



ACKNOWLEDGEMENTS ON BEHALF OF ITALIAN MINISTRIES:

- Law 1086/71 issued with Ministerial Decree dated 27/11/82 no.22913 "Tests performed on construction materials".
- Legal Decree 21/07/06 "CE Certification for recreational units".
- Ministerial Decree 04/08/94 "EEC Certification for machinery".
- Notice no. 757890 dated 15/12/98 "EEC Certification for gas equipment".
- Ministerial Decree 09/07/93 "EEC Certification for simple pressurised containers".
- Ministerial Decree 08/07/93 "EEC Certification regarding toy safety".
- Safety and product conformity inspection tasks for market surveillance and consumer protection.
- Ministerial Decree 02/04/98 "Issuance of certificates of conformity for the energy characteristics and performance of buildings and systems".
- Law 818/84 and Ministerial Decree 26/03/85 with authorisation dated 21/03/86 "Testing for reaction to fire according to Ministerial Decree 26/06/84".
- Law 818/84 and Ministerial Decree 26/03/85 with authorisation dated 03/07/92 "Testing for resistance to fire according to ministerial memorandum no.7 dated 02/04/91 directive CNVVF/CCI UNI 9723".
- Law 818/84 and Ministerial Decree 26/03/85 with authorisation dated 08/02/08 "Testing for resistance to fire according to Ministerial Decree 21/06/04 and Ministerial Decree 16/02/07".
- Law 46/82 with Ministerial Decree 09/10/85 "insertion within the registry of laboratories authorised to perform applicative research in favour of small and medium industries".
- Protocol no.116 dated 27/03/87 "Enrolment in the National research Catalogue Archive with code no. E0490Y9Y".
- Legal Decree 24/05/02 "EC Certification of compliance for pressurised equipment".
- Legal Decree 13/12/04 "Certification of conformity for mobile pressurised equipment".
- Legal Decree 14/02/02 "EC Certification of conformity for environmental noise emissions of machinery and equipment".
- Legal Decree 05/02/03 "Performance of the evaluation procedures for the conformity of marine equipment".
- Legal Decree 17/09/04 "EC Certification for elevators and safety components".
- Notice for conformity certification activities with regards to the harmonised standards of the 89/106/EC Directive regarding construction materials.
- Legal Decree 20/01/05 "Inspections on medical devices".
- Legislative Decree 02/02/07 no. 22 "Certification based on Directive 2004/22/EC (MID) for single and tri-phase alternating current (a.c.) electrical energy meters and volumetric membrane gas meters".
- Legal Decree 11/09/07 "EC Certification for personal protection equipment".
- Legal Decree 10/12/07 no.218 "Production process certification for cement conglomerate product manufactured through industrial processes".

ACKNOWLEDGEMENTS ON BEHALF OF THIRD PARTY INSTITUTES:

- SINCERT: Accreditation no. 057A dated 19/02/00 "Quality management systems certification institute" e.n. 082B dated 12/04/06 "Product certification institute".
- SIT: Multi-branch Accreditation Centre no.20 (Bellaria - Pomezia) for thermometric and electric magnitude.
- ICIM: "Laboratory tests in field of product certification schemes".
- IMQ: "Laboratory tests in the field of product certification schemes for chimney flues".
- UNCSAAL: Acknowledgement dated 26/03/95 "UNCSAAL certification testing laboratory for locking mechanisms and continuous facades".
- KEYMARK for thermal insulation: "Thermal conductivity measurements for insulation materials".
- IFT: "Laboratory tests and in-house company monitoring in the field of product certification schemes for doors, windows, shutters (anti-theft) and locks".
- EFSG: "Laboratory tests on safes and other safekeeping devices".
- AENOR: "Evaluation of conformity for CE marking purposes for some products inherent to the construction products directive".
- VTT - Finland: "Evaluation of conformity for CE marking purposes for some products inherent to the construction products directive".
- C.C.I.A.A. Rimini: 28/01/04 "Periodic check of the metrological reliability of measurement devices in commercial contexts".
- FBT/VKF - Switzerland "Reference laboratory for the fire resistance testing of building components".

