

Evidence of Performance

Airborne sound insulation of fire rated products

Test report 13-000855-PR01
(PB-K03-04-en-01)



Client **Hilti Entwicklungsgesellschaft mbH**
Hiltistr. 6
86916 Kaufering
Germany

Product	Pipe DN 32 / DN 90 with Hilti Firestop Collar Endless CFS-C EL in wall penetration
Designation	Hilti Firestop Collar Endless CFS-C EL
Construction	Intumescent strips in glass cloth adhesive-coated with PUR soft foam
Nominal diameter	32 mm and 90 mm
Wall construction	Metal stud partition Double stud framing, double clad

Basis

ETAG N°026 Part 2:2008-01
EN ISO 10140-1 : 2010
+A1:2012
EN ISO 10140-2 : 2010
EN ISO 717-1 : 2013
Additionally

ASTM E 90-09
ASTM E 413-10

Test report no. 13-000855-PR01 (PB-K03-04-de-01) dated 09.08.2013.

Instructions for use

This test report serves to verify the sound insulation of fire rated products on the basis of ETAG 026, Part 2, Clause 2.4.9

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



Pipe DN 32 with Hilti Firestop Collar Endless CFS-C EL

$$D_{n,e,w} (C; C_{tr}) = 68 (-2;-6) \text{ dB}$$

Pipe DN 90 with Hilti Firestop Collar Endless CFS-C EL

$$D_{n,e,w} (C; C_{tr}) = 64 (-3;-3) \text{ dB}$$

Validity

The data and results given relate solely to the tested and described specimen.

Testing the sound insulation does not allow any statement to be made on any further characteristics of the present construction regarding performance and quality.

ift Rosenheim
11.09.2013

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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 abstract.

Contents

The test report contains a total of 15 pages:

- 1 Object
- 2 Procedure
- 3 Detailed results

Data sheets (5 Pages)

1 Object

1.1 Description of test specimen

Product	Pipe DN 32 / DN 90 with Hilti Firestop Collar Endless CFS-C EL in wall penetration
Product designation	Hilti Firestop Collar Endless CFS-C EL
Dimensions	nominal diameter 32 mm and 90 mm
Total length of pipes	1,155 mm
Composition	Intumescent strips in glass cloth, adhesive-coated with PUR soft foam
Type of mineral wool boards	ISOVER Protect BSP 40
Test variants	<ul style="list-style-type: none"> - test of double stud partition without opening - test with opening Ø = 60 mm and installed pipe DN 32 with Hilti Firestop Collar Endless CFS-C EL - test with opening Ø = 120 mm and installed pipe DN 90 with Hilti Firestop Collar Endless CFS-C EL
Metal stud partition	
Manufacturer*	metal stud partition mounted by ift Laboratory for Building Acoustics
Date of manufacture	29 May 2013
Sampling	by ift Laboratory for Building Acoustics at builder's merchant
Dimensions (W x H)	1,250 mm x 1,500 mm
Total thickness	155 mm
Structure	2 x 12.5 mm GKF 50 mm metal studs, mineral fibre insulation 40 mm 5 mm gap 50 mm metal studs, mineral fibre insulation 40 mm 2 x 12.5 mm GKF
Stud framing	metal studs from 50 mm C-wall channel section (CW 50x50x06)
Cladding	Knauf Piano sound insulation board F
Cavity insulation	mounted between stud framing
Penetration	
Clear opening	diameter 60 mm / 120 mm
Built-in components	(test variant 1)
Pipe	Valsir Triplus DN 32 x 1.8 HTEM
Tube insulation	Flex PE tube insulation CONEL 5/80
Sealing compound	Hilti fire rated filler CP 606 (= CFS-S ACR) (acrylic sealing compound)
Fire rated product	Hilti Firestop Collar Endless CFS-C EL
Installation	<ul style="list-style-type: none"> - pipe in tube insulation placed into opening, pipe projects



	on both side approx. 500 mm from partition, the open ends of the pipe were closed on both sides
	- annular gap filled with acrylic sealing compound
	- Hilti Firestop Collar Endless CFS-C EL on both sides placed tightly fitting around pipe, ends joined to cover plates and fixed to metal stud partition using 2 fastening hooks on each side.
Built-in components	(test variant 2)
Pipe	PVC-U 90 x 10
Tube insulation	Flex PE tube insulation CONEL 5/80
Sealing compound	Hilti fire rated filler CP 606 (= CFS-S ACR) (acrylic sealing compound)
Fire rated product	Hilti Firestop Collar Endless CFS-C EL
Installation	- pipe in tube insulation placed into opening, pipe projects on both side approx. 500 mm from partition, the open ends of the pipe were closed on both sides - - annular gap filled with acrylic sealing compound - Hilti Firestop Collar Endless CFS-C EL on both sides placed tightly fitting around pipe, ends joined to cover plates and fixed to metal stud partition using 2 fastening hooks on each side

The description is based on inspection of the test specimen at **ift** Laboratory for Building Acoustics. Item designations / numbers as well as material specifications were provided by the client. Additional data provided by the client are marked with *

1.2 Mounting to test rig

Test rig	Window test rig „Z-Wall“ with suppressed flanking transmission acc. to EN ISO 10140-5: 2010; the test rig includes a mounting frame with a continuous acoustic break which is sealed in the test opening with closed-cell permanently resilient sealant.
Mounting of test specimen	Mounted by ift Laboratory for Building Acoustics and employees of the client.
Mounting conditions	Test specimen mounted to test opening and sealed on both sides with sealant type Perennator 2001 S grey.
Sealing	Pipes were sealed towards partition with elastic sealant.
Drying time	Rendering of the gypsum plasterboards was not necessary because the opening was in a board (without joints).

