

Evidence of Performance

Airborne sound insulation of fire safety board

Test report 164 41706/1e

This is a translation of the test report 164 41706/1 of 16. November 2009



Client **Hilti Entwicklungsgesellschaft mbH**
Hiltistrasse 6

86916 Kaufering
Germany

Basis

ETAG N° 026 Part 2:2008-01
EN ISO 140-1:1997+A1:2004
EN 20140-3 :1995+A1:2004
EN 20140-10 : 1992
EN ISO 717-1 : 1996+A1:2006
Additional:
ASTM E 90-04
ASTM E 413-04

Product	Mineral wool board, coated, installed in wall penetration
Designation	Fire safety board CP 670
Construction	2 boards of mineral wool 50 mm with 55 mm distance, type Paroc Pyrotec Slab 140, with coating type CP 670 on one side
External dimensions	400 mm × 500 mm
Total thickness	155 mm
Mass per unit area	17 kg/m ²
Wall construction	Double metal stud partition wall with two layers plasterboard on double stud frame

Informations for use

This test report may be used to validate the sound insulation of a fire safety board on basis of ETAG 026, Part 2, section 2.4.9

Weighted normalized sound level difference of small building elements $D_{n,e,w}$
Spectrum adaptation terms C and C_{tr}
Weighted sound reduction index R_w
Spectrum adaptation terms C and C_{tr}

Validity

The data and results given relate solely to the described, tested object.
Testing the acoustic properties does not allow any statement to be made on further characteristics of the present structure which could define performance and quality.



$$D_{n,e,w}(C; C_{tr}) = 58 \text{ (-4;-8) dB} \\ \text{referring to } A_0 = 10 \text{ m}^2$$
$$R_w(C; C_{tr}) = 51 \text{ (-4;-8) dB} \\ \text{referring to } S = 1,88 \text{ m}^2$$
$$R_w(C; C_{tr}) = 41 \text{ (-4;-8) dB} \\ \text{referring to } S = 0,2 \text{ m}^2$$

Notes on publication

The ift Guidance Sheet "Conditions and Guidance for the use of ift Test Documents" applies.
The cover sheet can be used as a summary.

ift Rosenheim
10 December 2009

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Contents

This test report includes 14 pages
1 Test specimen
2 Test procedure
3 Test results
4 Instructions for use
Data sheet (5 pages)



1 Object

1.1 Description of test specimen

Product	Mineral wool board, coated, installed in wall penetration
Product designation	Fire safety board CP 670
Dimensions (W x H)	400 mm × 500 mm
Mass per unit area	17 kg/m ²
Total thickness	155 mm
Configuration	2 boards of mineral wool, each coated on one side. Coating facing the emission and receiving room resp.
Type of mineral wool board	Paroc Pyrotec Slab 140
Board density *	140 kg/m ³
Thickness of board	each 50 mm
Distance between boards	55 mm
Preparation of fire safety boards	11. September 2009 by staff of client.
Test variants	<ul style="list-style-type: none"> - test of metal stud wall without penetration - test of metal stud wall with penetration. without filling - test of metal stud wall with penetration, filled with fire safety boards

Metal stud partition

Manufacturer**	Metal stud partition mounted by ift Centre for Acoustics	
Date of manufacture*	13.October 2009	
Sampling	By the ift Centre for Acoustics at builders merchants	
Dimensions (W x H)	1230 mm × 1480 mm	
Mass per unit area	45.9 kg/m ²	
Total thickness	155 mm	
Configuration	2 x 12.5 mm	Fire-resistant board, GKF
	50 mm	Metal stud frame
		Mineral fibre insulation 40 mm
	5 mm	Separating joint, air gap
	50 mm	Metal stud frame
		Mineral fibre insulation 40 mm
	2 x 12.5 mm	Fire-resistant board , GKF

Cladding (2 layer)

Manufacturer	Knauf Gips AG
Product designation	Knauf Piano sound insulation board F
Material	Fire-resistant board, GKF
Thickness	12.5 mm (2 layer)
Mass per unit area	10.7 kg/m ²
Mounting	Screwed to stud frame, screws spaced first layer approx. 700 mm, screw size 3.9 x 25 mm, second layer approx. 200 mm, screw size 3.9 x 35 mm, without butt joints

Stud frame

Type	Metal stud made from 50 mm C-sections (CW 50x50x06) mounted with 5 mm air gap between studs
Profile cross section (D × W × T)	50 mm × 50 mm × 0.6 mm
Spacing	675 mm / 250 mm
Clearance between claddings	105 mm
Material	Sheet steel
Assembly	inserted into edge sections

Edge section

Type	Floor and ceiling trims made from sheet steel (UW 50)
Profile cross section (D x W x T)	40 mm x 50 mm x 0.6 mm

Cavity insulation

Manufacturer*	Saint-Gobain Isover G+H AG, 67005 Ludwigshafen, Germany
Product designation*	Protect BSP 40
Material*	Mineral wool fire-resistant board
Size of board	1200 mm × 625 mm
Thickness of board *	40 mm
Mass per unit area	1.54 kg/m ²
Fixing method	Clamped between stud frame

Penetration

Clear opening dimensions (W x H)	400 mm x 400 mm
Position	Centre of stud partition
Reveals	Perimeter cladding using 2 x 12.5 mm fire-resistant board GKF
Joints	Sealed with silicone
Separating joint of stud frame	Bridged with reveal claddings

The description is based on inspection of the test specimen at **ift** Centre for Acoustics. Article designations/numbers as well as material specifications were given by the client. Additional manufacturer data are marked with *).

