Evidence of Performance

Airborne sound insulation of a cable penetration

Test report 164 44278e

This is a translation of the test report 164 44278/ dated 10. December 2010

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	cable penetration assembly 2" and 4" in wall opening
Designation	Hilti Firestop sleeve CP 653 CFS-SL-S
Construction	Profiled metal tube with internal membrane
External dimensions	2" and 4" diameter
Wall construction	Double metal stud partition wall with two layers plasterboard

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, clause 2.4.9

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

Cable penetration assembly 2"
$D_{n,e,w}\ (C;\ C_{tr})$ = 53 (-2;-3) dB

Cable penetration assembly 4"
$D_{n,e,w}\ (C;\ C_{tr})$ = 47 (-3;-5) dB

The lowest measured value is stated.

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.

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
2 March 2011

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Contents

This test report includes 14 pages

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Sachverständige Prüfstelle Gruppe I
für Eignungs- und Güteprüfung DIN 4109

1 Object

1.1 Description of test specimen

Product	cable penetration assembly 2" and 4" in wall opening	
Product designation	Hilti Firestop sleeve CP 653 CFS-SL-S	
Dimensions (W x H)	2" and 4" diameter (nominal dimensions, equal to approx. 5 cm resp. 10 cm	
Total length	315 mm	
Configuration	cable penetration assemblies in metal with twisted seal closure	
Type of mineral wool board	Paroc Pyrotec Slab 140	
Test variants	- test of 2" and 4" variants - test with and without cable harnesses - test of 1 and 2 cable penetration assemblies	
Metal stud partition		
Manufacturer*	Metal stud partition mounted by **ift** Centre for Acoustics	
Date of manufacture*	2. December 2010	
Sampling	By the **ift** Centre for Acoustics at builders merchants	
Dimensions (W x H)	1230 mm × 1480 mm	
Total thickness	100 mm	
Configuration	2 x 12.5 mm	Fire-resistant board, GKF
	50 mm	Metal stud frame
		Mineral fibre insulation 50 mm
	2 x 12.5 mm	Fire-resistant board, GKF
Stud frame	Metal stud made from 50 mm C-sections (CW 50x50x06)	
Cladding	Knauf Piano sound insulation board F	
Cavity insulation	Clamped between stud frame	
Penetration		
Clear opening dimensions (W x H)	diameter 2,5" bzw. 4,5"	
Joints	Selaed with acrylat type Hilti CP 606 (CFS-S ACR)	
Installation of cable penetration assembly	as specified by client	

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 in test rig

Test rig	Window test rig „Z-Wall“ with suppressed flanking transmission acc. to EN ISO 10140; the test rig includes a mounting frame with a 5 cm continuous acoustic break which is sealed in the test opening with elastic sealant.
Mounting of test specimens	The test specimen was mounted by the **ift** Centre for Acoustics and staff of client.
Einbaubedingungen	Einsetzen des Elementes in die Prüföffnung und beidseitige Abdichtung mit Dichtstoff Typ Perennator 2001 S grau.
Sealing	The cable penetration assemblies were sealed towards the wall using elastic sealant .
Drying time	Rendering was not necessary because the opening was in a 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 Metal stud wall installed in window test rig, with opening for two 2" cable penetration assemblies, prepared by ift Centre for Acoustics