1.3 Representation of test specimen

The structural details were examined solely on the basis of the characteristics to be classified.

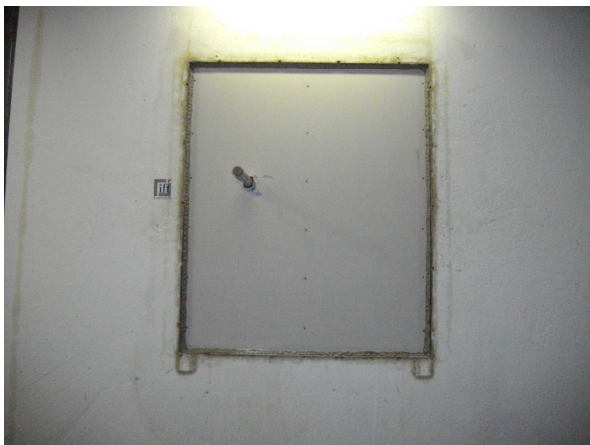


Source room



Receiving room

Fig. 1 Photos of metal stud partition mounted to window test rig, taken by ift Laboratory for Building Acoustics



Source room



Receiving room

Fig. 2 Installation of test variant 1



Source room



Receiving room

Fig. 3 Installation of test variant 2

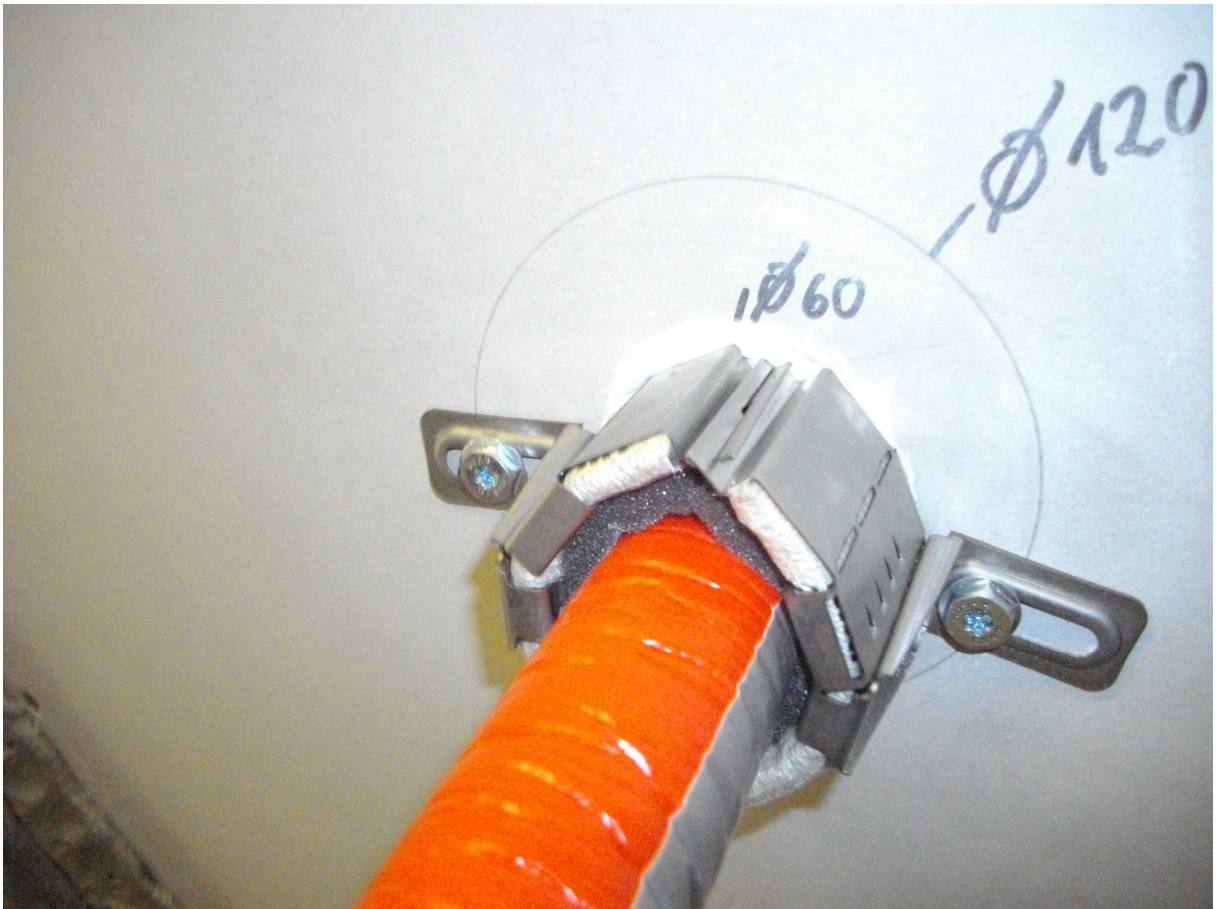


Photo 4 Pipe DN 32 in tube insulation with attached Hilti Firestop Collar Endless CFS-C EL