CLAUSES

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TEST REPORT NO. 261365

Place and date of issue: Bellaria-Igea Marina – Italy, 23/10/2009

Customer: EMMEDUE S.p.A. – Via Toniolo, 39/B – 61032 FANU (PU)

Test request date: 30/09/2009

Order number and date: 46699, 13/10/2009

Date of testing: 20/10/2009

Purpose of the test: To determine the normalised acoustic insulation with respect to the reverberation time for external dividing walls according to the UNI EN ISO 140-5:2000 and UNI EN ISO 717-1:2007 directives.

Testing location: Residential building – Via Case Nuove – 61041 Acqualagna (PU) – Italy

Sample denomination *.

The panels utilised for building the sample which was subjected to the test are denominated "EMMEDUE PDM 150 5+5".



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This test report is made up of 9 pages.

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Description of the sample.

The sample subjected to testing consisted in the external wall of the residential building, built from double “EMMEDUE PDM 150 5+5” panels, with the size characteristics shown in the table below.

Width	3600 mm
Maximum height	4950 mm
Minimum height	3980 mm
Thickness	300 mm
Useful acoustic surface	16.07 m ²

The “EMMEDUE PDM 150 5+5” panel is specifically made up of the following elements, starting with the surface which is exposed to the noise:

- a layer of plaster in cement mortar, with an average thickness of 25 mm;
- a slab of self-extinguishing polystyrene, with a density of 30 kg/m³ and a thickness of 50 mm, corrugated on the side to be plastered and fitted with:
 - a galvanized steel wire mesh on the external portion of the side for the application of plaster, made from longitudinal wires with a diameter of 2.5 mm, set at intervals of 70 mm, and transversal wires with a diameter of 2.5 mm, set at intervals of 70 mm;
 - a galvanized steel wire mesh on the internal portion of the side of the central concrete divider made from longitudinal wires with a diameter of 5 mm, set at intervals of 100 mm, and transversal wires with a diameter of 5 mm, set at intervals of 280 mm;
- a central concrete divider, with an average thickness of 150 mm;
- a slab of self-extinguishing polystyrene, with a density of 30 kg/m³ and a thickness of 50 mm, corrugated on the side to be plastered and fitted with:
 - a galvanized steel wire mesh on the external portion of the side for the application of plaster, made from longitudinal wires with a diameter of 2.5 mm, set at intervals of 70 mm, and transversal wires with a diameter of 2.5 mm, set at intervals of 70 mm;