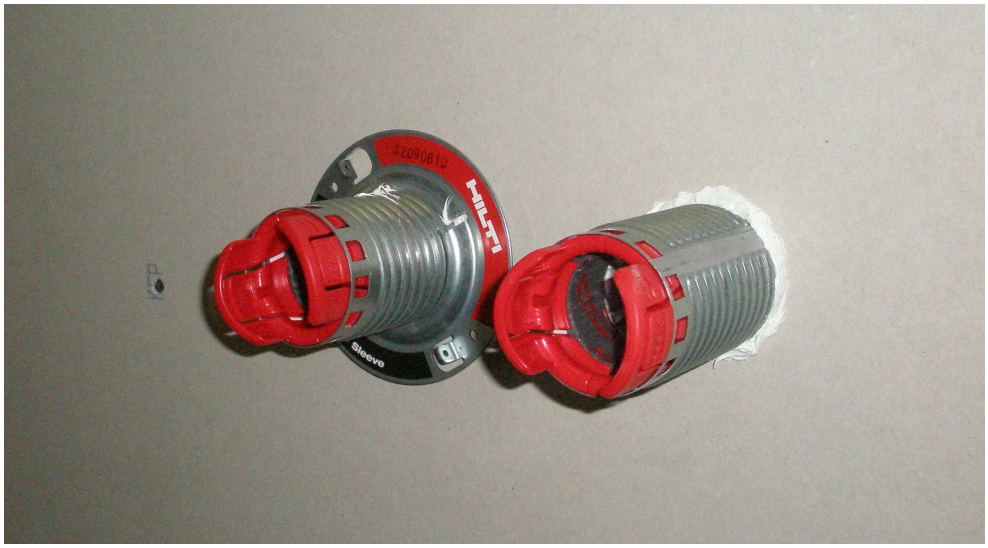


Fig. 2 Installation of cable penetration assemblies

Fig. 3 2" cable penetration assembly with 5 cable pieces each

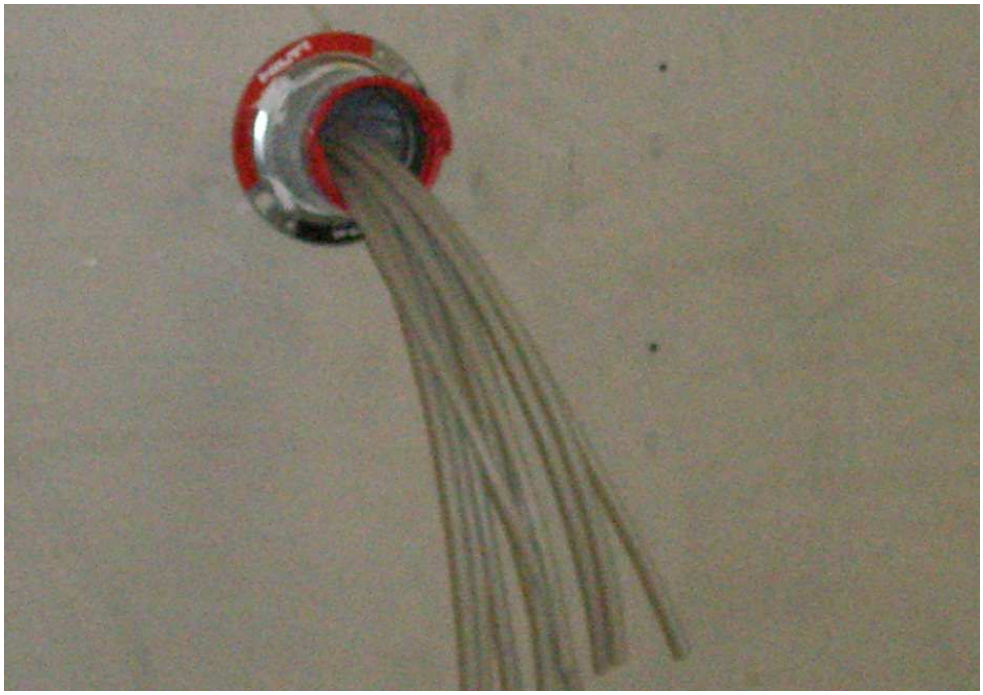


Fig. 4 4" cable penetration assembly with 10 cable pieces each

2 Procedure

2.1 Sampling

Selection of test specimen	The test specimens were selected by the client
Quantity	1
Manufacturer	Hilti AG, Schaan
Manufacturing plant	Hilti Werk 14
Date of manufacture / Date of sampling	25.10.2010
Sampling	Sampling on 25.10.2010 by MPA Stuttgart according to official seal. Seal removed on day of test (2.12.2010).
Responsible for sampling	Mr. Schulze
Delivered to **ift**	2. December 2010 by the client
ift registration number	29344