2 Procedure

2.1 Sampling

Sampling	The samples were selected by the client
Quantity	1 carton box with 7 reels
Manufacturer	Hilti AG, BU Chemicals, Feldkircher Str. 100, FL-9494 Schaan
Manufacturing plant	Hilti Werk 5B
Batch number	00701348
Date of sampling	13 December 2012
Procedure of sampling	Official initial sampling on 13 December 2012 at production plant by auditor Mike Nicholson on behalf of Warrington Certification Limited. The seal (see photo 5) of the marked-up samples was removed by an employee of the ift Laboratory for Building Acoustics on the date of test (03.06.2013).
Responsible for sampling	Mr. Rump
Delivery at ift	3 June 2013 by the client
ift registration number	34805



Carton box



Individual roll

Photo 5 Samples received, sealed and marked up



2.2 Method/s

Basis

ETAG N°026, Part 2:2008 Guideline for European Technical Approval of Fire Stopping and Fire Sealing Products

EN ISO 10140-1:2010 + A1 : 2012 Acoustics; Laboratory measurement of sound insulation of building elements - Part 1: Application rules for specific products (ISO 10140-1:2010+Amd.1:2012)

EN ISO 10140-2:2010 Acoustics; Laboratory measurement of sound insulation of building elements - Part 2: Measurement of airborne sound insulation (ISO 10140-2:2010)

EN ISO 717-1 : 2013 Acoustics; Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation

Correspond/s to the national German standard/s:

DIN EN ISO 10140-1:2012-05, DIN EN ISO 10140-2:2010-12 und DIN EN ISO 717-1 : 2013-06

Additional basis

ASTM E 90-09 Standard test method for laboratory measurement of airborne sound transmission loss of building partitions and elements

ASTM E 413-10 Classification for rating sound insulation

Boundary conditions

As specified by the standards. According to ETAG 026 Part 2 Clause 2.4.9 sound insulation must be tested to EN ISO 140-10 and evaluated in accordance with EN ISO 717. Additional comparative testing to EN ISO 140-3 is furthermore required.

Upon request by the client additional evaluations of the STC were carried out in accordance with ASTM E 413-10. The standards EN ISO 140-10 and EN ISO 140-3 were superseded by the standard EN ISO 10140-2 in 2010. The test was conducted in accordance with this standard.

The test methods of EN ISO 10140 and EN ISO 140 are identical.

Deviation

The linear flow resistance of the insulating material was not determined.

Test noise

Pink noise

Measuring filter

One-third-octave band filter



Measurement limits

Low frequencies	The dimensions of the receiving room were smaller than recommended for testing in the frequency range from 50 Hz to 80 Hz as per EN ISO 10140-4:2010 Annex A (informative). A moving loudspeaker was used.
Background noise level	The background noise level in the receiving room was determined during measurement and the receiving room level L_2 corrected by calculation as per EN 10140-4: 2010 Clause 4.3.
Maximum sound insulation	The difference between sound insulation and maximum sound insulation of the test setup is partly smaller than 15 dB. It was corrected by calculation as per EN ISO 10140-2:2010 Annex A. The graphs presented in the Annex include maximum sound insulation.

Measurement of

reverberation time	Arithmetical mean: 6 measurements each of 2 loudspeaker positions with rotating microphone (total of 12 measurements).
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Measurement equation A	$A = 0,16 \cdot \frac{V}{T} \text{ m}^2$
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Measurement of sound level

difference	Minimum of 2 loudspeaker positions and rotating microphones.
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Measurement equation	$R = L_1 - L_2 + 10 \cdot \lg \frac{S}{A} \text{ dB}$
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Measurement equation $D_{n,e}$	$D_{n,e} = L_1 - L_2 + 10 \cdot \lg \frac{n \cdot A_0}{A} \text{ in dB}$
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KEY

A	Equivalent absorption area in m^2
L_1	Sound pressure level source room in dB
L_2	Sound pressure level receiving room in dB
R	Sound reduction index in dB
$D_{n,e}$	Normalized sound level difference of small building elements in dB
T	Reverberation time in s
V	Volume of receiving room in m^3
S	Testing area of the specimen in m^2
n	Number of tested units

2.3 Test equipment

Device	Type	Manufacturer
Integrating sound meter	Type Nortronic 830	Norsonic-Tippkemper
Microphone preamplifiers	Type 1201	Norsonic-Tippkemper
Microphone unit	Type 1220	Norsonic-Tippkemper
Calibrator	Type 1251	Norsonic-Tippkemper
Dodecahedron loudspeakers	Own production	-
Amplifier	Type E120	FG Elektronik
Rotating microphone boom	Own production / Type 231-N-360	Norsonic-Tippkemper

The **ift** Laboratory for Building Acoustics participates in comparative measurements at the Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig every three years, the last one was in April 2013. The sound level meter used, Series No. 17956, was calibrated by the Dortmund Eichamt (calibration agency) on 8 March 2012. The calibration is valid until 31 December 2014. The sound level meter used, Series No. 17956, was DKD calibrated by the company Norsonic Tippkemper (DKD - Deutscher Kalibrierdienst "German Calibration Service") on 14 March 2013.

2.4 Testing

Date	3 June 2013
Operating testing officer	Stefan Bacher

3 Detailed results

The values of the measured normalized sound level difference of small building elements of the tested elements are plotted as a function of frequency in the annexed data sheet and tabled.