1.2 Mounting to test rig

Test rig	Window test rig with suppressed flanking sound transmission acc. to EN 140-1; the test rig has a continuous acoustic break of 5 cm width. The joint of the test opening is filled with permanently elastic closed-pore sealant.
Mounting of test specimens	The test specimen was mounted by the ift Centre for Acoustics and staff of client.
Mounting position	Installation in the opening of the double wall of the window test rig facing the source room. The acoustic break was not bridged.
Sealing of test rig	Sealing between test rig and edge sections via Acryl.
Drying time	No plastering of the GFK boards was required, because the opening was built out of one board.

1.3 Representation of test specimen

The constructional details were inspected solely on the basis of the characteristics to be classified. The illustrations are based on unchanged documentation provided by the client.

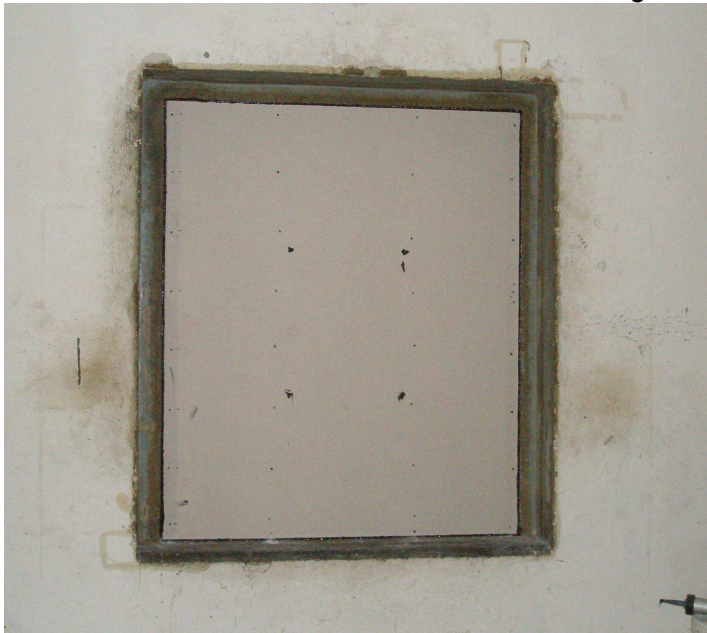


Fig 1 Photo of installed metal stud partition, taken by ift Centre for Acoustics



Fig 2 Photo of metal stud partition with penetration

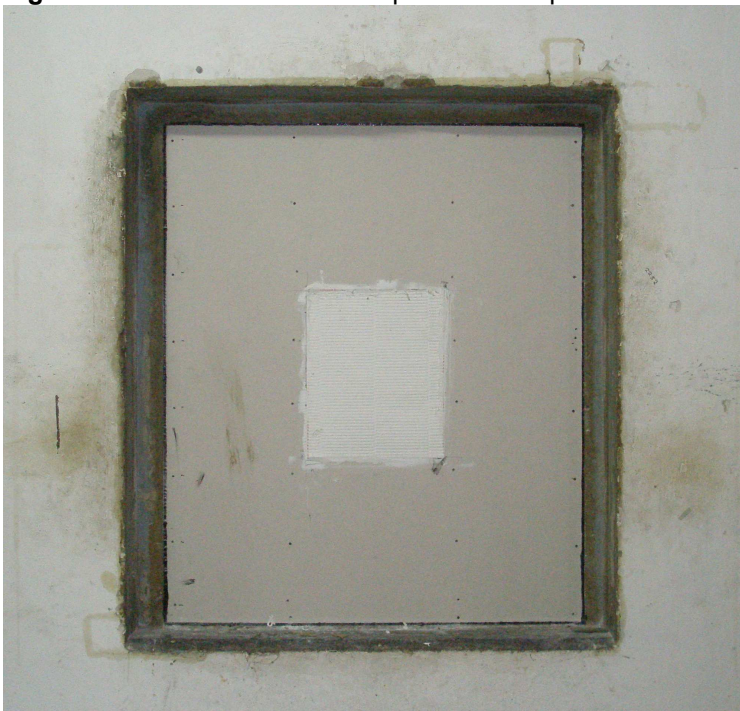


Fig 3 Photo of metal stud partition with penetration, fire safety board installed in penetration.



