Certified Translation

NEVOGA GmbH.
Znaimer Strasse 4
D-83395 Freilassing

(Emblem)

MUNICIPALITY OF THE CITY OF VIENNA
MA 39 – VFA
MUNICIPALITY DEPARTMENT 39
TEST AND RESEARCH ESTABLISHMENT OF THE CITY OF VIENNA
founded in1879
ACCREDITED TEST AND MONITORING AUTHORITY
A-1110 Vienna Pinnböckstrasse 15
Phone: (Domestic 01), (International +431) 79514-8039 or DW
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MA 39 – VFA 2001-1278.01

Vienna, September 26th 2001
Round stamp imprint: MUNICIPALITY DEPARTMENT 39/VIENNA/
(Emblem)

# Test Report

**on the**

**Measurement of the airborne sound insulation of a wall made of concrete prefabricated elements with Octagon spacers 25 cm (Spacer seal in two variations)**

| | |
|---|---|
| **Applicant:** | NEVOGA GmbH. |
| **Date of application:** | January 2001 or August 07th 2001 in writing by Mr. J. Mösl |
| **Test Material:** | 25 cm thick concrete prefabricated elements with Octagon spacers 25 cm<br>3 pieces of element: 2.35 m x 1.1 m x 0.25 each with 3 spacers respectively<br>(cover with plug or rubber cork + plug) |
| **Test location:** | Sound Test Rooms of the Test and Research Establishment<br>of the City of Vienna – MA 39-VFA |
| **Order:** | Measurement of airborne sound insulation pursuant to ÖNORM (Ecological Standards) EN 20140-3, 1995 edition and Assessment of Results based on ÖNORM B 8115, 1998 edition. |

lfk

The Result covers 5 pages
and 1 Annex (3 pages).

## 1 Application

On the basis of your request of January 2001 and written order of August 07th 2001, a concrete wall made of prefabricated elements (with octagon spacer 25 cm) was to be erected in accordance with the dimensions of the test aperture of 2.40 m x 3.40 available to the Test Establishment and examined for its airborne sound insulation (upon differing seal arrangements of the spacer). The evaluated Sound Reduction Index $R_w$ and the related spectrum adaptation values C and $C_{tr}$ were determined respectively.

## 2 Build-up of wall

**2.1 Wall elements:**
3 pieces of prefabricated elements made of concrete with 3 pieces of spacers of average weight 1540 kg measuring 2350 mm x 1110 mm x 250 mm

**2.2 Spacer:**
Octagon spacer 25 cm, 3 pieces per element
arranged in linear order at an interval of 99.5 cm from one another
Variation 1: Spacer seal: Plug / Plug,
Hollow space without mineral fibers
Variation 2: Spacer seal: Plug / Rubber cork + Plug
Hollow space stuffed with mineral fiber

**2.3 Jointing:**
with KZ mortar, maximum width of joint 20 mm
(bulk density: > 2000 kg/m³)

**2.4 Connection with the brickwork of test platform:**
with KZ mortar, maximum width of joint 25 mm
(bulk density > 2000 kg/m³)

**2.5 Weight of unrendered wall with regards to area:**
595 kg/m²

**2.6 Thickness of wall:**
25 cm (= thickness of elements)

## 3 Performance of measurement

The measurements were performed with a calibrated sound measuring system of the company Norsonic (Type RTA 840 serial No. 18666), which was calibrated by means of a calibrated acoustic calibrator of the company Brüel & Kjaer (Type 4230, serial No. 596718) (Date of measurement: August 7th, 2001).

The measurement of airborne sound insulation was performed in one direction (optional for separating walls; inwards from the outside for exterior walls,). In each of the measurement series, noise was generated on the test piece on one side (transmission side) within the frequency range of 100 to 5000 Hz (in third octave bandwidth) and the sound pressure level recorded and saved with mobile microphones on the transmitting as well as receiving sides. The reverberation time of the respective reception room was determined thereafter.

## 4 Definitions

The evaluated Sound Reduction Index $R_w$ and the spectrum adaptation values C and $C_{tr}$ serve the purpose of the single value specification for the assessment of the airborne sound insulation of structural elements. The following calculation instructions and definitions can be found (literally) on these parameters in ÖNORM EN ISO 717-1:1997.