They are used to calculate the weighted sound reduction index R_w / the weighted normalized sound level difference $D_{n,e,w}$ and the spectrum adaptation terms C and C_{tr} for the frequency range 100 Hz to 3,150 Hz, as described in Table 1. Additional to the weighting according to EN ISO 717-1 a weighting according to ASTM E 413-10 was carried out. The sound transmission class STC according to ASTM E 413-10 for the frequency range from 125 Hz up to 4,000 Hz was calculated as follows:

Table 1 Results of acoustic test

Data sheet No	Record No.	Component	Testing standard / Results in dB / Datum surface		
			EN ISO 10140-2	EN ISO 10140-2	E 413-10
			$D_{n,e,w} (C; C_{tr})$	$R_w (C; C_{tr})$	STC
			$A_0 = 10 \text{ m}^2$	$S = 1,88 \text{ m}^2$	$S = 1,88 \text{ m}^2$
1	Z1B	Metal stud partition without penetration		61 (-2;-7)	60
2	Z2B	Pipe DN 32 with Hilti Firestop Collar Endless CFS-C EL	--	61 (-3;-6)	60
3	Z2.1B	Pipe DN 32 with Hilti Firestop Collar Endless CFS-C EL	68 (-2;-6)	--	--
4	Z3B	Pipe DN 90 with Hilti Firestop Collar Endless CFS-C EL	--	56 (-2;-2)	53
5	Z3.1B	Pipe DN 90 with Hilti Firestop Collar Endless CFS-C EL	64 (-3;-3)	--	--

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

ift Rosenheim
Laboratory for Building Acoustics
11.09.2013

Sound reduction index according to ISO 10140 - 2

Laboratory measurements of airborne sound insulation of building elements

Client: Hilti Entwicklungsgesellschaft, 86916 Kaufering, Germany

Product designation Hilti Firestop Collar Endless CFS-C EL



Design of test specimen

2 x 12,5 mm GKF
50 mm Metal stud CW 50 with
40 mm mineral wool
5 mm Gap
50 mm Metal stud CW 50 with
40 mm mineral wool
2 x 12,5 mm GKF

Test date 3 June 2013

Test surface S 1.25 m x 1.50 m = 1.88 m²

Partition wall Double-leaf concrete wall, insert frame

Test noise pink noise

Volumes of test rooms $V_S = 104 \text{ m}^3$
 $V_R = 67.5 \text{ m}^3$

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

Mounting conditions

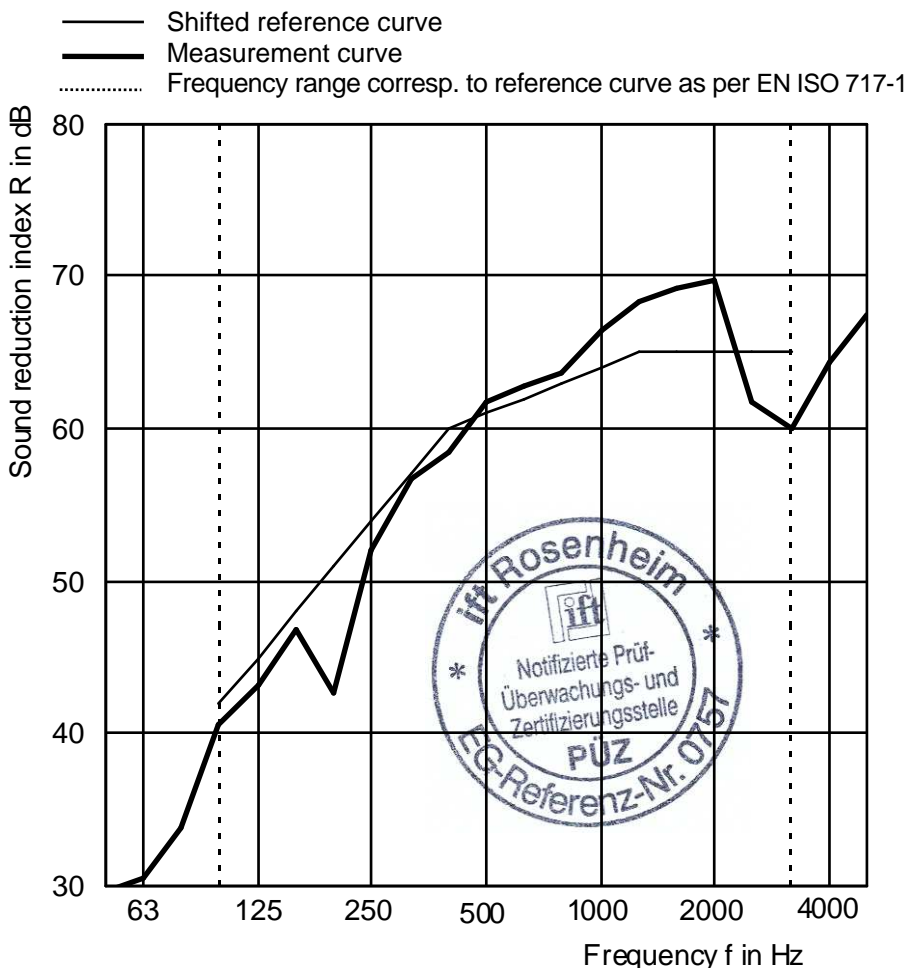
Device inserted in test opening closed by a wall unit.