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, Clause 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, Clause 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 $A = 0{,}16 \cdot \frac{V}{T}$ m²

Measurement of sound level difference Minimum of 2 loudspeaker positions and rotating microphones

Measurement equations $R = L_1 - L_2 + 10 \cdot \lg \frac{S}{A}$ dB

Measurement equations $D_{n,e}$ $D_{n,e} = L_1 - L_2 + 10 \cdot \lg \frac{n \cdot A_0}{A}$ in dB

KEY

A	Equivalent absorption surface in m²
L_1	Sound level of source room in dB
L_2	Sound level of receiving room in dB
R	Sound reduction index in dB
$D_{n,e}$	normalized level difference of small building elements in dB
T	Reverberation times in s
V	Volume of receiving room in m³
S	Test surface of test specimen in m²
n	Quantity of the tested elements

2.3 Test equipment

Device	Type	Manufacturer
Integrating sound meter	Type Nortronic 121	Norsonic-Tippkemper
Microphone preamplifiers	Type 1201	Norsonic-Tippkemper
Microphone units	Type 1220	Norsonic-Tippkemper
Calibrator	Type 1251	Norsonic-Tippkemper
Dodecahedron loudspeakers	Own design	Norsonic-Tippkemper
Amplifiers	Type E120	Norsonic-Tippkemper
Rotating microphone boom	Own design / type 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 April 2010. The sound level meter used, Series No. 31423 was calibrated by the Dortmund Eichamt (calibration agency) on 19 January 2010. The calibration is valid until 31 December 2012.

2.4 Testing

Date	2. December 2010
Test engineer	Bernd Saß

3 Detailed results

The values of the measured normalized level difference of small building elements of the test specimen are plotted against frequency in the enclosed data sheet and are tabled .

This is used to calculate the weighted sound reduction index R_w, the weighted normalized level difference $D_{n,e,w}$ and the spectrum adaptation terms C and C_{tr} as per table 1, for the frequency range 100 Hz to 3,150 Hz as set out by EN ISO 717-1. Supplementary to the evaluation as per EN ISO 717-1, the data were evaluated as per ASTM E 413-04. As per ASTM E 413-04, the sound transmission class STC is determined for the frequency range between 125 Hz and 4,000 Hz as indicated below.

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 m²	A_0 = 2x10m²	S = 1,88 m²	S = 1,88 m²
-	Z1	Metal stud partition without wall opening	64 (2;-9)		57 (-3;-9)	57
1	Z4	One 2" cable penetration assembly without cable	54 (-1;-4)			47
2	Z2	two 2" cable penetration assembly without cable		53 (-2;-3)	43	40
3	Z3	Two 2" cable penetration assembly with 5 cable pieces each		53 (0;-2)	43	43
4	Z5	4" cable penetration assembly without cable	47 (-3;-5)		40	33
5	Z6	4" cable penetration assembly with 10 cable pieces each	47 (-1;-2)		40	38

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

ift Rosenheim
Centre for Acoustics
2 March 2011

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 Hilti Firestop sleeve CP 653 CFS-SL-S

Design of test specimen

cable penetration assembly 2" and 4" in wall opening

One 2" cable penetration assembly without cable

Test date 2. December 2010

Reference absorption area $n \times A_0$ = 10 m² (n=1)