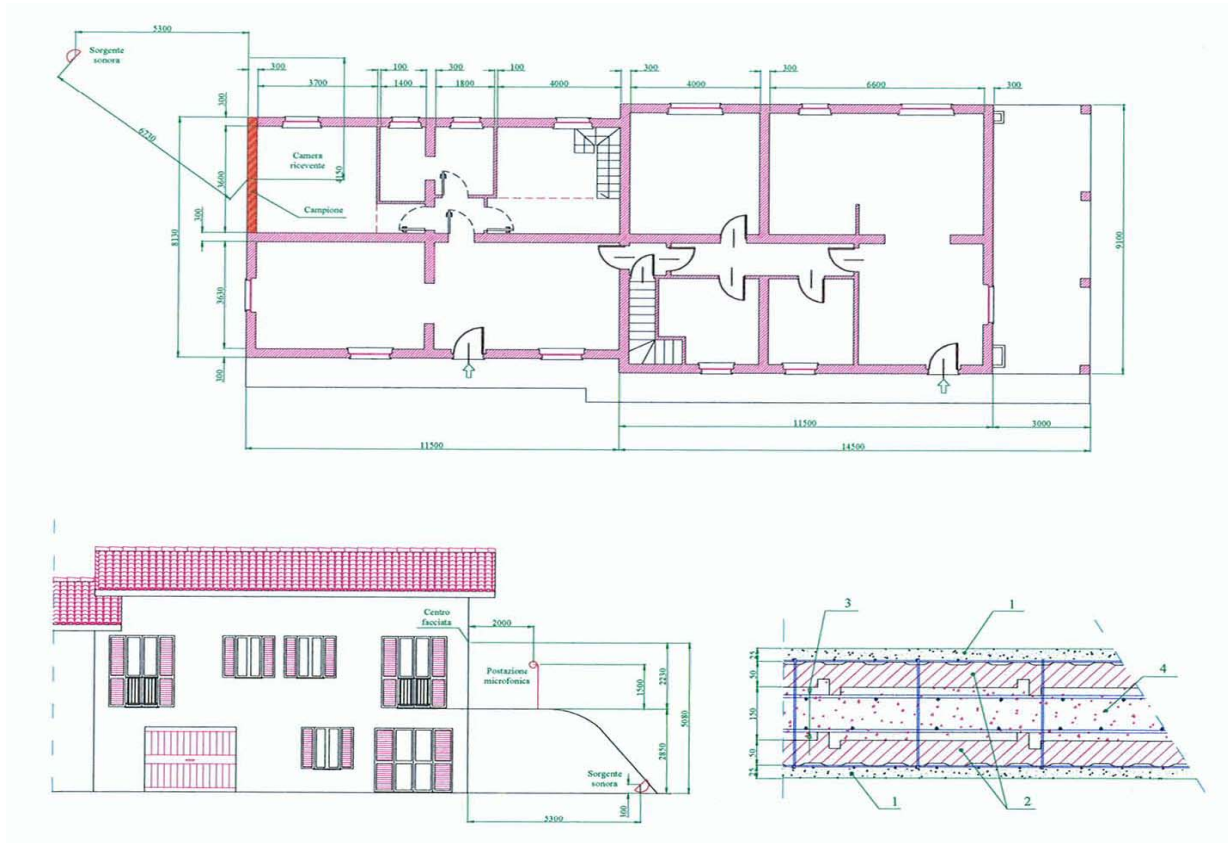
- a galvanized steel wire mesh on the internal portion of the side of the central concrete divider made from longitudinal wires with a diameter of 5 mm, set at intervals of 100 mm, and transversal wires with a diameter of 5 mm, set at intervals of 280 mm;
- a layer of plaster in cement mortar, with an average thickness of 25 mm.

The mesh on the external portion was interconnected with 3 mm diameter wires, with an application frequency of 70 wires/m², while the mesh on the internal portions was interconnected with 3 mm diameter wires, with an application frequency of 70 wires/m².



Photograph of the building's external façade. **Photograph of the receiving chamber.**

**FLOOR PLAN OF THE RESIDENTIAL BUILDING'S
GROUND FLOOR HIGHLIGHTING THE DIVIDING WALL
WHICH WAS SUBJECTED TO TESTING, AS WELL AS THE
CROSS SECTION OF THE DIVIDING WALL ITSELF**



Legend

Symbol	Description
1	Layer of plaster in cement mortar, with an average thickness of 25 mm
2	Slab of self-extinguishing polystyrene, with a density of 30 kg/m^3 and a thickness of 50 mm, corrugated on the side to be plastered
3	Internal mesh
4	Central concrete divider, with an average thickness of 150 mm



Normative references.

The test was performed according to the requirements of the following standards:

- UNI EN ISO 140-5:2000 dated 31/10/2000 “Acoustics - Measurement of Sound Insulation in Buildings and of Building Elements - Field Measurements of Airborne Sound Insulation of Facade Elements and Facades”;
- UNI EN ISO 717-1:2007 dated 19/07/2007 “Acoustics. Rating of sound insulation in buildings and of building elements. Part 1: airborne sound insulation”.

Testing Equipment

The following equipment was used to perform the test:

- a four-channel real-time analyzer model “SoundBook Quadro 974301.6” manufactured by the company Sinus Messtecnik, serial number 6114;
- a Ø ½” microphone model "MCE 212" manufactured by the company 01 dB Stell, serial number 39566;
- a microphone preamplifier model “PRE 21 S” manufactured by the company 01 dB Stell, serial number 10982;
- a 94 dB – 1000 Hz noise level calibrator model “Cal 21” manufactured by the company 01 dB, serial number 51031017;
- a dodecahedral loudspeaker model “DL 301”, manufactured by the company Look Line;
- a loudspeaker model “FL 301” manufactured by the company Look Line;
- a power amplifier model “D 301” manufactured by the company Look Line;
- required accessories.



