Walls

IBMB

Official Testing Institute for the Building Industry
The Institute for Building Materials, Solid Building and Fire Prevention
Director: H. Falkner, Prof. Dr. B/Eng

Express Letter
EUROMAC 2
Carreau de la mine B.P. 22
F - 57730 Folschviller
France

Your Reference	Your Message from	Our Reference	Official	Tel Ext.	Date
mdl.	08.04.2004	49/Nau/Ma	H.Nause	-5475	14.04.2004

Fire prevention regulation evaluation of MM 100 walls, made from Styrofoam building blocks, connected to each other by metal struts with a 16cm thick reinforced concrete casing, with regard to classification in the fire resistance class F90

Dear Sir/Madam

Referring to the testing completed in 1993 on fire prevention regulation for MM 100 walls. These MM 100 walls are made from basic 45 mm thick polystyrene building blocks and are connected together by metal struts (Sheet thickness 1mm). The distance between both polystyrene partitions is 16cm. The polystyrene building blocks are embossed on three sides so that they fit together like a model, building both upwards and side wards. The cavity between the partitions is effused with 16cm thick supporting concrete. Further construction details for the MM 100 walls are contained in enclosure 1 with this letter.

In respect to fire prevention regulations, the polystyrene building block can be looked on as casing or shuttering. This means that the boundary conditions of a classification in the fire prevention class F 90 can be furnished, due to the 160mm thick reinforced concrete core of the wall. There are no reservations about classifying the MM 100 walls according to DIN standard 4102, pt.4, and table 35, edit.1993. It follows from this that in consideration of the

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classification of supporting walls in the fire prevention class F 90, at least 140mm thick walls with a saturation factor of α = 1.0 are necessary, opposite an existing continuing wall of 160mm. The metal struts with sheet thickness of 1.0 mm do not affect the existing wall thickness sufficiently for there to be any problem with classification in the fire prevention class F 90- designation F90-AB.

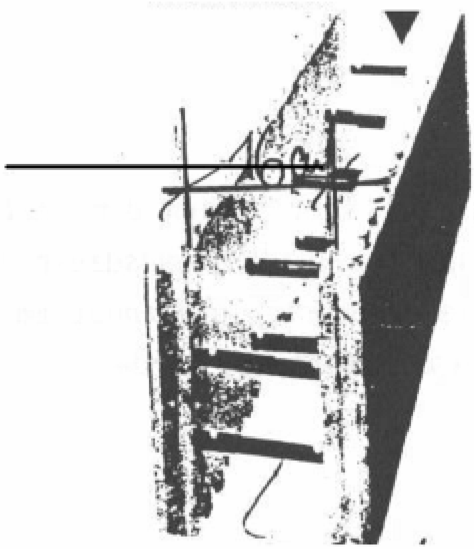
Particular Details

The afore said evaluation applies only in the case where supporting and load bearing building structures can endure fire resistance for at least 90 minutes. The validity of this evaluation ends on 14.01.2005. An extension of this period of validity can then be applied for.

Kind Regards,

Dip. Eng. Nause

Enclosure 1 to letter 49/Nau/Ma



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Frauenhof Institute for Building Physics

Head of Institute: Karl A. Gertis Prof. Dr. B/Eng

Officially recognised test station for the approval of new building materials, building parts and building methods.

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Calculation of the equivalent heat conductivity, heat resistance and heat transmission co-efficiency of masonry made from Expanded Polyurethane (EPS) hard foam elements

Applicant: EUROMAC 2 S.àr.l
B.P. 22
F - 57730 Folschviller/France

1. Task

The Frauenhof Institute for Building Physics were commissioned by the applicant to calculate the equivalent heat conductivity, heat resistance and heat transmission co-efficiency of masonry made from EPS hard-foam elements, type "M 100" (normal block) with concrete filling. The calculation was made using a three-dimensional Finite-Difference mathematical method.

2. Description of the element and the masonry

The basic construction elements are 1000mm long, 340mm wide and 300mm high EPS foam structures, each with 4 integrated cavities that measure 174mm x 152mm. In between each, there are two supporting struts, with a diameter of 4mm. The elements are braced consecutively and form the cross section norm of the outer wall. Figure 1 shows a photographic view of an EPS basic construction element. Figure 2 is a plan view of this element.