Partition wall Double-leaf concrete wall, mounting frame

Test noise Pink noise

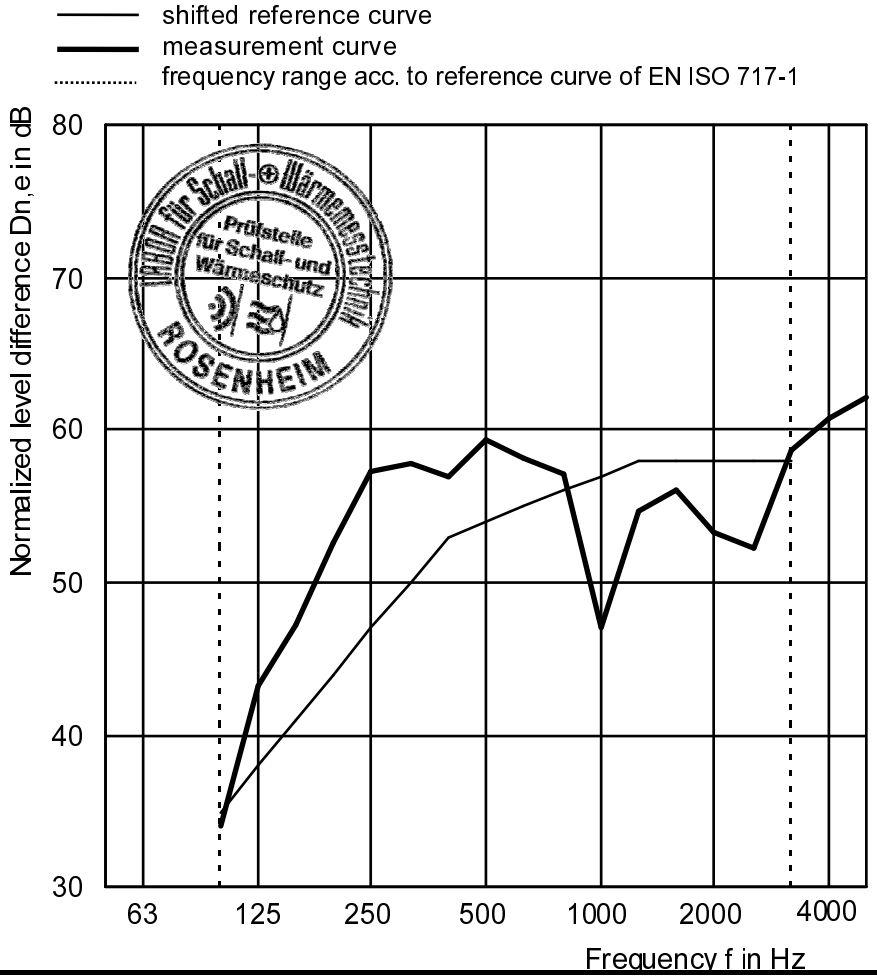
Volumes of test rooms V_S = 104 m³, V_E = 67.5 m³

Maximum normalized level difference $D_{n,e,w,max}$ = 69 dB (related to A_0 = 10 m²)

Mounting conditions
Device installed in test opening closed by a wall unit.

Climate in test rooms 23°C / 32% RF

f in Hz	$D_{n,e}$ in dB
50	-
63	-
80	-
100	34.1
125	43.2
160	47.2
200	52.6
250	57.3
315	57.9
400	56.9
500	59.3
630	58.2
800	57.1
1000	47.0
1250	54.7
1600	56.0
2000	53.3
2500	52.3
3150	58.7
4000	60.7
5000	62.2



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

$D_{n,e,w}$ (C;C_{tr}) = 54 (-1;-4) dB $C_{50\text{-}3150}$ = - dB; $C_{100\text{-}5000}$ = 0 dB; $C_{50\text{-}5000}$ = - dB

$C_{tr,50\text{-}3150}$ = - dB; $C_{tr,100\text{-}5000}$ = -4 dB; $C_{tr,50\text{-}5000}$ = - dB

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Centre for Acoustics
2 March 2011

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Head of Testing Department

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 Hilti Firestop sleeve CP 653 CFS-SL-S

Design of test specimen

cable penetration assembly 2" and 4" in wall opening

Two 2" cable penetration assembly without cable

Test date 2. December 2010

Reference absorption area $n \times A_0$ = 20 m² (n=2)

