



Crown street Manchester

ASSESSMENT OF ACOUSTIC PERFORMANCE OF THE FAÇADE THE REQUIREMENT $R_w + C_{tr}$ 40 dB

Z1-SIP-G251-Rp-XX-002

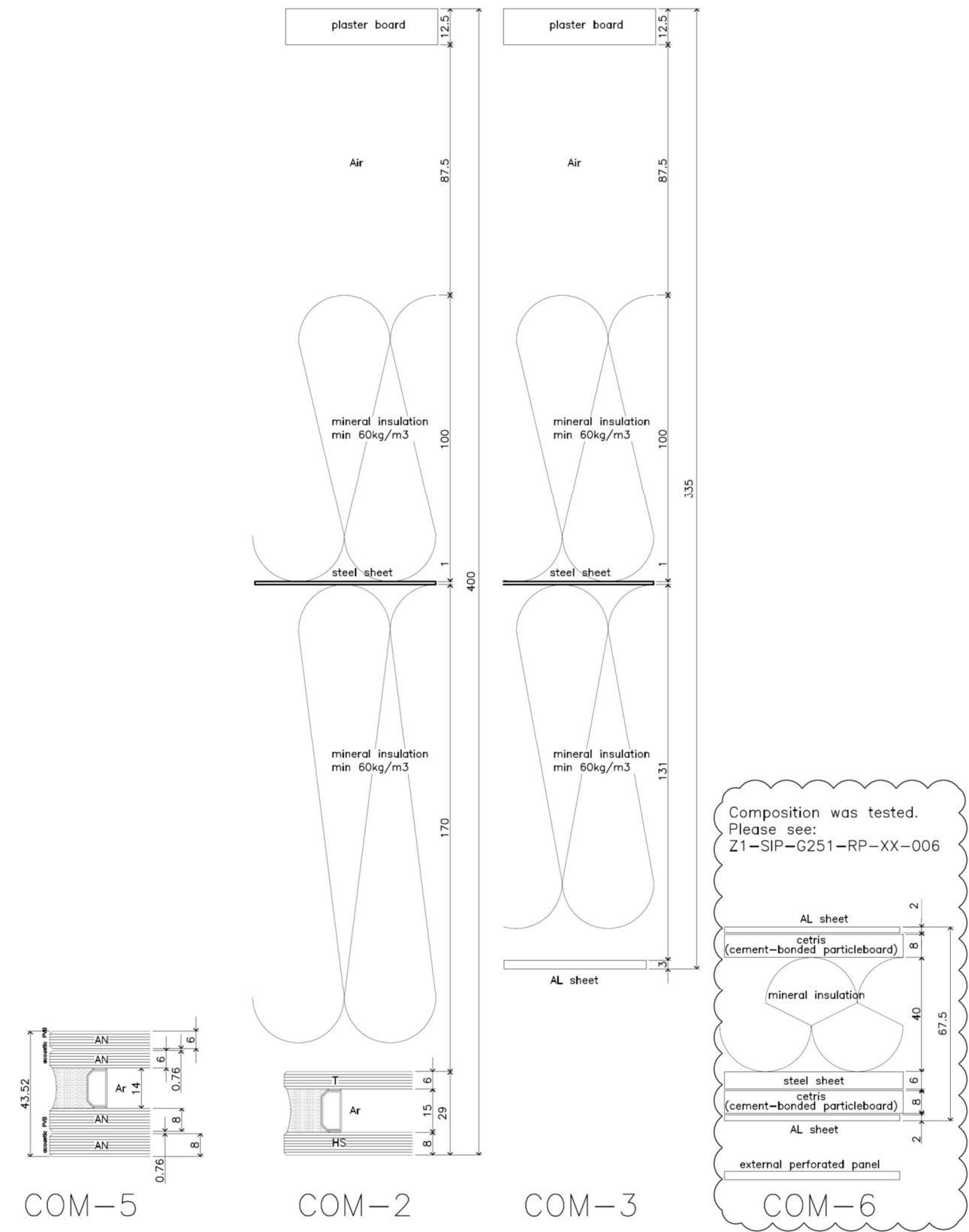
Revision number: P04

05/2019
Jitka Cibulková
Sipral a.s.