2 Procedure

2.1 Sampling

Selection of test specimen	The test specimen were selected by the client
Quantity	1
Manufacturer	Hilti Entwicklungsgesellschaft mbH
Manufacturing plant	Hilti Werk 9a
Date of manufacture /	11. September 2009 (coating of fire safety board)
Date of sampling	
Responsible for sampling	Mister Schulze
Delivered to ift	10. September 2009 by client
ift registration number	26659

2.2 Process

Basis

ETAG N° 026, Part 2:2008 Guideline for european technical approval of fire and fire sealing products

EN 20140-10 : 1992 Acoustics; Measurement of sound insulation in buildings and of building elements - Part 10: Laboratory measurements of airborne sound insulation of small building elements

EN ISO 140-1:1997 + A1:2004 Acoustics; Measurement of sound insulation in buildings and of building elements - Part 1: Requirements for laboratory test facilities with suppressed flanking transmission

EN 20140-3:1995 + A1:2004 Acoustics; Measurement of sound insulation in buildings and of building elements - Part 3: Laboratory measurements of airborne sound insulation of building elements

EN ISO 717-1 : 1996 + A1:2006 Acoustics; Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation

Corresponds to national German version:

DIN EN 20140-10:1992-09, DIN EN ISO 140-1:2005-03, DIN EN ISO 140-3:2005-03 und DIN EN ISO 717-1 : 2006-11

Additional standards

ASTM E 90-04	Standard test method for laboratory measurement of airborne sound transmission loss of building partitions and elements
ASTM E 413-04	Classification for rating sound insulation

Boundary conditions

As specified by the standards. According to ETAG 026 part 2, section 2.4.9 the sound insulation shall be tested according to EN ISO 140-10 and rated according to EN ISO 717. In addition



ETAG 026 part 2, section 2.4.9 demands comparison test according to EN ISO 140-3. On request of the client the STC acc. to ASTM E 413-04 was evaluated.

Deviation	The linear flow resistance of the insulating material was not determined.
Test noise	Pink noise
Measuring filter	One-third-octave band filter
Measurements limits	
Background noise level	The background noise level of the receiving room was determined during measurement and the receiving room level L_2 was corrected by calculation as set out by EN 20140-3:1995 + A1:2004 Clause 6.5.
Maximum sound insulation	The difference of the measured sound reduction index to the maximum sound insulation was partly less than 15 dB. Not corrected by calculation.
Measurement of reverberation time	Arithmetical mean: Six measurements each of 2 loudspeaker and 6 microphone positions (total of 12 measurements).
Measurement equation A	$A = 0,16 \cdot \frac{V}{T} \text{ m}^2$
Measurement of sound level difference	Minimum of 2 loudspeaker positions and rotating microphones
Measurement equations	$R = L_1 - L_2 + 10 \cdot \lg \frac{S}{A} \text{ dB}$

KEY

- A Equivalent absorption surface in m^2
- L_1 Sound level of source room in dB
- L_2 Sound level of receiving room in dB
- R Sound reduction index in dB
- T Reverberation times in s
- V Volume of receiving room in m^3
- S Test surface of test specimen in m^2



2.3 Test equipment

Device	Type	Manufacturer
Integrating sound meter	Type Nortronic 840	Norsonic-Tippkemper
Microphone preamplifiers	Type 1201	Norsonic-Tippkemper
Microphone units	Type 1220	Norsonic-Tippkemper
Calibrator	Type 1251	Norsonic-Tippkemper
Dodecahedron loudspeakers	Type 229, 96 Ohm	Norsonic-Tippkemper
Amplifiers	Type 235, 100 W	Norsonic-Tippkemper
Rotating microphone boom	Typ 231-N-360	Norsonic-Tippkemper

The ift Centre for Acoustic participates in comparative measurements at the Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig every three years, the last one was in January 2007. The sound level meter used, Series No. 17848 was calibrated by the Dortmund Eichamt (calibration agency) on 22 January 2009. The calibration is valid until 31 December 2011.

2.4 Testing

Date 13. October 2009
Test engineer Bernd Saß

3 Detailed results

The values of the measured sound reduction index of the tested elements are plotted against frequency in the enclosed data sheets and are tabled .

As per EN ISO 717-1, they are used to calculate the weighted sound reduction index R_w and the spectrum adaptation terms C and C_{tr} acc. to table 1 for the frequency range 100 Hz to 3150 Hz. In addition to the rating according to EN ISO 717-1 an evaluation according to ASTM E 413-04 was made. The result of this evaluation was given in terms of the sound transmission class STC according to ASTM E 413-04 for the frequency range from 125 Hz up to 4000 Hz:

Table 1 Measured results

Data Sheet No.	Record No.	Building elements	Test standard / Results in dB / reference surface			
			EN 20140-10	EN ISO 140-3		E 413-04
			$D_{n,e,w} (C;C_{tr})$	$R_w (C;C_{tr})$		STC
			$A_0 = 10 \text{ m}^2$	$S = 0,2 \text{ m}^2$	$S = 1,88 \text{ m}^2$	$S = 1,88 \text{ m}^2$
1	1	Metal stud wall without penetration	Not specified		61 (-2;-8)	61
2	2	Metal stud wall with penetration, without filling			10 (0; 0)	9
-			17 (0; 0)	0 (0; 0)		
3	3	Metal stud wall with penetration, filled with fire safety board CP 670	58 (-4;-8)			
4					51 (-4;-8)	44
5				41 (-4;-8)		