### 4.1 Evaluated Sound Reduction Index $R_w$

To evaluate the results of measurements that were performed in accordance with ISO 140-3 in third octave bands provided on 0.1 dB, the reference curve is shifted in stages from against the measurement curve 1 dB until the sum of the unfavorable deviations grows to the highest possible level but not in excess of 32.0 dB. An unfavorable deviation is deemed given at a specific frequency if the measurement result is lower than the reference value. Only unfavorable deviations are taken into considerations.

The value of the shifted reference curve at 500 Hz is the evaluated Sound Reduction Index $R_w$. The evaluated Sound Reduction Index is given in Decibel (dB).

### 4.2 Spectrum Adaptation Values C, $C_{tr}$,

Spectrum Adaptation Value is the decibel value that should be added to the evaluated Sound Reduction Index for the purpose of taking a specific sound spectrum into due consideration. The mathematical definitions of the different spectra as well as the calculation instructions for the Spectrum Adaptation Values are given in ÖNORM EN ISO 717-1:1997.

The Spectrum Adaptation Value is calculated at 0.1 dB and rounded up as a whole figure in accordance with ISO 31-0.
The assignment of the different sources of noise to the respective Spectrum Adaptation Value is given below. This assignment can be used as Guideline for the application of the Spectrum Adaptation Values on the rating of sound insulation with regards to such sources of noise.

The Spectrum Adaptation Value C basically takes medium and high frequency sources of noise into consideration. This includes amongst others, routine domestic activities (chatting, music, radio, TV), children playing, rail traffic at medium and high speed, highway traffic above 80 km/h, jet planes with short interval as well as companies that are predominantly emitting medium and high frequency noises.

The Spectrum Adaptation Value $C_{tr}$ basically takes low and medium frequency sources of noise into consideration. This includes amongst others, urban road traffic, low-speed rail traffic, propeller planes, jet planes with long interval, disco music as well as such companies as predominantly emit low and medium frequency noises.

## 5 Results

The following values were derived from the measurements:

| Set-up of wall | Evaluated Sound Reduction Index ($C$; $C_{tr}$; $C_{100\text{-}5000}$; $C_{tr,\ 100\text{-}5000}$) |
|---|---|
| 25 cm concrete pre-fabricated elements pursuant to item 2, Spacer: Variation 1 | **58 (-2; -5; -1; -5) dB** |
| 25 cm concrete pre-fabricated elements pursuant to item 2, Spacer: Variation 2 | **58 (-2; -5; -1; -5) dB** |

In page 1 of the Annex, the measured curve (thick measurement curve) of the Sound Reduction Index R is presented, i.e. the individual values are presented numerically in dependence on the frequency (from 100 Hz to 5000 Hz) as well as the reference curve (thin curve) in accordance with ÖNORM EN ISO 717-1:1997.

## 6 Technical Regulations

| | |
|---|---|
| Measurement standard: | ÖNORM EN 20140-3:1995 |
| Test Platform standard: | ÖNORM EN ISO 140-1:1998 |
| Requirement standard: | ÖNORM B 8115-2:1998 |
| Terms and units: | ÖNORM EN ISO 717-1:1997 and B 8115-1:1998 |

## 7 Standards required pursuant to ÖNORM B 8115-2

### 7.1 Usage as exterior structural component

The minimum noise protection standard ($R'_{res,w}$ or $R'_w$) for exterior structural components is specified in ÖNORM B 8115, Part 2, 1998 edition. According to this, the minimum noise protection standard for exterior structural components (including windows and external doors) depends on the determinant level of external noises and the type of building. Excluding windows and external doors, exterior walls must have a minimum sound insulation of $R_w$ = 47 dB. The Spectrum Adaptation Value $C_{tr}$ shall also be taken into consideration in addition to the evaluated Sound Reduction Index $R_w$ while assessing the sound insulation of exterior structural components. Since the sum of $R_w + C_{tr}$ describes the difference between the A-evaluated sound-pressure level of the road-traffic noise outside before the façade and the interior, a structural component with the same $R_w$ – value but higher $R_w + C_{tr}$ value is rated more favorable from a building acoustic point of view. The sum of $R_w + C_{tr}$ shall not fall short of the required standard as contained in tables 4a and 4b by more than 5 dB for exterior structural components.

