Evidence of Performance
Joint sound reduction of filling material

Test Report
No. 16-001466-PR01
(PB Z1-K02-04-en-01)

ROSENHEIM

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

Product	Gunned Acrylate - Sealant, joint was sealed on both sides
Designation	HILTI CFS-S ACR / HILTI CP 606
Density	0.5 kg/running metres
Special features	-/-

Weighted sound reduction index of joints $R_{s,w}$
Spectrum adaptation terms C and C_{tr}

$$[R_{s,w}\,(C;\,C_{tr}) \geq 64\ (-2;-7)\ \text{dB}]$$

Determined for 25 mm width of joint

ift Rosenheim
17.05.2016

Dr. Joachim Hessinger, Dipl.-Phys.
Head of Testing Department
Building Acoustics

Andreas Preuss, Dipl.-Ing. (FH)
Head of Laboratory
Building Acoustics

Basis

EN ISO 10140-1: 2010
+A1: 2012 + A2:2014
EN ISO 10140-2 : 2010
EN ISO 717-1 : 2013
16-001466-PR01 (PB Z1-K02-04-de-01) dated 12.05.2016

Representation

Instructions for use

This procedure is suitable for the comparison of construction products designed for sealing (e.g. gaskets/seals, fillers for joints). The results can be used to evaluate the sound power ratio τ_e according to EN 12354-3 Annex B.
Using the calculated sound reduction of the joint for the calculation of the overall sound reduction is not a substitute for the sound reduction verification of the overall construction.

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 construction submitted regarding 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 an abstract.

Contents

The test report contains a total of 9 pages:

ift Rosenheim GmbH
Theodor-Gietl-Str. 7-9
D-83026 Rosenheim

Kontakt
Tel. +49.8031.261-0
Fax +49.8031.261-290
www.ift-rosenheim.de

1 Obect

1.1 Description of test specimen

Product	Gunned Acrylate - Sealant, joint was sealed on both sides
Date of manufacturing of test specimen	2nd of May 2016
Product designation	HILTI CFS-S ACR / HILTI CP 606
Item code	435859
Dimension	
Length of joint l	1,200 mm
Depth of joint d	100 mm
Width of joint w	25 mm
Joint cover	without
Joint sealing material	Joint filled with mineral wool and sealed on both sides with Acrylate - Sealant
Density	Not specified
Sealant thickness (nominal dimensions)	12 mm
Curing time	1 week
Density	0.5 kg/running metres

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

1.2 Mounting to test rig

The sound reduction index R_S of the joint was measured in a mobile joint measuring apparatus as per EN ISO 10140-1:2010 + A1:2012 + A2:2014 (see Figs. 1 and 2). This mobile measuring apparatus consists of a high-performance sound insulating element made of metal profiles and Bondal sheet with slide-in cassettes. The profiles of the slide-in cassettes are filled with sand. Using these cassettes, a great variety of joints with varying joint widths w can be created (Fig. 1).

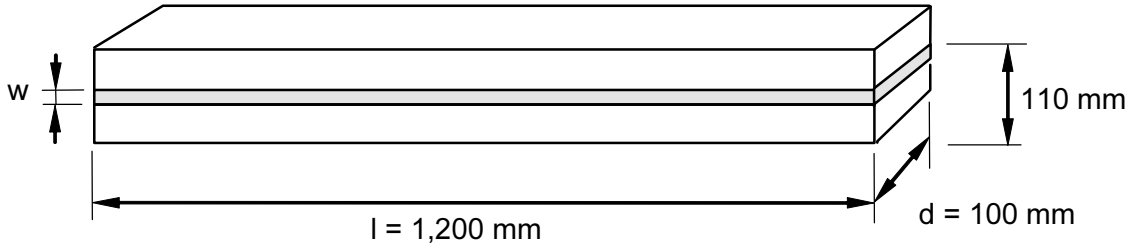


fig 1 slide-in cassettes

These slide-in cassettes were produced by the **ift** Laboratory for Building Acoustic and employees of the client 1 week before the date of test using the filling material to be tested. After hardening the material was cut on the edges and mounted in the highly sound insulating element (Fig. 2), which was mounted in the test opening of the window-test rig

(Z-wall) acc. to EN ISO 10 140-5. The joints to the test opening were filled with cellular material and sealed with plastic sealant on both sides.