Climate in test rooms 16°C / 57% RF / 966 hPa

Metal stud partition without opening

Total thickness 155 mm
Mass per unit area 50,0 kg/m²

f in Hz	R in dB
50	29.7
63	30.5
80	33.8
100	40.5
125	43.1
160	46.9
200	42.6
250	52.0
315	56.8
400	58.4
500	61.7
630	62.8
800	63.6
1000	66.5
1250	68.4
1600	69.3
2000	69.7
2500	61.8
3150	60.1
4000	64.4
5000	67.5



Rating according to EN ISO 717-1 (in third octave bands):

$R_w (C; C_{tr}) = 61 (-2; -7) \text{ dB}$
 $C_{50-3150} = -4 \text{ dB}; C_{100-5000} = -1 \text{ dB}; C_{50-5000} = -3 \text{ dB}$
 $C_{tr,50-3150} = -13 \text{ dB}; C_{tr,100-5000} = -7 \text{ dB}; C_{tr,50-5000} = -13 \text{ dB}$

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Laboratory for Building Acoustics

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Operating testing officer

Sound reduction index according to ISO 10140 - 2

Laboratory measurements of airborne sound insulation of building elements

Client: Hilti Entwicklungsgesellschaft, 86916 Kaufering, Germany

Product designation Hilti Firestop Collar Endless CFS-C EL



Design of test specimen

2 x 12.5 mm GKF
50 mm Metal stud CW 50 with
40 mm mineral wool
5 mm Gap
50 mm Metal stud CW 50 with
40 mm mineral wool
2 x 12.5 mm GKF

Metal stud partition with opening $\varnothing = 60$ mm
Filled with pipe DN 32 with Hilti Firestop Collar
Endless CFS-C EL on both sides

Test date 3 June 2013

Test surface S 1.25 m x 1.50 m = 1.88 m²

Partition wall Double-leaf concrete wall, insert frame

Test noise pink noise

Volumes of test rooms $V_S = 104$ m³
 $V_R = 67.5$ m³

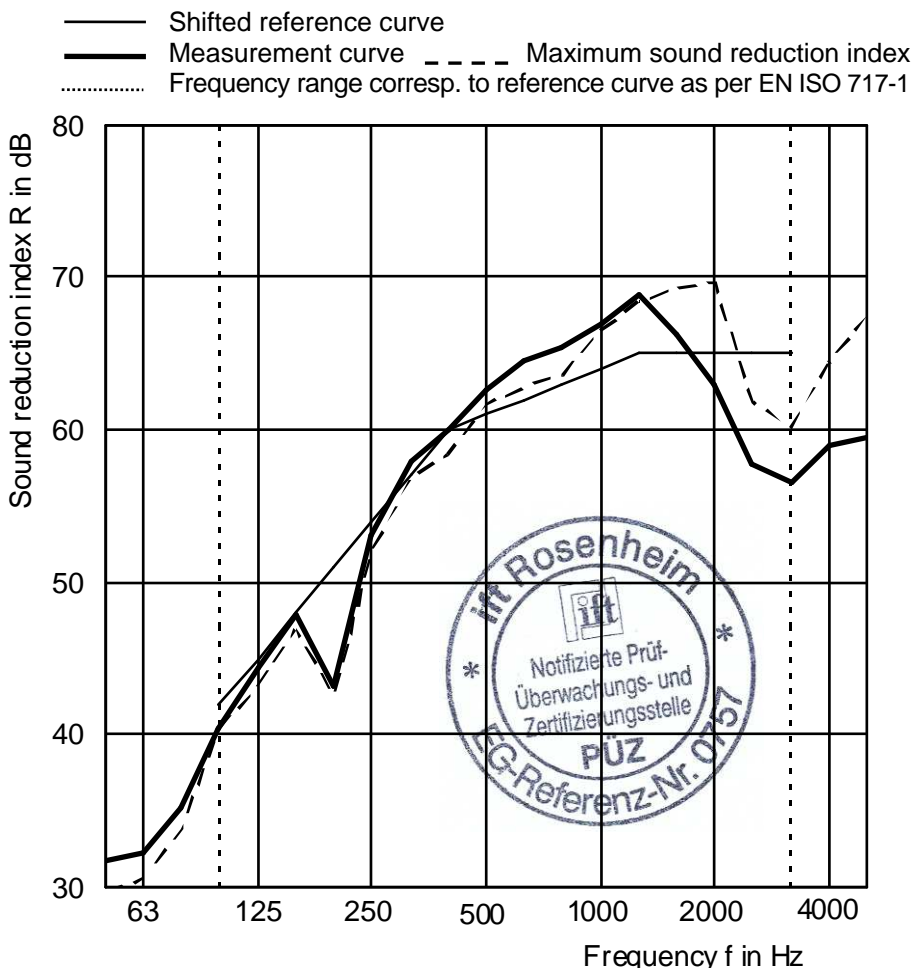
Maximum sound reduction index
 $R_{w,max} = 61$ dB (related to test surface)

Mounting conditions

Device inserted in test opening closed by a wall unit.

