione delle emissioni di composti organici volatili da prodotti da costruzione e da prodotti di finitura - Metodo in camera di prova di emissione".

The test was carried out according to standard UNI EN ISO 16000-9:2006 dated 06/07/2006 "Indoor air - Part 9: Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method".

Modalità della prova.

Test method.

Le dimensioni del campione di prova e il fattore di carico sono stati scelti in funzione del Decreto di riferimento e su richiesta specifica del Committente.

Le condizioni di prova sono descritte nella tabella seguente.

Dimensions of the test specimen and the loading factors have been chosen from the Decree of reference and according to a specific customer request.

The operating conditions of the test are described in the following table.

Volume camera <i>Chamber volume</i>	1 m ³
Peso del campione di prova <i>Weight of test specimen</i>	//
Spessore del campione di prova <i>Thickness of test specimen</i>	6 mm
Superficie del campione <i>Test specimen surface</i>	1 m ²
Temperatura dell'aria <i>Temperature</i>	(23 ± 2) °C
Umidità dell'aria <i>Relative humidity</i>	(50 ± 5) %
Ricambio d'aria <i>Air flow rate</i>	0,5/1 h ⁻¹
Tasso di carico <i>Loading factor</i>	1 m ² /m ³
Portata d'emissione specifica superficiale <i>Area specific air flow rate</i>	0,5/1 m ³ /m ² · h
Velocità dell'aria <i>Air velocity</i>	(0,2 ± 0,1) m/s

I campioni d'aria sono stati raccolti dopo 28 giorni dall'inserimento del campione dentro la camera, in fiale assorbenti Markes (Carbopack C 60/80, Carbopack B 60/80, Carbosieve SIII 60/80) per le analisi dei VOC in GC-MS e in fiale gel di silice + 2,4-dinitrofenilidrazina (DNPH) per le analisi delle aldeidi in HPLC-UV.

Air sampling has been done after 28 days after introduction of the test specimen in the emission test chamber, using Markes sorbent tubes (Carbopack C 60/80, Carbopack B 60/80, Carbosieve SIII 60/80) for VOC analysis by GC-MS and using tubes containing silica gel coated with 2,4-dinitrophenylhydrazine (DNPH) for aldehyde analysis by HPLC-UV.

Risultati della prova.Test results.

Parametri analizzati <i>Testing parameters</i>	Risultati** <i>Results</i>		Classe di emissione*** <i>Emission class</i>			
	3 giorni <i>3 days</i> [µg/m³]	28 giorni <i>28 days</i> [µg/m³]	C [µg/m³]	B [µg/m³]	A [µg/m³]	A+ [µg/m³]
Formaldeide/Formaldehyde	n.d.	8	> 120	< 120	< 60	< 10
Acetaldeide/Acetaldehyde	n.d.	29	> 400	< 400	< 300	< 200
Toluene/Toluene	n.d.	7	> 600	< 600	< 450	< 300
Tetracloroetilene/Tetrachloroethylene	n.d.	< 2	> 500	< 500	< 350	< 250
Xileni isomeri/Xylene isomers	n.d.	8	> 400	< 400	< 300	< 200
1,2,4 Trimetilbenzene/1,2,4 Trimethylbenzene	n.d.	17	> 2000	< 2000	< 1500	< 1000
1,4 Diclorobenzene/Dichlorobenzene	n.d.	< 2	> 120	< 120	< 90	< 60
Etilbenzene/Ethylbenzene	n.d.	4	> 1500	< 1500	< 1000	< 750
2 Butossietanolo/2-Butoxyethanol	n.d.	< 2	> 2000	< 2000	< 1500	< 1000
Stirene/Styrene	n.d.	13	> 500	< 500	< 350	< 250
TVOC*	n.d.	77	> 2000	< 2000	< 1500	< 1000

(*) (C6-C16) quantificati come toluene (norma ISO 16000-6).

(C6-C16) expressed in toluene equivalent (standard ISO 16000-6).

(**) n.d. = non determinato.

n.d. = not determined.

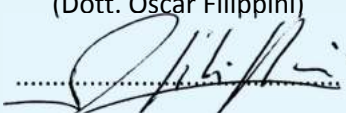
(***) Classificazione secondo il Decreto Francese n. 321/2011 del 23/03/2011 e Arrêté del 19/04/2011, basata sull'emissione dopo 28 giorni.

Classification according to the French Decree No. 321/2011 of March 23, 2011 and Order of April 19, 2011, based on emission after 28 days.

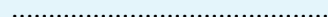
Il Responsabile
Tecnico di Prova
Test Technician
(Per. Ind. Armando Ciccione)



Il Responsabile del Laboratorio
di Chimica
Head of Chemistry Laboratory
(Dott. Oscar Filippini)



L'Amministratore Delegato
Chief Executive Officer





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REA: c/o C.C.I.A.A. (RN) 156766
Registro Imprese di Rimini n. 00 549 540 409

RAPPORTO DI PROVA N. 344125

TEST REPORT No. 344125

Luogo e data di emissione: Bellaria-Igea Marina - Italia, 25/07/2017

Place and date of issue:

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

Customer:

Data della richiesta della prova: 23/05/2017

Date testing requested:

Numero e data della commessa: 73319, 23/05/2017

Order number and date:

Data del ricevimento del campione: 31/05/2017

Date sample received:

Data dell'esecuzione della prova: dal/from 01/06/2017 al/to 05/06/2017

Date of testing:

Oggetto della prova: misurazione in laboratorio dell'isolamento acustico per via aerea secondo le

Purpose of testing:

norme UNI EN ISO 10140-2:2010 e UNI EN ISO 717-1:2013 su pannelli

laboratory measurements of airborne sound insulation on panels according to standards UNI EN ISO 10140-2:2010 and UNI EN ISO 717-1:2013

Luogo della prova: Istituto Giordano S.p.A. - Via Erbosa, 78 - 47043 Gatteo (FC) - Italia

Place of testing:

Provenienza del campione: campionato e fornito dal Committente

Origin of sample:

sampled and supplied by the Customer

Identificazione del campione in accettazione: 2017/1282

Identification of sample received:

Denominazione del campione*.

Sample name.*

Il campione sottoposto a prova è denominato "AQUAFIRE", "SUPERSIL", [REDACTED] e "FLEXBIFIRE".

The test sample is called "AQUAFIRE", "SUPERSIL", [REDACTED] and "FLEXBIFIRE".

(*) secondo le dichiarazioni del Committente.
according to information supplied by the Customer.



LAB N° 0021

Comp. AV
Revis. RB

Il presente rapporto di prova è composto da n. 32 fogli e n. 1 allegato ed è emesso in formato bilingue (italiano e inglese);
in caso di dubbio, è valida la versione in lingua italiana.
*This test report is made up of 32 sheets and 1 annex and it is issued in a bilingual format (Italian and English);
in case of dispute the only valid version is the Italian one.*

Foglio / Sheet
1 / 32

CLAUSOLE: Il presente documento si riferisce solamente al campione o materiale sottoposto a prova e non può essere riprodotto parzialmente, salvo approvazione scritta dell'Istituto Giordano.
CLAUSES: This document relates only to the sample or material tested and shall not be reproduced except in full without Istituto Giordano's written approval.

Descrizione del campione*.*Description of sample*.*

Il campione sottoposto a prova è costituito da n. 8 pannelli aventi le caratteristiche fisiche riportate nella seguente tabella. / The test sample is constituted by No. 8 panels having the physical characteristics stated in the following table.

	AQUAFIRE	AQUAFIRE + AQUAFIRE	SUPERSIL	SUPERSIL + SUPERSIL
Campione Sample	1	2	3	4
Larghezza rilevata Measured width	1200 mm	1200 mm	1200 mm	1200 mm
Altezza rilevata Measured height	1480 mm	1480 mm	1480 mm	1480 mm
Spessore nominale Nominal thickness	12,5 mm	50,0 mm	12,0 mm	24,0 mm
Larghezza rilevata dell'apertura di prova Measured width of test opening	1250 mm	1250 mm	1250 mm	1250 mm
Altezza rilevata dell'apertura di prova Measured height of test opening	1500 mm	1500 mm	1500 mm	1500 mm
Superficie acustica utile Effective acoustic surface	1,88 m ²	1,88 m ²	1,88 m ²	1,88 m ²
Massa unitaria misurata Measured mass per unit area	13,25 kg/m ²	26,50 kg/m ²	12,85 kg/m ²	25,70 kg/m ²

				FLEXBIFIRE
Campione Sample	5	6	7	8
Larghezza rilevata Measured width	1200 mm	1200 mm	1200 mm	1230 mm
Altezza rilevata Measured height	1480 mm	1480 mm	1480 mm	1480 mm
Spessore nominale Nominal thickness				41,2 mm
Larghezza rilevata dell'apertura di prova Measured width of test opening	1250 mm	1250 mm	1250 mm	1250 mm
Altezza rilevata dell'apertura di prova Measured height of test opening	1500 mm	1500 mm	1500 mm	1500 mm
Superficie acustica utile Effective acoustic surface	1,88 m ²	1,88 m ²	1,88 m ²	1,88 m ²
Massa unitaria misurata Measured mass per unit area				13,50 kg/m ²

Il campione è prodotto dal Committente e montato nell'apertura di prova a cura del personale dell'Istituto Giordano. / The sample is manufactured by the Customer and it was mounted in the test opening by Istituto Giordano staff.

(*) secondo le dichiarazioni del Committente, ad eccezione delle caratteristiche espressamente indicate come rilevate.
according to information supplied by the Customer, apart from characteristics specifically stated to be measurements.

Campione <i>Sample</i>	Denominazione del campione <i>Sample name</i>
1	AQUAFIRE

DISEGNO SCHEMATICO DEL CAMPIONE*SCHEMATIC DRAWING OF SAMPLE***LEGENDA***KEY*

Simbolo <i>Symbol</i>	Descrizione <i>Description</i>
1	Lastra in cemento alleggerito fibrorinforzato "AQUAFIRE", spessore nominale 12,5 mm e densità nominale 960 kg/m³. "AQUAFIRE" fibre-reinforced lightweight cement boards, nominal thickness 12,5 mm and nominal density 960 kg/m³

Apparecchiatura di prova.**Test apparatus.**

Per l'esecuzione della prova è stata utilizzata la seguente apparecchiatura:

- amplificatore di potenza 2000 W modello "EP2000" della ditta Behringer;
- equalizzatore digitale a terzi d'ottava modello "DEQ2496" della ditta Behringer;
- diffusore acustico dodecaedrico mobile con percorso rettilineo, lunghezza 1,6 m ed inclinazione 15°, posizionato nella camera emittente;
- diffusore acustico dodecaedrico fisso posizionato nella camera ricevente;
- n. 2 aste microfoniche rotanti con percorso circolare, raggio 1 m ed inclinazione 30°;
- n. 2 microfoni $\phi \frac{1}{2}$ " modello "4192" della ditta Brüel & Kjær;
- n. 2 preamplificatori microfoniche "2669" della ditta Brüel & Kjær;
- analizzatore a n. 4 canali in tempo reale modello "Soundbook" della ditta Sinus;
- calibratore per la calibrazione dei microfoni modello "CAL200" della ditta Larson Davis;
- n. 2 termoigrometri modello "HD206-1" della ditta Delta Ohm;
- barometro modello "UZ001" della ditta Brüel & Kjær;
- bilancia a piattaforma elettronica modello "VB 150 K 50LM" della ditta Kern;
- fettuccia metrica modello "Tri-Matic 5m/19mm" della ditta Sola;
- misuratore di distanza laser modello "DLE 50 Professional" della ditta Bosch;
- accessori di completamento.

Testing was carried out using the following equipment:

- Behringer "EP2000" 2000 W power amplifier;
- Behringer "DEQ2496" digital $\frac{1}{3}$ -octave equaliser;
- portable dodecahedron speaker with line-of-sight path, length 1,6 m and 15° tilt, positioned in the source room;
- fixed dodecahedron speaker positioned in the receiving room;
- No. 2 rotating microphone booms with sweep radius 1 m and 30° tilt;
- No. 2 Brüel & Kjær "4192" $\frac{1}{2}$ " random-incidence microphones;
- No. 2 Brüel & Kjær "2669" microphone preamplifiers;
- Sinus "Soundbook" 4-channel real-time analyser;
- Larson Davis "CAL200" acoustic calibrator for microphone calibration;
- No. 2 Delta Ohm "HD206-1" thermo-hygrometers;
- Brüel & Kjær "UZ001" barometer;
- Kern "VB 150 K 50LM" electronic platform scale;
- Sola "Tri-Matic 5 m/19 mm" metric tape measure;
- Bosch "DLE 50 Professional" laser range finder;
- complementary accessories.

Modalità della prova.Test method.

La prova è stata eseguita utilizzando la procedura interna di dettaglio PP017 nella revisione vigente alla data della prova.

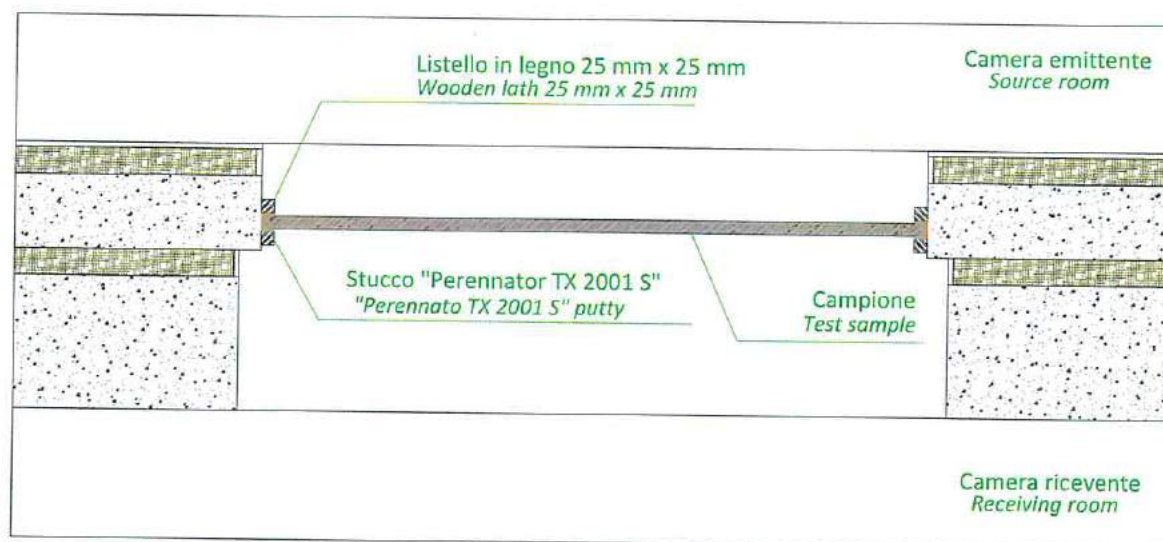
L'ambiente di prova è costituito da due camere, una delle quali, definita "camera emittente", contiene la sorgente di rumore, mentre l'altra, definita "camera ricevente", è caratterizzata acusticamente mediante l'area di assorbimento acustico equivalente.

Il campione, dopo essere stato condizionato per almeno 24 h all'interno degli ambienti di misura, è stato installato nell'apertura di prova posta tra le due camere secondo le modalità riportate nel disegno seguente.

The test was carried out using detailed internal procedure PP017 in its current revision at testing date.

The test environment consists of two chambers, one of which, known as "source room", contains the noise source, whilst the other, known as "receiving room", is characterised acoustically by the equivalent sound absorption area.

The sample, after being conditioned for at least 24 h inside measurement environment, was installed in the test opening between the two rooms, as shown in the following drawing.



**Particolare del posizionamento del campione
nell'apertura fra le due camere dell'ambiente di prova.**

Close-up of sample positioning in the opening between the two rooms of the test environment.