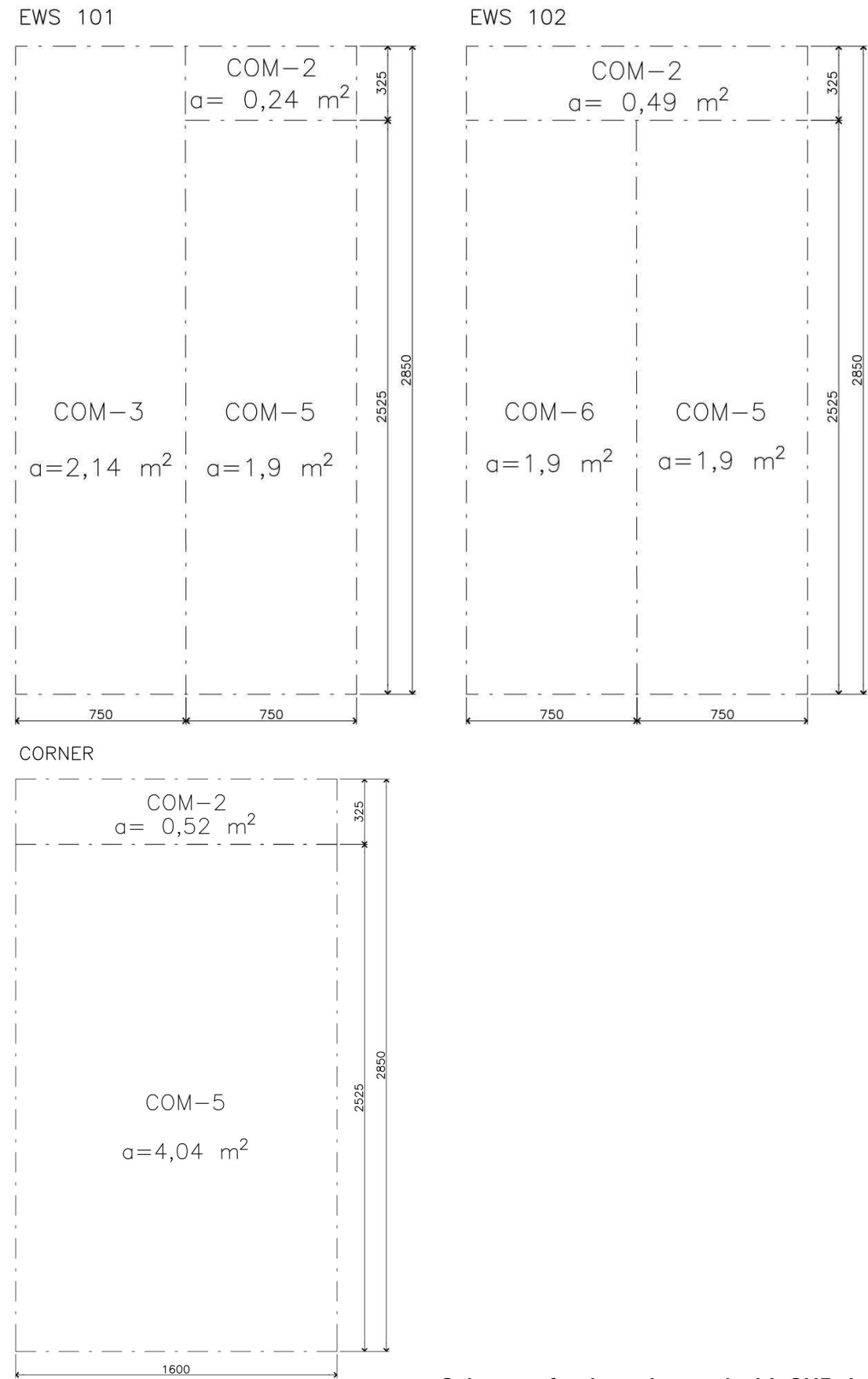
1. References

Sound insulation prediction were done in the software Insul (Marshall Day Acoustics)

2. Compositions



3.Scheme of units



Scheme of units to be read with SHP drawings.

- Sound insulation prediction of COM-5
Based on tested composition 88.2/15/66.2 by producer AGC.