3. Calculation Process

3.1 The calculations were made using a three-dimensional fixed Finite-Difference method described in [1].

3.2 Material Values

The heat conductivity of EPS hard-foam elements was measured as 0.035 W/ (m · K) (see [2]). For the remaining components of the masonry, the results of the heat conduction calculations were:

Heavy Concrete Filling	2.1 W/ (m · K)
Reinforcement Steel	60 W/ (m · K)
Plaster Beam Facing	0.7 W/ (m · K)

By the investigation of heat transmission co-efficiency (K value) in addition, an inner plaster 15mm thick gave a 0.7 W/ (m · K) of heat conductivity and a 20mm thick outer plaster resulted in 0.87 W/ (m · K) of heat conductivity.

3.3 Limiting Conditions

As limiting conditions, air temperatures and heat transmission co-efficiency on both sides of the masonry were limited as follows:

Internal Air Temperature	20 ^{0}C
External Air Temperature	0 ^{0}C
External Heat Transmission Co-efficiency	23 W/ (m^2 · K)
Internal Heat Transmission Co-efficiency	8 W/ (m^2 · K)

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3.4 Calculation Results

The calculation resulted in the following findings:

Equivalent Heat Conduction of Masonry:

$$\Lambda eq = 0.070 \quad W/(m \cdot K)$$

Heat Transmission Resistance of Masonry:

$$1/\Lambda \; 4.87 \; m^2 \cdot K/W$$

Heat Transmission Co-efficiency (K value) of the wall with internal and external plaster

$$k_W = 0.20 \; W/(m^2 \cdot K)$$

In the unit Kcal / (m · h · grd), accounting for the conversion factor 1 W/ (m^2 · K) = 0.860 kcal / (m^2 · h · grd) of heat transmission co-efficiency

Heat resistance of masonry
(Without layer of plaster):

$$1/\Lambda = 5.66 \; m^2 \cdot h \cdot grd/kcal$$

And heat transmission co-efficiency
(With layer of plaster):

$$k_W = 0.17 \; kcal/(m^2 \cdot h \cdot grd)$$

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5. Literature

[1] Koenig, N., G. and Schule, M.: The effect of measurement and cavity building from hollow building blocks on the heat insulation of masonry made from pumice building materials. Research carried out under the commission of the Research Association of Rheine Pumice Industry (Rheinisvhen Bimindustrie e.V Neuwied (1984). Report BW 171/84 of the Frauenhof Institute for Building Physics (1984).

[2] Test report P1-473/ 1993 of the Frauenhof Institute for Building Physics from October 28.1993 about the appropriateness of heat conduction according to DIN regulation 52 612 (slab equipment) from EPS slabs, manufactured from EPS casing stones.

This test report consists of 4 pages and 2 figures.

Stuttgart, 06.Feb. 1995

Frauenhofer Institute for Building Physics P7-474/1993

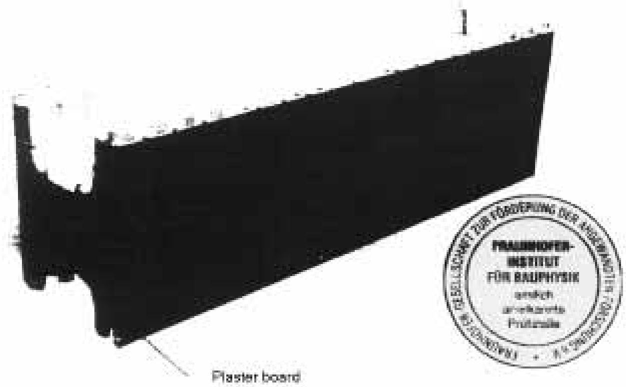

Figure 1 Photographic view of Styropor construction element Type M 100/25 with external plaster board. Euromac2, S.a.r.L. F-57730 Folschviller/France.

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Airborne sound absorption of an outer wall in accordance with DIN standard 52 210

Applicant: EUROMAC 2
Carreau de la mine B.P. 22
F - 57730 Folschviller
France

1. Place and Date of Measurement

The measurement was carried out on Oct.15.1993 in the Schreer family home in Rosbruck.