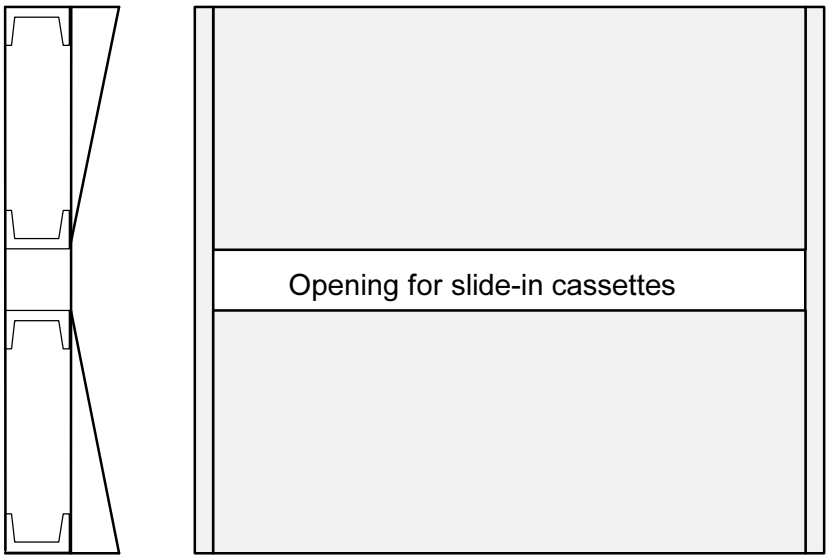


fig 2 Set-up of joint testing apparatus (high performance sound insulating element)

fig 3 Photo(s) of the mounted element, taken by **ift** Laboratory for Building Acoustics

2 Procedure

2.1 Sampling

Sampling	The samples were selected by the client. The slide-in cassettes were filled by the **ift** Laboratory for Building Acoustics with the filler to be tested according to the instructions of the manufacturer.
Quantity	1
Manufacturer	Hilti AG, BU Chemicals, Feldkircher Straße 100, FL-9494 Schaan
Manufacturing plant	Hilti Plant 4a
Date of manufacture / Date of sampling	29th of April 2016
Charge No.	7223672
Responsible for sampling	Mr. Schulze
Delivery at **ift**	2nd of May 2016 by the client
ift registration number	41374/1

2.2 Process

Basis

EN ISO 10140-1:2010 + A1 : 2012 + A2 : 2014	Acoustics; Laboratory measurement of sound insulation of building elements - Part 1: Application rules for specific products (ISO 10140-1: 2010 + Amd. 1 : 2012 + Amd. 2: 2014)
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

Corresponds to the national German standard/s:
DIN EN ISO 10140-1:2014-09, DIN EN ISO 10140-2:2010-12 and 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
ASTM E 1332-10a	Standard Classification for Determination of Outdoor-Indoor Transmission Class

Boundary conditions	As specified by the standard.
Deviation	There are no deviations from the test method/s and/or test conditions acc. to EN ISO 10140.

	The volume of the test room falls below the minimum volume of 80 m³ as defined in ASTM E 90-09.
Test noise	Pink noise
Measuring filter	One-third-octave band filter
Measurement limits	
Low frequencies	The dimensions of the receiving room are 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 ISO 10140-4: 2010 Clause 4.3.
Maximum insulation	The maximum insulation of the test rig is partly within the range of the test results. Therefore the tested values are minimum values. A correction by calculation was performed for maximum sound insulation.
Measurement of reverberation time	Arithmetical mean: two measurements each of 2 loudspeaker and 3 microphone positions (a total of 12 independent 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 equation	$R_S = L_1 - L_2 + 10\log\frac{S_N \cdot l}{A \cdot l_N}$ dB

KEY

R_{ST}	Joint sound reduction index in dB
L_1	Sound pressure level source room in dB
L_2	Sound pressure level receiving room in dB
l	Length of joint in m
S_N	Reference area (1 m²)
l_N	Reference length (1 m)
A	Equivalent absorption area in m²
V	Volume of receiving room in m³
T	Reverberation time in s

This sound reduction index of joints is comparable to the linear sound reduction index of a building component with 1 m joint length for each m^2 area and where the sound is transmitted only through the joint.

If the joint is combined with a building component (e.g. window with area S and sound reduction index R) and assuming the building component's area S_1 >> than the opening area of the joint (w · l, w = joint width), for the associated joint length l the resulting sound reduction index R_{res} is calculated as follows:

$$R_{res} = -10\log\left(10^{-\frac{R}{10}} + \frac{l}{S}\cdot 10^{-\frac{R_S}{10}}\right) \text{ dB}$$

2.3 Test apparatus

Device	Type	Manufacturer
Integrating sound meter	Type Nortronic 121	Co. Norsonic-Tippkemper
Microphone preamplifiers	Type 1201	Co. Norsonic-Tippkemper
Microphone unit	Type 1220	Co. Norsonic-Tippkemper
Calibrator	Type 1251	Co. Norsonic-Tippkemper
Dodecahedron loudspeakers	Own design	-
Amplifier	Type E120	Co. FG Elektronik
Rotating microphone boom	Own design / Type 231-N-360	Co. 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. 31423, was DKD calibrated by the company Norsonic Tippkemper (DKD - Deutscher Kalibrierdienst “German Calibration Service”) on 22nd of June 2015.