Nell'intervallo di bande di $\frac{1}{3}$ d'ottava compreso tra 100 Hz e 5000 Hz, il potere fonoisolante "R", pari a n. 10 volte il logaritmo decimale del rapporto fra la potenza sonora incidente e la potenza sonora trasmessa attraverso il campione, è stato calcolato utilizzando la formula seguente:

$$R = L_1 - L_2 + 10 \log \frac{S}{A}$$

dove: R = potere fonoisolante, espresso in dB;

L_1 = livello medio di pressione sonora nella camera emittente, espresso in dB, generato con rumore rosa;

L_2 = livello medio di pressione sonora nella camera ricevente, espresso in dB, corretto del rumore di fondo e calcolato utilizzando la formula seguente:

$$L_2 = 10 \log [10^{\frac{L_{2b}}{10}} - 10^{\frac{L_b}{10}}]$$

dove: L_{2b} = livello medio di pressione sonora combinato del segnale e del rumore di fondo, espresso in dB;

L_b = livello medio del rumore di fondo, espresso in dB;

se la differenza dei livelli [$L_{2b} - L_b$] è inferiore a 6 dB, viene applicata una correzione massima pari a 1,3 dB ed il corrispondente valore del potere fonoisolante "R" è da considerarsi come un valore limite della misurazione;

S = superficie utile di misura del campione in prova, espressa in m^2 ;

A = area di assorbimento acustico equivalente della camera ricevente, espressa in m^2 , calcolata a sua volta utilizzando la formula seguente:

$$A = \frac{0,16 \cdot V}{T}$$

dove: V = volume della camera ricevente, espresso in m^3 ;

T = tempo di riverberazione, espresso in s.

L'indice di valutazione " R_w " del potere fonoisolante "R" è pari al valore in dB della curva di riferimento a 500 Hz secondo il procedimento della norma UNI EN ISO 717-1. Sono stati inoltre calcolati n. 2 termini correttivi in dB che tengono conto delle caratteristiche di particolari spettri sonori in sorgente e precisamente:

- termine correttivo " C " da sommare all'indice di valutazione " R_w " con spettro in sorgente relativo a rumore rosa (pink) ponderato A;
- termine correttivo " C_{tr} " da sommare all'indice di valutazione " R_w " con spettro in sorgente relativo a rumore da traffico (traffic) ponderato A.

La prova è stata eseguita subito dopo l'allestimento del campione.

In the 1/3-octave frequency range 100 Hz to 5000 Hz, the sound reduction index "R", equal to 10 times the common logarithm of the ratio of the sound power which is incident on the test sample to the sound power transmitted through the sample, was calculated using the following equation:

$$R = L_1 - L_2 + 10 \log \frac{S}{A}$$

where: R = sound reduction index in dB;

L_1 = average sound pressure level in the source room, in dB, generated by pink noise;

L_2 = average sound pressure level in the receiving room, in dB, adjusted for background noise and calculated using the following equation:

$$L_2 = 10 \log [10^{\frac{L_{2b}}{10}} - 10^{\frac{L_b}{10}}]$$

where: L_{2b} = combined average sound pressure level of signal and background noise in dB;

L_b = average background noise level in dB;

if the difference between the levels [$L_{2b} - L_b$] is less than 6 dB, a maximum correction of 1,3 dB is applied and the corresponding value of the sound reduction index "R" shall be considered a measurement limit value;

S = effective measuring surface of test sample, expressed in m^2 ;

A = equivalent sound absorption area in the receiving room, expressed in m^2 , in turn calculated using the following equation:

$$A = \frac{0,16 \cdot V}{T}$$

where: V = receiving room volume, expressed in m^3 ;

T = reverberation time, in seconds.

The single-number quantity " R_w " of the sound reduction index " R " is equal to the value in dB of the reference curve at 500 Hz in accordance with the method specified by standard UNI EN ISO 717-1. Furthermore, 2 adaptation terms have been calculated in dB that take account of the characteristics of certain source sound spectra, more specifically:

- adaptation term " C " to be added to single-number rating " R_w " with source spectrum for A-weighted pink noise;
- adaptation term " C_{tr} " to be added to single-number rating " R_w " with source spectrum for A-weighted traffic noise.

The test was carried out immediately after completion of sample preparation.

Incertezza di misura.

Uncertainty of measurement.

L'incertezza di misura è stata determinata in accordo con la guida JCGM 100:2008 del settembre 2008 "Evaluation of measurement data - Guide to the expression of uncertainty in measurement", individuando per ciascuna frequenza il numero di gradi di libertà effettivi " ν_{eff} " e l'incertezza estesa " U " del valore del potere fonoisolante " R ", stimata con fattore di copertura " k " relativo ad un livello di fiducia pari al 95 %.

L'incertezza di misura dell'indice di valutazione " $U(R_w)$ " è stimata con fattore di copertura $k = 2$ relativo ad un livello di fiducia pari al 95 % utilizzando la procedura di calcolo riportata nell'allegato B della norma UNI EN ISO 12999-1:2014 del 26/06/2014 "Acustica - Determinazione e applicazione dell'incertezza di misurazione nell'acustica in edilizia - Parte 1: Isolamento acustico" in cui si presuppone una piena correlazione positiva tra i valori in bande di $\frac{1}{3}$ d'ottava di isolamento acustico.

Uncertainty of measurement was determined in accordance with guide JCGM 100:2008 dated September 2008 "Evaluation of measurement data - Guide to the expression of uncertainty in measurement", by calculating for each frequency the number of effective degrees of freedom " ν_{eff} " and expanded uncertainty " U " of the sound reduction index " R ", using a coverage factor " k " representing a confidence level of 95 %.

Uncertainty of measurement of the single-number quantity " $U(R_w)$ " is calculated with a coverage factor $k = 2$ representing a confidence level of 95 % using the calculation procedure stated in the Annex B standard UNI EN ISO 12999-1:2014 dated 26/06/2014 "Acoustics - Determination and application of measurement uncertainties in building acoustics - Part 1: Sound insulation" where is assumed a full positive correlation between the $\frac{1}{3}$ -octave band values of sound insulation.

Condizioni ambientali al momento della prova.

Environmental conditions during test.

	Camera emittente Source room	Camera ricevente Receiving room	Camera emittente Source room	Camera ricevente Receiving room
Data di prova Date of testing	01/06/2017		05/06/2017	
Pressione atmosferica Atmospheric pressure	(101800 ± 50) Pa	(101800 ± 50) Pa	(101200 ± 50) Pa	(101200 ± 50) Pa
Temperatura media Average temperature	(25 ± 1) °C	(25 ± 1) °C	(25 ± 1) °C	(26 ± 1) °C
Umidità relativa media Average relative humidity	(50 ± 5) %	(49 ± 5) %	(57 ± 5) %	(58 ± 5) %



LAB N° 0021

Risultati della prova.Test results.

Campione <i>Sample</i>	Denominazione del campione <i>Sample name</i>
1	AQUAFIRE

Data di prova <i>Date of testing</i>	01/06/2017
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Frequenza <i>Frequency</i> [Hz]	R [dB]	R _{rif} [dB]	V _{eff}	k	U [dB]
100	19,1	13,0	6	2,45	2,6
125	22,8	16,0	7	2,36	2,0
160	23,7	19,0	7	2,36	1,1
200	23,6	22,0	9	2,26	0,9
250	24,8	25,0	11	2,00	0,8
315	25,8	28,0	13	2,00	0,7
400	27,5	31,0	15	2,00	0,5
500	29,9	32,0	18	2,00	0,5
630	31,7	33,0	24	2,00	0,5
800	33,8	34,0	17	2,00	0,5
1000	35,5	35,0	22	2,00	0,4
1250	36,7	36,0	17	2,00	0,4
1600	37,1	36,0	16	2,00	0,4
2000	33,1	36,0	30	2,00	0,4
2500	29,2	36,0	19	2,00	0,4
3150	32,7	36,0	18	2,00	0,4
4000	36,3	//	16	2,00	0,4
5000	39,8	//	18	2,00	0,4

Note / Notes: //

Superficie utile di misura del campione:*Sample effective measuring surface:*1,88 m²**Volume della camera emittente:***Source room volume:*98,6 m³**Volume della camera ricevente:***Receiving room volume:*86,4 m³**Esito della prova*:***Test result*:*

Indice di valutazione a 500 Hz
 nella banda di frequenze comprese fra 100 Hz e 3150 Hz:

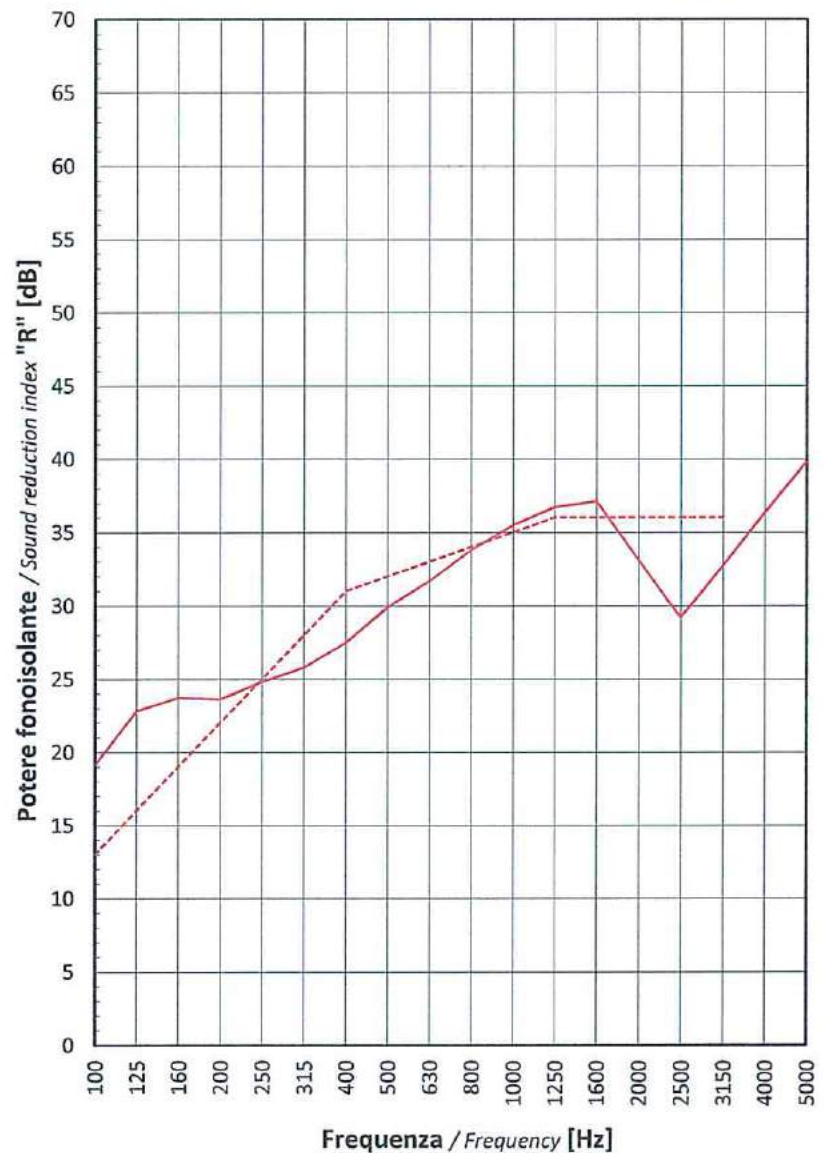
Single-number rating at 500 Hz in the frequency range 100 Hz to 3150 Hz:

 $R_w = 32 \text{ dB}^{}$** **Termini di correzione:***Adaptation terms:* **$C = -1 \text{ dB}$** **$C_{tr} = -2 \text{ dB}$**

(*) valutazione basata su risultati di misurazioni di laboratorio ottenuti mediante un metodo tecnico.

evaluation based on laboratory measurement results obtained by an engineering method.

(**) indice di valutazione del potere fonoisolante elaborato procedendo a passi di 0,1 dB e incertezza di misura dell'indice di valutazione $U(R_w)$:
single-number quantity of sound reduction index measured in steps of 0,1 dB and uncertainty of measurement of the single number quantity $U(R_w)$:

 $R_w = (32,9 \pm 0,5) \text{ dB}$ **$R_w + C = (31,4 \pm 0,6) \text{ dB}$** **$R_w + C_{tr} = (29,9 \pm 0,9) \text{ dB}$** 

— Rilievi sperimentali / Test plots

- - - Curva di riferimento / Reference curve

TEST REPORT No. 351075

Place and date of issue: Bellaria-Igea Marina - Italy, 27/04/2018

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

Date test requested: 25/01/2018

Order number and date: 75527, 25/01/2018

Date sample received: 26/01/2018

Test date: 07/02/2018

Purpose of test: testing an exterior wall made from fibre-reinforced lightweight cement board to determine air permeability, watertightness under static pressure and resistance to wind load according to standards UNI EN 12153:2002, UNI EN 12155:2002 and UNI EN 12179:2002, respectively, and classification in accordance with UNI EN 12152:2003, UNI EN 12154:2001 and UNI EN 13116:2002 and UNI EN 13830:2015

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

Sample origin: sampled and supplied by the Customer

Identification of sample received: No. 2018/0174

Sample name*

The test sample is called "PARETE PERIMETRALE AQUAFIRE" ("AQUAFIRE PERIMETER WALL").

(*) according to that stated by the Customer.

Comp. AV
Revis. PB

This test report consists of 18 sheets and 1 annex.
This document is the English translation of the test report No. 351075 dated 27/04/2018 issued in Italian;
in case of dispute the only valid version is the Italian one. Date of translation: 29/06/2018.

Sheet
1 of 18

Description of sample*

The test sample is an infilling perimeter wall with external cladding made from Aquafire airtight, watertight and wind-resistant fibre-reinforced lightweight cement board, comprising:

- exterior cladding formed by:
 - skim coating comprising two coats of Aquafire powdered one-component ready-mixed lightweight-cement-based skim plaster, thickness 3 mm, embedded with Aquafire alkali-resistant fibreglass reinforcement mesh;
 - Aquafire fibre-reinforced lightweight cement board, nominal size 2000 mm × 1200 mm, nominal thickness 12,5 mm, nominal density 960 kg/m³, Euroclass A1 fire rating, CE marking, designed for both indoor and outdoor use, water-, frost- wind-, heat-resistant, arranged with staggered joints in accordance with the Bifire technical installation manual, secured by Aquafire Star steel screws with a centre-to-centre distance of 200 mm, resistant in a salt spray solution for up to 1000 h, size 4 mm × 41 mm;
- external metal framework:
 - rails made from steel U-channel, size 40 mm × 100 mm × 40 mm, length 3000 mm and thickness 1 mm, secured to the test frame by steel self-tapping screws with a centre-to-centre distance of 500 mm;
 - studs made from made from steel C-channel, size 48 mm × 100 mm × 49 mm, length 3000 mm and thickness 1 mm, installed inside the rails at a centre-to-centre distance of 600 mm; the abutments are secured to the test frame by steel self-tapping screws with a centre-to-centre distance of 500 mm; Advinrock 40 stone wool, thickness 70 mm and density 40 kg/m³;
- intermediate cladding:
 - Aquafire fibre-reinforced lightweight cement board, nominal size 2000 mm × 1200 mm, nominal thickness 12,5 mm, nominal density 960 kg/m³, Euroclass A1 fire rating, CE marking, designed for both indoor and outdoor use, water-, frost- wind-, heat-resistant, arranged with staggered joints in accordance with the Bifire technical installation manual, secured by Aquafire Star steel screws with a centre-to-centre distance of 200 mm, resistant in a salt spray solution for up to 1000 h, size 4 mm × 41 mm;
 - 15 mm air space;
- internal metal framework:
 - rails made from steel U-channel, size 40 mm × 75 mm × 40 mm, length 3000 mm and thickness 0,6 mm, secured to the test frame by steel self-tapping screws with a centre-to-centre distance of 500 mm;

(*) according to that stated by the Customer; the description of the sample also includes Customer-supplied drawings as shown in Annex A herein.

- studs made from made from steel C-channel, size 48 mm × 75 mm × 49 mm, length 3000 mm and thickness 0,6 mm, installed inside the rails at a centre-to-centre distance of 600 mm; the abutments are secured to the test frame by steel self-tapping screws with a centre-to-centre distance of 500 mm;
- Advinrock 40 stone wool, thickness 70 mm and density 40 kg/m³;
- internal lining:
 - first layer of standard gypsum plasterboard type A, BA 13 edge with CE marking in accordance with standard UNI EN 520, reaction to fire class A2-s1, d0, size 3000 mm × 1200 mm, thickness 12,5 mm, weight 9,3 kg/m³, comprising a plaster core encased in two paper liners, arranged with staggered joints and secured to framework by 3,5 mm × 25 mm phosphate-coated steel self-tapping screws with a centre-to-centre distance of 600 mm;
 - second (exposed) layer of standard gypsum plasterboard type A, BA 13 edge with CE marking in accordance with standard UNI EN 520, reaction to fire class A2-s1, d0, size 3000 mm × 1200 mm, thickness 12,5 mm, weight 9,3 kg/m³, comprising a plaster core encased in two paper liners, arranged with staggered joints and secured to framework by 3,5 mm × 35 mm phosphate-coated steel self-tapping screws with a centre-to-centre distance of 250 mm;
 - gypsum putty and reinforcing tape for joints and heads of exposed screws.