Climate in test rooms 16°C / 57% RF / 966 hPa

f in Hz	R in dB
50	> 31.7
63	> 32.2
80	> 35.2
100	> 40.4
125	> 44.4
160	> 47.9
200	> 43.2
250	> 53.1
315	> 58.0
400	> 60.0
500	> 62.7
630	> 64.5
800	> 65.4
1000	> 67.0
1250	> 68.8
1600	66.2
2000	62.9
2500	57.8
3150	56.5
4000	58.9
5000	59.5



Rating according to EN ISO 717-1 (in third octave bands):

$R_w(C;C_{tr}) = 61 (-3;-6)$ dB

$C_{50-3150} = -4$ dB; $C_{100-5000} = -3$ dB; $C_{50-5000} = -3$ dB

$C_{tr,50-3150} = -11$ dB; $C_{tr,100-5000} = -6$ dB; $C_{tr,50-5000} = -11$ dB

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Normalized sound level difference acc. to ISO 10140 - 2
Laboratory measurements of airborne sound insulation of building elements

Client: Hilti Entwicklungsgesellschaft. 86916 Kaufering, Germany

Product designation Hilti Firestop Collar Endless CFS-C EL



Design of test specimen

2 x 12.5 mm GKF
50 mm Metal stud CW 50 with
40 mm mineral wool
5 mm Gap
50 mm Metal stud CW 50 with
40 mm mineral wool
2 x 12.5 mm GKF

Test date 3 June 2013

Reference absorption area $n \times A_0 = 10 \text{ m}^2$ ($n=1$)

Partition wall Double-leaf concrete wall, insert frame

Test noise pink noise

Volumes of test rooms $V_S = 104 \text{ m}^3$
 $V_R = 67.5 \text{ m}^3$

Maximum sound reduction index
 $D_{n,e,w,max} = 69 \text{ dB}$ (related to $A_0 = 10 \text{ m}^2$)

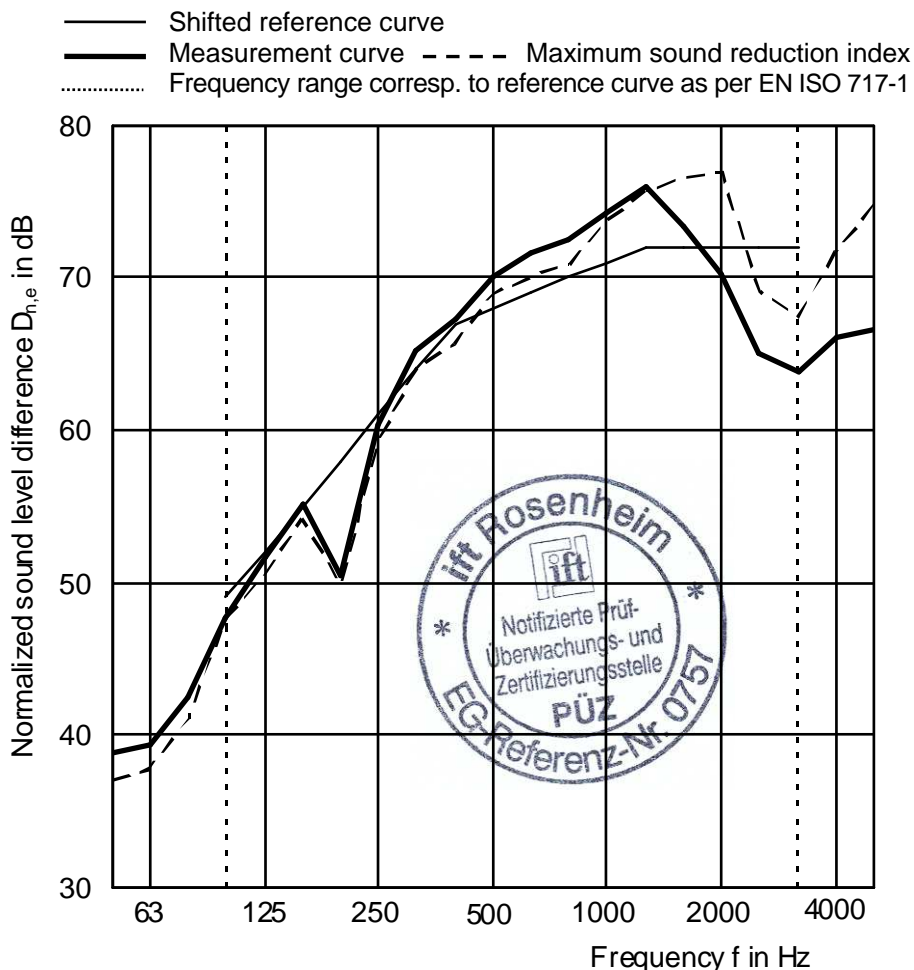
Mounting conditions

Device inserted in test opening closed by a wall unit.

Climate in test rooms 16°C / 57% RF / 966 hPa

**Metal stud partition with opening $\varnothing = 60 \text{ mm}$
Filled with pipe DN 32 with Hilti Firestop Collar
Endless CFS-C EL on both sides**

f in Hz	$D_{n,e}$ in dB
50	> 38.9
63	> 39.4
80	> 42.5
100	> 47.7
125	> 51.7
160	> 55.1
200	> 50.5
250	> 60.4
315	> 65.3
400	> 67.3
500	> 70.0
630	> 71.7
800	> 72.6
1000	> 74.3
1250	> 76.0
1600	73.4
2000	70.2
2500	65.0
3150	63.8
4000	66.1
5000	66.7



Rating according to EN ISO 717-1 (in third octave bands):

$D_{n,e,w} (C; C_{tr}) = 68 (-2; -6) \text{ dB}$

$C_{50-3150} = -3 \text{ dB}$; $C_{100-5000} = -2 \text{ dB}$; $C_{50-5000} = -3 \text{ dB}$