Partition wall Double-leaf concrete wall, mounting frame

Test noise Pink noise

Volumes of test rooms V_S = 104 m³, V_E = 67.5 m³

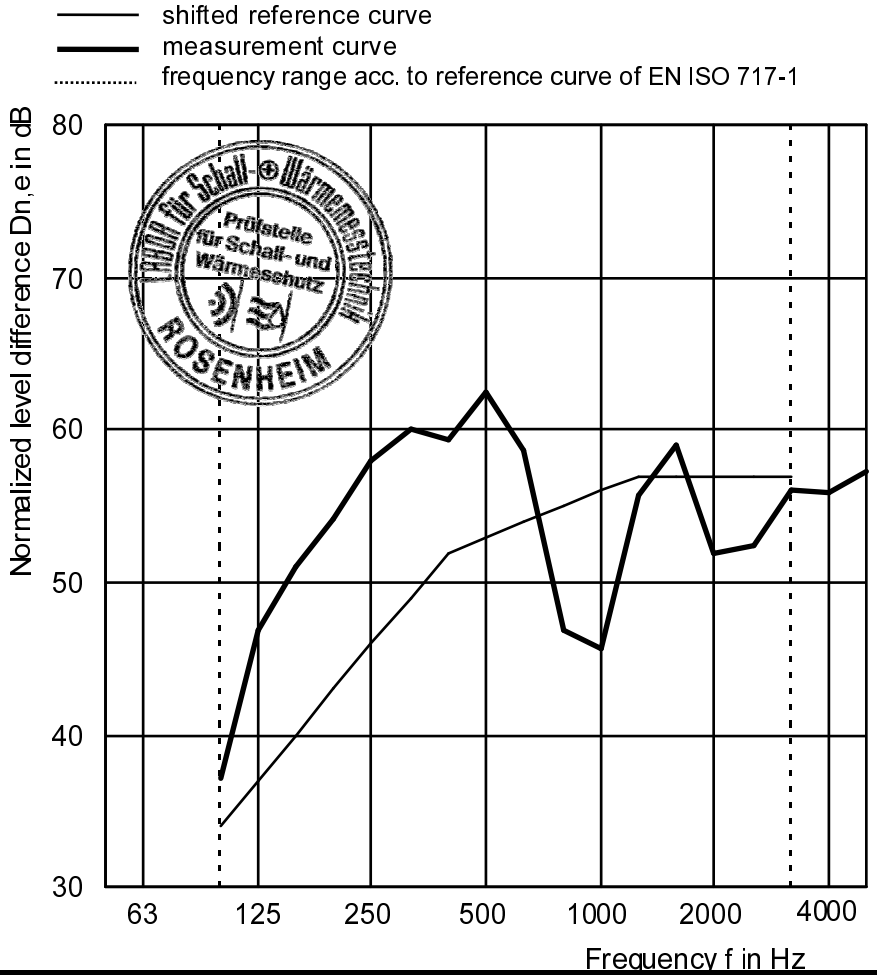
Maximum normalized level difference $D_{n,e,w,max}$ = 72 dB (related to A_0 = 20 m²)

Mounting conditions

Device installed in test opening closed by a wall unit.

Climate in test rooms 23°C / 32% RF

f in Hz	$D_{n,e}$ in dB
50	-
63	-
80	-
100	37.1
125	46.9
160	51.1
200	54.2
250	58.0
315	60.0
400	59.3
500	62.5
630	58.7
800	46.9
1000	45.6
1250	55.8
1600	59.1
2000	52.0
2500	52.4
3150	56.1
4000	55.9
5000	57.3



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

$D_{n,e,w}$ (C;C_{tr}) = 53 (-2;-3) dB $C_{50\text{-}3150}$ = - dB; $C_{100\text{-}5000}$ = -1 dB; $C_{50\text{-}5000}$ = - dB

$C_{tr,50\text{-}3150}$ = - dB; $C_{tr,100\text{-}5000}$ = -3 dB; $C_{tr,50\text{-}5000}$ = - dB

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Data sheet 2

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Centre for Acoustics

2 March 2011

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Head of Testing Department

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 Hilti Firestop sleeve CP 653 CFS-SL-S

Design of test specimen

cable penetration assembly 2" and 4" in wall opening

Two 2" cable penetration assembly with 5 cable pieces each

Test date 2. December 2010

Reference absorption area $n \times A_0$ = 20 m² (n=2)