Finally, the sample has a surrounding steel frame used to hold the test installation securely in place.

Further details of the sample's characteristics can be seen in the Customer-supplied schematic drawing in Annex "A" herein.

Sample measurements

Overall dimensions	width	2000 mm
	height	3900 mm
Overall area		7,80 m ²



Sample photo

Normative references

Save for the different product type, at the Customer's request, the test was carried out in accordance with the requirements of the following standards:

- UNI EN 13830:2015 dated 27/08/2015 "Curtain walling - Product standard";
- UNI EN 12153:2002 dated 01/02/2002 "Curtain walling - Air permeability - Test method" with test parameters and classification of results according to standard UNI EN 12152:2003 dated 01/03/2003 "Curtain walling - Air permeability - Performance requirements and classification";

- UNI EN 12155:2002 dated 01/02/2002 “Curtain walling - Watertightness - Laboratory test under static pressure” with test parameters and classification of results according to standard UNI EN 12154:2001 dated 30/09/2001 “Curtain walling - Watertightness - Performance requirements and classification”;
- UNI EN 12179:2002 dated 01/02/2002 “Curtain walling - Resistance to wind load - Test method” with test parameters and classification of results according to standard UNI EN 13116:2002 dated 01/08/2002 “Curtain walling - Resistance to wind load - Performance requirements”.

Test apparatus

The test was carried out using a computerised semiautomatic control and measurement system capable of performing all tests with the parameters requested by the normative references and fitted with the following equipment:

- for the measurement of air leakage rate: pressure differential devices (orifice plates, nozzles and Venturi tubes) compliant with standards ASME MFC-14M:2003 “Measurement of fluid flow using small bore precision orifice meters”, UNI EN ISO 5167-1:2004 dated 01/10/2004 “Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 1: General principles and requirements” and UNI EN ISO 5167-2:2004 dated 01/10/2004 “Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 2: Orifice plates”;
- for measurement of pressure inside the test chamber: differential pressure transducers;
- for the measurement of fluid flow: flow meters with flow rate suitable for size of sample;
- for deflection measurement: 6 electronic displacement transducers;
- digital tape measure.

Pre-test conditioning of sample

The sample was conditioned for four hours immediately prior to testing under the environmental conditions specified in the following table.

Temperature	$(16 \pm 3) ^\circ\text{C}$
Relative humidity	$(44 \pm 10) \%$

Environmental conditions during test

Atmospheric pressure	$(1002 \pm 10) \text{ hPa}$
Ambient temperature	$(16 \pm 1) ^\circ\text{C}$
Relative humidity	$(44 \pm 5) \%$

Test method

The test was performed using detailed internal procedure PP050 in the revision applicable at time of testing. The sample was fitted to the test apparatus and subjected in sequence to:

- measurement of air permeability under positive pressure;
- measurement of air permeability under negative pressure;
- measurement of watertightness;
- resistance to wind load with:
 - measurement of deflection under wind load with design pressure;
 - air permeability test;
 - watertightness test;
 - increased load test (sample safety).

Test results

Air permeability through fixed parts under positive pressure

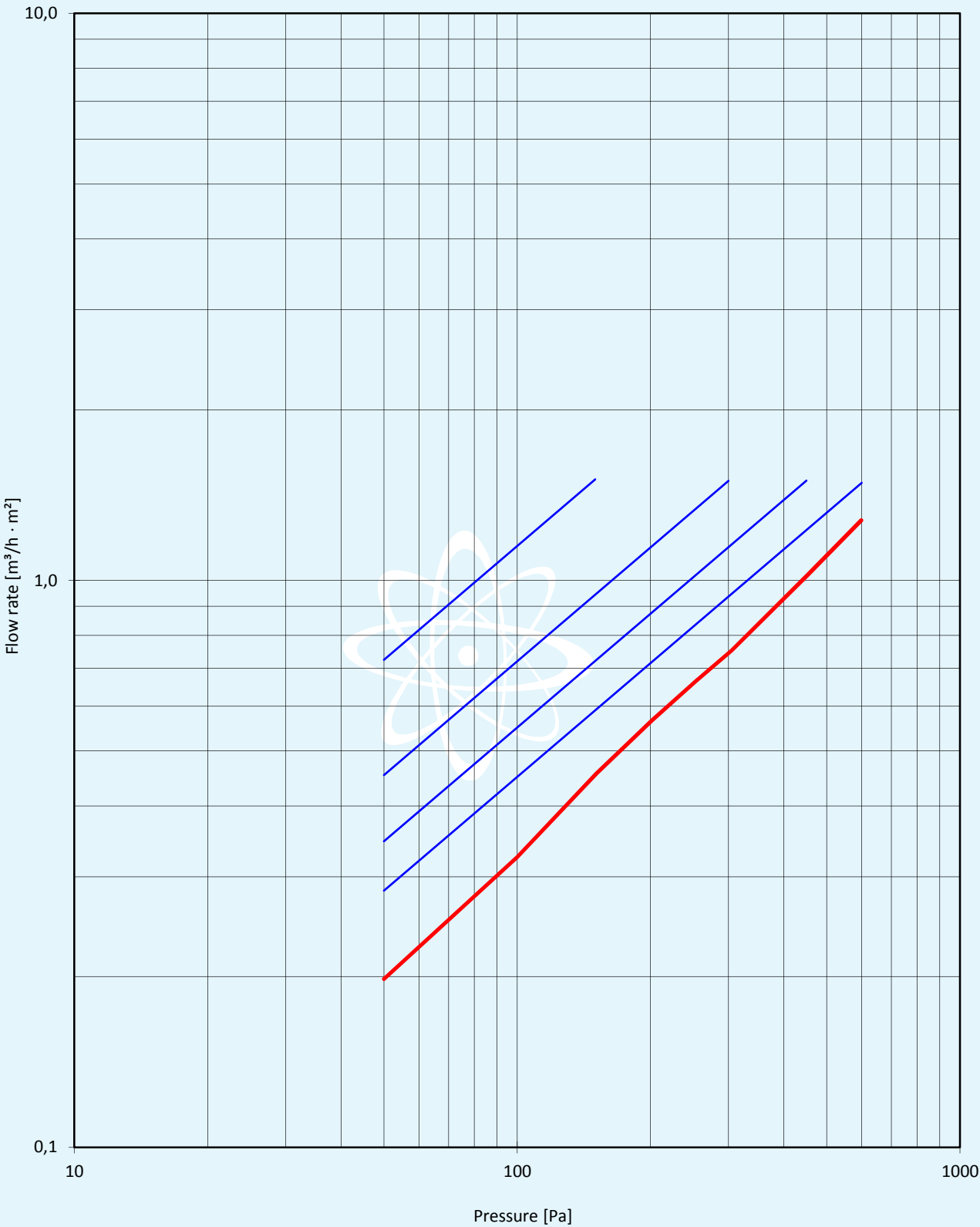
Positive pressure		Air flow rate*		
nominal	test	total	related to the overall area and relative uncertainty**	related to fixed joint length and relative uncertainty**
[Pa]	[Pa]	[m ³ /h]	[m ³ /h · m ²]	[m ³ /h · m]
50	50	1,546	0,198 ± 0,010	0,131 ± 0,009
100	100	2,537	0,325 ± 0,010	0,215 ± 0,012
150	151	3,554	0,456 ± 0,010	0,301 ± 0,015
200	202	4,423	0,567 ± 0,011	0,375 ± 0,019
250	253	5,183	0,664 ± 0,013	0,439 ± 0,022
300	305	5,864	0,752 ± 0,015	0,497 ± 0,025
450	452	7,966	1,021 ± 0,019	0,675 ± 0,034
600	598	9,956	1,276 ± 0,024	0,844 ± 0,042

(*) figures refer to pressure of 101,3 kPa and temperature of 293 K.

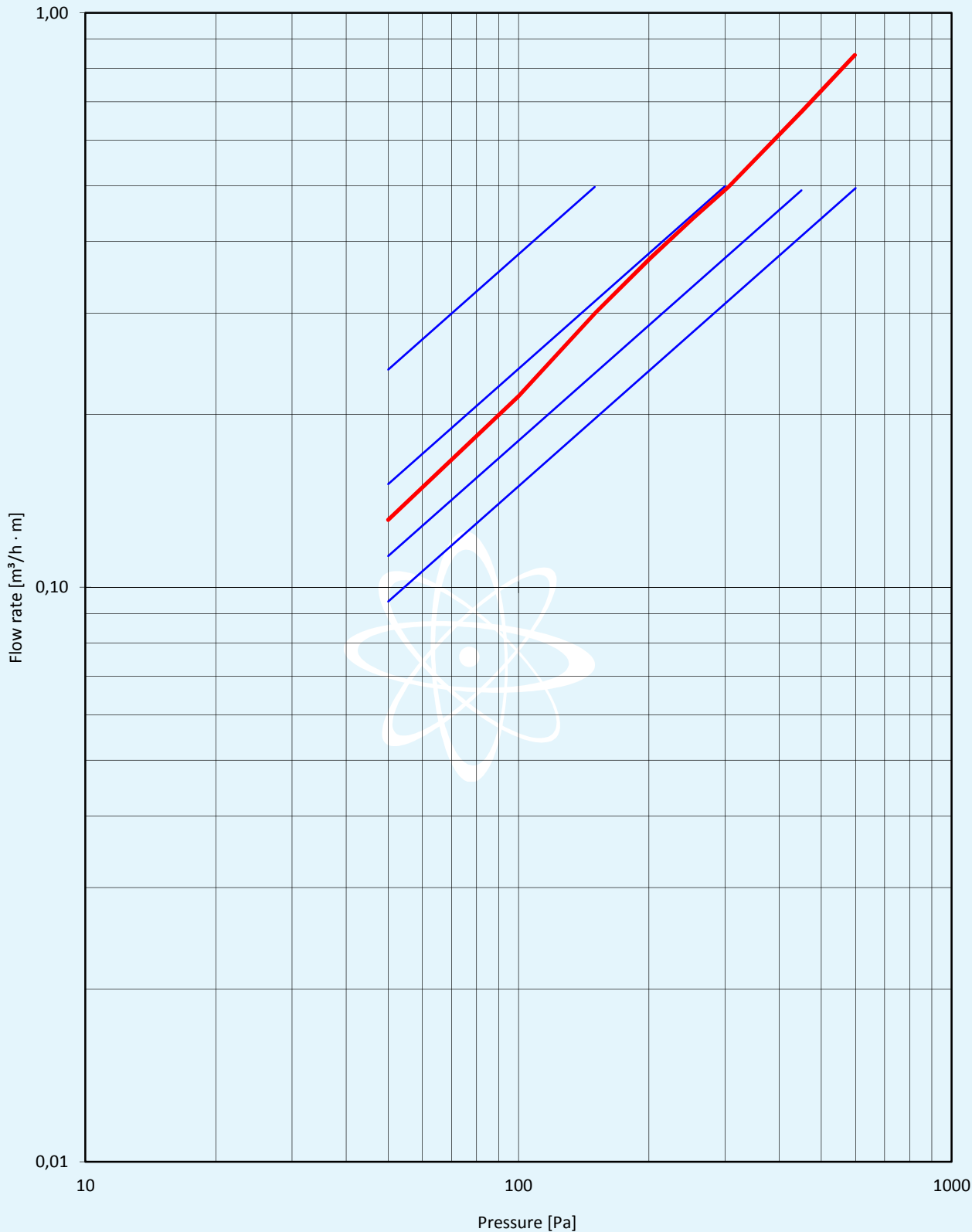
(**) uncertainty considers contributions caused by measurement of the following quantities: air flow rate, test chamber pressure and size of sample; expanded uncertainty has been calculated using a coverage factor "k" of 2, corresponding to a confidence level of 95,45 %.

Observations: //

GRAPH OF AIR PERMEABILITY THROUGH FIXED PARTS
RELATED TO THE OVERALL AREA
(positive pressure)



GRAPH OF AIR PERMEABILITY THROUGH FIXED PARTS
RELATED TO FIXED JOINT LENGTH
(positive pressure)



Air permeability through fixed parts under negative pressure

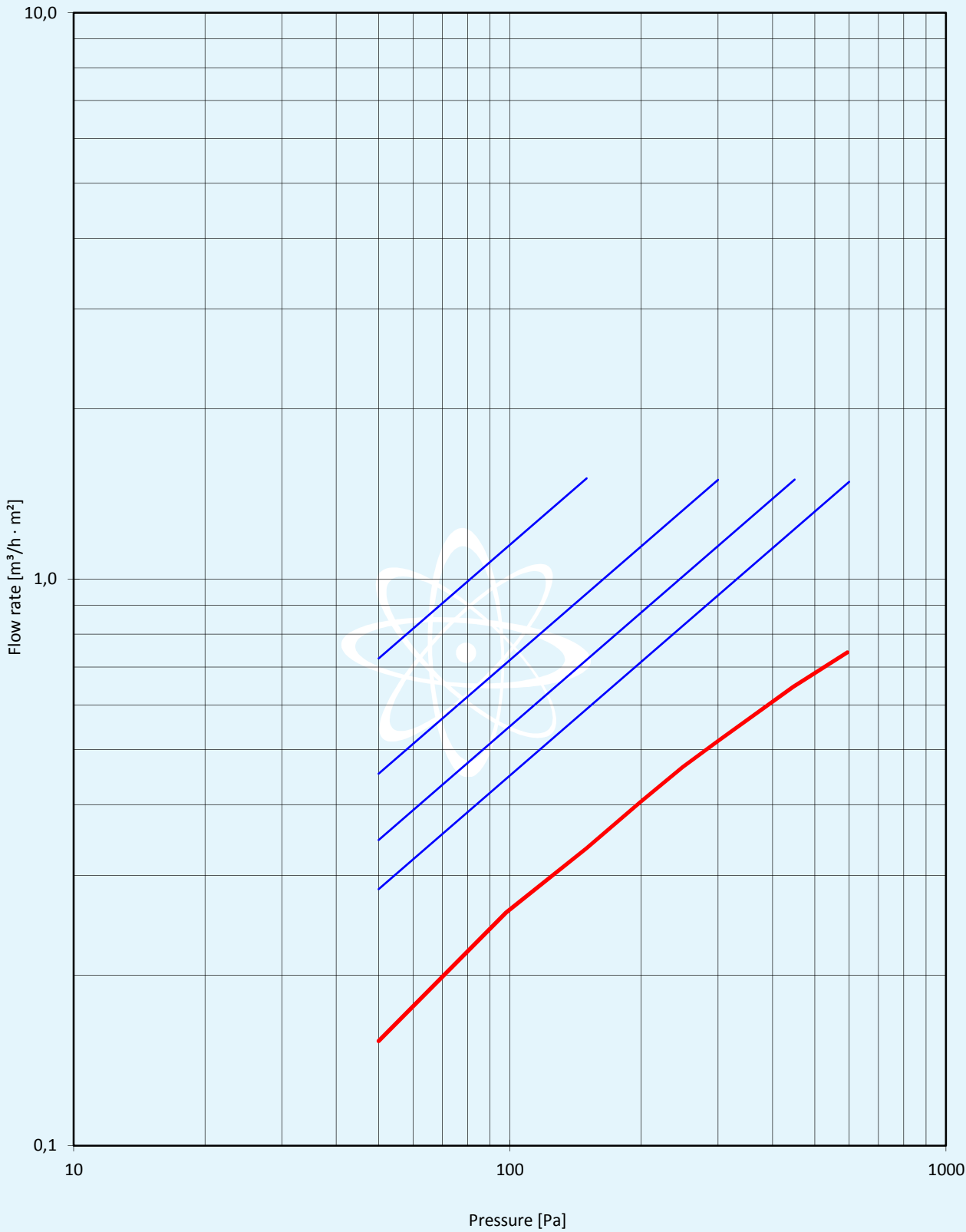
Negative pressure		Air flow rate*		
nominal	test	total	related to the overall area and relative uncertainty**	related to fixed joint length and relative uncertainty**
[Pa]	[Pa]	[m ³ /h]	[m ³ /h · m ²]	[m ³ /h · m]
50	50	1,191	0,153 ± 0,009	0,101 ± 0,008
100	98	2,009	0,258 ± 0,009	0,170 ± 0,010
150	150	2,610	0,335 ± 0,009	0,221 ± 0,012
200	199	3,154	0,404 ± 0,009	0,267 ± 0,014
250	249	3,632	0,466 ± 0,009	0,308 ± 0,015
300	299	4,031	0,517 ± 0,010	0,342 ± 0,017
450	446	5,034	0,645 ± 0,012	0,427 ± 0,021
600	594	5,797	0,743 ± 0,014	0,491 ± 0,024

(*) figures refer to pressure of 101,3 kPa and temperature of 293 K.