2.4 Testing

Date	9th of May 2016
Operating Testing Officer	Mr. Bernd Saß

3 Detailed results

The values of the measured sound reduction index R_S of the joint for the tested seals are plotted against frequency in the data sheets (Annex). Based on EN ISO 717 - 1, this is used to calculate the weighted sound reduction index $R_{S,w}$ of the joint and the spectrum adaptation terms C and C_{tr}, related to joint length l = 1,200 mm , for the frequency range 100 Hz to 3,150 Hz.

The diagram includes the maximum sound reduction of the test set-up (related to l = 1,200 mm), with a maximum weighted sound reduction index $R_{S,w\ max}$ (C; C_{tr}) = 63 (-2;-7) dB.

The resulting sound reduction indices for joints are within the range for maximum sound insulation; in these cases the values obtained are minimum values. For maximum insulation, it has been corrected by calculation as per EN ISO 10140-1:2010 + A1:2012+A2:2014. Table 1 lists the weighted sound reduction indices of the different joint designs.

Table 1 Test results, Depth of joint *d* = 100 mm

Weighted joint sound reduction index $R_{S,w}$ (C; C_{tr}) in dB	Measures taken, comments
63 (-2;-7)	Maximum sound insulation
≥ 64 (-2;-7)	Joint width 25 mm, filled with HILTI CFS-S ACR / HILTI CP 606

On order of the client supplementary to the rating as per EN ISO 717-1 an evaluation according to ASTM E 413-10 and ASTM E 1332-10a was carried out. The sound transmission class STC according to ASTM E 413-10 was determined for the frequency range from 125 Hz up to 4,000 Hz

STC 64

The Outdoor-Indoor transmission class OITC according to ASTM E 1332-10a for the frequency range from 80 Hz up to 4000 Hz was calculated to

OITC 55

The rating was done with spectrum of joint sound reduction index which is tabled in annexed data sheet.

4 Instructions for use

General remarks:

The method is suitable for comparing construction products designed for sealing purposes (e.g. seals/gaskets, fillers to seal joints). The results can be used to evaluate the sound power ratio τ_e as per EN 12354-3 Annex B. Using the calculated sound reduction of the joint for the calculation of the overall sound reduction is not a substitute for the verification of the overall construction

In practice, e.g. when combining the sound insulation of a window with that of a joint in an existing opening, the following must be taken into account:

a) for physical reasons, the sound reduction index of joints must be corrected by approx. –3 dB in the area of corners and edges;
b) the existing thickness of the window frame profile (joint depth d) must be adapted with a correction between –1 dB and –2 dB.

c) experience shows that the filling of window niches in edges and difficult reachable areas are weak points by handling

Remark on transfer of the test results

Assessments as per ASTM E 413-10 and ASTM E 1332-10a were based on sound insulation testing as per EN ISO 10140-1. For some details there are deviations from test standard ASTM E 90-09, in particular as regards the required room volume (min. 80 m³) and regards the sound reduction index of joints (length related sound reduction index)

ift Rosenheim
Laboratory for Building Acoustics
17.05.2016

Joint sound reduction index according to ISO 10140-1

Determination of sound reduction index of joints

Client: **Hilti Entwicklungsgesellschaft mbH**, 86916 Kaufering (Germany)

Product designation HILTI CFS-S ACR / HILTI CP 606

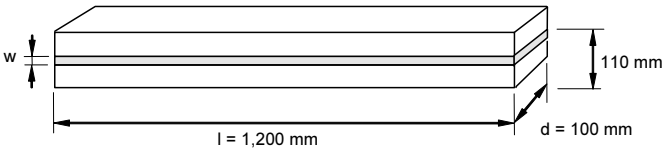
Design of test specimen

Gunned Acrylate - Sealant, joint was sealed on both sides

Joint size

Length l	1,200 mm
Depth d	100 mm
Width w	25 mm
Density	0.5 kg/running metres

Drawing of the test arrangement



Test date	9th of May 2016
Test length l	1.2 m
Test rig	as per EN ISO 10140-5
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 of joints

$R_{S,w,max}$ = 63dB (related to test length)