### 7.2 Usage as separating structural component

The required minimum standard for airborne sound insulation in buildings ($D_{nT,w}$) between rooms is given in ÖNORM B 8115, Part 2, 1998 edition, Table 5. According to this, the required minimum evaluated standard sound level difference $D_{nT,w}$ is 50 dB (e.g. between the adjoining rooms of different residential units), 55 dB (e.g. between the lounges of residential units) or 60 dB (e.g. between neighboring buildings) all depending on the state of the separating structural components.

## 8 Assessment and Summary

### 8.1 General

As can be seen in the measurement results (Sound Reduction Index of the pre-fabricated concrete wall with octagon spacers), there is no difference from a sound-technical viewpoint, between Variation 1 (octagon spacers on both sides fitted with plugs, no hollow space) and Variation 2 (octagon spacers each fitted with plugs or rubber corks + plugs, hollow space filled with mineral fibers). This applies to the evaluated Sound Reduction Index $R_w$ as well as the Spectrum Adaptation Values C and $C_{tr}$.

### 8.2 Usage as exterior structural component

Given the determined value of $R_w(C; C_{tr})$ = 58 (-2; -5) dB (applies to both variations), the standard required of sound protection for exterior walls ($R_w + C_{tr}$ = 42 dB) pursuant to ÖNORM B 8115-2:1998 is favorably exceeded and therefore, met. Since the wall was examined without thermal insulation layer, which however, impacts the overall sound insulation of the wall set-up, a precise specification of the favorable excessive value of the required standard is impossible. Depending on the type of the thermal insulation bonding system (insulation layer ➔ polystyrene, mineral fiber, cork etc.), there may be a reduction or boosting of sound insulation against the wall-forming element (= in this case, the examined wall itself). The favorable excess in the standardized requirement will therefore, be within the approximate range of 6 dB (wall with WDVS with polystyrene) up to 14 dB (wall with WDVS with mineral fiber).

It should be noted that the fulfillment of the standard required of sound insulation for the complete exterior structural component $R'_{res,w}$ is also dependent on the evaluated Sound Reduction Index of the transparent structural components (e.g. windows) in addition to the evaluated Sound Reduction Index of the wall and the share of area from transparent to non-transparent structural components and these parameters are therefore, to be observed in the measurement of sound protection.

### 8.3 Usage as separating structural component

Given the determined value of $R_w(C; C_{tr})$ = 58 (-2; -5) dB (applies to both variations), the examined wall is basically suited for meeting the minimum standard required of airborne sound insulation in buildings pursuant to ÖNORM B 8115-2:1998.

Since the fulfillment of the standard required of airborne sound insulation in buildings is also dependent on the longitudinal line of sound in the accompanying structural elements in addition to the evaluated Sound Reduction Index of the wall (sound transmission through the separating structural component), the dimensioning of these structural components is of vital importance. Structural components like walls, ceilings, doors and eventual built-in structures (installation shafts etc.) bordering on the separating wall shall be di-

mensioned in such a way that the evaluated standard sound level difference is complied with, depending on the state of the separating structural components.

| Officer-in-Charge | Laboratory Manager | Manager Test and Research Establishment |
|---|---|---|
| Signed: (Signature illegible)<br>K. Fleischhacker (Engnr.)<br>Executive Techn. Officer | Signed: (Signature illegible)<br>C. Pöhn (Grad. Engnr.)<br>Senior Executive Constr. Officer of the Municipal Admin. | Signed: (Signature illegible)<br>W. Fleck (Grad. Engnr.)<br>Senate's Executive Officer |

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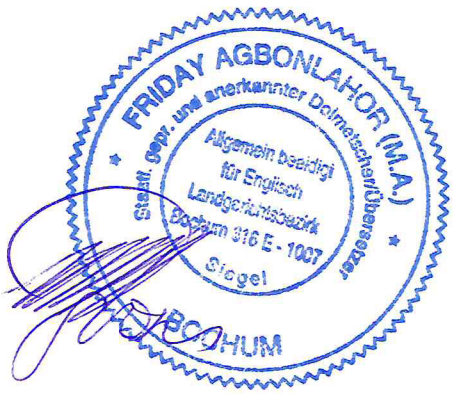
Bochum, March 29th 2007

I hereby certify that the true and correct translation of the foregoing document from German into English was done conscientiously, to the best of my knowledge and ability.