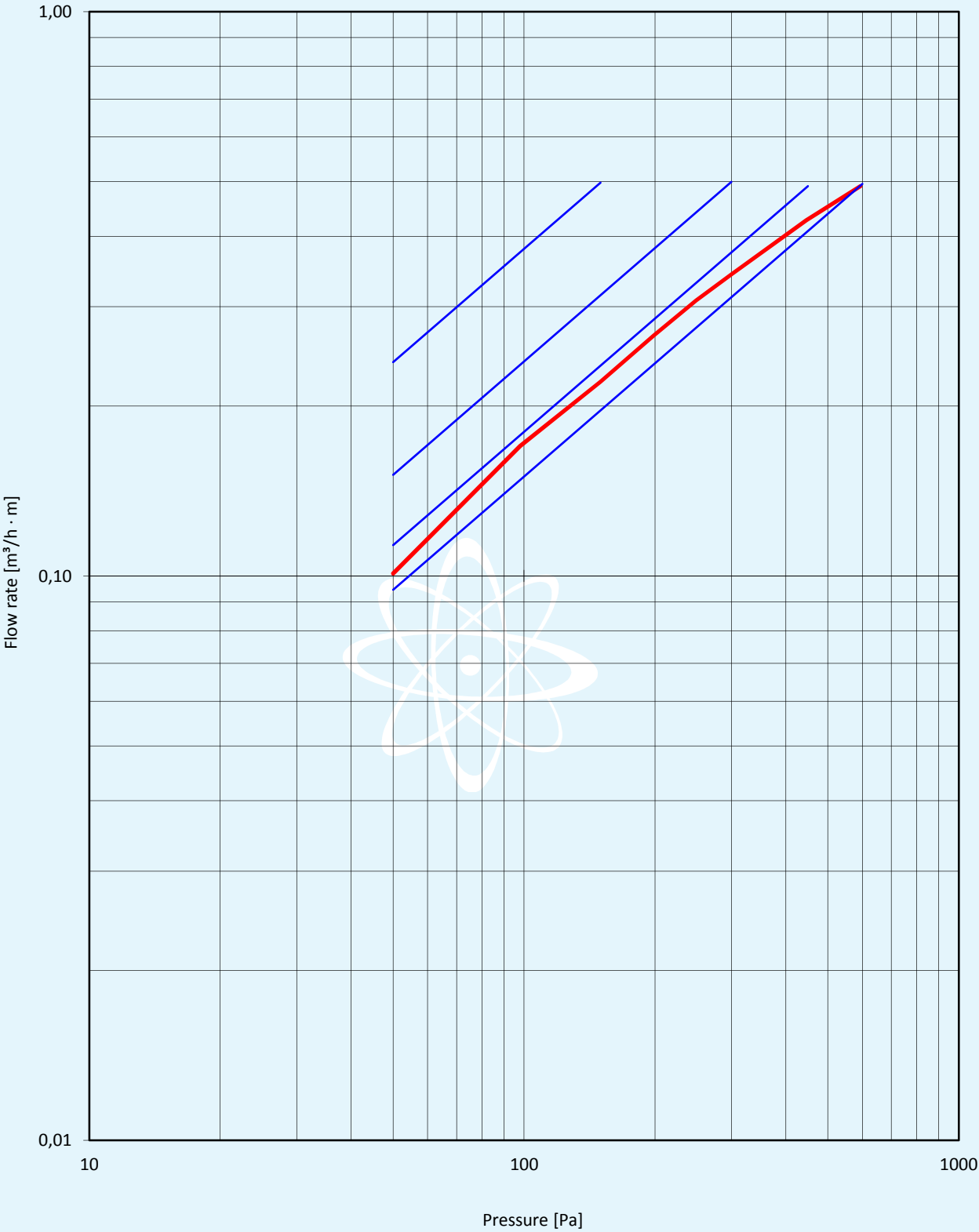
(**) uncertainty considers contributions caused by measurement of the following quantities: air flow rate, test chamber pressure and size of sample; expanded uncertainty has been calculated using a coverage factor "k" of 2, corresponding to a confidence level of 95,45 %.

Observations: //

GRAPH OF AIR PERMEABILITY THROUGH FIXED PARTS
RELATED TO THE OVERALL AREA
(negative pressure)



GRAPH OF AIR PERMEABILITY THROUGH FIXED PARTS
RELATED TO FIXED JOINT LENGTH
(negative pressure)



Measurement of watertightness

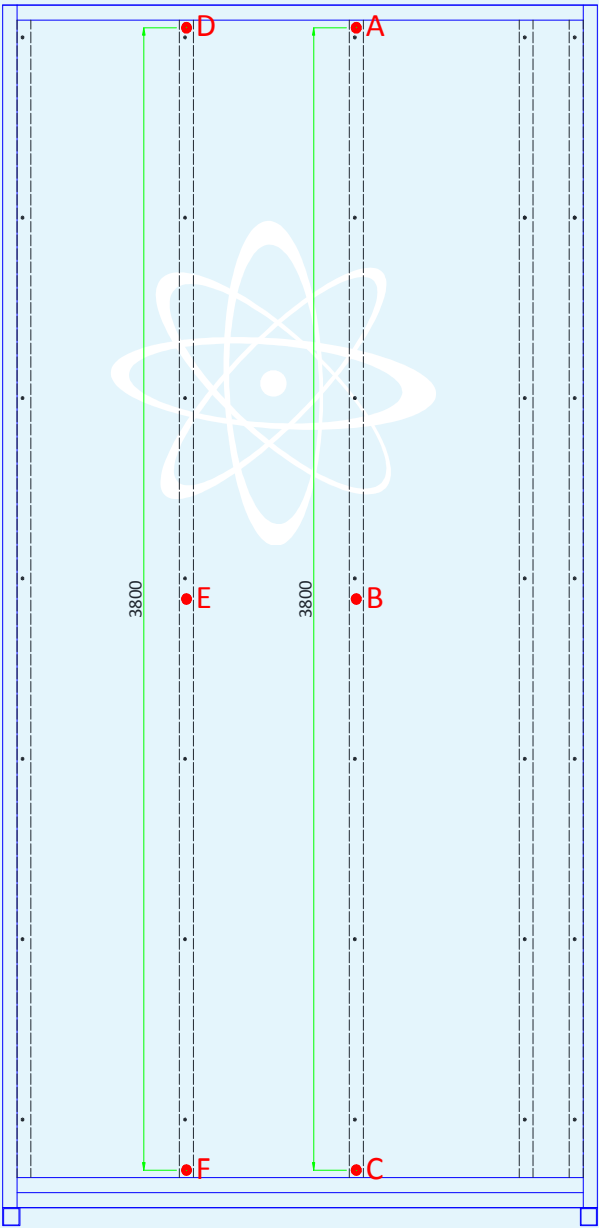
Spraying method utilised	as per Figure 3 of standard EN 12155
Water flow rate per unit area	2 l/(min·m ²)
Water flow rate	936 l/h

Pressure		Spraying time	Observations
nominal	test		
[Pa]	[Pa]	[min]	
0	0	15	no leakage
50	50	5	no leakage
100	100	5	no leakage
150	150	5	no leakage
200	200	5	no leakage
300	300	5	no leakage
450	450	5	no leakage
600	600	5	no leakage
750	750	5	no leakage
900	900	5	no leakage
1050	1050	5	no leakage
1200	1200	5	no leakage
1350	1350	5	no leakage
1500	1500	5	no leakage
1650	1650	5	no leakage
1800	1800	5	no leakage
1950	1950	5	no leakage

Wind load resistance

Design load	1250 Pa	-1250 Pa
Increased load (safety) test pressure (1,5 times design wind load)	1875 Pa	-1875 Pa

Clear span of section A-C	3800 mm
Clear span of section D-F	3800 mm



Sample elevation showing measuring points

Measurement of deflection under design wind load

Pressure		Frontal displacement at measuring points						Frontal deflection		Relative frontal deflection noted and relative uncertainty**		Permissible relative frontal deflection
nominal	test	A	B	C	D	E	F	AC	D<E>F	AC	D<E>F	
[Pa]	[Pa]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[1/xxx]	[1/xxx]	[mm]
0	0	0,00	0,00	0,00	0,00	0,00	0,00	//	//	//	//	//
313	314	0,07	2,45	0,17	0,09	2,32	0,27	2,33	2,14	1/1631	1/1778	
625	630	0,12	5,64	0,21	0,12	5,46	0,21	5,48	5,29	1/694	1/718	
938	930	0,13	8,35	0,26	0,05	8,19	0,19	8,15	8,07	1/466	1/471	
1250	1252	0,55	17,62	0,90	0,25	17,47	1,09	16,90	16,80	1/(225 ± 42)	1/(226 ± 43)	17,67
0*	0	0,00	-0,01	0,00	0,00	-0,01	0,00	//	//	//	//	//
0	0	0,00	0,00	0,00	0,00	-0,01	0,00	//	//	//	//	
313	-317	-0,06	-2,48	-0,18	-0,03	-2,47	0,00	-2,36	-2,44	1/1612	1/1556	
625	-609	-0,11	-4,36	-0,31	-0,07	-4,31	0,00	-4,16	-4,26	1/915	1/892	
938	-906	-0,15	-6,40	-0,41	-0,12	-6,43	0,00	-6,11	-3,91	1/621	1/971	
1250	-1259	-0,19	-7,38	-0,46	-0,14	-7,29	0,00	-7,05	-7,20	1/(540 ± 100)	1/(527 ± 99)	17,67
0*	0	0,04	1,68	0,08	0,07	1,70	0,41	//	//	//	//	//

(*) pressure set to zero in order to measure permanent deformation after 1 h.

(**) uncertainty considers contributions caused by measurement of the following quantities: test chamber pressure, net span of elements verified, frontal displacement; expanded uncertainty has been calculated using a coverage factor "k" of 2, corresponding to a confidence level of 95,45 %.

(***) 5 mm + 1/300 if 3000 mm ≤ clear span < 7500 mm.

Air permeability test

Air permeability through sample fixed parts before and after the wind resistance test								
Classification pressure	Initial air flow	Initial air flow per unit area and relative uncertainty*		End air flow	End air flow per unit area and relative uncertainty		Difference	
		[m³/m²·h]	[m³/m·h]		[m³/m²·h]	[m³/m·h]	[m³/m²·h]	[m³/m·h]
600	10,00	1,282 ± 0,024	0,848 ± 0,042	0,29	0,037 ± 0,008	0,025 ± 0,006	-1,245	-0,823
-600	5,87	0,752 ± 0,009	0,497 ± 0,014	0,45	0,058 ± 0,008	0,038 ± 0,006	-0,694	-0,459

(*) figures refer to pressure of 101,3 kPa and temperature of 293 K. If measured values are less than measurement uncertainty, air flow is expressed as: "< sum of measurement uncertainties and measured value".

Watertightness test

Spraying method utilised	as per Figure 3 of standard EN 12155
Water flow rate per unit area	2 l/(min·m ²)
Water flow rate	936 l/h

Pressure		Spraying time [min]	Observations
nominal [Pa]	test [Pa]		
0	0	15	no leakage
50	50	5	no leakage
100	100	5	no leakage
150	150	5	no leakage
200	200	5	no leakage
300	300	5	no leakage
450	450	5	no leakage
600	600	5	no leakage
750	750	5	no leakage
900	900	5	no leakage
1050	1050	5	no leakage
1200	1200	5	no leakage
1350	1350	5	no leakage
1500	1500	5	no leakage
1650	1650	5	no leakage
1800	1800	5	no leakage
1950	1950	5	no leakage

Increased load test (sample safety)

Positive/negative pressure [Pa]	Observations
1875	No breakage, detachment of parts or apparent loss of operating efficiency
-1875	No breakage, detachment of parts or apparent loss of operating efficiency

Classification

Classification was determined in order to qualify the product even though its type does not fall within the scope of the standards.

In accordance with the tests performed, the results obtained and the provisions of standards UNI EN 12152:2003, UNI EN 12154:2001 and UNI EN 13116:2002:

- total air permeability through fixed parts is less than $1,5 \text{ m}^3/\text{m}^2\cdot\text{h}$ and $0,5 \text{ m}^3/\text{m}\cdot\text{h}$ at a test pressure of 600 Pa;
- no leakage of water was detected up to a pressure of 1950 Pa;
- under the design loads of +1250 Pa and -1250 Pa, frontal deflection does not exceed 5 mm + 1/300 mm of the span of each framing member;
- permanent frontal deformation 1 h after removal of load is less than 5 % of deflection under load;
- permanent frontal displacement of fixings of framing members at their connections to structural components is less than 1 mm;
- air permeability through fixed parts related to the overall area after being subjected to the wind load does not increase by more than $0,3 \text{ m}^3/\text{m}^2\cdot\text{h}$ and $0,1 \text{ m}^3/\text{m}\cdot\text{h}$ at the classification pressure of 600 Pa;
- after the wind load test, no leakage of water was detected up to a pressure of 1950 Pa;
- under the safety test pressures of +1875 Pa and -1875 Pa, the sample shows no detachment of parts or apparent loss of operating efficiency.

Therefore, the test sample, comprising a portion of infilling perimeter wall with external cladding made from Aquafire fibre-reinforced lightweight cement board called "AQUAFIRE PERIMETER WALL" submitted by the company BIFIRE S.r.l. - Via Giosuè Carducci, 8 - 20123 MILANO (MI) - Italy, is awarded the performance classes* listed in the following table.

Test type		Test standard	Classification standard	Class **
Air permeability through fixed parts	related to overall area	UNI EN 12153	UNI EN 12152	A4
	relating to fixed joint length			A4
Watertightness		UNI EN 12155	UNI EN 12154	RE1950
Resistance to design wind load of +1250 Pa and -1250 Pa		UNI EN 12179	UNI EN 13116	pass

(*) Classification was determined in order to qualify the product even though its type does not fall within the scope of the standards.

(**) Classification has been determined on the basis of values obtained by measurement during testing in line with clause 2.6 of ILAC-G8:03/2009 "Guidelines on the reporting of compliance with specification".

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

.....