Partition wall Double-leaf concrete wall, mounting frame

Test noise Pink noise

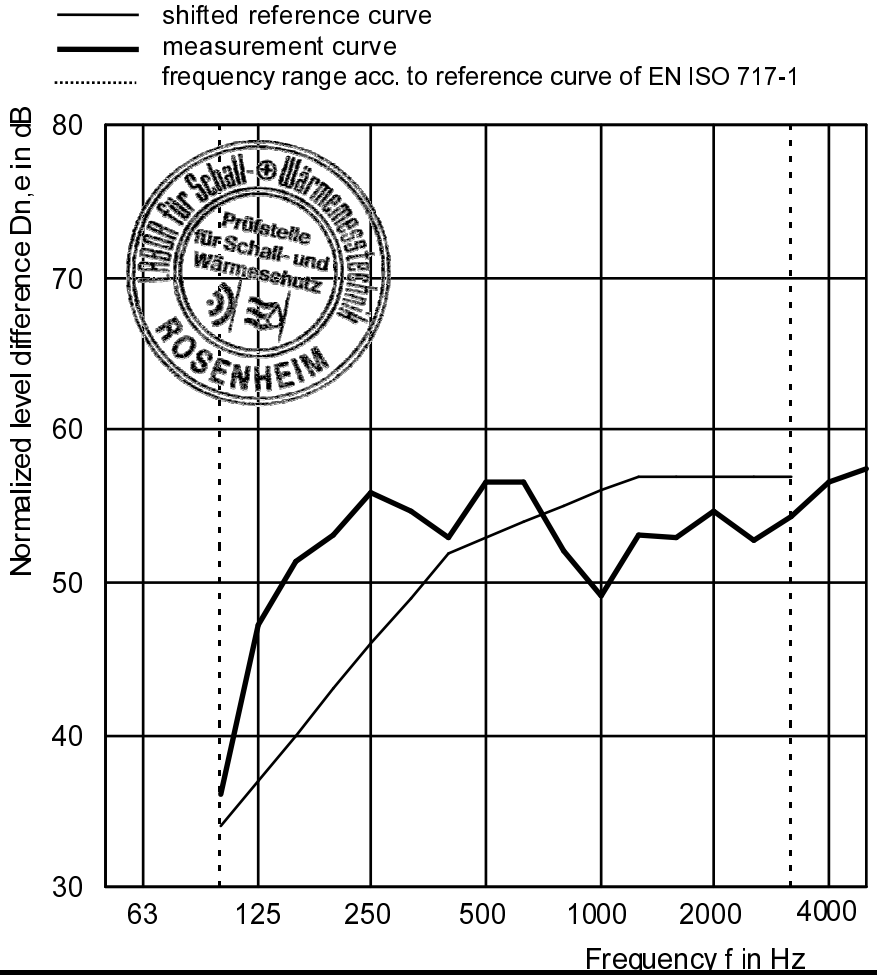
Volumes of test rooms V_S = 104 m³, V_E = 67.5 m³

Maximum normalized level difference $D_{n,e,w,max}$ = 72 dB (related to A_0 = 10 m²)

Mounting conditions
Device installed in test opening closed by a wall unit.

Climate in test rooms 23°C / 32% RF

f in Hz	$D_{n,e}$ in dB
50	-
63	-
80	-
100	36.1
125	47.2
160	51.4
200	53.1
250	55.9
315	54.7
400	53.0
500	56.5
630	56.6
800	52.1
1000	49.1
1250	53.2
1600	52.9
2000	54.7
2500	52.8
3150	54.4
4000	56.5
5000	57.5



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

$D_{n,e,w}$ ($C;C_{tr}$) = 53 (0;-2) dB $C_{50-3150}$ = - dB; $C_{100-5000}$ = 0 dB; $C_{50-5000}$ = - dB

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

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Centre for Acoustics
2 March 2011

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Head of Testing Department

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 Hilti Firestop sleeve CP 653 CFS-SL-S

Design of test specimen

cable penetration assembly 2" and 4" in wall opening

One 4" cable penetration assembly without cable

Test date 2. December 2010

Reference absorption area $n \times A_0$ = 10 m² (n=1)