Friday Agbonlahor (M.A.)
State-examined and accredited
Translator and Interpreter of the English language
Judicially sworn for English



Certified Translation

**Sound Reduction Index ISO 140-3:1995**

Measurement of the airborne sound insulation of structural components on test platform

(Emblem) Annex page 1 of
MA 39 – VFA 2001-1278.01

Mandated by: NEVOGA GmbH, Znaimer Straße 4
Test object installed by: Company staff

Product designation: Pre-fabricated elements with spacer
Designation of Test room: Test Hall 1 / Test Hall 2
Date of test: August 07th, 2001

Build-up of object of test:
25 cm pre-fabricated concrete elements (2.35 m x 1.1 m x 0.25 m)
with 3 pieces of spacers (with plugs on both sides, hollow space without mineral fiber)

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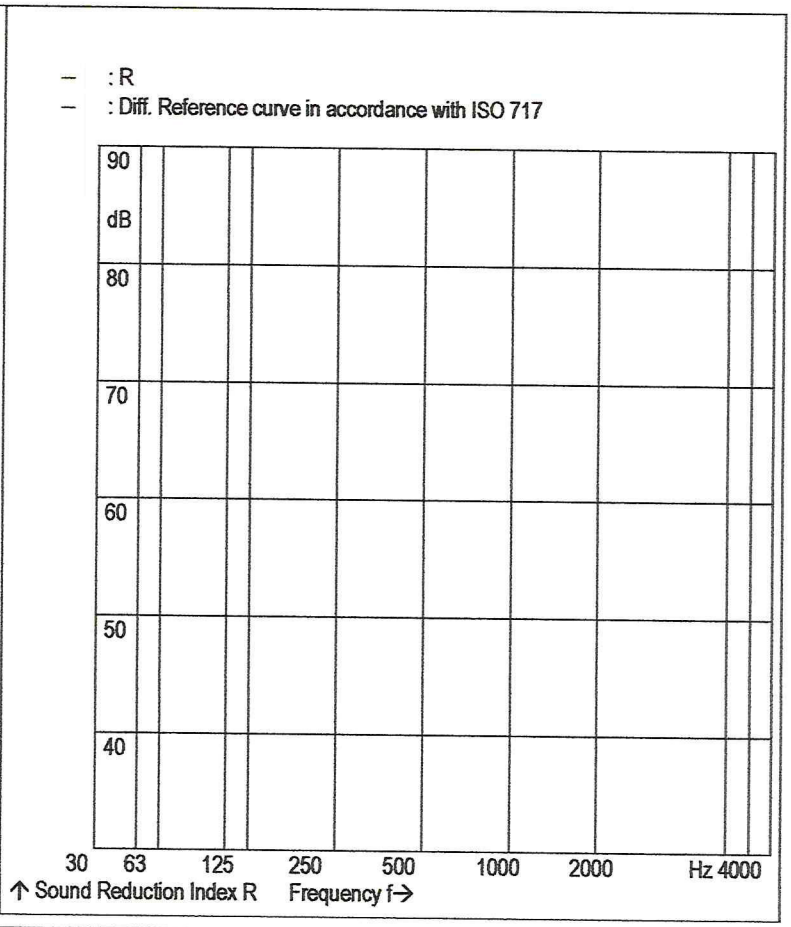
Test area: 8.3 m²
Area-related weight: 595 kg/m²
Temperature [°C]: 22.7
Humidity: [%]: 71.9
Volume of transmission room: 198.1 m³
Volume of reception room: 98.5 m³

| Frequency [Hz] | R Third octave [dB] |
|---|---|
| 50 | -.- |
| 63 | -.- |
| 80 | -.- |
| 100 | 42.9 |
| 125 | 42.6 |
| 160 | 45.1 |
| 200 | 44.8 |
| 250 | 48.7 |
| 315 | 49.0 |
| 400 | 50.0 |
| 500 | 52.2 |
| 630 | 54.6 |
| 800 | 57.6 |
| 1000 | 59.8 |
| 1250 | 62.4 |
| 1600 | 64.7 |
| 2000 | 65.9 |
| 2500 | 67.1 |
| 3150 | 68.8 |
| 4000 | 70.8 |
| 5000 | 71.6 |