ANNEX "A"
TO TEST REPORT No. 351075

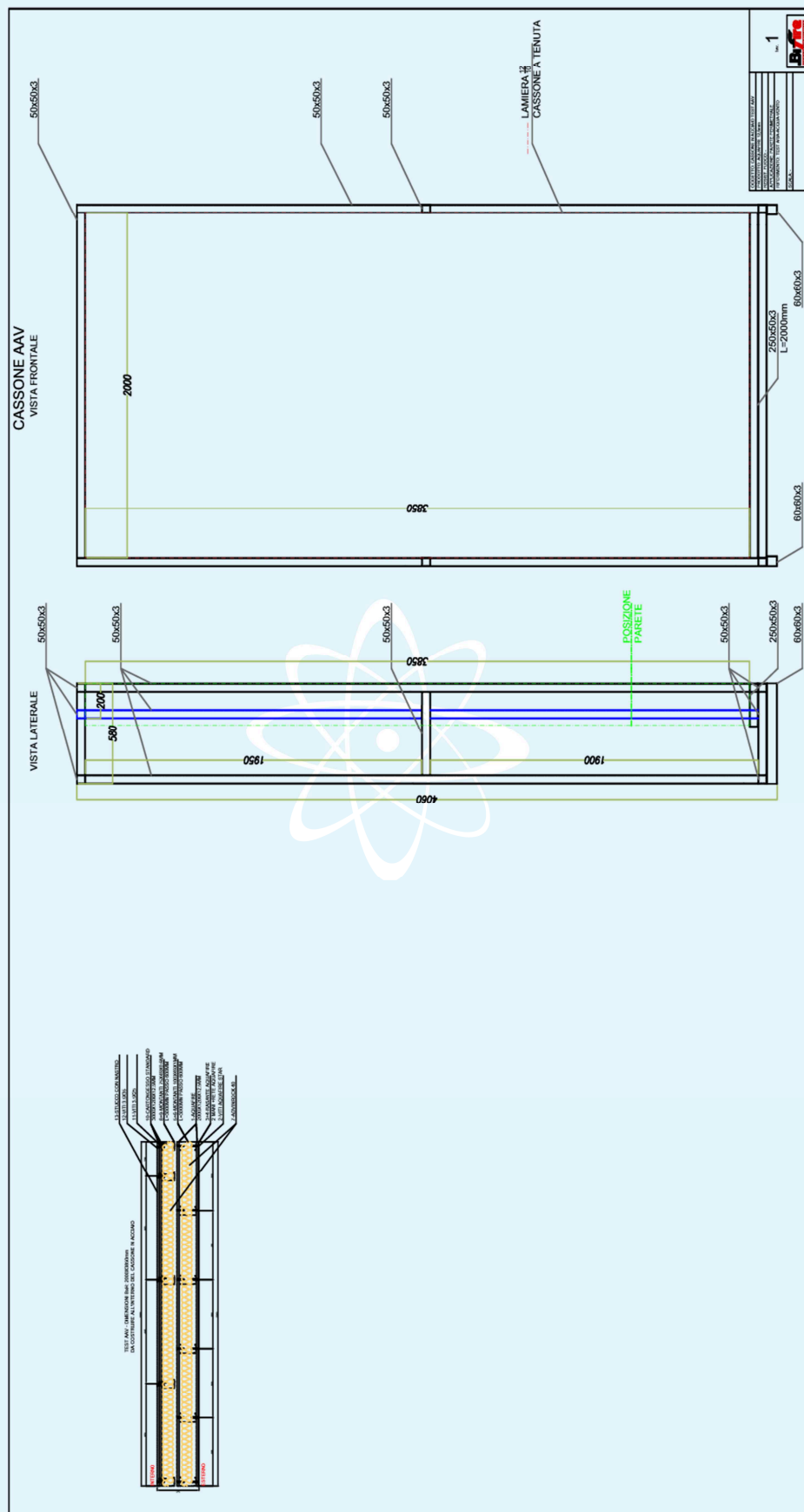
Place and date of issue: Bellaria-Igea Marina - Italy, 27/04/2018

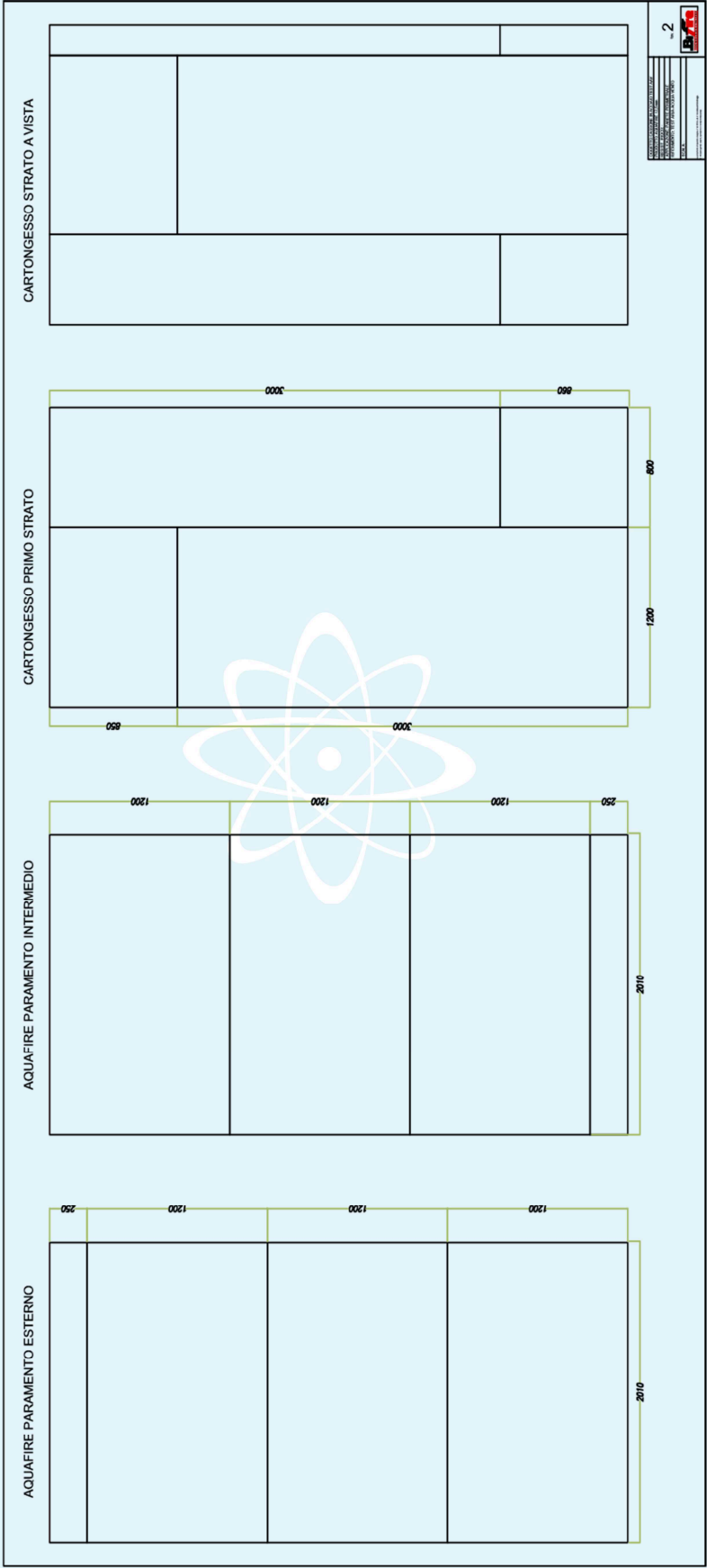
Customer: BIFIRE S.r.l. - Via Giosuè Carducci, 8 - 20123 MILANO (MI) - Italy

Purpose: sample technical documentation

The following sheets show Customer-supplied schematic drawings of the sample.









TEST REPORT No. 355334

Place and date of issue: Bellaria-Igea Marina - Italy, 28/09/2018

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

Date testing requested: 25/01/2018

Order number and date: 75527, 25/01/2018

Date sample received: 26/01/2018

Date of testing: from 07/02/2018 to 08/02/2018

Purpose of testing: testing an external wall with external layer in fibre-reinforced lightweight cement board to determining large missile impact test according to TAS 201-94 procedure and cyclic wind pressure load test according to TAS 203-94 procedure

Place of testing: Istituto Giordano S.p.A. - Strada Erbosa Uno, 72 - 47043 Gatteo (FC) - Italy

Origin of sample: sampled and supplied by the Customer

Identification of sample received: No. 2018/0174

Sample name*

The test sample is called "PARETE PERIMETRALE AQUAFIRE".

(*) according to that stated by the Customer.

Comp. AV
Revis. PB

This test report consists of 13 sheets.

Sheet
1 of 13

Description of sample*

The test sample consists of an external wall with external layer in fibre-reinforced lightweight cement board Aquafire, water-resistant, windproof and burglar resistant boards, made by:

- outdoor layer composed of:
 - premixed single component cement coating in lightweight powder, thickness 3 mm, with drowning alkali-resistant glass fibre Aquafire coating reinforcing mesh;
 - fibre-reinforced lightweight cement board Aquafire, nominal dimensions 2000 mm × 1200 mm, thickness 12,5 mm, density 960 kg/m³, Euroclass A1 reaction to fire, CE marked, suitable for outdoor and indoor applications, resistant to water, freeze, wind, heat, laid with staggered joints according to the Bifire installation technical manual, fixed by Aquafire Star screws in treated steel step 200 mm, resistant up to 1000 h of salt spray, dimensions 4 mm × 41 mm;
- outside metal frame composed of:
 - horizontal metal guides in steel profiles “U” section, dimensions 40 mm × 100 mm × 40 mm, length 3000 mm and thickness 1 mm, fixed to the test frame with self-drilling steel screws with step 500 mm;
 - vertical metal frame in steel profiles “C” section, dimensions 48 mm × 100 × 49 mm, length 4000 mm, thickness 1 mm, step 600 mm inside the guides; the uprights at the ends are fixed to the test frame with self-drilling steel screws with step 500 mm;
 - rock wool Advinrock 40, thickness 70 mm and density 40 kg/m³;
- intermediate layer composed of:
 - fibre-reinforced lightweight cement board Aquafire, nominal dimensions 2000 mm × 1200 mm, thickness 12,5 mm, density 960 kg/m³, Euroclass A1 reaction to fire, CE marked, suitable for outdoor and indoor applications, resistant to water, freeze, wind, heat, laid with staggered joints according to the Bifire installation technical manual, fixed by Aquafire Star screws in treated steel step 200 mm, resistant up to 1000 h of salt spray, dimensions 4 mm × 41 mm;
 - air gap, thickness 15 mm;
- inside metal frame composed of:
 - horizontal metal guides in steel profiles “U” section, dimensions 40 mm × 75 mm × 40 mm, length 3000 mm and thickness 0,6 mm, fixed to the test frame with self-drilling steel screws with step 500 mm;
 - vertical metal frame in steel profiles “C” section, dimensions 48 mm × 75 mm × 49 mm, length 4000 mm and thickness 0,6 mm, with step 600 mm inside the guides; the uprights at the ends are fixed to the test frame with self-drilling steel screws with step 500 mm;
 - rock wool Advinrock 40, thickness 70 mm and density 40 kg/m³;

(*) according to that stated by the Customer.

- indoor layer composed of:
 - first standard plasterboard type A, edge BA 13 CE marked in according with standard UNI EN 520, reaction to fire class A2-s1, d0, nominal dimensions 3000 mm × 1200 mm, thickness 12,5 mm and weight 9,3 kg/m³, composed of a plaster core embedded between two sheets of cardboard, fixed with joints offset to the structure with self-drilling 3,5 mm × 25 mm phosphated steel screws with step 600 mm;
 - second layer made by standard plasterboard type A, edge BA 13 CE marked in according with standard UNI EN 520, reaction to fire class A2-s1, d0, nominal dimensions 3000 mm × 1200 mm, thickness 12,5 mm and weight 9,3 kg/m³, composed of a plaster core embedded between two sheets of cardboard, fixed with joints offset to the structure with self-drilling 3,5 mm × 25 mm phosphated steel screws with step 250 mm;
 - joints and screw heads are plastered with gypsum-based coat and reinforcement tape.

Further details of sample specifications can be seen in Customer-supplied component list and schematic drawings shown in the following sheets.

Customer supplied component list*

Code	Description
1	Fibre-reinforced lightweight cement board Aquafire, nominal dimensions 2000 mm × 1200mm, thickness 12,5 mm, density 960 kg/m ³ , Euroclass A1 reaction to fire, CE marked, suitable for outdoor and indoor applications, resistant to water, freeze, wind, heat,
2	Aquafire Star screws in treated steel resistant up to 1000 h of salt spray, dimensions 4 mm × 41 mm
3	Rasante Aquafire premixed single component cement coating in lightweight powder
4	Rete Aquafire coating reinforcing mesh, Alkali resistant fibreglass
5	Horizontal metal guides in steel profiles "U" section, dimensions 40 mm × 100 mm × 40 mm, length 3000 mm, thickness 1 mm
6	Vertical metal frame in steel profiles "C" section, dimensions 48 mm × 100 mm × 49 mm, length 4000 mm, thickness 1 mm
7	Rock wool Advinrock 40, thickness 70 mm, density 40 kg/m ³ ;
8	Horizontal metal guides in steel profiles "U" section, dimensions 40 mm × 750 mm × 40 mm, length 3000 mm, thickness 0,6 mm
9	Vertical metal frame in steel profiles "C" section, dimensions 48 mm × 75 mm × 49 mm, length 4000 mm, thickness 0,6 mm

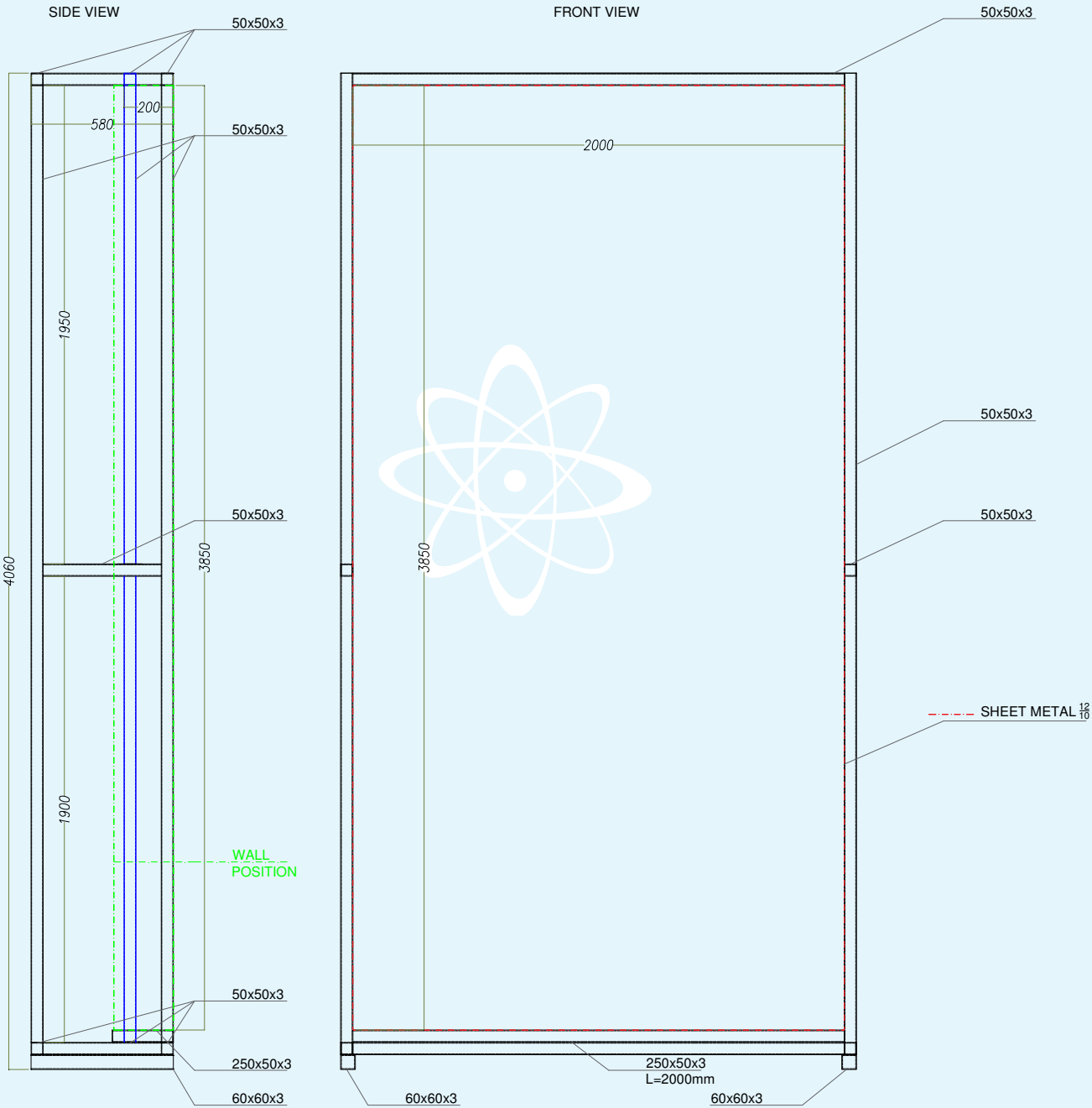
(*) according to that stated by the Customer.