The tests on sound insulation with the fire safety board are documented in the data sheets 3, 4 and 5. In data sheet 3 results were evaluated in terms of the normalized level difference (reference equivalent sound absorption area = 10 m^2). In data sheets 4 and 5 the results were evaluated in terms of the sound reduction index related to the total area of the window test opening ($S = 1.88 \text{ m}^2$, see data sheet 4) and related to the opening of the penetration of the metal stud wall ($S = 0.4 \text{ m} \times 0.5 \text{ m} = 0.2 \text{ m}^2$, see data sheet 5)

This test report is not an evidence of suitability as per DIN 4109: 1989-11. A calculated value has not been provided.

ift Rosenheim
Schallschutzzentrum
10. December 2009

Sound Reduction Index acc. to ISO 140 - 3

Laboratory measurements of airborne sound insulation of building elements

Client: Hilti Entwicklungsgesellschaft, 86916 Kaufering, Germany

Product designation Fire safety board CP 670



Design of test specimen

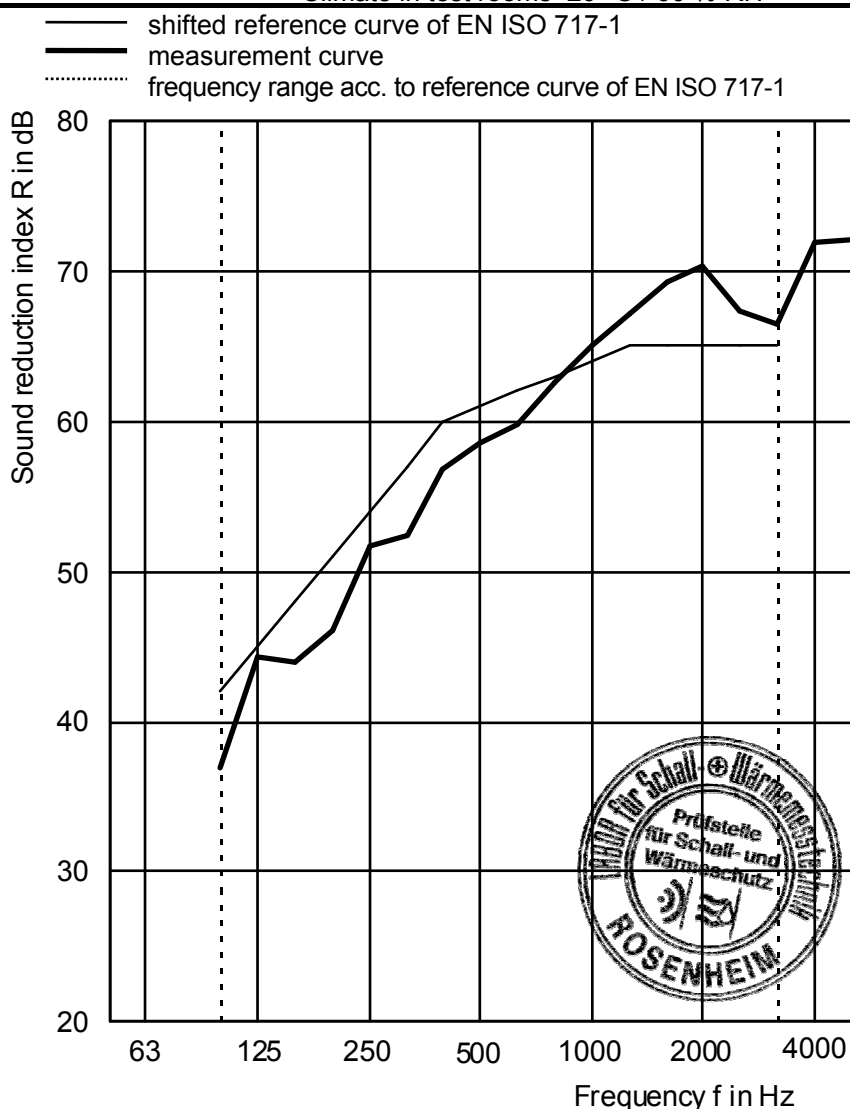
Double metal stud partition wall with two layers plasterboard on double stud frame

Partition wall without penetration

Total thickness 155 mm
Mass per unit area 45.9 kg/m²

Date of test 13. October 2009
Test surface S 1.25 m × 1.50 m = 1.88 m²
Test rig as per EN ISO 140-1
Test noise Pink noise
Volumes of test rooms V_S = 109.9 m³
V_r = 101.3 m³
Maximum sound reduction index R_{w,max} = 62 dB (related to test surface)
Installation The test specimen was mounted by the **ift** Centre for Acoustics and staff of client.
Climate in test rooms 20 °C / 60 % RH

f in Hz	R in dB
50	-
63	-
80	-
100	37.0
125	44.3
160	43.9
200	46.0
250	51.7
315	52.4
400	56.7
500	58.6
630	59.8
800	62.6
1000	65.1
1250	67.2
1600	69.2
2000	70.4
2500	67.4
3150	66.5
4000	71.9
5000	72.1



Rating acc. to EN ISO 717-1 (in one-third-octave bands) and acc. to ASTM E 413-04:

R_w (C;C_{tr}) = 61 (-2;-8) dB C₅₀₋₃₁₅₀ = - dB; C₁₀₀₋₅₀₀₀ = -1 dB; C₅₀₋₅₀₀₀ = - dB
STC 61 C_{tr,50-3150} = - dB; C_{tr,100-5000} = -8 dB; C_{tr,50-5000} = - dB

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Data sheet 1
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10. Dezember 2009

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Sound Reduction Index acc. to ISO 140 - 3

Laboratory measurements of airborne sound insulation of building elements

Client: Hilti Entwicklungsgesellschaft, 86916 Kaufering, Germany

Product designation Fire safety board CP 670



Design of test specimen

Double metal stud partition wall with two layers plasterboard on double stud frame.