Evaluation in accordance with ISO 717-1
$R_w(C, C_{tr})$ = 58 (-2; -5) dB

$C_{50\text{-}3150}$: –
$C_{tr50\text{-}3150}$: –
$C_{50\text{-}5000}$: –
$C_{tr50\text{-}5000}$: –
$C_{100\text{-}5000}$: -1 dB
$C_{tr100\text{-}5000}$ -5 dB

**The result is based on test results from the test platform as derived from third octave bands.**

**MA 39 – VFA**

**(Emblem)**

Order number: VFA 2001-1278.01
Vienna, August 7th, 2001

Signature: (Signed: Signature illegible)

**Sound Reduction Index ISO 140-3:1995**

Measurement of the airborne sound insulation of structural components on test platform



Mandated by: NEVOGA GmbH, Znaimer Straße 4
Test object installed by: Company staff

Product designation: Pre-fabricated elements with spacer
Designation of Test room: Test Hall 1 / Test Hall 2
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Build-up of object of test:
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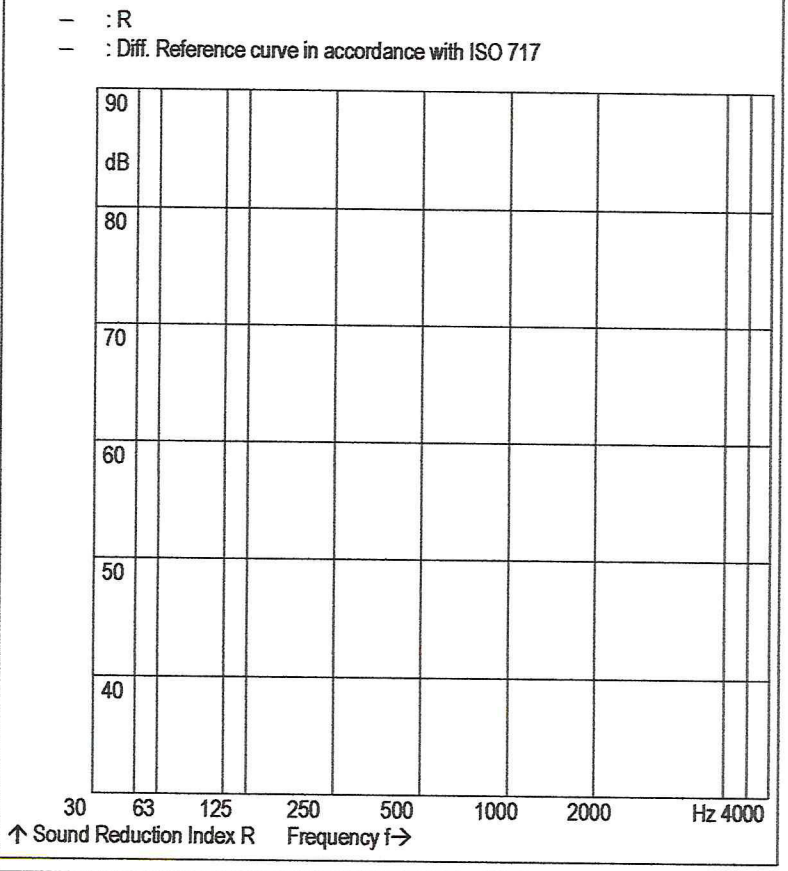
with 3 pieces of spacers (with plugs on both sides, hollow space without mineral fiber)

Round stamp imprint: MUNICIPALITY DEPARTMENT 39/VIENNA

Test area: 8.3 m²
Area-related weight: 595 kg/m²

Temperature [°C]: 22.7
Humidity: [%]: 71.9
Volume of transmission room: 198.1 m³
Volume of reception room: 98.5 m³

| Frequency [Hz] | R Third octave [dB] |
|---|---|
| 50 | -.- |
| 63 | -.- |
| 80 | -.- |
| 100 | 43.9 |
| 125 | 43.0 |
| 160 | 45.7 |
| 200 | 44.6 |
| 250 | 48.5 |
| 315 | 49.5 |
| 400 | 50.0 |
| 500 | 52.2 |
| 630 | 54.4 |
| 800 | 57.7 |
| 1000 | 59.8 |
| 1250 | 62.4 |
| 1600 | 64.7 |
| 2000 | 66.0 |
| 2500 | 67.0 |
| 3150 | 69.0 |
| 4000 | 70.9 |
| 5000 | 71.9 |




