

**OBJECT: LAMINAM – adhesion performance of the glassfiber reinforcement**

Laminam SpA manufactures multilayered slabs, composed by one or two ceramic slabs and a glassfiber:

- Laminam 3+ Porcelain ceramic slab (nominal thickness 3mm) with reinforcement glassfiber applied onto the backside;
- Laminam 5+ Porcelain ceramic slab (nominal thickness 5.6mm) with reinforcement glassfiber applied onto the backside;
- Laminam 7 Sandwich (nominal thickness 7mm) made of two Laminam 3 slabs with a fiberglass mat placed between them. The front surfaces are turned in the same direction. Hence, the backside of the lower slab is also the backside of Laminam 7;
- Laminam 3+3 Sandwich (nominal thickness 7mm) made of two Laminam 3 slabs with fiberglass matting placed between the two slabs and front surfaces, turned to opposite directions. Consequently both surfaces of Laminam 3+3 turn out to be frontal;
- Laminam 5+3 Sandwich (nominal thickness 8mm) made of Laminam 5 and Laminam 3 slabs with a fiberglass mat placed between the two slabs. The front surfaces of the slabs are turned to the same direction. Hence, the backside of the lower slab is also the backside of Laminam 5+3.

Laminam SpA applies the glassfiber as a reinforcement onto the back side of the ceramic slab or between two layers of ceramic slabs with a controlled and automatic process, which allows to obtain high quality standards, verified by internal control procedure, and repeatability and consistency of product performance (process conforming to ISO 9001).

The evaluation of the final adhesion performances of the applied glassfiber and the maintenance of this performance were verified before and after several conditioning cycles. The conditionings were selected as extreme conditions, simulating the worse conditions which Laminam products may undergo during the life of use of the final application, especially outdoor.

<b>Conditionings</b>	
28 d at 23°C (73,4 °F)	Standard condition
20 d at 50°C (122 °F)	Exposure to high temperature
41 d at 50°C (122°F)	
14 d at 70°C (158 °F)	
1 d at 80°C (176 °F)	Immersion in water
20 d in water	
21 d in water + 25 cycles -15/+15°C (5/+59 °F)	Immersion in water + Freeze/thaw
1 d at -20°C (-4°F)	
1 d at -40°C (-40°F)	Exposure to low temperatures
7 d in 3%NaCl solution	
7 d in pH=3 solution	
7 d in pH=13 solution	Immersion in basic solution

The test report confirms the good adhesion between the components making up the products mentioned: the adhesion resistance does not have any decrease after each conditioning cycle compared to the standard conditions.

The minimum value of adhesion resistance measured during the test is 2 N/mm<sup>2</sup> (average value); this value is confirmed even after each conditioning cycle.

We take as a comparison 1 N/mm<sup>2</sup>, which is the pull out resistance of C2-class cementitious adhesives, the pull out resistance of suitable plaster for exterior cladding and the average pull out resistance of structural adhesives, indicated in the principle international standards.


The complete test campaign was followed and reported by Istituto Giordano SpA (test reports n° 323607, 323622, 323623 and 323624), as an external Laboratory.

Sure to have communicated in the best technical information, we remain at your disposal for any further information.

Best regards

Laminam SpA  
Project Management

## ATTACHMENTS: frontispiece of test report about adhesion glass fiber onto Laminam slab after aging



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REA: vs0332AA (RN) 156766  
Registro Imprese di Rimini n. 00549540489

**TECHNICAL REPORT No. 323624**

**Place and date of issue:** Bellaria-Igea Marina - Italy, 09/04/2015  
**Customer:** LAMINAM S.p.A. - Via Ghiarola Nuova, 258 - 41042 FIORANO MODENESE (MO) - Italy  
**Application date:** 26/11/2014  
**Order number and date:** 65073, 09/12/2014  
**Date sample received:** from 16/12/2014 to 10/02/2015  
**Test date:** from 16/12/2014 to 17/03/2015  
**Purpose:** audit report of pull tensile force and peel resistance testing of fibre-reinforced ceramic panels  
**Test site:** adhesive supplier's in-house laboratory and Istituto Giordano S.p.A. - Via Erbosca, 74 - 47043 Gatteo (FC) - Italy  
**Sample origin:** sampled and supplied by the Customer  
**Identification of sample received:** No. 2015/0232

**Sample name\***

The types of panel tested are called LAMINAM 3+, LAMINAM 5+ and "LAMINAM 5+3".