$C_{tr,50-3150} = -11 \text{ dB}$; $C_{tr,100-5000} = -6 \text{ dB}$; $C_{tr,50-5000} = -11 \text{ dB}$

Test report No.: 13-000855-PR01 (PB-K03-04-en-01)

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Sound reduction index according to ISO 10140 - 2

Laboratory measurements of airborne sound insulation of building elements

Client: Hilti Entwicklungsgesellschaft. 86916 Kaufering, Germany

Product designation Hilti Firestop Collar Endless CFS-C EL



Design of test specimen

2 x 12.5 mm GKF
50 mm Metal stud CW 50 with
40 mm mineral wool
5 mm Gap
50 mm Metal stud CW 50 with
40 mm mineral wool
2 x 12.5 mm GKF

Test date 3 June 2013

Test surface S 1.25 m x 1.50 m = 1.88 m²

Partition wall Double-leaf concrete wall, insert frame

Test noise pink noise

Volumes of test rooms $V_S = 104 \text{ m}^3$
 $V_R = 67.5 \text{ m}^3$

Maximum sound reduction index
 $R_{w,max} = 61 \text{ dB}$ (related to test surface)

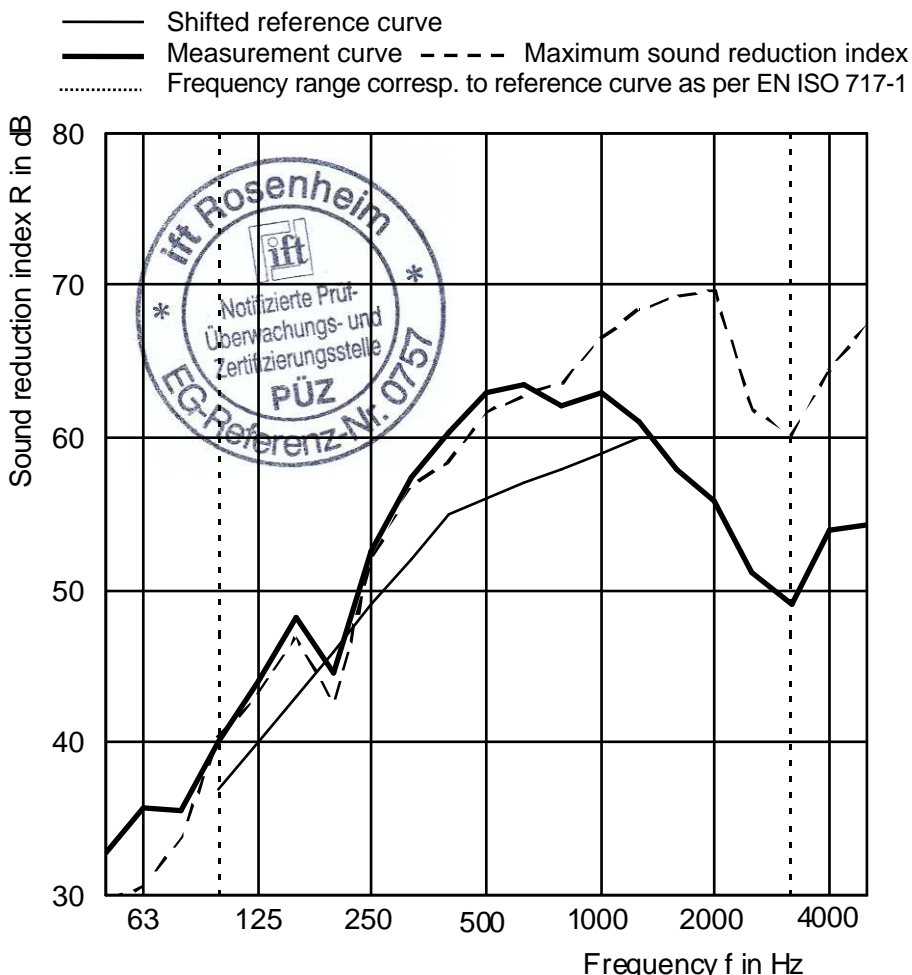
Mounting conditions

Device inserted in test opening closed by a wall unit.

Climate in test rooms 16°C / 57% RF / 966 hPa

**Metal stud partition with opening $\varnothing = 120 \text{ mm}$
Filled with pipe DN 90 with Hilti Firestop Collar
Endless CFS-C EL on both sides**

f in Hz	R in dB
50	> 32.7
63	> 35.8
80	> 35.5
100	> 40.1
125	> 44.1
160	> 48.3
200	> 44.6
250	> 52.6
315	> 57.5
400	> 60.3
500	> 63.0
630	> 63.5
800	> 62.1
1000	63.0
1250	61.0
1600	58.0
2000	55.9
2500	51.1
3150	49.0
4000	54.0
5000	54.3



Rating according to EN ISO 717-1 (in third octave bands):

$R_w(C;C_{tr}) = 56 (-2;-2) \text{ dB}$

$C_{50-3150} = -2 \text{ dB}$; $C_{100-5000} = -2 \text{ dB}$; $C_{50-5000} = -2 \text{ dB}$

$C_{tr,50-3150} = -6 \text{ dB}$; $C_{tr,100-5000} = -2 \text{ dB}$; $C_{tr,50-5000} = -6 \text{ dB}$