Test method.

The global method, with a loudspeaker, was used for the test. The loudspeaker was positioned outside of the building.

The receiving environment was acoustically characterized by the equivalent area of sound absorption.

After positioning the instrumentation, the sound pressure level was read at various frequencies, in the range between 50 Hz and 5000 Hz, both outside, by placing the microphone at 2.0 m from the centre of the facade at a height of 1.5 m from the floor of the receiving chamber, as well as within the receiving chamber itself; in the latter, the reverberation times within the same operating range were also measured.

The evaluation index “ $D_{2m,nT,w}$ ” of the normalized sound insulation, with respect to the reverberation time, was equal to the value in dB of the reference curve at 500 Hz, according to the procedures described by the UNI EN ISO 717-1:2007 standard.

The façade’s normalized sound insulation, with respect to the reverberation time “ $D_{2m,nT}$ ”, was calculated using the following formula:

$$D_{2m,nT} = L_{1,2m} - L_2 + 10 \cdot \log \frac{T}{T_0}$$

Where: $L_{1,2m}$ = the average sound pressure level outside, expressed in dB;

L_2 = the average sound pressure level in the receiving chamber, expressed in dB;

T = the reverberation time in the receiving chamber, expressed in s;

T_0 = the reference reverberation time, equal to 0.5 s.

The average sound pressure levels were corrected for background noise by means of the following relationship:

$$L = 10 \cdot \log \left(10^{\frac{L_{sb}}{10}} - 10^{\frac{L_b}{10}} \right)$$

Where: L_{sb} = the average combined sound pressure level of the signal emitted from the sound source and the background noise, expressed in dB;

L_b = the average background noise sound pressure level, expressed in dB;



if the difference between the levels $[L_{2b} - L_b]$ was less than 6 dB, a maximum correction of 1.3 dB was applied, and the corresponding value of the façade's normalised sound insulation with respect to the reverberation time " $D_{2m,nT}$ " was considered as a limit measurement value.

As proposed by UNI EN ISO 717-1:2007, two corrective terms in dB we also calculated, which take into account the characteristics of particular source sound spectra, namely:

- corrective term " C ", to be summed with the evaluation index " $D_{2m,nT,w}$ ", with a source spectrum relative to pink noise, weighted A;
- corrective term " C_{tr} ", to be summed with the evaluation index " $D_{2m,nT,w}$ ", with a source spectrum relative to traffic noise, weighted A.

Environmental conditions at the time of testing.

Room temperature	15 °C
Relative humidity	50%



Test results.

Microphone positions	1 microphone positioned outside at 2.0 m from the façade and 6 microphones positioned inside the receiving chamber
Sound field generation	Sound source in the square opposite: 0.30 m off the ground and 8.25 m from the centre of the façade, with an incidence angle of 50°

Frequency [Hz]	L_{1,2m} [dB]	L₂ [dB]	T [s]	D_{2m,nT} [dB]	Reference curve [dB]
50	75.7	48.9	7.88	32.6	//
63	77.0	52.5	2.53	31.5	//
80	76.8	54.3	2.46	29.4	//
100	79.2	57.3	2.71	29.2	21.0
125	82.8	55.4	2.77	34.8	24.0
160	83.7	53.1	3.04	38.4	27.0
200	80.6	51.9	2.88	36.3	30.0
250	75.3	49.6	2.34	32.4	33.0
315	80.1	44.5	2.34	42.3	36.0
400	75.8	41.6	1.79	39.7	39.0
500	77.1	43.1	1.54	8.9	40.0
630	79.5	49.4	1.46	34.8	41.0
800	82.	55.6	1.25	30.6	42.0
1000	83.1	52.7	1.30	34.5	43.0
1250	82.7	45.7	1.17	40.7	44.0
1600	80.9	41.3	1.11	43.1	44.0
2000	78.2	31.8	1.13	49.9	44.0
2500	80.6	25.4	1.11	58.7	44.0
3150	76.9	13.4	1.07	66.8	44.0
4000	76.4	8.3	1.07	71.4*	//
5000	71.9	6.0	0.95	68.7*	//

(*) Limit measurement value due to the effect of background noise.