Code	Description
10	Standard plasterboard type A, edge BA 13 CE marked in according with standard UNI EN 520, reaction to fire class A2-s1, d0, nominal dimensions 3000 mm × 1200 mm, thickness 12,5 mm, weight 9,3 kg/m ³ , composed of a plaster core embedded between two sheets of cardboard
11	Self-drilling 3,5 mm × 25 mm phosphated steel screws
12	Self-drilling 3,5 mm × 35 mm phosphated steel screws
13	Gypsum-based coat and reinforcement tape

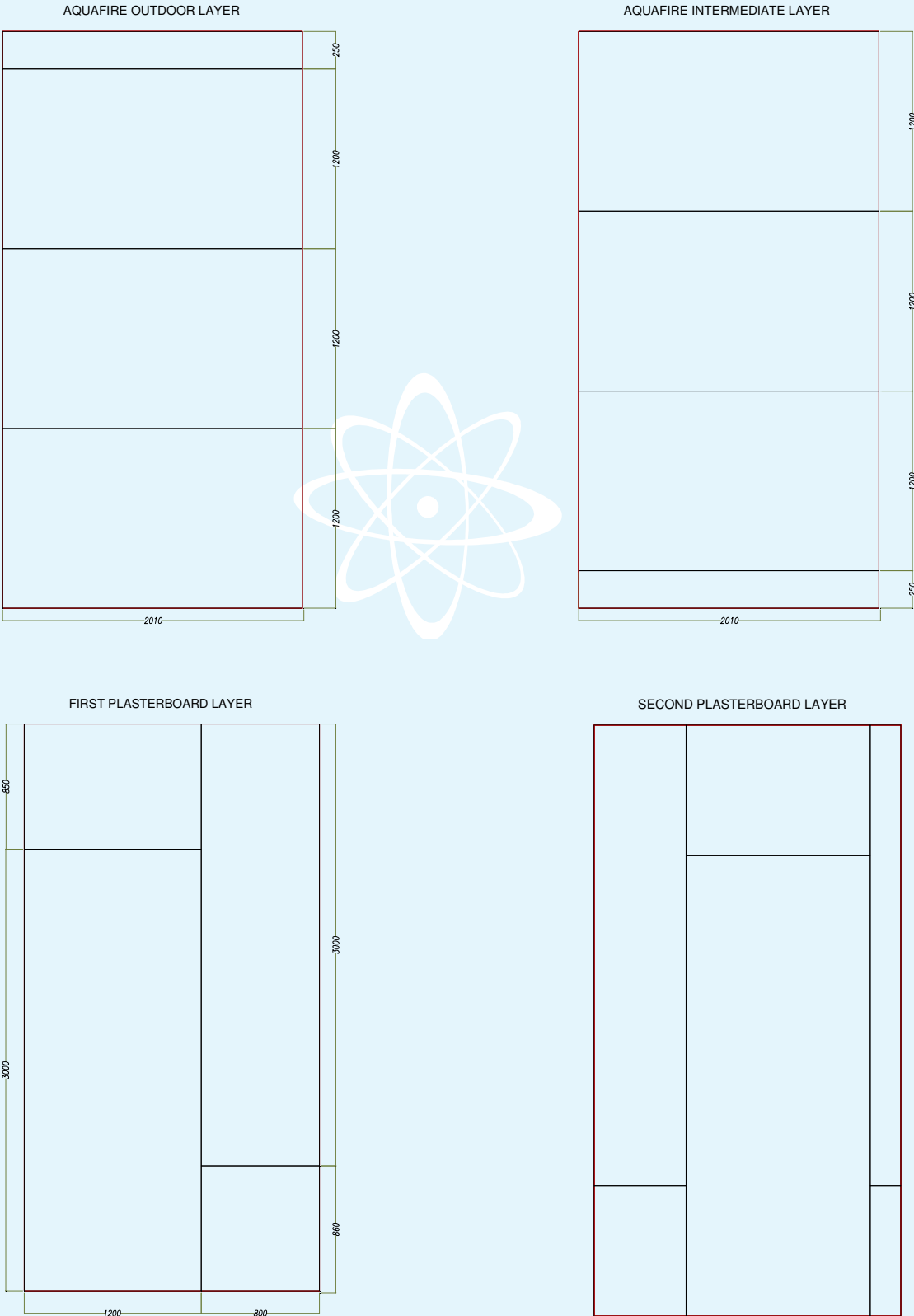


Photograph of the sample

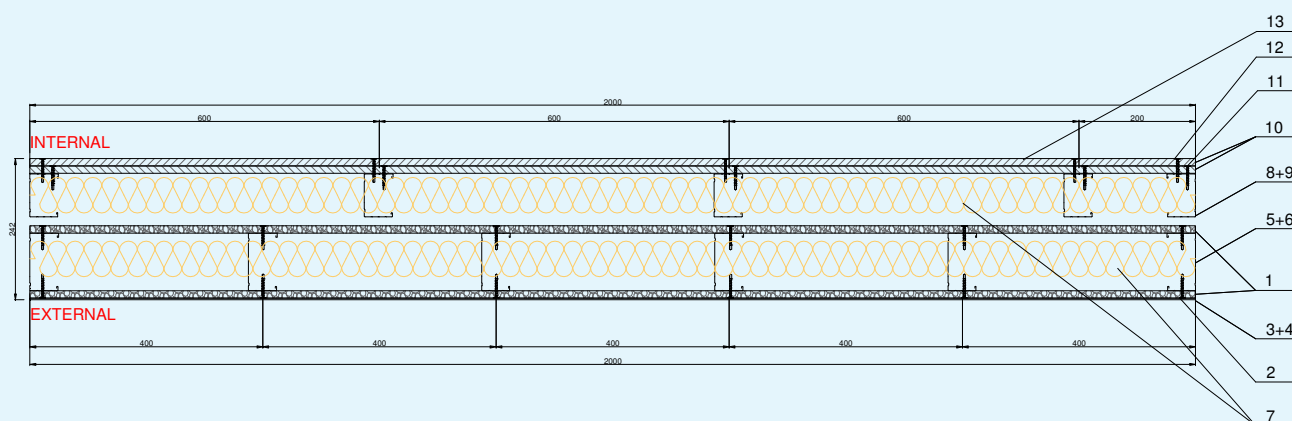
SAMPLE SCHEMATIC DRAWING



SAMPLE SCHEMATIC DRAWING



SAMPLE HORIZONTAL SECTION



Data obtained from the sample

Overall dimensions	width	2000 mm	6,56 ft
	height	3900 mm	12,80 ft
Overall area		7,80 m ²	83,97 ft ²

Normative references

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

- Florida Building Code - Test Protocols for High-Velocity Hurricane Zones - Fifth Edition (2014) dated March 2015, and in detail:
 - TAS 201-94 “Impact test procedures”;
 - TAS 202-94 “Criteria for testing impact & nonimpact resistant building envelope components using uniform static air pressure”;
 - TAS 203-94 “Criteria for testing products subject to cyclic wind pressure loading”;
- Florida Building Code - Building - Fifth Edition (2014).

Test apparatus

The test was carried out using a computerised semiautomatic control and measurement system capable of performing all tests with the parameters requested by the normative references and fitted with the following equipment:

- differential pressure transducers;
- measuring tape;
- large missile cannon compliant to TAS 201-94.

Environmental conditions at the time of testing

Atmospheric pressure	(1001 ± 10) hPa
Ambient temperature	(15 ± 5) °C
Relative humidity	(46 ± 15) %

Test method

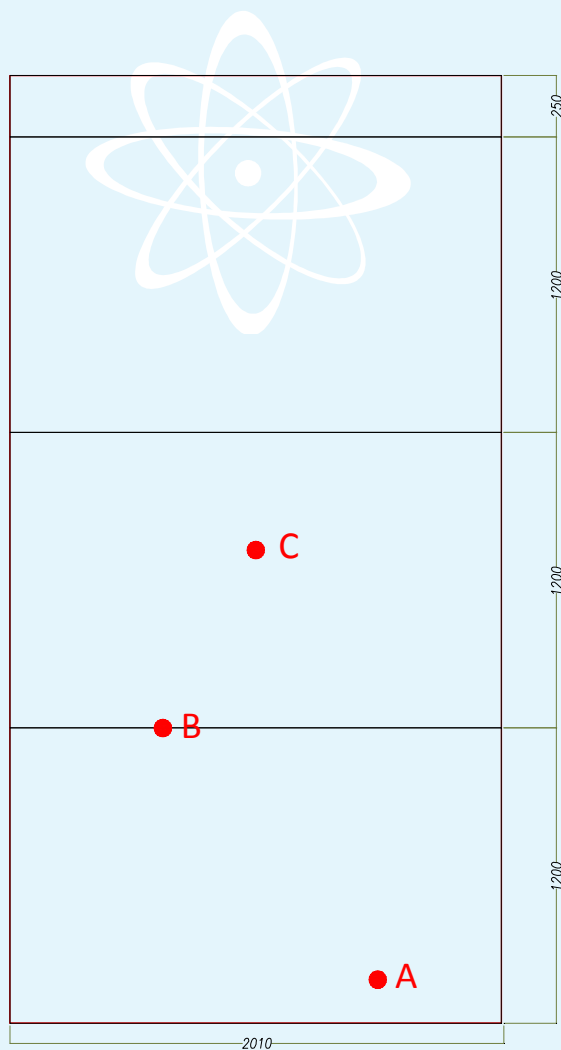
The sample was fitted to the test apparatus and subjected to this test sequence:

- large missile impact in accordance with standard TAS 201-94;
- cyclic wind pressure load (design load = ± 1250 Pa) in accordance with standard TAS 203-94.

Test results

Impact test (large missile impact) according to TAS 201-94

Impact point	Impact area	Missile	Impact velocity [m/s]	Results
1	A	southern yellow pine, weight 9 lb (4,1 kg), length 7 ft (2,1 m), section 2" × 4" (51 mm × 102 mm)	15,28	breakage of the outside layer, without complete penetration
2	B		15,31	
3	C		15,36	



Sample elevation displaying impact points



Photographs of the sample after large missile impact test in area A



Photographs of the sample after large missile impact test in area B



Photographs of the sample after large missile impact test in area C

Cyclic static air pressure loading according to TAS 203-94

Positive pressure				
Air pressure cycles [No.]	Range [%]	Air pressure cycles		Observation
		[psf]	[Pa]	
3500	20-50	[5,2 ; 13,1]	[250 ; 625]	no more crack forming
300	0-60	[0,0 ; 15,7]	[0 ; 750]	no more crack forming
600	50-80	[13,1 ; 20,9]	[625 ; 1000]	no more crack forming
100	30-100	[7,8 ; 26,1]	[375 ; 1250]	no more crack forming

Negative pressure				
Air pressure cycles [No.]	Range [%]	Air pressure cycles		Observation
		[psf]	[Pa]	
50	30-100	[-7,8; -26,1]	[-375; -1250]	no more crack forming
1050	50-80	[-13,1; -20,9]	[-625; -1000]	no more crack forming
50	0-60	[-0,0; -15,7]	[-0; -750]	no more crack forming
3350	20-50	[-5,2; -13,1]	[-250; -625]	no more crack forming

Findings

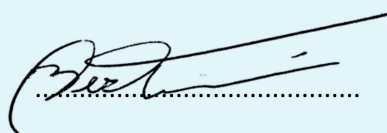
In accordance with the tests performed, the provisions of standards TAS 201-94, TAS 203-94, the test sample, comprising an external wall with external layer in fibre-reinforced lightweight cement board, called "PARETE PERIMETRALE AQUAFIRE" submitted by the company BIFIRE S.r.l. - Via Giosuè Carducci, 8 - 20123 MILANO (MI) - Italy, obtains the results listed in the following table.

Test	Test standard	Outcome	Admissible value	Compliance
Small missile impact	TAS 201-94	no penetration	no penetration	pass
Cyclic static air pressure loading	TAS 203-94	crack forming	no crack forming longer than 5" (127 mm) or wider than 1/16" (1,6 mm) through which air can pass	pass

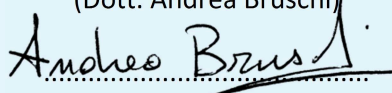
The results given refer exclusively to the test sample itself and are only valid under the same conditions in which testing was carried out.

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

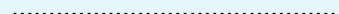
Test Technician
(Dott. Ing. Paolo Bertini)



Head of
Security and Safety Laboratory
(Dott. Andrea Bruschi)



Chief Executive Officer



RAPPORTO DI PROVA N. 349982

Luogo e data di emissione: Bellaria-Igea Marina - Italia, 15/03/2018

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

Data della richiesta della prova: 17/01/2018

Numero e data della commessa: 75528, 25/01/2018

Data del ricevimento del campione: 30/01/2018

Data dell'esecuzione della prova: 08/02/2018

Oggetto della prova: resistenza all'effrazione e classificazione (resistenza sotto carico statico, resistenza sotto carico dinamico e resistenza all'azione manuale di effrazione) secondo le norme UNI EN 1627:2011, UNI EN 1628:2016, UNI EN 1629:2016 e UNI EN 1630:2016 di parete prefabbricata leggera

Luogo della prova: Istituto Giordano S.p.A. - Strada Erbosa Uno, 72 - 47043 Gatteo (FC) - Italia

Provenienza del campione: campionato e fornito dal Committente

Identificazione del campione in accettazione: n. 2018/0200

Denominazione del campione*.

Il campione sottoposto a prova è denominato "PARETE PERIMETRALE AQUAFIRE".

(*) secondo le dichiarazioni del Committente.

Comp. MB
Revis. RP

Il presente rapporto di prova è composto da n. 13 fogli e n. 1 allegato.

Foglio
n. 1 di 13

Descrizione del campione*.

Il campione sottoposto a prova è costituito da una parete perimetrale di tamponamento con paramento esterno in lastre di cemento alleggerito fibrorinfozato Aquafire, resistente all'aria, all'acqua e al vento, costituita da:

- paramento esterno formato da:
 - rasatura in due mani con Rasante Aquafire premiscelato cementizio monocomponente in polvere alleggerito, spessore 3 mm, con annegamento Rete Aquafire di rinforzo per rasature, in fibra di vetro resistente agli alcali;
 - lastra in cemento alleggerito fibrorinforzato Aquafire, dimensioni nominali 2000 mm × 1200 mm, spessore nominale di 12,5 mm, densità nominale 960 kg/m³, Euroclasse A1 di reazione al fuoco, marchiata CE, indicata per applicazioni in esterno ed interno, resistente all'acqua, al gelo, al vento, al caldo, posata a giunti sfalsati secondo manuale tecnico di installazione Bifire, fissata con Viti Aquafire Star in acciaio a passo 200 mm, resistenti fino a 1000 h in nebbia salina, dimensioni 4 mm × 41 mm;
- struttura metallica esterna:
 - guide metalliche orizzontali in profilati d'acciaio con sezione a "U", sviluppo 40 mm × 100 mm × 40 mm, lunghezza 3000 mm e spessore 1 mm, fissate all'intelaiatura di prova con viti auto perforanti in acciaio a passo 500 mm;
 - orditura metallica verticale in profili d'acciaio con sezione a "C", sviluppo 48 mm × 100 mm × 49 mm, lunghezza 3000 mm e spessore 1 mm, posata a passo 600 mm all'interno delle guide; i montanti alle estremità sono fissati all'intelaiatura di prova con viti auto perforanti in acciaio a passo 500 mm;
 - lana di roccia Advinrock 40, spessore 70 mm e densità 40 kg/m³;
- paramento intermedio:
 - lastra in cemento alleggerito fibrorinforzato Aquafire, dimensioni nominali 2000 mm × 1200 mm, spessore nominale 12,5 mm, densità nominale 960 kg/m³, Euroclasse A1 di reazione al fuoco, marchiata CE, indicata per applicazioni in esterno ed interno, resistente all'acqua, al gelo, al vento, al caldo, posata a giunti sfalsati secondo manuale tecnico di installazione Bifire, fissata con Viti Aquafire Star in acciaio a passo 200 mm, resistenti fino a 1000 h in nebbia salina, dimensioni 4 mm × 41 mm;
 - intercapedine d'aria 15 mm;
- struttura metallica interna:
 - guide metalliche orizzontali in profilati d'acciaio con sezione a "U", sviluppo 40 mm × 75 mm × 40 mm, lunghezza 3000 mm e spessore 0,6 mm, fissate all'intelaiatura di prova con viti auto perforanti in acciaio a passo 500 mm;
 - orditura metallica verticale in profili d'acciaio con sezione a "C", sviluppo 48 mm × 75 mm × 49 mm,

(*) secondo la documentazione tecnica fornita dal Committente, ed in base a controlli effettuati da personale qualificato di questo Istituto.

- lunghezza 3000 mm e spessore 0,6 mm, posata a passo 600 mm all'interno delle guide; i montanti alle estremità sono fissati all'intelaiatura di prova con viti auto perforanti in acciaio a passo 500 mm;
- lana di roccia Advinrock 40, spessore 70 mm e densità 40 kg/m³;
 - paramento interno:
 - prima lastra in gesso rivestito standard tipo A, bordo BA 13 marchiata CE secondo la norma UNI EN 520, classe di reazione al fuoco A2-s1, d0, dimensioni 3000 mm × 1200 mm, spessore 12,5 mm, peso 9,3 kg/m³, composte da nucleo in gesso incorporato fra due fogli di cartone, fissata a giunti sfalsati alla struttura con viti in acciaio fosfatate auto perforanti 3,5 × 25 mm a passo 600 mm;
 - seconda lastra (a vista) in gesso rivestito standard tipo A, bordo BA 13 marchiata CE secondo la norma UNI EN 520, classe di reazione al fuoco A2-s1, d0, dimensioni 3000 mm × 1200 mm, spessore 12,5 mm, peso 9,3 kg/m³, composte da nucleo in gesso incorporato fra due fogli di cartone, fissata a giunti sfalsati alla struttura con viti in acciaio fosfatate auto perforanti 3,5 mm × 35mm a passo 250 mm;
 - stucco base gesso e nastro di rinforzo per i giunti e le teste delle viti a vista.