Partition wall Double-leaf concrete wall, mounting frame

Test noise Pink noise

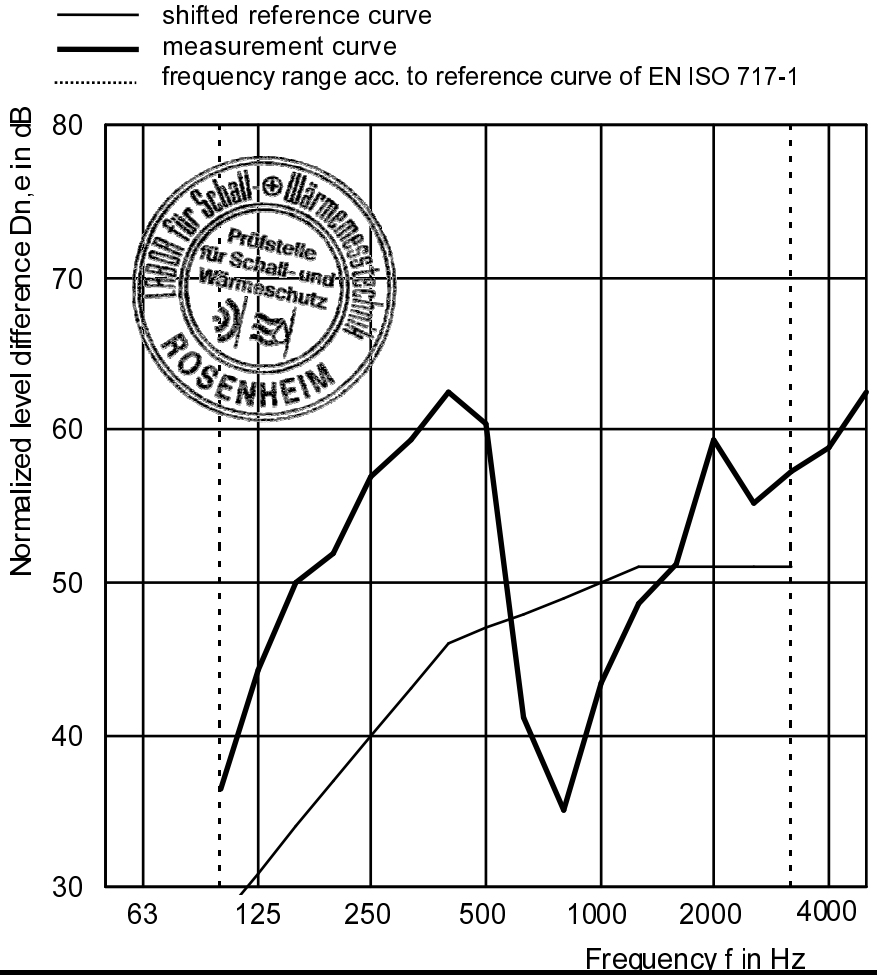
Volumes of test rooms V_S = 104 m³, V_E = 67.5 m³

Maximum normalized level difference $D_{n,e,w,max}$ = 69 dB (related to A_0 = 10 m²)

Mounting conditions
Device installed in test opening closed by a wall unit.

Climate in test rooms 23°C / 32% RF

f in Hz	$D_{n,e}$ in dB
50	-
63	-
80	-
100	36.5
125	44.2
160	50.0
200	52.0
250	57.0
315	59.4
400	62.5
500	60.4
630	41.2
800	35.1
1000	43.4
1250	48.6
1600	51.2
2000	59.4
2500	55.2
3150	57.2
4000	58.8
5000	62.4



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

$D_{n,e,w}$ (C;C_{tr}) = 47 (-3;-5) dB $C_{50-3150}$ = - dB; $C_{100-5000}$ = -2 dB; $C_{50-5000}$ = - dB

$C_{tr,50-3150}$ = - dB; $C_{tr,100-5000}$ = -5 dB; $C_{tr,50-5000}$ = - dB

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2 March 2011

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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 Hilti Firestop sleeve CP 653 CFS-SL-S