Test report No.: 13-000855-PR01 (PB-K03-04-en-01)

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Laboratory for Building Acoustics

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Normalized sound level difference acc. to ISO 10140 - 2
Laboratory measurements of airborne sound insulation of building elements

Client: Hilti Entwicklungsgesellschaft. 86916 Kaufering

Product designation Hilti Firestop Collar Endless CFS-C EL, Germany



Design of test specimen

2 x 12.5 mm GKF
50 mm Metal stud CW 50 with
40 mm mineral wool
5 mm Gap
50 mm Metal stud CW 50 with
40 mm mineral wool
2 x 12.5 mm GKF

Test date 3 June 2013

Reference absorption area $n \times A_0 = 10 \text{ m}^2$ ($n=1$)

Partition wall Double-leaf concrete wall, insert frame

Test noise pink noise

Volumes of test rooms $V_S = 104 \text{ m}^3$
 $V_R = 67.5 \text{ m}^3$

Maximum sound reduction index
 $D_{n,e,w,max} = 69 \text{ dB}$ (related to $A_0 = 10 \text{ m}^2$)

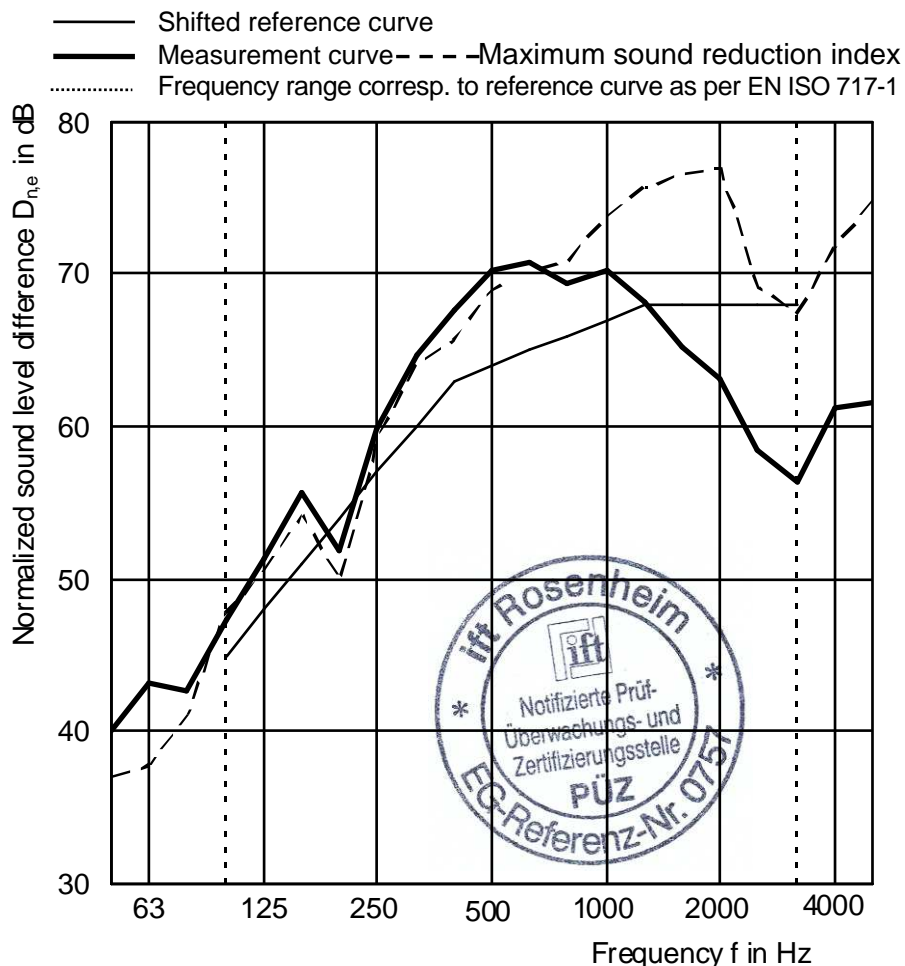
Mounting conditions

Device inserted in test opening closed by a wall unit.

Climate in test rooms 16°C / 57% RF / 966 hPa

**Metal stud partition with opening $\varnothing = 120 \text{ mm}$
Filled with pipe DN 90 with Hilti Firestop Collar
Endless CFS-C EL on both sides**

f in Hz	$D_{n,e}$ in dB
50	> 40.0
63	> 43.1
80	> 42.7
100	> 47.4
125	> 51.3
160	> 55.6
200	> 51.9
250	> 59.8
315	> 64.7
400	> 67.6
500	> 70.3
630	> 70.8
800	> 69.4
1000	70.2
1250	68.2
1600	65.3
2000	63.1
2500	58.4
3150	56.3
4000	61.3
5000	61.6



Rating according to EN ISO 717-1 (in third octave bands):

$D_{n,e,w} (C; C_{tr}) = 64 (-3; -3) \text{ dB}$ $C_{50-3150} = -3 \text{ dB}$; $C_{100-5000} = -3 \text{ dB}$; $C_{50-5000} = -3 \text{ dB}$
 $C_{tr,50-3150} = -7 \text{ dB}$; $C_{tr,100-5000} = -3 \text{ dB}$; $C_{tr,50-5000} = -7 \text{ dB}$

Test report No.: 13-000855-PR01 (PB-K03-04-en-01)

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