Il campione presenta, infine, una cornice perimetrale di contenimento in acciaio per l'adattamento ed il bloccaggio all'impianto di prova.

Per ulteriori dettagli sulle caratteristiche del campione si rimanda al disegno schematico fornito dal Committente e riportato nell'allegato "A" al presente rapporto di prova.



Fotografia del campione.

Riferimenti normativi.

La prova è stata eseguita secondo le prescrizioni delle seguenti norme:

- UNI EN 1627:2011 del 16/06/2011 “Porte pedonali, finestre, facciate continue, inferriate e chiusure oscil-lanti - Resistenza all’effrazione - Requisiti e classificazione”;
- UNI EN 1628:2016 del 04/02/2016 “Porte pedonali, finestre, facciate continue, inferiate e chiusure oscu-ranti - Resistenza all’effrazione - Metodo di prova per la determinazione della resistenza sotto carico sta-tico”;
- UNI EN 1629:2016 del 04/02/2016 “Porte pedonali, finestre, facciate continue, inferiate e chiusure oscu-ranti - Resistenza all’effrazione - Metodo di prova per la determinazione della resistenza sotto carico di-namico”;
- UNI EN 1630:2016 del 04/02/2016 “Porte pedonali, finestre, facciate continue, inferiate e chiusure oscu-ranti - Resistenza all’effrazione - Metodo di prova per la determinazione della resistenza all'azione ma-nuale di effrazione”.

**Modalità della prova.**

La prova è stata eseguita secondo le prescrizioni delle norme citate al paragrafo “Riferimenti normativi” uti-lizzando la procedura interna di dettaglio PP009 revisione 13 del 08/01/2014 “Porte, porte pedonali, finestre, facciate continue, inferriate e chiusure oscuranti - Resistenza all’effrazione: Metodi di prova e classificazio-ne”.

Verifica della documentazione fornita e del campione da sottoporre a prova.

In conformità a quanto richiesto nelle norme UNI EN 1627:2011, UNI EN 1628:2016, UNI EN 1629:2016 e UNI EN 1630:2016 è stata verificata la presenza della seguente documentazione:

- descrizione del campione (tipo di prodotto, caratteristiche dei profili, materiali utilizzati e spessore del-le tamponatura o vetrazioni);
- caratteristiche meccaniche dei materiali costituenti;
- data di produzione del campione;
- dichiarazione della classificazione della vetratura;
- dichiarazione della classificazione della ferramenta;
- lato di attacco;

- disegni costruttivi incluse tolleranze ed elenco componenti;
- istruzioni di installazione.

Carico statico secondo la norma UNI EN 1628:2016.

Il campione in esame è stato sottoposto ad una serie di carichi statici per la classe di resistenza 2.

I carichi sono stati applicati tramite un pressore, collegato ad un pistone pneumatico, diametro 250 mm, comandato da valvola di riduzione motorizzata in grado di applicare il carico con un gradiente prestabilito.

I carichi sono stati rilevati mediante l'utilizzo di una cella di carico, fondo scala 25000 N.

Le deformazioni sono state verificate con una serie di dime passa/non passa conformi alle specifiche del paragrafo A.10 della norma UNI EN 1628:2016.

Le apparecchiature utilizzate rispettano i requisiti di accuratezza richiesti nel paragrafo 4.8 "Tollerances" della norma UNI EN 1628:2016, pertanto la conformità alla classe è attribuita senza tener conto della banda di incertezza sul valore della deformazione, in linea con il paragrafo 2.6 della guida ILAC-G8:03/2009 "Guidelines on the Reporting of Compliance with Specification".

Carico dinamico secondo la norma UNI EN 1629:2016.

Il campione in esame è stato sottoposto ad una serie di urti per la classe di resistenza 2 con elemento di impatto di massa 50 kg conformemente alla figura A.23 "Side-hinged windows, sliding windows and pivot windows with one or more casements for fixed windows" della norma UNI EN 1629:2016.

Attacco manuale secondo la norma UNI EN 1630:2016.

Il campione in esame è stato sottoposto a due prove di accesso con operatore per la classe di resistenza 2 sulle seguenti aree:

- zona con spazio libero nella struttura portante esterna in acciaio;
- zona con spazio libero nella struttura portante interna in acciaio.

Per le prove preliminari si è utilizzata la serie di strumenti "A1" e "A2".

Apparecchiatura di prova.

Per l'esecuzione della prova è stata utilizzata la seguente apparecchiatura:

- banco di prova antintrusione (codice di identificazione interna dell'apparecchiatura: EDI048) munito di dispositivo di carico (codice di identificazione interna dell'apparecchiatura: FT481) e cella di carico con lettore da 25 kN corredata di rapporto di taratura emesso da Istituto Giordano S.p.A.;
- serie di dispositivi di carico (codici di identificazione interna dell'apparecchiatura: EDI074a, EDI074b, EDI074c, EDI074d, EDI074e, EDI074f e EDI074g);
- serie di dime calibrate (codici di identificazione interna dell'apparecchiatura: EDI075a, EDI075b, EDI075c e EDI075d);
- dispositivo meccanico per l'applicazione dei carichi dinamici costituito da apposito sistema di sollevamento e di regolazione dell'altezza completamente elettromeccanico e da sistema meccanico della posizione di traslazione laterale e da elemento di impatto (codice di identificazione interna dell'apparecchiatura: EDI012);
- metro digitale per le misure dimensionali e l'altezza di caduta del corpo molle (codice di identificazione interna dell'apparecchiatura: FT364);
- calibro digitale (codice di identificazione interna dell'apparecchiatura: EDI066);
- cronometro per la misura del tempo di resistenza (codice di identificazione interna dell'apparecchiatura: FT462);
- termigigrometro misura condizioni ambientali (codice di identificazione interna dell'apparecchiatura: FT231);
- videocamera per la ripresa delle attività di prova;
- strumenti per la prova di attacco manuale (codice di identificazione interna dell'apparecchiatura: FT341), definiti in funzione della classe di prova e riportati nella seguente tabella.

Quantità [n.]	Descrizione	Codice dell'utensile
1	Pinza a pappagallo, lunghezza massima (250 ± 10) mm	1.1
1	Cacciavite, lunghezza massima totale (260 ± 20) mm, diametro massimo del fusto (8 ± 2) mm e larghezza della lama (10 ± 1) mm	1.2
1	Set di piccoli cacciaviti con differenti tipi di impronta, diametro massimo del fusto (6 ± 2) mm e lunghezza massima totale 250 mm	1.3
//	Chiavi a brugola, lunghezza massima 120 mm	1.4
//	Chiavi esagonali, lunghezza massima 180 mm	1.5

Quantità [n.]	Descrizione	Codice dell'utensile
1	Pinza da meccanico, lunghezza massima 200 mm	1.6
1	Pinzetta	1.7
1	Coltello, lunghezza massima della lama 120 mm e spessore della lama non maggiore di 3 mm	1.8
1	Torcia elettrica	1.9
//	Ganci	1.10
//	Cavo in acciaio	1.11
//	Nastro adesivo	1.12
//	Cavi e corde	1.13
1	Martello in gomma, durezza (90 ± 10) Shore, massa della testa (100 ± 20) g, massa totale (145 ± 20) g e lunghezza massima (260 ± 20) mm	1.14
1	Chiave universale	1.15
1	Cacciavite, lunghezza massima totale (365 ± 25) mm e larghezza della lama (16 ± 2) mm	2.1
1	Pinza da tubista, lunghezza massima (240 ± 20) mm	2.2
2	Cunei in plastica, lunghezza massima (200 ± 25) mm e spessore (40 ± 5) mm	2.3
2	Cunei in legno, lunghezza massima (200 ± 25) mm e spessore (40 ± 5) mm	2.4
1	Segaccio (con due lame a bimetallo o HSS), lunghezza massima (310 ± 25) mm	2.5
1	Portalama (con due lame a bimetallo o HSS) lunghezza massima $300 \times 13 \times 0,65$ mm	2.6
1	Portasega ad arco (con due lame a bimetallo o HSS) lunghezza massima (330 ± 25) mm	2.7
1	Tubo di estensione, lunghezza massima 500 mm, diametro massimo 30 mm e spessore massimo di 3 mm	2.8

Squadra operativa.

La squadra operativa che ha eseguito la prova finale è composta dalle persone riportate nella seguente tabella.

Funzione operativa	Nominativi
Responsabile	Geom. Roberto Porta
Cronometrista	Geom. Roberto Porta
Operatore	Sig. Ulisse Mari

Condizioni ambientali al momento della prova.

Pressione atmosferica	(1012 ± 5) mbar
Temperatura ambiente	(17 ± 1) °C
Umidità relativa	(48 ± 10) %

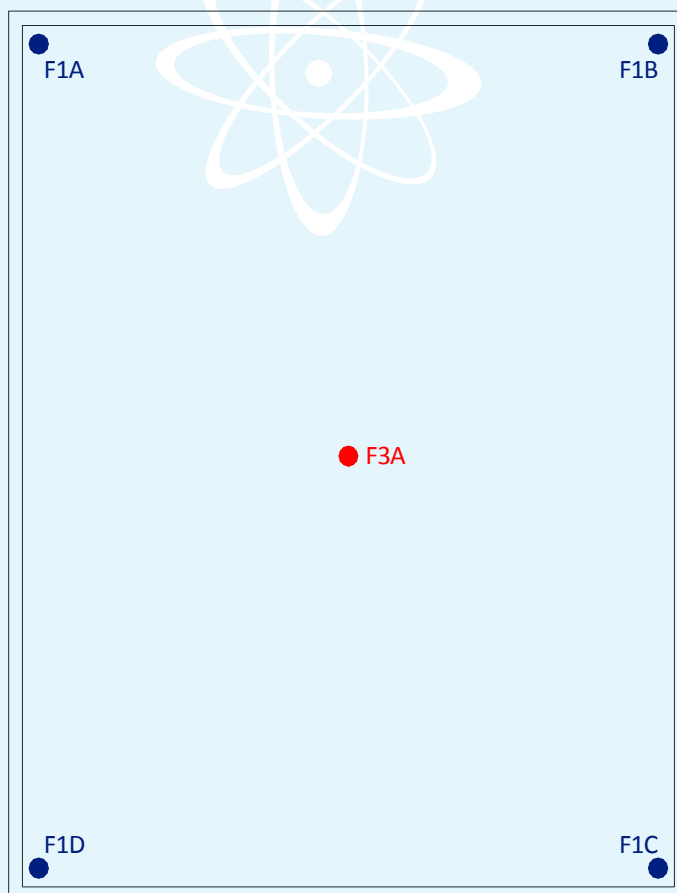
Risultati della prova.**Verifica della documentazione fornita e del campione da sottoporre a prova.**

L'esito delle verifiche eseguite è riportato nella seguente tabella riepilogativa.

Documento da fornire	Riferimento fornito	Esito
Descrizione del campione	documento denominato "TEST ANTINTRUSIONE.DOCX"	Conforme
Caratteristiche materiali	documento denominato "TEST ANTINTRUSIONE.DOCX"	Conforme
Data di produzione	Assemblato in laboratorio	Conforme
Classe vetrazione	Non fornita	Non applicabile
Classe ferramenta	Non fornita	Non applicabile
Lato di attacco	Comunicato dal Committente	Conforme
Disegni costruttivi con tolleranze dimensionali	Disegno denominato "antintrusione_rel0.dwg"	Conforme
Istruzioni di installazione	Documento denominato "antintrusione_rel0.dwg"	Conforme

Carico statico secondo la norma UNI EN 1628:2016.

RC 2 prodotto classificabile in gruppo 4				
Punto di applicazione del carico	Tampone di carico	Carico applicato [kN]	Tipo di dima di verifica	Esito della verifica
F3A	1	3	C	Conforme
F1A	1	3	C	Conforme
F1B				Conforme
F1C				Conforme
F1D				Conforme

**SCHEMA DEI PUNTI DI APPLICAZIONE DEI CARICHI
DURANTE LA PROVA DI CARICO STATICO**


Carico dinamico secondo la norma UNI EN 1629:2016.

RC 2	
Esito della prova	lesione localizzata sulla parete esterna nella zona direttamente sottoposta ad urto



Particolare della lesione.

Attacco manuale (attacco lato esterno) secondo la norma UNI EN 1630:2016.

Prove - RC 2			
Zona di attacco	Tempo operativo [min:s]	Strumenti utilizzati	Descrizione operazioni di attacco
spazio libero nella struttura portante esterna in acciaio	3:00	1.1, 1.8, 1.14	Attacco con il cacciavite e il tubo alle lastre esterne del rivestimento. Demolizione e taglio con la sega dello strato esterno delle lastre in gesso rinforzato. Rimozione dell'isolante interno e rottura della lastra centrale. Al termine del tempo operativo solo sulle lastre esterne il campione presenta un passo d'uomo di poco più piccolo della dima 250 mm × 400 mm, mentre la lastra interna rinforzata è solo danneggiata in più punti.
spazio libero nella struttura portante interna in acciaio	3:00	1.1, 1.8, 1.14	Attacco con il cacciavite ed il tubo alle lastre esterne del rivestimento. Demolizione e taglio con la sega dello strato esterno delle lastre in gesso rinforzato. Rimozione dell'isolante interno e rottura della lastra centrale. Al termine del tempo operativo il campione presenta una passo d'uomo di poco più piccolo della dima di 250 mm × 400 mm, in quanto i montanti, con passo inferiore a 300 mm, lasciano lo spazio intermedio minore della larghezza della dima.

**Particolare del campione al termine dell'attacco.**

Classificazione.

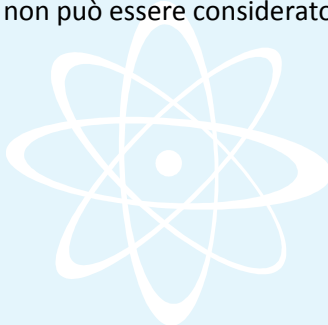
In base alla prova eseguita, in base ai risultati ottenuti ed in base a quanto indicato nelle norme UNI EN 1627:2011, UNI EN 1628:2016, UNI EN 1629:2016 e UNI EN 1630:2016, il campione in esame, costituito da una parete prefabbricata leggera, denominato "PARETE PERIMETRALE AQUAFIRE" e presentato dalla ditta BIFIRE S.r.l. - Via Giosuè Carducci, 8 - 20123 MILANO (MI) - Italia, ha superato le prove previste dalle norme stesse.

Pertanto, secondo quanto riportato nella norma UNI EN 1627:2011, il campione risulta appartenere alla

RC 2^{*}

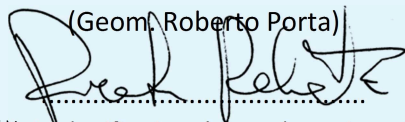
I risultati riportati si riferiscono al solo campione provato e sono validi solo nelle condizioni in cui la prova è stata effettuata.

Il presente rapporto di prova, da solo, non può essere considerato un certificato di conformità.



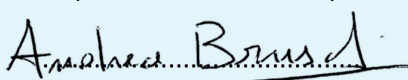
I Responsabile
Tecnico di Prova

(Geom. Roberto Porta)



Il Responsabile del Laboratorio
di Edilizia (Security and Safety)

(Dott. Andrea Bruschi)



L'Amministratore Delegato

.....

(*) La classificazione è stata determinata in linea al paragrafo 2.6 della guida ILAC-G8:03/2009; per maggiori dettagli si rimanda al paragrafo "Modalità della prova".
L'originale del presente documento è costituito da un documento informatico firmato digitalmente ai sensi della legislazione Italiana applicabile.

