Expert Statement

No.: 17-001738-PR03 (GAS-E03-04-en-02)*

Date	21.02.2018
Client	**Hilti Entwicklungsgesellschaft mbH** Hiltistr. 6 86916 Kaufering Germany
Order	Expert statements to test reports No. 17-001738-PR01 (PB 01-E03-04-de-02) and 17-001738-PR01 (PB 02-E03-04-de-03) dated 27 July 2017
Object	Metal-Stud-Wall with joint to floor by employing the Hilti-sealing tape CFS-TTS E9 and CFS-TTS ES

Contents

*) Replaces statement no. 17-001738-PR03 (GAS-E03-04-en-01) dated 3 August 2017

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1 Object

With letter dated 24th July 2017 the company Hilti Entwicklungsgesellschaft mbH, 86916 Kaufering (Germany), commissioned **ift** Centre for Acoustics to prepare an expert statement on the following:

The results from test reports 17-001738-PR01 (PB 01-E03-04-de-02) and 17-001738-PR01 (PB 02-E03-04-de-03) dated 27 July 2017 shall be used to estimate the sound insulation of a metal-stud-wall with joint to ceiling by employing Hilti-sealing tape CFS-TTS E9 and CFS-TTS ES.
Results shall be rendered in terms of the weighted sound reduction index R_w as well as a weighted standardized level difference $D_{nT,w}$ plus spectrum adaptation term C_{tr} according to a laboratory test.

This statement relates solely to the acoustic properties of the described test element. A statement on the acoustic properties does not allow any statement to be made on further characteristics of the present structure regarding performance and quality.

This statement is based on the basic documents stated in section 2 valid for the specified version. Other details, not described in these documents were not taken into account.

2 Basis

The statement is based on the following documents:

2.1 Documents rendered by client

[1] Test report No. 17-001738-PR01 (PB 01-E03-04-de-02) dated 27 July 2017 by ift Rosenheim for joint sound insulation of a masonry joint with Hilti sealing tape CFS-TTS E9 on order of Hilti Entwicklungsgesellschaft mbH

[2] Test report No. 17-001738-PR01 (PB 02-E03-04-de-03) dated 27 July 2017 by ift Rosenheim for joint sound insulation of a masonry joint with Hilti sealing tape CFS-TTS ES on order of Hilti Entwicklungsgesellschaft mbH

2.2 Standards and literature

[3] DIN 4109-1: 2018-01, „Sound insulation in buildings – Part 1: Minimum requirements"

[4] DIN 4109-2: 2018-01, „Sound insulation in buildings – Part 2: Verification of compliance with the requirements by calculation”

[5] DIN 4109-33: 2016-07, „Sound insulation in buildings – Part 33: Data for verification of sound insulation (component catalogue) – timber construction-, lightweight construction- and dry walling"

[6] DIN 4109-35: 2016-07, „Sound insulation in buildings – Part 35: Data for verification of sound insulation (component catalogue) – Elements, windows, doors, curtain walling”

[7] The Building Regulations 2010 “Resistance to the passage of sound, Approved Document E"

[8] DIN 4109: 1989-11, "Sound insulation in buildings, requirements and verification"

[9] DIN 4109 Bbl. 1: 1989-11, "Sound insulation in buildings; construction examples and calculation methods"

[10] EN ISO 12999-1:2014-06, "Acoustics, Determination and application of measurement uncertainties in building acoustics, Part 1: Sound insulation (ISO 12999-1:2014)"

[11] EN ISO 717-1:2013, " Acoustics; Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation (ISO 717-1:2013)"

[12] EN ISO 10140-1: 2016-08, "Acoustics – Laboratory measurement of sound insulation of building elements –Part 1: Application rules for specific products (ISO 10140-1: 2016"

[13] EN ISO 10140-2:2010-09, "Acoustics – Laboratory measurement of sound insulation of building elements –Part 2: Measurement of airborne sound insulation (ISO 10140-2:2010)"