Technical Advisory Service
AGC Glass Europe
Avenue Jean Monnet, 4
1348 Louvain-la-Neuve
Belgium

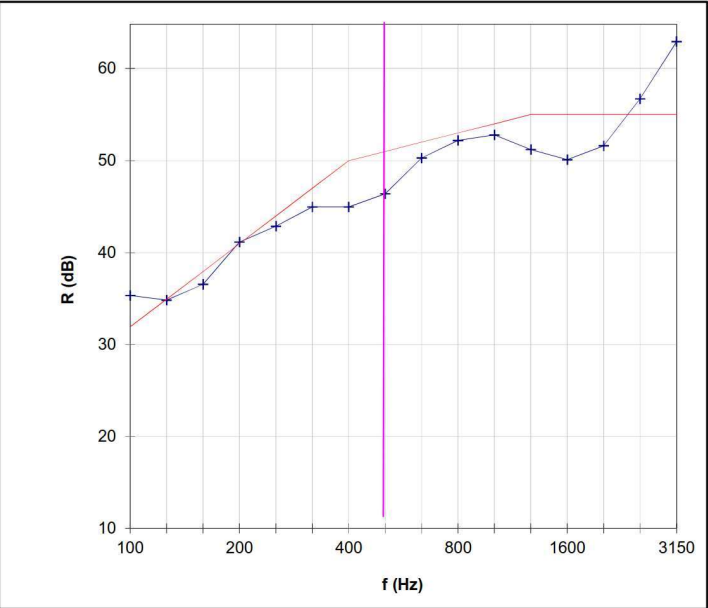
Sound reduction indexes according to international standards

Outer glass Stratophone 88,2
Spacer 15 mm
Inner glass Stratophone 66,2

Test reference : IFT (2004)
Internal reference : 1117

Measurement results

Frequency (Hertz)	1/3 octave (dB)	Octave (dB)
100	35,4	35,6
125	34,9	
160	36,6	
200	41,2	42,8
250	42,9	
315	45,0	
400	45,0	46,7
500	46,4	
630	50,3	
800	52,2	52,0
1000	52,8	
1250	51,2	
1600	50,1	52,0
2000	51,6	
2500	56,7	
3150	62,9	65,1
4000	67,7	
5000	66,1	



Sound reduction indexes

International/European standard EN ISO 717-1 (1996)	
Rw :	51 dB
(C; Ctr) :	(-1; -4) dB

French standard Following EN ISO 717-1	
RA = Rw + C	50 dB
RA,tr = Rw + Ctr	47 dB

Dutch standard NEN 5079 (1989)	
Road noise (Ra) :	46 dB(A)
Railway noise (Ra,r) :	50 dB(A)
Air traffic (Ra,l) :	48 dB(A)

Belgian standard NBN S 01-400 (1977)	
Class :	Vd

US standard	
ASTM E413 - 16	STC : 51 dB
ASTM E1332 - 16	OITC : 44 dB

These sound reduction indexes correspond to glazings which are 1,23 m by 1,48 m and are tested in laboratory conditions following EN ISO 10140-3. In-situ performances may vary according to the effective glazing dimensions, frame system, noise sources, etc.

The accuracy of the given indexes is not better than +/- 1 dB.

• Sound insulation prediction of COM-2

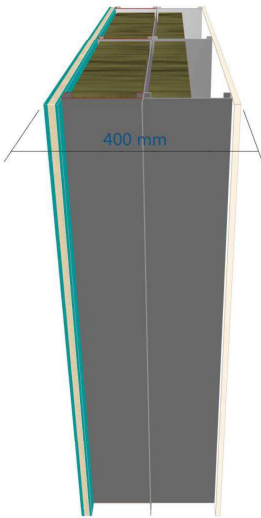
Sound Insulation Prediction (v9.0.4)

Program copyright Marshall Day Acoustics 2017

- Key No. 5634
Job Name:
Job No.: Initials:Cibulkova
Date:17.10.2018
File Name:COM-2_new.ixl



Notes:



Rw 54 dB
C -1 dB
Ctr -4 dB

Mass-air-mass resonant frequency = ~37 Hz , 82 Hz

Panel Size = 2,7 m x 4,0 m

Partition surface mass = 57,7 kg/m²

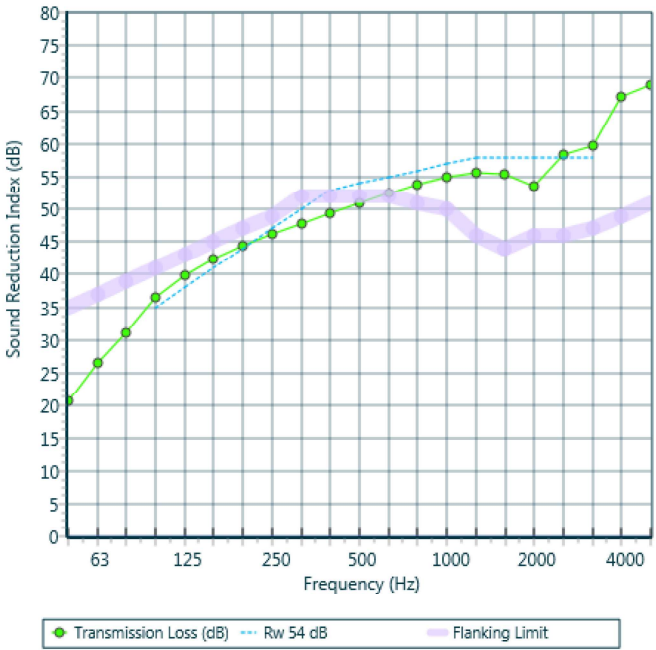
System description

Panel 1 : 1 x 29,0 mm Glazing Unit (8/15/6)

Frame: Metallständer (1,0-1,6mm); Cavity Width 170 mm ,Stud spacing 750 mm , 1 x Rockwool (60kg/m3) Thickness 160 mm (p:0 kg/m3, Rf:22000 Rayl/m)
Panel 2 + 1 x 1,0 mm Steel

Frame: Metallständer (1,0-1,6mm); Cavity Width 187 mm ,Stud spacing 750 mm , 1 x Rockwool (60kg/m3) Thickness 100 mm (p:60 kg/m3, Rf:22000 Rayl/m)
Panel 3 + 1 x 13,0 mm CSR Gyprock 13mm standard plasterboard

freq.(Hz)	TL(dB)	TL(dB)
50	21	24
63	27	
80	31	
100	36	39
125	40	
160	42	
200	44	
250	46	46
315	48	
400	49	
500	51	
630	52	51
800	54	
1000	55	
1250	56	
1600	56	55
2000	54	
2500	58	
3150	60	
4000	67	63
5000	69	



- Sound insulation prediction of COM-3

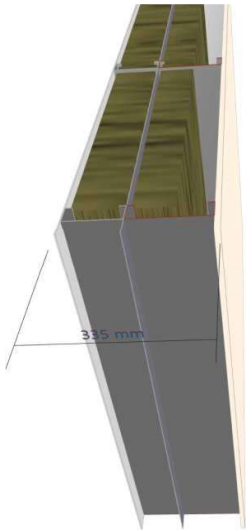
Sound Insulation Prediction (v9.0.4)

Program copyright Marshall Day Acoustics 2017

- Key No. 5634
Job Name:
Job No.: Initials:Cibulkova
Date:12.10.2018
File Name:COM-3_allcomposition.ixl



Notes:



Rw 48 dB
C -1 dB
Ctr -6 dB

Mass-air-mass resonant frequency = 52 Hz , 95 Hz
Panel Size = 2,7 m x 4,0 m
Partition surface mass = 37,5 kg/m²

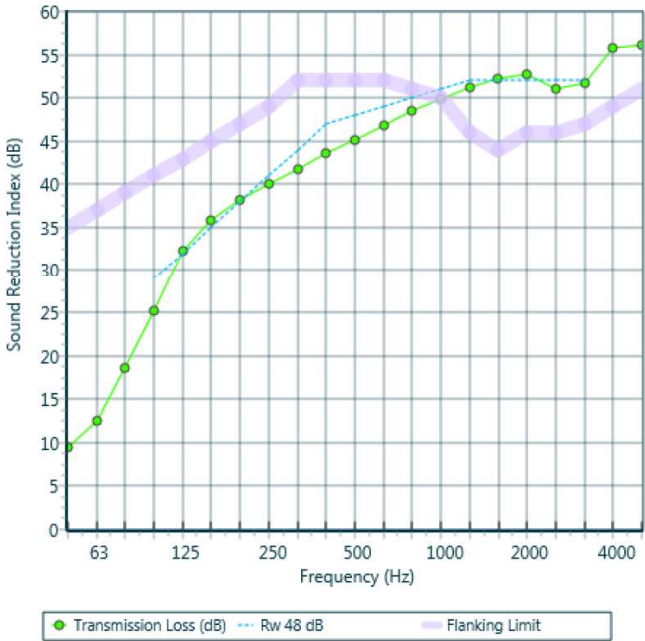
System description

Panel 1 : 1 x 3,0 mm Aluminium

Frame: Metallständer (1.0-1.6mm); Cavity Width 131 mm ,Stud spacing 750 mm , 1 x Rockwool (60kg/m3) Thickness 120 mm (p:60 kg/m3, Rf:22000 Rayl/m)
Panel 2 + 1 x 1,0 mm Steel