Evaluation in accordance with ISO 717-1

$R_w(C; C_{tr}) = 58 (-2; -5)$ dB

$C_{50\text{-}3150}$: –
$C_{tr50\text{-}3150}$: –
$C_{50\text{-}5000}$: –
$C_{tr50\text{-}5000}$: –
$C_{100\text{-}5000}$: -1 dB
$C_{tr100\text{-}5000}$ -5 dB

**The result is based on test results from the test platform as derived from third octave bands.**

**MA 39 – VFA** **(Emblem)**

Order number: VFA 2001-1278.01
Vienna, August 7th, 2001

Signature: (Signed: Signature illegible)

Round stamp imprint: MUNICIPALITY DEPARTMENT 39/VIENNA

(Photo)

Picture No. 4470.22A

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| | |
|---|---|
| Test Variation 1: | Plug<br>Octagon spacer (without fill-up)<br>Plug |
| Test Variation 2: | Plug<br>Octagon spacer (with mineral fiber fill-up)<br>Rubber cork<br>Plug |

Bochum, March 29th 2007

I hereby certify that the true and correct translation of the foregoing document from German into English was done conscientiously, to the best of my knowledge and ability.

Friday Agbonlahor (M.A.)
State-examined and accredited
Translator and Interpreter of the English language
Judicially sworn for English

FRIDAY AGBONLAHOR (M.A.)
Staatl. gepr. und anerkannter Dolmetscher/Übersetzer
Allgemein beeidigt für Englisch Landgerichtsbezirk Bochum 316 E - 1007
Siegel
BOCHUM

# Schalldämm-Maß ISO 140-3:1995

Messung der Luftschalldämmung von Bauteilen im Prüfstand



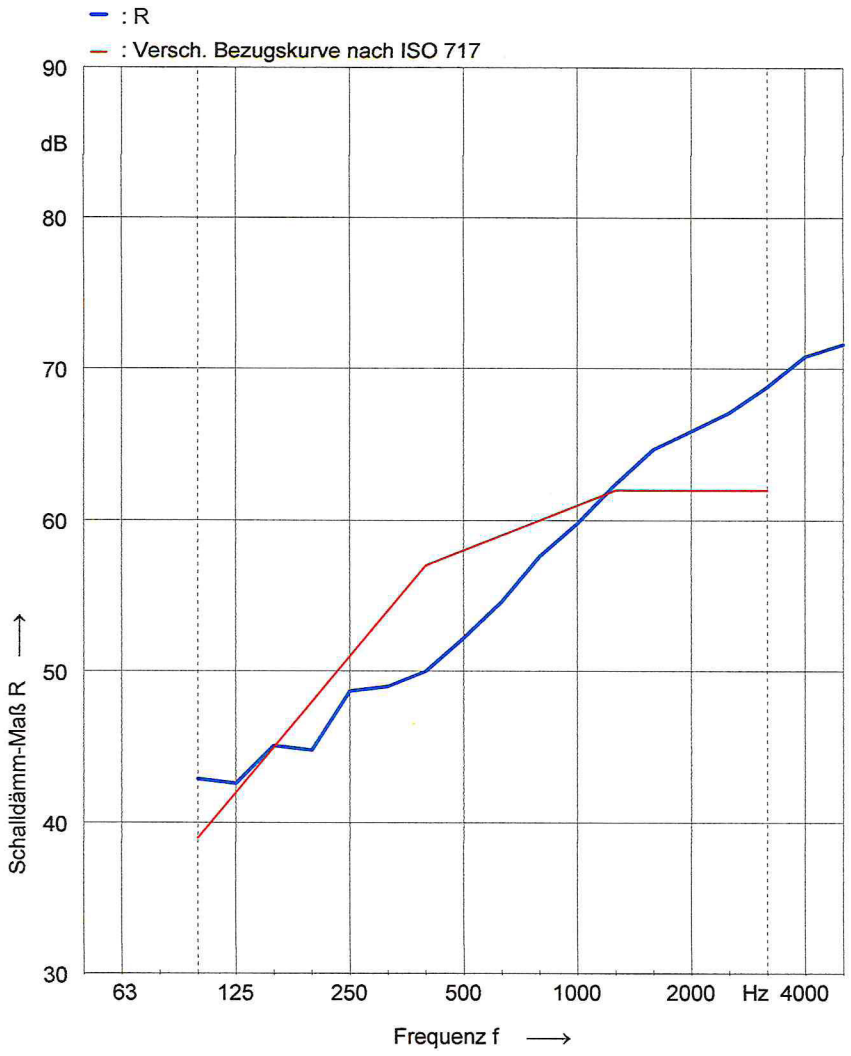
Auftraggeber: NEVOGA GmbH, Znaimer Straße 4
Prüfgegenstand eingebaut von: Firmenpersonal