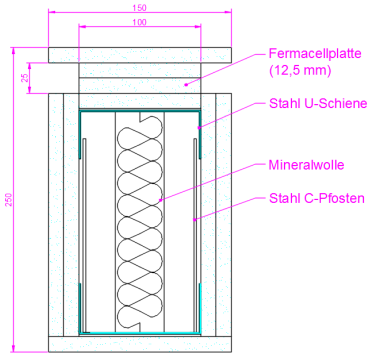
[14] EN ISO 12354-1:2017-08, "Building acoustics - Estimation of acoustic performance of buildings from the performance of elements, Part 1: Airborne sound insulation between rooms“

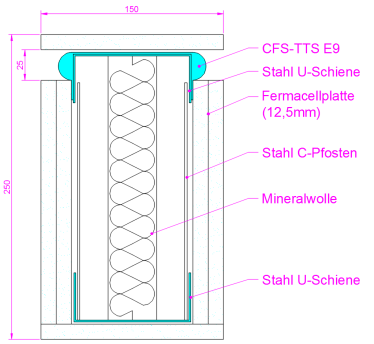
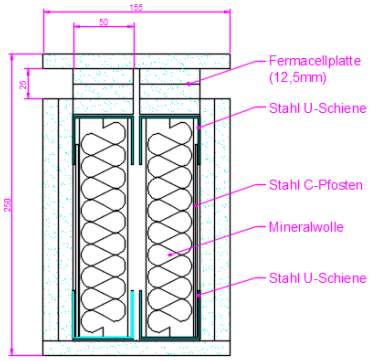
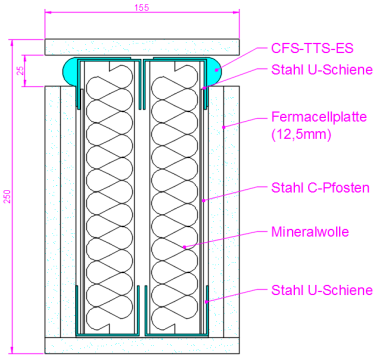
[15] EN ISO 12354-3:2017-08, "Building acoustics - Estimation of acoustic performance of buildings from the performance of elements, Part 3: Airborne sound insulation against outdoor sound“

[16] (RAL) Guideline for installation of windows and external pedestrian doors (Montageleitfaden), RAL-Gütegemeinschaft Fenster und Haustüren e.V., Frankfurt 2014

3 Evaluation

Table 1 Tested construction / construction to be evaluated

Tested configuration	Joint sound insulation of insert-element built of metal-stud-single and double-wall element with joint to ceiling Tested configurations were: Metal-stud-wall with 100 mm metal stud Conventional configuration with flexible joint Result: **$R_{S,w}$ (C; C_{tr}) = 36 (-2; -1) dB** 

	Metal-stud-wall with 100 mm metal stud flexible joint with Hilti sealing tape CFS-TTS E9 Result: **$R_{S,w}$ (C; C_{tr}) = 62 (-2; -5) dB**  Metal-stud-double wall with 2 × 50 mm metal stud Conventional configuration with flexible joint Result: **$R_{S,w}$ (C; C_{tr}) = 42 (-1; 0) dB**  Metal-stud-double wall with 2 × 50 mm metal stud flexible joint with Hilti sealing tape CFS-TTS ES Result: **$R_{S,w}$ (C; C_{tr}) = 63 (-1; -4) dB** 
Construction to be evaluated	Metal-stud-wall with plasterboard cladding including sound transmission via joint to ceiling Wall thickness 150 mm, dimensions 4 m width × 2.5 m height Construction 2 × 50 mm or 100 mm CW-studs with 2 × 12.5 mm gypsum plasterboard cladding on both sides Metal-stud-walls with different acoustic performance shall be evaluated. The sound insulation of the wall shall vary in the range of R_w = 40 dB and R_w = 60 dB (when described in terms of sound reduction index) resp. in the range of $R_w + C_{tr}$ = 30 dB and $R_w + C_{tr}$ = 54 dB (when described in terms of sound reduction index plus spectrum adaptation term). Sound insulation shall vary in steps of 2 dB for both descriptions. Configuration of joint to the ceiling shall be as tested [1], [2], i.e. in conventional configuration with flexible joint and flexible joint with Hilti