Metall stud wall with penetration, without filling

Total thickness 155 mm

Mass per unit area -

Date of test 13. October 2009

Test surface S 1.25 m × 1.50 m = 1.88 m²

Test rig as per EN ISO 140-1

Test noise Pink noise

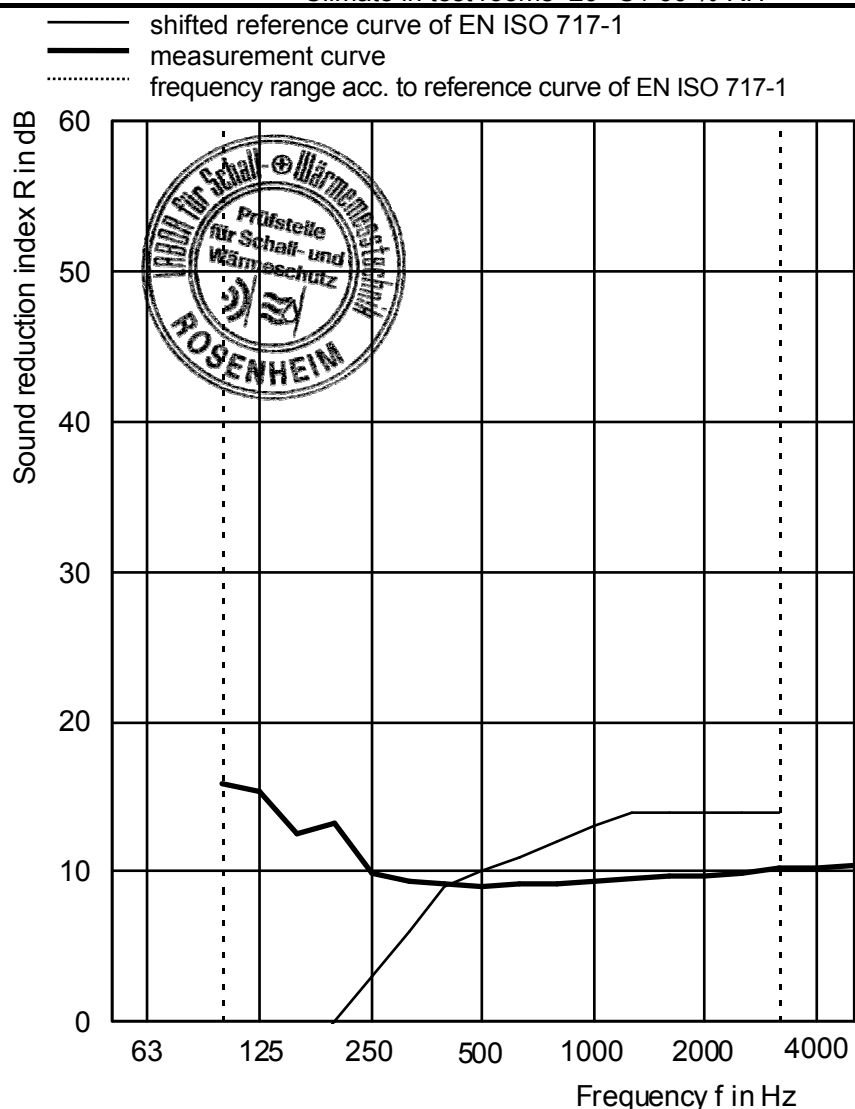
Volumes of test rooms V_S = 109.9 m³
V_r = 101.3m³

Maximum sound reduction index
R_{w,max} = 62 dB (related to test surface)

Installation The test specimen was mounted by the **ift** Centre for Acoustics and staff of client.