2. Test Matter

Outer wall without window (see figure 1)

Assembly of the outer wall (from outside in):

18mm Base plaster

45 mm Styropor hard foam (Gross density unknown)

160 mm Reinforced concrete

45 mm Styropor hard foam (Gross density unknown)

18 mm Gypsum plaster (cement plaster)

Flagstone casing

Area related mass approx. 420 kg/m^2

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3. Test Benches

The bathroom, (throughout the test, referred to as the reception room) used for the reading, had a volume of approx. $24m^3$. The wall for testing had an area of $10m^2$.

Accompanying Building Parts

Outer wall: As tested outer wall

Inner wall: As outer wall

Floor: Flagstone casing

45 mm	Cement coating
50 mm	Pressure plate made from reinforced concrete with steel mat padding
160 mm	Polystyrene hard foam hollow components EUROMAC 2

Individual width 0.6 m, in between, reinforcement beams and bracing, filled with concrete as far as the lower edge of the pressure plate

10 mm Plasterboard

Ceiling: As floor

4. Test Method

The measurement was carried out in accordance with DIN standard 52 210, pt.1, Edit.1984 and pt. 5, Edit. 1985.

The calculation of the airborne sound absorption was carried out in accordance with DIN standard 52 210, pt.4, Edit. 1984

Test sounds were third sounds. A box with directed sound irradiation was used as a loudspeaker. The loudspeaker box was placed at a distance of about 5m away at an angle of 45^0 to the outer wall area – standing normally.

The distance of the microphone from the external side of the outer wall was 1cm. With a microphone and a third octave band filter connected, the spatial and temporal sound pressure levels were taken, at different measuring points in the room. The airborne sound measurement was calculated in the following way.

$$R'ς = L_1 - L_2 + 101g \frac{S. \cos g}{A} dB$$

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Where these symbols are equal to:

$R'\varsigma$	=	Airborne Sound Measurement
L_1	=	Sound level on the surface of the test object
L_2	=	Sound level in room
S	=	Area of the test object
A	=	Equivalent sound absorption area in room, determined from Reverberation period measurements
ς	=	Sound angle of incidence

5. Measurement Results

The values of the sound absorption measurement are dependant on the frequency illustrated in figure 2. The estimated sound absorption measurement amounted to:

$$R'\varsigma_{w} = 44dB$$

The test report consists of 4 pages and 2 figures. Publication of extracts is only permitted with written approval from the Frauenhof Institute for Building Physics.

Stuttgart, 15\03\1994

Originator — Test Centre and Department
Manager

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Frauenhof Insitute for Building Physics