	sealing tape CFS-TTS ES resp. CFS-TTS E9. Except for sound transmission through the joint to the ceiling no other sound transmission paths shall be regarded, that means sound transmission via other masonry joints and via all flanking walls, floors and ceiling were not judged and not taken into account.
Evaluation of construction	Sound transmission through the wall and the joint to the ceiling shall be determined and combined by calculation. Sound transmission through the wall will be described by the weighted sound reduction index R_w resp. the weighted sound reduction index plus spectrum adaptation term $R_w + C_{tr}$. Sound transmission via the joint was determined by tests [1], [2], i.e. the weighted sound reduction index for joints $R_{s,w}$ resp. the weighted sound reduction index for joints plus spectrum adaptation term $R_{s,w} + C_{tr}$ were taken as input data for calculation. The calculation were performed separately for the evaluation of $R_{w,Wall\ with\ joint}$ and $D_{nT,w} + C_{tr}$. **Calculation of $R_{w,Wall\ with\ joint}$** If the joint is combined with a building component (e.g. wall with area S and weighted sound reduction index R_w) and assuming the building component's area S >> than the opening area of the joint (w · l, w = joint width), for the associated joint length l and a reference length l_0 = 1 m the resulting sound reduction index $R_{w,Wall\ with\ joint}$ of the wall with joint to ceiling is calculated as follows [4], [14], [15]: $$R_{w,Wall\ with\ joint} = -10 \cdot log\left(10^{-\frac{R_w}{10}} + \frac{l \cdot l_0}{S} \cdot 10^{-\frac{R_{s,w}}{10}}\right) dB$$ For the calculation example the geometric data l = 4 m and S = 10 m² were used as input data. Calculation was done for 4 configurations (single- / double stud / conventional flexible joint / flexible joint with Hilti sealing tape) and the results are given in Table 2 und 3. **Calculation of $D_{nT,w} + C_{tr}$** If the joint is combined with a building component (e.g. wall with area S and weighted sound reduction index plus spectrum adaptation term R_w+C_{tr}) and assuming the building component's area S >> than the opening area of the joint (w · l, w = joint width), for the associated joint length l and a reference length l_0 = 1 m the resulting sound reduction index plus spectrum adaptation term $R_{w,Wall\ with\ joint} +C_{tr}$ of the wall with joint to ceiling is calculated as follows [4], [14], [15]:

	$$R_{w,Wall\ with\ joint} + C_{tr} = -10 \cdot \log\left(10^{-\frac{R_w + c_{tr}}{10}} + \frac{l \cdot l_0}{S} \cdot 10^{-\frac{R_{s,w} + C_{tr}}{10}}\right) \text{dB}$$ For the calculation example the geometric data l = 4 m and S = 10 m² were used as input data. In general accordance with the application in England, Wales and NI [7] the results were converted into a weighted standardized level difference plus spectrum adaptation term $D_{nT,w} + C_{tr}$ according to: $$D_{nT,w} + C_{tr} = R_{w,Wall\ with\ joint} + C_{tr} + 10 \cdot \log\left(\frac{0.32 \cdot V}{S}\right) \text{dB}$$ For calculation an arbitrary receiving room volume of 30 m³ was assumed. Calculation was done for 4 configurations (single- / double stud / conventional flexible joint / flexible joint with Hilti sealing tape) and the results are given in Table 4 and 5.