RAPPORTO DI PROVA N. 349982

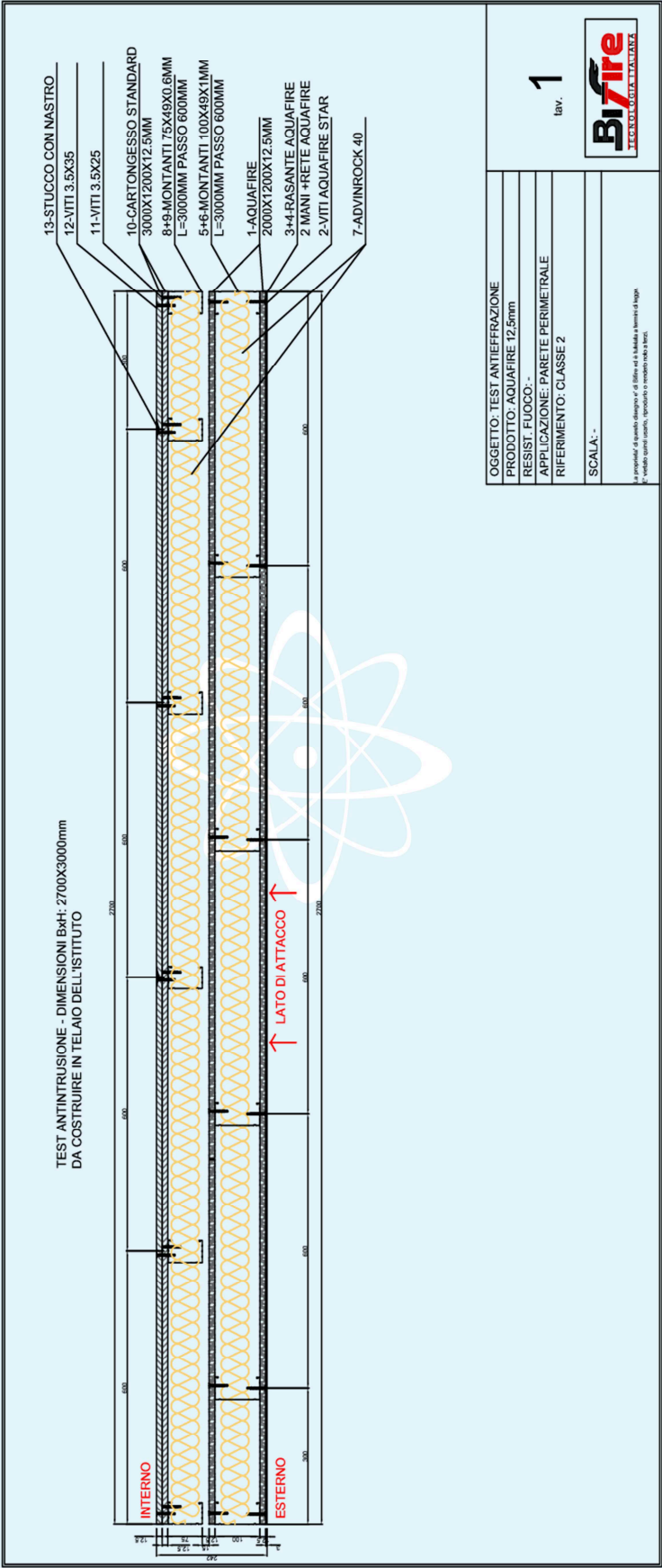
Luogo e data di emissione: Bellaria-Igea Marina - Italia, 15/03/2018

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

Oggetto: Documentazione tecnica del campione

Nel foglio seguente sono riportati i disegni schematici forniti dal Committente relativi al campione.





Environmental Product Declaration



In accordance with ISO 14025 and EN 15804 for:

Aquafire and Supersil (6, 9 and 12 mm)

from

Bifire srl



Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-01593
Publication date:	2019-05-17
Valid until:	2024-05-14
Geographical scope	Global



Aqua*fire*
TECNOLOGIA ITALIANA

Supersil
TECNOLOGIA ITALIANA

Programme information

Programme:	The International EPD[®] System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com
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Product category rules (PCR): *CONSTRUCTION PRODUCTS AND CONSTRUCTION SERVICES 2012:01, VERSION 2.3*
sub PCR ACOUSTICAL SYSTEM SOLUTIONS (CONSTRUCTION PRODUCT) (v2.2) PCR 2012:01-SUB-PCR-C rev.16/11/2018

PCR review was conducted by: *The Technical Committee of the International EPD[®] System. Chair: Massimo Marino.*
Contact via info@environdec.com

Independent third-party verification of the declaration and data, according to ISO 14025:2006:

☐ EPD process certification ☒ EPD verification

Third party verifier: *Rina Services Spa - signature*

In case of accredited certification bodies:
Accredited by: *Accredia, Accreditation n. 001H.*

Procedure for follow-up of data during EPD validity involves third party verifier:

☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

Company information

Owner of the EPD: Bifire srl, Via Lavoratori Autobianchi, 1, 20832 Desio MB, tel: +39 0362 364570 – mail: bifire@bifire.it

Description of the organisation: BIFIRE®, leader in the production of products for fire protection in construction, industry and marine, offers advantageous technological solutions through a wide mix of products, which constitute a "cut" proposal exactly on the needs of individual customers.

Product-related or management system-related certifications:

- Occupational Health and Safety Management System according to OHSAS 18001: OHS-2399
- Quality Management System according to ISO 9001: 7690/02/S
- Environmental Management System according to ISO 14001: EMS-5106/AN

Name and location of production site:

- Via Lavoratori Autobianchi, 1, 20832 Desio MB: Aquafire production site
- via Bergamo 16, 20037 Paderno Dugnano: Supersil production site

Product information

Aquafire

Product identification: slabs for fire protection and soundproofing in construction

Product description: Fiber-reinforced lightweight concrete slab for indoor or outdoor use, 12,5 mm thick.

Very light, highly insulating, water resistant for use in environments with high humidity, it can be used for internal or external applications.

Supplied with smooth side for internal applications with traditional grouting and rough side for plaster and smoothing applications.

UN CPC code: 375 Articles of concrete, cement and plaster

Geographical scope: Global

Supersil

Product identification: slabs for fire protection and soundproofing in construction

Product description:

SUPERSIL is a high density calcium fiber silicate totally free of asbestos composed of silicates, cement, fibers and inert additives.

It is available in 6 mm, 9 mm and 12 mm thicknesses.

SUPERSIL sheets are treated in an autoclave, making the finished product totally stable in the event of fire, incombustible (class 0), and guaranteeing high mechanical strength and resistance to atmospheric humidity.

SUPERSIL is supplied in rigid self-supporting panels with mechanical stability, flexibility, abrasion resistance and excellent heat performance.

Its high mechanical strength allows it to be used in the most severe conditions within its operating temperatures.

UN CPC code: 375 Articles of concrete, cement and plaster

Geographical scope: Global

Technical data		Aquafire	Supersil
Dry density	[kg/m ³]	960	900
Width	[mm]	1200	1200
Length	[mm]	2000	Da 2000 a 3000
Thickness			6
			9
	[mm]	12,5	12
Weight			5,4
			8,1
	[kg/m ²]	12	10,8
Reaction to fire	-	A1	0/A1

LCA information

Declared unit: 1 m² of product

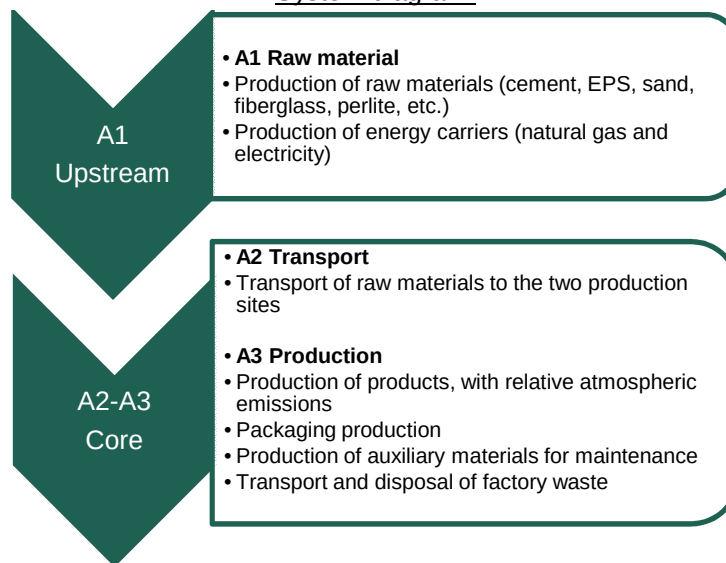
Sima pro 9.0

Time representativeness: the data refer to the year 2018.

Description of system boundaries: Type of EPD: cradle to gate

Database(s) and LCA software used:
ecoinvent v. 3.5, November 2018.

System diagram:



Excluded lifecycle stages: the study is limited to the factory gate, as the subsequent phases are optional.

More information:

A 1% cut-off was used, in terms of environmental relevance.

In cut off were considered:

- the labels affixed to the products during shipment;

- general office consumption;
- packaging of packaging materials.

Specific energy consumption per production line was used in the study.

Maintenance and atmospheric emissions are also line specific.

Name and contact information of LCA

practitioner: LCA study was carried out by e3 studio associato di consulenza, info@ecubo.it

Content declaration

Aquafire

Materials / chemical substances	%	Environmental / hazardous properties
Portland cement	23-33%	H315, H318, H317, H335
EPS expanded polystyrene	0,6-1,0%	-
Sand	63-77%	-
Glass fiber mesh	0,9 - 1,3%	-
Chemical agent	0,5-1,1%	-

Supersil

Materials / chemical substances	%	Environmental / hazardous properties
Portland cement	5-13%	H315, H318, H317, H335
Expanded perlite	3-7%	-
Sand *	1-8%	-
Glass fiber	1,2-1,5%	-
Calcium-based mineral	65-75%	-
Glass fiber mesh	0,3-1,3 %	
Glass fiber matte	0,3-0,65 %	

* the sand can be replaced by internal recovery aggregates

Both products don't contain substances listed in the "Candidate List of Substances of Very High Concern for Authorisation over 0,1%".

Packaging

Consumer and distribution packaging: the products are distributed on pallets, packaged with cardboard corners and metal straps.

Recycled material

In both products there is material deriving from the recycling of internal cuts from cutting, in a variable percentage between 6 and 12%.

Environmental performance: Aquafire

Potential environmental impact

1 m2 Aquafire	Unit	A1	A2	A3	Total
Global Warming potential (GWP)	kg CO2 eq	4,77	0,08	0,05	4,91
Formation potential of tropospheric ozone (POCP)	kg C2H4 eq	6,18E-04	1,30E-05	1,03E-05	6,42E-04
Acidification potential (AP)	kg SO2 eq	0,0129	0,0003	0,0001	0,0134
Eutrophication potential (EP)	kg PO4---eq	3,83E-03	7,25E-05	7,65E-05	3,98E-03
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq	2,16E-07	1,53E-08	3,25E-09	2,35E-07
Abiotic depletion potential – Elements	kg Sb eq	5,46E-06	1,50E-07	3,02E-07	5,91E-06
Abiotic depletion potential – Fossil resources	MJ	36,6	1,3	0,4	38,3

Use of resources

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Non Renewable	Use as energy carrier	MJ, net calorific value	31	1	0	33
	Used as raw materials	MJ, net calorific value	10	0	0	10
	TOTAL	MJ, net calorific value	41	1	0	43
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	5	0	0	5
	Used as raw materials	MJ, net calorific value	0	0	1	1
	TOTAL	MJ, net calorific value	5	0	1	6
Secondary material		kg	0	0	0	0
Renewable secondary fuels		MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	0	0	0	0
Net use of fresh water		m ³	6,4	0,1	0,2	6,7

Waste production

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	2,6E-05	7,4E-07	7,6E-07	2,8E-05
Non-hazardous waste disposed	kg	0,17	0,11	0,01	0,29
Radioactive waste disposed	kg	1,2E-04	8,7E-06	1,8E-06	1,3E-04

Environmental performance: Supersil

Potential environmental impact

1 m2 Supersil 6 mm	Unit	A1	A2	A3	Total
Global Warming potential (GWP)	kg CO2 eq	2,04	0,09	0,63	2,76
Formation potential of tropospheric ozone (POCP)	kg C2H4 eq	4,96E-04	1,47E-05	1,83E-05	5,28E-04
Acidification potential (AP)	kg SO2 eq	0,0092	0,0004	0,0002	0,0097
Eutrophication potential (EP)	kg PO4---eq	2,55E-03	8,22E-05	7,25E-05	2,70E-03
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq	2,31E-07	1,74E-08	2,02E-09	2,50E-07
Abiotic depletion potential – Elements	kg Sb eq	4,10E-06	1,71E-07	3,13E-07	4,59E-06
Abiotic depletion potential – Fossil resources	MJ	28,3	1,4	0,2	29,9

1 m2 Supersil 9 mm	Unit	A1	A2	A3	Total
Global Warming potential (GWP)	kg CO2 eq	2,90	0,12	0,89	3,92
Formation potential of tropospheric ozone (POCP)	kg C2H4 eq	6,80E-04	2,04E-05	2,56E-05	7,26E-04
Acidification potential (AP)	kg SO2 eq	0,0132	0,0005	0,0003	0,0139
Eutrophication potential (EP)	kg PO4---eq	3,58E-03	1,14E-04	9,81E-05	3,79E-03
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq	3,27E-07	2,42E-08	2,88E-09	3,54E-07
Abiotic depletion potential – Elements	kg Sb eq	5,51E-06	2,39E-07	3,27E-07	6,08E-06
Abiotic depletion potential – Fossil resources	MJ	39,9	2,0	0,3	42,2

1 m2 Supersil 12mm	Unit	A1	A2	A3	Total
Global Warming potential (GWP)	kg CO2 eq	3,62	0,15	1,20	4,98
Formation potential of tropospheric ozone (POCP)	kg C2H4 eq	8,10E-04	2,52E-05	3,35E-05	8,69E-04
Acidification potential (AP)	kg SO2 eq	0,0165	0,0006	0,0003	0,0174
Eutrophication potential (EP)	kg PO4---eq	4,39E-03	1,41E-04	1,24E-04	4,66E-03
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq	4,17E-07	2,98E-08	3,67E-09	4,50E-07
Abiotic depletion potential – Elements	kg Sb eq	6,48E-06	2,95E-07	3,40E-07	7,12E-06
Abiotic depletion potential – Fossil resources	MJ	50,6	2,4	0,4	53,5

Use of resources

Supersil 6 mm		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Non Renewable	Use as energy carrier	MJ, net calorific value	31	1	0	32
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	31	1	0	32
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	6	0	0	6
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	6	0	0	6
Secondary material		kg	0	0	0	0
Renewable secondary fuels		MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	0	0	0	0
Net use of fresh water		m ³	4,2	0,1	0,1	4,4

Supersil 9 mm		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Non Renewable	Use as energy carrier	MJ, net calorific value	43	2	0	46
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	43	2	0	46
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	8	0	0	8
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	8	0	0	8
Secondary material		kg	0	0	0	0
Renewable secondary fuels		MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	0	0	0	0
Net use of fresh water		m ³	5,9	0,1	0,1	6,1

Supersil 12 mm		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Non Renewable	Use as energy carrier	MJ, net calorific value	55	2	0	58
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	55	2	0	58
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	9	0	0	9
	Used as raw materials	MJ, net calorific value	0	0	1	1
	TOTAL	MJ, net calorific value	9	0	1	9
Secondary material		kg	0	0	0	0
Renewable secondary fuels		MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	0	0	0	0
Net use of fresh water		m ³	7,4	0,1	0,2	7,7

Waste production

Supersil 6 mm	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	1,1E-02	8,4E-07	4,5E-07	1,1E-02
Non-hazardous waste disposed	kg	0,12	0,12	0,01	0,25
Radioactive waste disposed	kg	6,4E-05	9,8E-06	1,2E-06	7,5E-05

Supersil 9 mm	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	1,3E-02	1,2E-06	5,9E-07	1,3E-02
Non-hazardous waste disposed	kg	0,17	0,17	0,01	0,35
Radioactive waste disposed	kg	9,0E-05	1,4E-05	1,6E-06	1,1E-04

Supersil 12 mm	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	1,1E-02	1,4E-06	7,1E-07	1,1E-02
Non-hazardous waste disposed	kg	0,21	0,21	0,01	0,42
Radioactive waste disposed	kg	1,1E-04	1,7E-05	2,0E-06	1,3E-04

Additional information

Emission of Volatile Organic Compounds (VOC) using testing chamber method according to standard UNI EN ISO 16000-9:2006 and classification "Décret n° 2011-321 du 23 mars 2011" and "Arrêté del 19/04/2011"):

- *Aquafire: Emission class A+ (TEST REPORT No. 340720 Istituto Giordano)*
- *Supersil: Emission class A+ (TEST REPORT No. 340041 Istituto Giordano)*

References

General Programme Instructions of the International EPD® System. Version 2.5., CONSTRUCTION PRODUCTS AND CONSTRUCTION SERVICES, 2012:01, VERSION 2.3

Rapporto LCA Bifire rev.1, 09/05/2019

ecoinvent v. 3.5, November 2018, www.ecoinvent.org