P-BA 55/ 1994

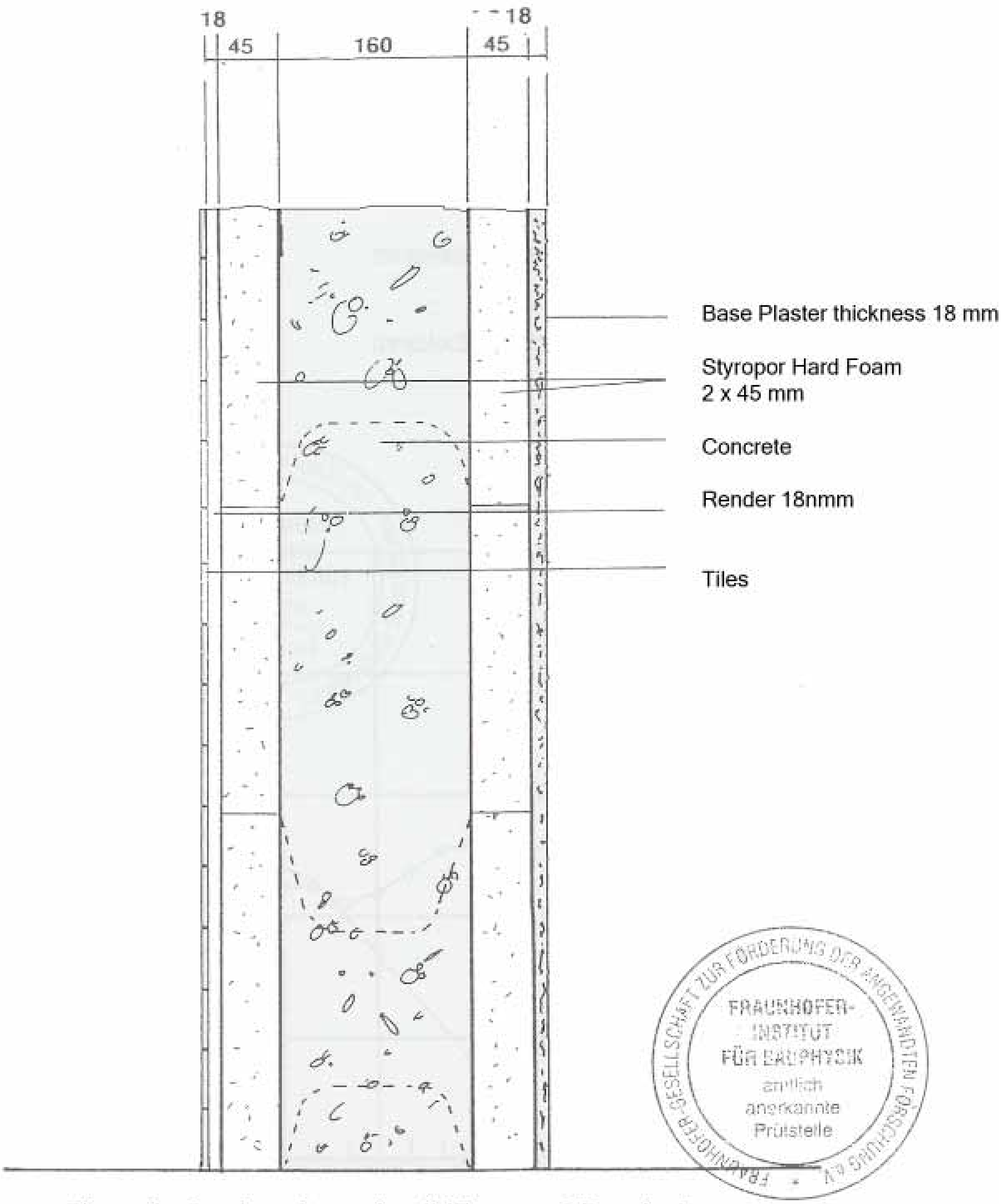

Figure 1 - Section of tested wall (Euromac2 Drawing)

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Sound Absorption Measure according to DIN 52 210 Section 5 Applicant: Euromac2 F - 57 730 Folschviller	P-BA 5/1994 Figure 2 Quality Testing

Test Object

Outer wall without window (see figure 1)

Assembly of outer wall (from outside to in)

18 mm Base render
45 mm Styropor hard foam (gross density unknowen)
160 mm Reinforced concrete
45 mm Cement plaster
Flagstone casing / tiling
Area related mass approx.420 kg/m2

Test Area - 10.00 m2

Test Room
Volume - Vs = -- m3
Ve = 24 m3

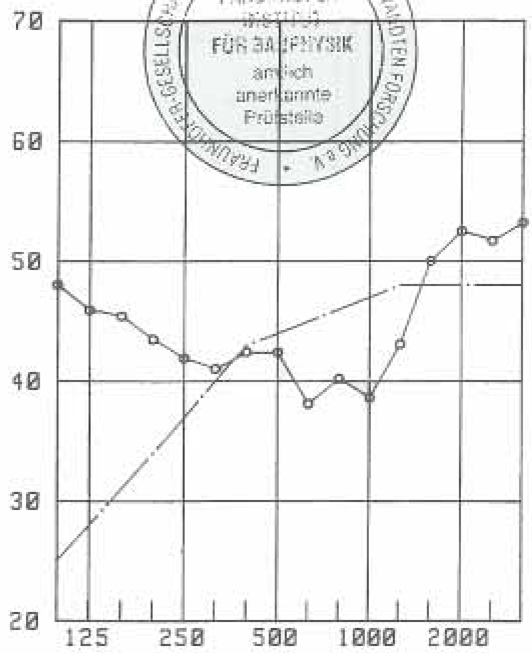
Type: Bathroom
Condition: Furnished

Test Sound Third Sounds

Test Method
DIN 52 210-05-LA-N
Test Date: Oct 15th 1993

Assesed Sound Aborption

R'ש,W = 44 dB



Stuttgart May 15th 1994	Fraunhofer - Institut für Bauphysik Test Center Manager i.V. [signature]

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