4 Results

Based on the evaluations and the experience of the testing body the test results (as given in test reports no. 17-001738-PR01 (PB 01-E03-04-de-02) and 17-001738-PR01 (PB 02-E03-04-de-03) dated 27 July 2017)) can be taken to calculate the sound transmission through the wall construction including joint to the ceiling as described in table 1. Results are given in tables 2 to 5.

Table 2 Sound transmission through a metal stud wall with gypsum plasterboard cladding (total thickness 150 mm, single stud) including the sound transmission via the joint to the ceiling, alternatively built in conventional flexible configuration ($R_{s,w}$ = 36 dB) resp. as flexible joint with Hilti sealing tape CFS-TTS E9 ($R_{s,w}$ = 62 dB). Evaluated in terms of $R_{w,Wall\ with\ joint}$.

Sound insulation of wall without sound transmission via joints $R_{w,Wall}$	Sound transmission through wall including the transmission via joint to ceiling with conventional flexible joint configuration ($R_{s,w}$ =36dB) $R_{w,Wall\ with\ joint}$	Sound transmission through wall including the transmission via joint to ceiling with flexible joint Hilti sealing tape CFS-TTS E9 ($R_{s,w}$ = 62 dB) $R_{w,Wall\ with\ joint}$
40 dB	37 dB	40 dB
42 dB	38 dB	42 dB
44 dB	39 dB	44 dB
46 dB	39 dB	46 dB
48 dB	39 dB	48 dB
50 dB	40 dB	50 dB
52 dB	40 dB	52 dB
54 dB	40 dB	54 dB
56 dB	40 dB	56 dB
58 dB	40 dB	57 dB
60 dB	40 dB	59 dB

Table 3 Sound transmission through a metal stud wall with gypsum plasterboard cladding (total thickness 150 mm, double stud) including the sound transmission via the joint to the ceiling, alternatively built in conventional flexible configuration ($R_{s,w}$ = 42 dB) resp. as flexible joint with Hilti sealing tape CFS-TTS ES ($R_{s,w}$ = 63 dB). Evaluated in terms of $R_{w,Wall\ with\ joint}$.

Sound insulation of party wall without sound transmission via joints $R_{w,Wall}$	Sound transmission through party wall including the transmission via joint to ceiling with conventional flexible joint configuration ($R_{s,w}$ =42 dB) $R_{w,Wall\ with\ joint}$	Sound transmission through party wall including the transmission via joint to ceiling with flexible joint Hilti sealing tape CFS-TTS ES ($R_{s,w}$ = 63 dB) $R_{w,Wall\ with\ joint}$
40 dB	39 dB	40 dB
42 dB	41 dB	42 dB
44 dB	42 dB	44 dB
46 dB	43 dB	46 dB
48 dB	44 dB	48 dB
50 dB	45 dB	50 dB
52 dB	45 dB	52 dB
54 dB	45 dB	54 dB
56 dB	46 dB	56 dB
58 dB	46 dB	57 dB
60 dB	46 dB	59 dB

Table 4 Sound transmission through a metal stud wall with gypsum plasterboard cladding (total thickness 150 mm, single stud) including the sound transmission via the joint to the ceiling, alternatively built in conventional flexible configuration ($R_{s,w}$ + C_{tr} = 35 dB) resp. as flexible joint with Hilti sealing tape CFS-TTS E9 ($R_{s,w}$ + C_{tr} = 57 dB). Evaluated in terms of $D_{nT,w}$ + C_{tr}.