**Description of sample\***

The test sample comprises 3 types of panel:  
 - LAMINAM 3+ porcelain panel, nominal thickness 3 mm, with fibreglass reinforcement applied to the back using special adhesive;

(\* according to that stated by the Customer.

Comp. AV	This technical report consists of 14 sheets and 3 annexes.	Sheet
Revis. MN	This document is the English translation of the technical report No. 323624 dated 09/04/2015 issued in Italian; in case of dispute the only valid version is the Italian one. Date of translation: 13/05/2015.	1 of 14

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**TEST REPORT No. 323607**

**Place and date of issue:** Bellaria-Igea Marina - Italy, 09/04/2015  
**Customer:** LAMINAM S.p.A. - Via Ghiarola Nuova, 258 - 41042 FIORANO MODENESE (MO) - Italy  
**Date test requested:** 26/11/2014  
**Order number and date:** 64985, 27/11/2014  
**Date sample received:** 10/02/2015  
**Test date:** 17/03/2015  
**Purpose of test:** peel resistance of a fibre-reinforced porcelain panel  
**Test site:** Istituto Giordano S.p.A. - Via Erbosca, 72 - 47043 Gatteo (FC) - Italy  
**Sample origin:** sampled and supplied by the Customer  
**Identification of sample received:** No. 2015/0232

**Sample name\***

The test sample is called "LAMINAM 3+".


**Description of sample\***

The test sample comprises porcelain panels, nominal thickness 3 mm, with fibreglass reinforcement applied to the back using special adhesive.  
 The panels are mainly used as cladding for ventilated rainscreens with various fixing systems: to this end, the porcelain panel's reinforced backing protects against fallout in the event of breakage.

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**TEST REPORT No. 323622**

**Place and date of issue:** Bellaria-Igea Marina - Italy, 09/04/2015  
**Customer:** LAMINAM S.p.A. - Via Ghiarola Nuova, 258 - 41042 FIORANO MODENESE (MO) - Italy  
**Date test requested:** 26/11/2014  
**Order number and date:** 64985, 27/11/2014  
**Date sample received:** 10/02/2015  
**Test date:** 17/03/2015  
**Purpose of test:** peel resistance of a fibre-reinforced porcelain panel  
**Test site:** Istituto Giordano S.p.A. - Via Erbosca, 72 - 47043 Gatteo (FC) - Italy  
**Sample origin:** sampled and supplied by the Customer  
**Identification of sample received:** No. 2015/0232

**Sample name\***

The test sample is called "LAMINAM 5+".


**Description of sample\***

The test sample comprises porcelain panels, nominal thickness 5,6 mm, with fibreglass reinforcement applied to the back using special adhesive.  
 The panels are mainly used as cladding for ventilated rainscreens with various fixing systems: to this end, the porcelain panel's reinforced backing protects against fallout in the event of breakage.

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**TEST REPORT No. 323623**

**Place and date of issue:** Bellaria-Igea Marina - Italy, 09/04/2015  
**Customer:** LAMINAM S.p.A. - Via Ghiarola Nuova, 258 - 41042 FIORANO MODENESE (MO) - Italy  
**Date test requested:** 26/11/2014  
**Order number and date:** 64985, 27/11/2014  
**Date sample received:** 10/02/2015  
**Test date:** 17/03/2015  
**Purpose of test:** pull tensile force of a fibre-reinforced porcelain sandwich panel  
**Test site:** Istituto Giordano S.p.A. - Via Erbosca, 72 - 47043 Gatteo (FC) - Italy  
**Sample origin:** sampled and supplied by the Customer  
**Identification of sample received:** No. 2014/2611

**Sample name\***

The test sample is called "LAMINAM 5+3".

**Description of sample\***

The test sample is a composite formed by two porcelain panels, respective nominal thickness 5,6 mm and 3 mm, bonded to a reinforcing interlayer of fibreglass using a special adhesive.  
 The fibreglass reinforcement is bonded using an automated industrial process guaranteeing high standards of quality that are monitored by internal inspections of individual production batches, along with repeatability and constancy of performance of the product (process complying with ISO 9001).

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