Climate in test rooms 20 °C / 60 % RH

f in Hz	R in dB
50	-
63	-
80	-
100	15.9
125	15.3
160	12.5
200	13.3
250	9.9
315	9.4
400	9.1
500	9.0
630	9.1
800	9.1
1000	9.4
1250	9.6
1600	9.7
2000	9.8
2500	9.9
3150	10.3
4000	10.2
5000	10.4



Rating acc. to EN ISO 717-1 (in one-third-octave bands and acc. to ASTM E 413-04:

R_w (C; C_{tr}) = 10 (0; 0) dB C₅₀₋₃₁₅₀ = - dB; C₁₀₀₋₅₀₀₀ = 0 dB; C₅₀₋₅₀₀₀ = - dB

STC 9 C_{tr,50-3150} = - dB; C_{tr,100-5000} = -2 dB; C_{tr,50-5000} = - dB

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Data sheet 2

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Normalized Level Difference acc. to ISO 140 - 10

Laboratory measurement of airborne sound insulation of small building elements



Client: Hilti Entwicklungsgesellschaft, 86916 Kaufering, Germany

Product designation Fire safety board CP 670

Design of test specimen

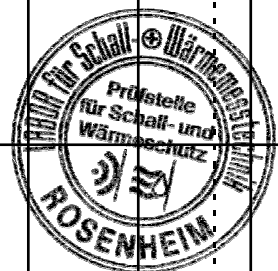
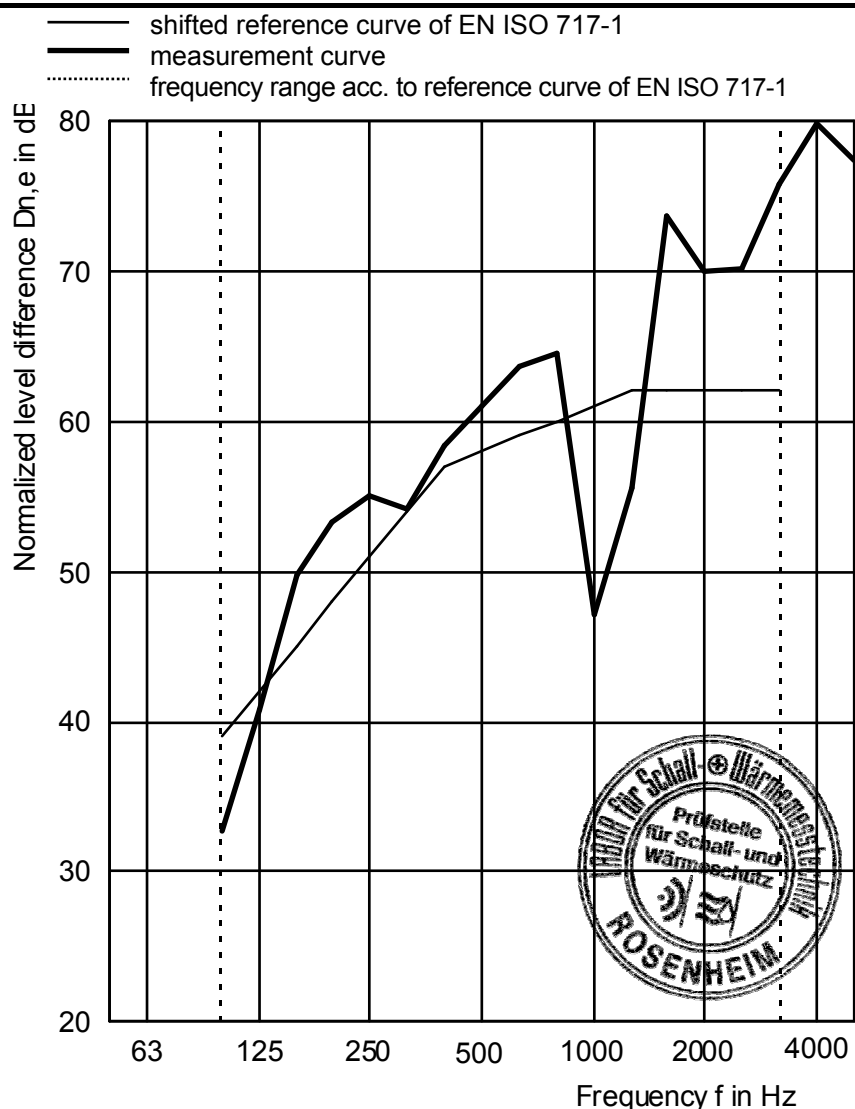
Double metal stud partition wall with two layers plasterboard on double stud frame.

Metal stud wall with penetration, filled with 2 fire safety boards type Paroc Pyrotec Slab 140 with coating Type CP 670 on one side

Total thickness 155 mm
Mass per unit area 17 kg/m²

Date of test 13. October 2009
Reference absorption surface $n_x A_0 = 10 \text{ m}^2$ (n=1)
Test rig as per EN ISO 140-1
Test noise Pink noise
Maximum sound reduction index
 $D_{n,e,w,max} = 69 \text{ dB}$ (related to $A_0 = 10 \text{ m}^2$)
Volumes of test rooms $V_S = 109.9 \text{ m}^3$
 $V_E = 101.3 \text{ m}^3$
Installation The test specimen was mounted by the ift Centre for Acoustics and staff of client.
Climate in test rooms 20 °C / 60 % RH

f in Hz	D _{n,e} in dB
50	-
63	-
80	-
100	32.7
125	40.8
160	49.7
200	53.3
250	55.1
315	54.2
400	58.4
500	61.0
630	63.7
800	64.5
1000	47.1
1250	55.5
1600	73.6
2000	70.0
2500	70.1
3150	75.8
4000	79.8
5000	77.4



Rating acc. to EN ISO 717-1 (in one-third-octave bands):

D_{n,e,w} (C; C_{tr}) = 58 (-4; -8) dB
 $C_{50-3150} = -$ dB; $C_{100-5000} = -3$ dB; $C_{50-5000} = -$ dB
 $C_{tr,50-3150} = -$ dB; $C_{tr,100-5000} = -8$ dB; $C_{tr,50-5000} = -$ dB

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Data sheet 3

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Sound Reduction Index acc. to ISO 140 - 3

Laboratory measurements of airborne sound insulation of building elements

Client: Hilti Entwicklungsgesellschaft, 86916 Kaufering, Germany

Product designation Fire safety board CP 670



Design of test specimen

Double metal stud partition wall with two layers plasterboard on double stud frame.