Design of test specimen

cable penetration assembly 2" and 4" in wall opening

One 4" cable penetration assembly with 10 cable pieces each

Test date 2. December 2010

Reference absorption area $n \times A_0$ = 10 m² (n=1)

Partition wall Double-leaf concrete wall, mounting frame

Test noise Pink noise

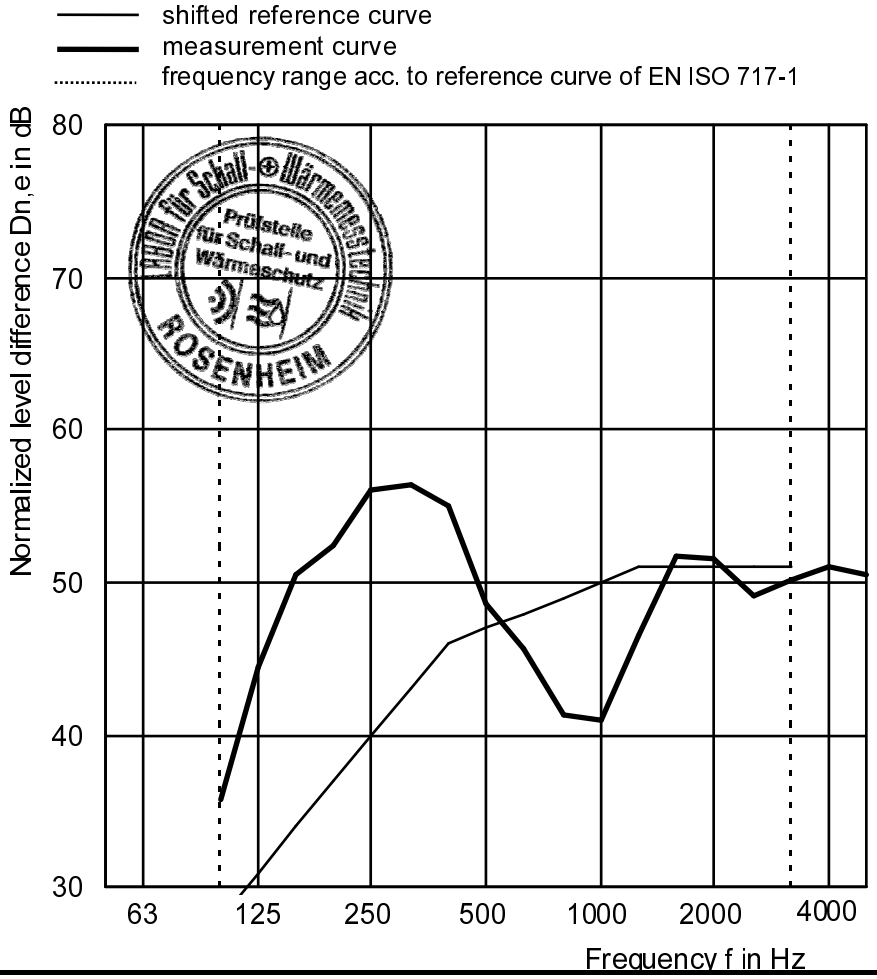
Volumes of test rooms V_S = 104 m³, V_E = 67.5 m³

Maximum normalized level difference $D_{n,e,w,max}$ = 69 dB (related to A_0 = 10 m²)

Mounting conditions
Device installed in test opening closed by a wall unit.

Climate in test rooms 23°C / 32% RF

f in Hz	$D_{n,e}$ in dB
50	-
63	-
80	-
100	35,8
125	44,4
160	50,6
200	52,5
250	56,0
315	56,4
400	55,0
500	48,7
630	45,7
800	41,4
1000	41,0
1250	46,5
1600	51,8
2000	51,5
2500	49,2
3150	50,1
4000	51,0
5000	50,5



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

$D_{n,e,w}$ (C;C_{tr}) = 47 (-1;-2) dB $C_{50-3150}$ = - dB; $C_{100-5000}$ = 0 dB; $C_{50-5000}$ = - dB

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

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2 March 2011

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