Mounting conditions

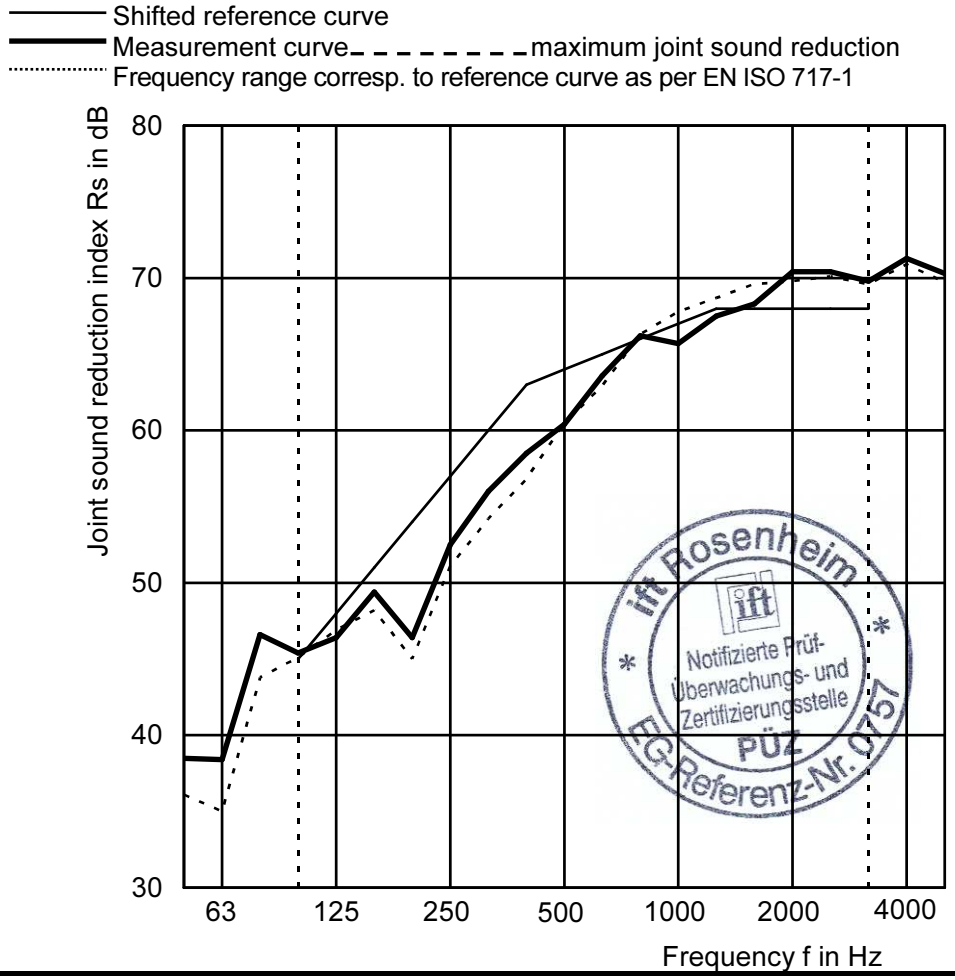
Mounting of the cassette in high performance sound insulating element.

Climate of test rooms 19°C / 50 % RH

Static air pressure 957 hPa

f in Hz	R_S in dB
50	(≥ 38.5)
63	(≥ 38.4)
80	(≥ 46.6)
100	(≥ 45.4)
125	(≥ 46.4)
160	(≥ 49.4)
200	(≥ 46.4)
250	(≥ 52.5)
315	(≥ 56.0)
400	(≥ 58.5)
500	(≥ 60.4)
630	(≥ 63.6)
800	(≥ 66.2)
1,000	65.7
1,250	(≥ 67.5)
1,600	(≥ 68.3)
2,000	(≥ 70.4)
2,500	(≥ 70.4)
3,150	(≥ 69.8)
4,000	(≥ 71.3)
5,000	(≥ 70.3)

(≥ = Minimum value)



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

[$R_{S,w}$ (C; C_{tr}) ≥ 64 (-2;-7) dB] $C_{50\text{-}3,150}$ = -3 dB; $C_{100\text{-}5,000}$ = -2 dB; $C_{50\text{-}5,000}$ = -2 dB

$C_{tr,50\text{-}3,150}$ = -9 dB; $C_{tr,100\text{-}5,000}$ = -7 dB; $C_{tr,50\text{-}5,000}$ = -9 dB

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Laboratory for Building Acoustics
17th of May 2016

Dipl. Ing. (FH) Mr. Bernd Saß
Operating Testing Officer