Useful surface area for sample measurement:

16.07 m²

Volume of the receiving chamber:

59.5 m³

Noise type:

Pink

Filter type:

1/3 octave

Test results:

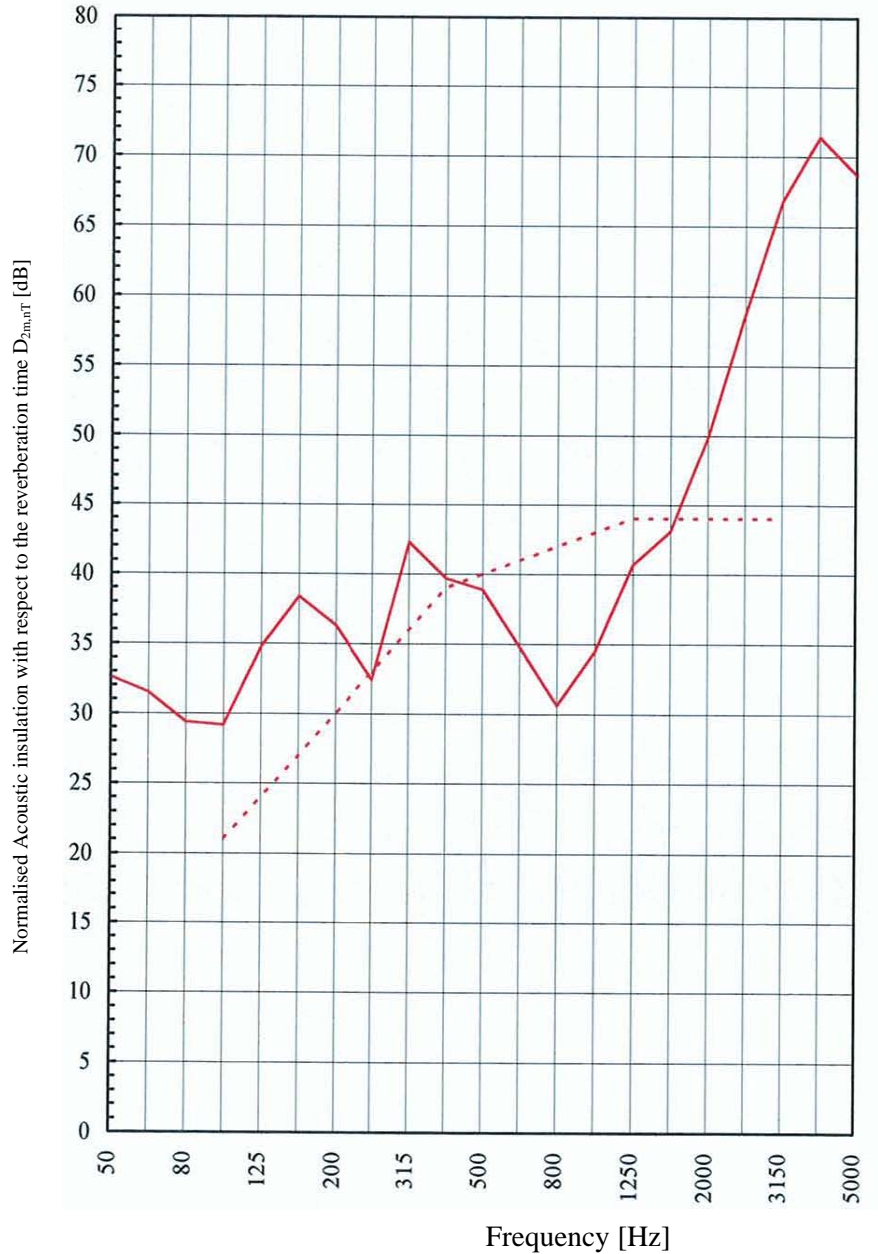
Evaluation index at 500 Hz in the frequency band between 100 Hz and 3150 Hz:

$D^2_{m,nTw} = 40 \text{ dB}$

Correction terms:

$C = -2 \text{ dB}$

$C_{tr} = -4 \text{ dB}$



— Test readings
 Reference curve



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