Produktbezeichnung: Fertigteileelemente mit Abstandhalter
Kennz. der Prüfräume: Hallraum 1 / Hallraum 2
Prüfdatum: 07. August 2001

Aufbau des Prüfgegenstandes:
25 cm Beton-Fertigteilelemente (2,35 m x 1,1 m x 0,25 m)
mit 3 Stück Abstandhalter (beidseits mit Stopfen, Hohlraum ohne Mineralwolle)

Prüffläche: 8.3 m²
Flächenbezogene Masse: 595 kg/m²
Temperatur [°C]: 22,7
Feuchtigkeit [%]: 71,9
Senderaum Volumen: 198.1 m³
Empfangsraum Volumen: 98.5 m³

| Frequenz [Hz] | R Terz [dB] |
|---|---|
| 50 | -,- |
| 63 | -,- |
| 80 | -,- |
| 100 | 42,9 |
| 125 | 42,6 |
| 160 | 45,1 |
| 200 | 44,8 |
| 250 | 48,7 |
| 315 | 49,0 |
| 400 | 50,0 |
| 500 | 52,2 |
| 630 | 54,6 |
| 800 | 57,6 |
| 1000 | 59,8 |
| 1250 | 62,4 |
| 1600 | 64,7 |
| 2000 | 65,9 |
| 2500 | 67,1 |
| 3150 | 68,8 |
| 4000 | 70,8 |
| 5000 | 71,6 |




Bewertung nach ISO 717-1
$R_w(C;C_{tr})$ = 58 ( -2; -5) dB

$C_{5o-315o}$: —
$C_{5o-5ooo}$: —
$C_{1oo-5ooo}$: -1 dB
$C_{tr5o-315o}$: —
$C_{tr5o-5ooo}$: —
$C_{tr1oo-5ooo}$: -5 dB

Die Ermittlung basiert auf Prüfstands-Messergebnissen, die in Terzbändern gewonnen wurden.

**MA 39 - VFA**

Auftragsnummer: VFA 2001-1278.01
Wien, 7.08.2001

Unterschrift:

# Schalldämm-Maß ISO 140-3:1995

Messung der Luftschalldämmung von Bauteilen im Prüfstand

Beilage Seite 2 zu
MA 39 - VFA 2001-1278.01

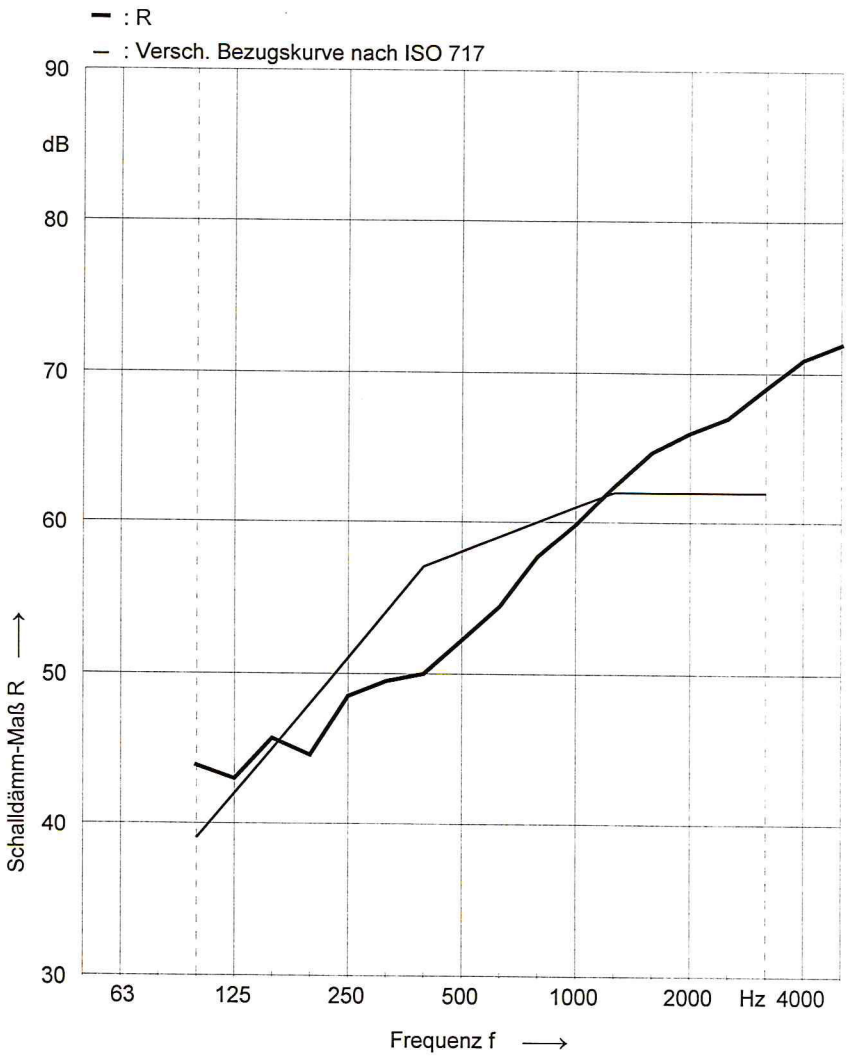
Auftraggeber: NEVOGA GmbH, Znaimer Straße 4
Prüfgegenstand eingebaut von: Firmenpersonal

Produktbezeichnung Fertigteilelemente mit Abstandhalter
Kennz. der Prüfräume: Hallraum 1 / Hallraum 2
Prüfdatum: 07. August 2001

Aufbau des Prüfgegenstandes:
25 cm Beton-Fertigteilelemente (2,35 m x 1,1 m x 0,25 m)
mit 3 Stück Abstandhalter (mit Stopfen und Gummipfropfen+Stopfen, Hohlraum mit Mineralwolle)

Prüffläche: 8.3 m²
Flächenbezogene Masse: 595 kg/m²
Temperatur [°C]: 22,7
Feuchtigkeit [%]: 71,9
Senderaum Volumen: 198.1 m³
Empfangsraum Volumen: 98.5 m³

| Frequenz [Hz] | R Terz [dB] |
|---|---|
| 50 | -,- |
| 63 | -,- |
| 80 | -,- |
| 100 | 43,9 |
| 125 | 43,0 |
| 160 | 45,7 |
| 200 | 44,6 |
| 250 | 48,5 |
| 315 | 49,5 |
| 400 | 50,0 |
| 500 | 52,2 |
| 630 | 54,4 |
| 800 | 57,7 |
| 1000 | 59,8 |
| 1250 | 62,4 |
| 1600 | 64,7 |
| 2000 | 66,0 |
| 2500 | 67,0 |
| 3150 | 69,0 |
| 4000 | 70,9 |
| 5000 | 71,9 |




Bewertung nach ISO 717-1
$R_w(C,C_{tr})$ = 58 ( -2; -5) dB

$C_{5o-315o}$: ---
$C_{5o-5ooo}$: ---
$C_{1oo-5ooo}$: -1 dB
$C_{tr5o-315o}$: ---
$C_{tr5o-5ooo}$: ---
$C_{tr1oo-5ooo}$: -5 dB

Die Ermittlung basiert auf Prüfstands-Messergebnissen, die in Terzbändern gewonnen wurden.

**MA 39 - VFA**

Auftragsnummer: VFA 2001-1278.01
Wien, 7.08.2001

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