Metal stud wall with penetration, filled with 2 fire safety boards Paroc Pyrotec Slab 140 with coating type CP 670 on one side

Total thickness 155 mm
Mass per unit area 17 kg/m²

Date of test 13. October 2009

Test surface S 1.25 m × 1.50 m = 1.88 m²

Test rig as per EN ISO 140-1

Test noise Pink noise

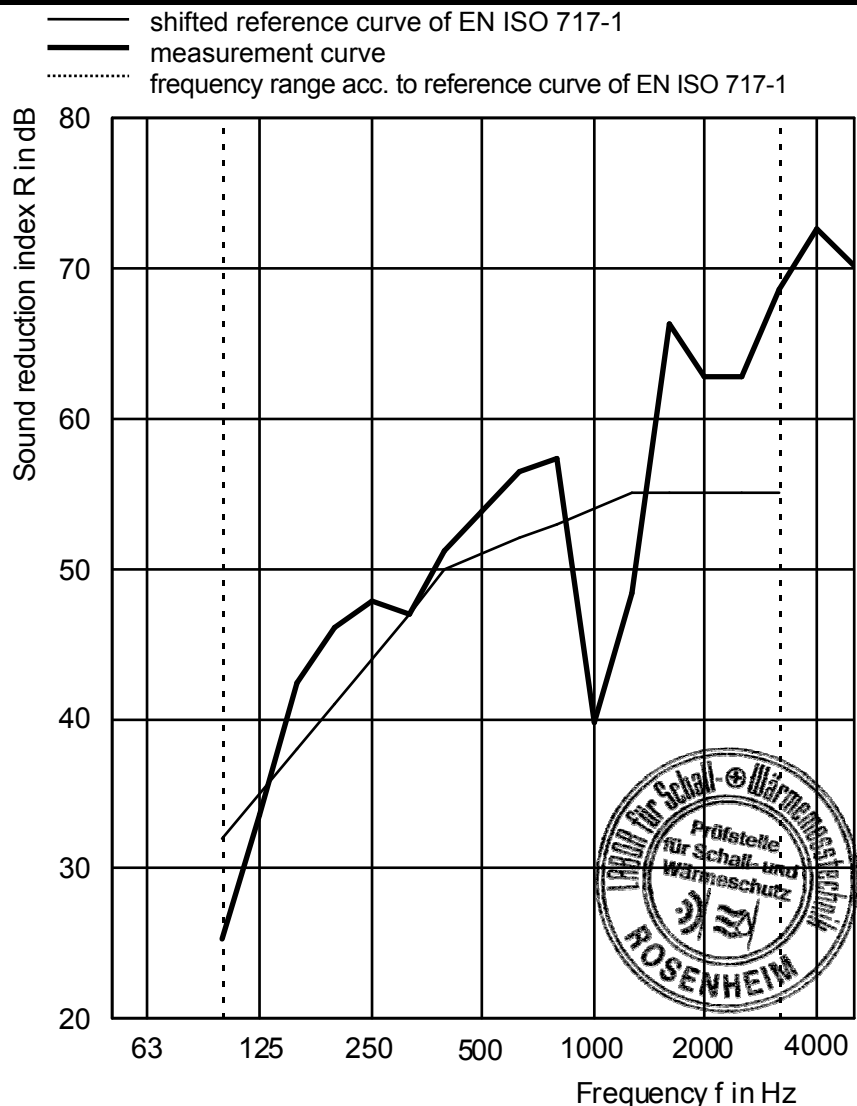
Volumes of test rooms V_S = 109.9 m³
V_r = 101.3 m³

Maximum sound reduction index R_{w,max} = 62 dB (related to test surface)

Installation The test specimen was mounted by the **ift** Centre for Acoustics and staff of client.

Climate in test rooms 20 °C / 60 % RH

f in Hz	R in dB
50	-
63	-
80	-
100	25.4
125	33.6
160	42.4
200	46.1
250	47.9
315	46.9
400	51.2
500	53.8
630	56.5
800	57.3
1000	39.8
1250	48.3
1600	66.3
2000	62.7
2500	62.8
3150	68.5
4000	72.6
5000	70.1



Rating acc. to EN ISO 717-1 (in one-third-octave bands): and acc. to ASTM E 413-04:

R_w (C; C_{tr}) = 51 (-4; -8) dB C₅₀₋₃₁₅₀ = - dB; C₁₀₀₋₅₀₀₀ = -3 dB; C₅₀₋₅₀₀₀ = - dB

STC 44 C_{tr,50-3150} = - dB; C_{tr,100-5000} = -8 dB; C_{tr,50-5000} = - dB

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Data sheet 4

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10. Dezember 2009

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Sound Reduction Index acc. to ISO 140 - 3

Laboratory measurements of airborne sound insulation of building elements

Client: Hilti Entwicklungsgesellschaft, 86916 Kaufering, Germany

Product designation Fire safety board CP 670



Design of test specimen

Double metal stud partition wall with two layers plasterboard on double stud frame.