Sound insulation of wall without sound transmission via joints $R_{w,Wall}$+ C_{tr}	Sound transmission through wall including the transmission via joint to ceiling with conventional flexible joint configuration ($R_{s,w}$ + C_{tr}=35dB) $D_{nT,w}$ + C_{tr}	Sound transmission through wall including the transmission via joint to ceiling with flexible joint Hilti sealing tape CFS-TTS E9 ($R_{s,w}$ + C_{tr} = 57 dB) $D_{nT,w}$ + C_{tr}
30 dB	29 dB	30 dB
32 dB	31 dB	32 dB
34 dB	33 dB	34 dB
36 dB	34 dB	36 dB
38 dB	35 dB	38 dB
40 dB	36 dB	40 dB
42 dB	37 dB	42 dB
44 dB	38 dB	44 dB
46 dB	38 dB	46 dB
48 dB	38 dB	48 dB
50 dB	38 dB	49 dB
52 dB	39 dB	51 dB
54 dB	39 dB	53 dB

Table 5 Sound transmission through a metal stud wall with gypsum plasterboard cladding (total thickness 150 mm, double stud) including the sound transmission via the joint to the ceiling, alternatively built in conventional flexible configuration ($R_{s,w}$ + C_{tr} = 42 dB) resp. as flexible joint with Hilti sealing tape CFS-TTS ES ($R_{s,w}$ + C_{tr} = 59 dB). Evaluated in terms of $D_{nT,w}$ + C_{tr}.

Sound insulation of party wall without sound transmission via joints $R_{w,Wall}$+ C_{tr}	Sound transmission through party wall including the transmission via joint to ceiling with conventional flexible joint configuration ($R_{s,w}$ + C_{tr}=42dB) $D_{nT,w}$ + C_{tr}	Sound transmission through party wall including the transmission via joint to ceiling with flexible joint Hilti sealing tape CFS-TTS ES ($R_{s,w}$ + C_{tr} = 59 dB) $D_{nT,w}$ + C_{tr}
30 dB	30 dB	30 dB
32 dB	32 dB	32 dB
34 dB	34 dB	34 dB
36 dB	35 dB	36 dB
38 dB	37 dB	38 dB
40 dB	39 dB	40 dB
42 dB	40 dB	42 dB
44 dB	42 dB	44 dB
46 dB	43 dB	46 dB
48 dB	44 dB	48 dB
50 dB	44 dB	50 dB
52 dB	45 dB	51 dB
54 dB	45 dB	53 dB

Calculation tables 2 to 5 do only take into account the direct sound transmission through the party wall including additional sound transmission via the joint to the ceiling. Except for the sound transmission through the joint to the ceiling no other additional sound transmission paths were regarded, that means sound transmission via other masonry joints and via all flanking walls, floors and ceiling were not judged and not taken into account.

Proof of performance for sound insulation acc. to DIN 4109-1:2018-01 [3] (resp. DIN 4109:1989-11 [8] or in connection with the building regulation [7]) requires the assessment of the direct sound transmission through the party wall and the sound transmission via all joints to the masonry and all flanking elements (walls, floor and ceiling). Those contributions to the overall sound transmission were not regarded within the tables 2 to 5. A calculation for proof of performance in Germany must comply to the rules laid down in DIN 4109-2:2018-01 [4] (resp. Beiblatt 1 zu DIN 4109:1989-11 [9]).

This expert statement was prepared according to the principles of objectivity and to the best of our knowledge. The results were evaluated by calculation on basis of standardized procedures under assumption of special presuppositions for sound insulation of the wall and geometric data (width and height of wall, receiving room volume). This calculation is

no substitute for a proof of performance by testing. Evidence of airborne sound insulation performance of the evaluated test elements can be provided only by measurement of sound insulation as per EN ISO 10140-2.

The specified sound reduction indices do not take into consideration any acoustic inaccuracies in buildings and of building elements as per EN ISO 12999-1. These inaccuracies have to be judged separately. Evaluation is based on comparative laboratory measurements. Prerequisite for conformity with the values is consistency in the quality of the material used as well as in the manufacture, assembly and adjustment/setting, being the same as tested.

5 Notes on publication

The **ift** Guidance Sheet "Conditions and Guidance for the Use of **ift** Test Documents" applies.

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