Metal stud wall with penetration, filled with 2 fire safety boards Paroc Pyrotec Slab 140 with coating type CP 670 on one side

Total thickness 155 mm
Mass per unit area 17 kg/m²

Date of test 13. October 2009

Test surface S 0.4 m × 0.5 m = 0.2 m²

Test rig as per EN ISO 140-1

Test noise Pink noise

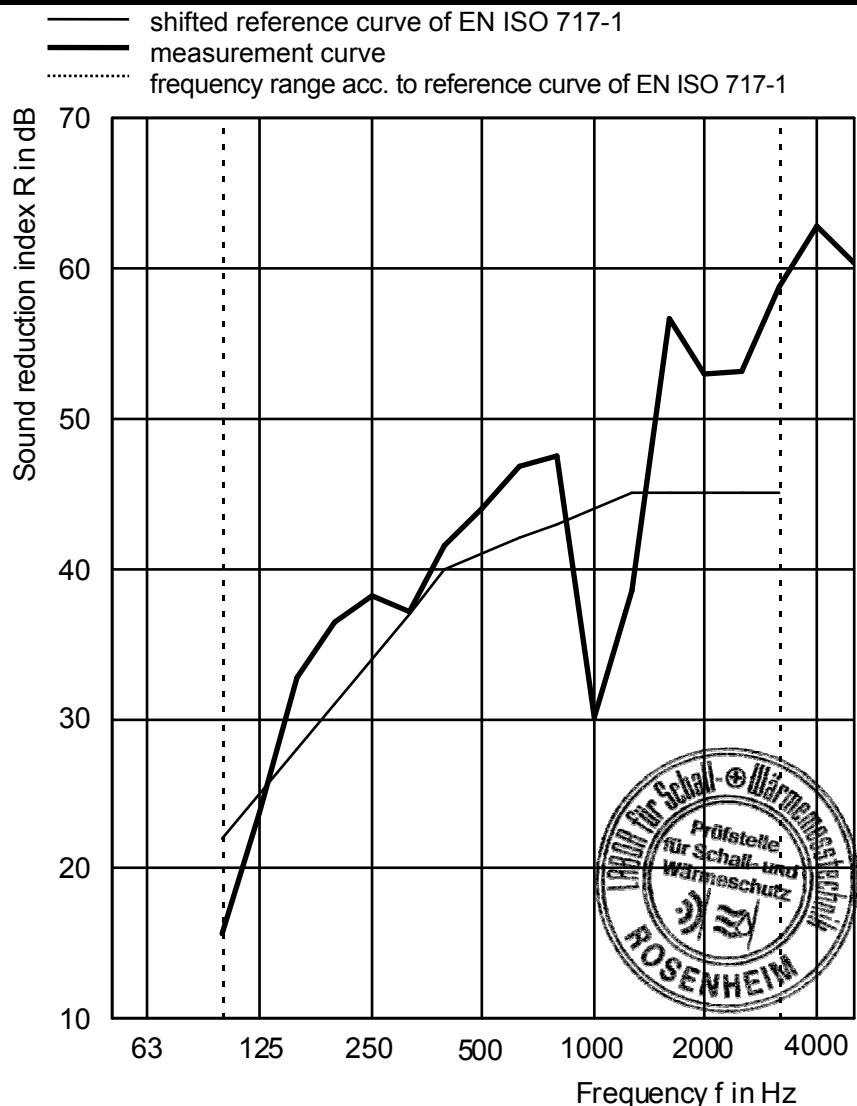
Volumes of test rooms V_S = 109.9 m³
V_F = 101.3 m³

Maximum sound reduction index R_{w,max} = 62 dB (related to test surface)

Installation The test specimen was mounted by the ift Centre for Acoustics and staff of client.

Climate in test rooms 20 °C / 60 % RH

f in Hz	R in dB
50	-
63	-
80	-
100	15.7
125	23.8
160	32.7
200	36.4
250	38.1
315	37.2
400	41.5
500	44.0
630	46.7
800	47.5
1000	30.1
1250	38.6
1600	56.6
2000	53.0
2500	53.1
3150	58.8
4000	62.8
5000	60.4



Rating acc. to EN ISO 717-1 (in one-third-octave bands):

R_w (C; C_{tr}) = 41 (-4; -8) dB C₅₀₋₃₁₅₀ = - dB; C₁₀₀₋₅₀₀₀ = -3 dB; C₅₀₋₅₀₀₀ = - dB
C_{tr,50-3150} = - dB; C_{tr,100-5000} = -8 dB; C_{tr,50-5000} = - dB

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Data sheet 5

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