Frame: Metallständer (1.0-1.6mm); Cavity Width 187 mm ,Stud spacing 750 mm , 1 x Rockwool (60kg/m3) Thickness 100 mm (p:60 kg/m3, Rf:22000 Rayl/m)
Panel 3 + 1 x 13,0 mm CSR Gyprock 13mm standard plasterboard

freq.(Hz)	TL(dB)	TL(dB)
50	10	
63	12	12
80	19	
100	25	
125	32	29
160	36	
200	38	
250	40	40
315	42	
400	44	
500	45	45
630	47	
800	48	
1000	50	50
1250	51	
1600	52	
2000	53	52
2500	51	
3150	52	
4000	56	54
5000	56	



For improvement at 63 Hz there can be double gypsum board at the back side. See the calculation on the next page.

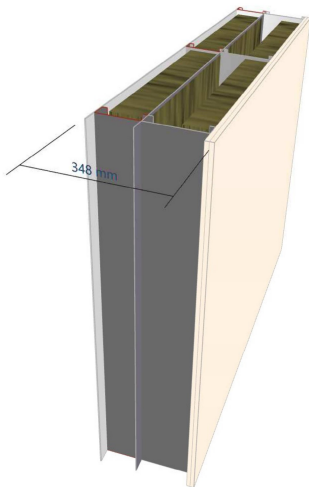
Sound insulation prediction of COM-3, with double gypsum board on the back side.

Sound Insulation Prediction (v9.0.8)

Program copyright Marshall Day Acoustics 2017
margin of error is generally within $R_w \pm 3$ dB
- Key No. 5634
Job Name:
Job No.: Initials:cibulkova
Date.:21.05.2019
File Name:



Notes:



R_w 52 dB
C -2 dB
Ctr -5 dB

Mass-air-mass resonant frequency = 43 Hz , 92 Hz
Panel Size = 2,7 m x 4,0 m
Partition surface mass = 46,6 kg/m²

System description

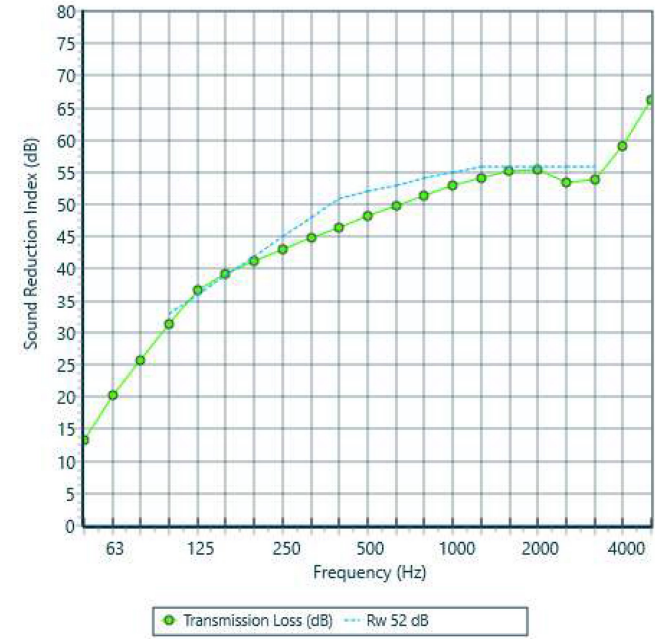
Panel 1 : 1 x 3 mm Aluminium

Frame: Steel Stud (1.0-1.6mm); Cavity Width 131 mm ,Stud spacing 750 mm , 1 x Rockwool (60kg/m3) Thickness 120 mm
Panel 2 + 1 x 1 mm Steel

Frame: Steel Stud (1.0-1.6mm); Cavity Width 187 mm ,Stud spacing 750 mm , 1 x Rockwool (60kg/m3) Thickness 100 mm
Panel 3 + 2 x 13 mm CSR Gyprock 13mm standard plasterboard

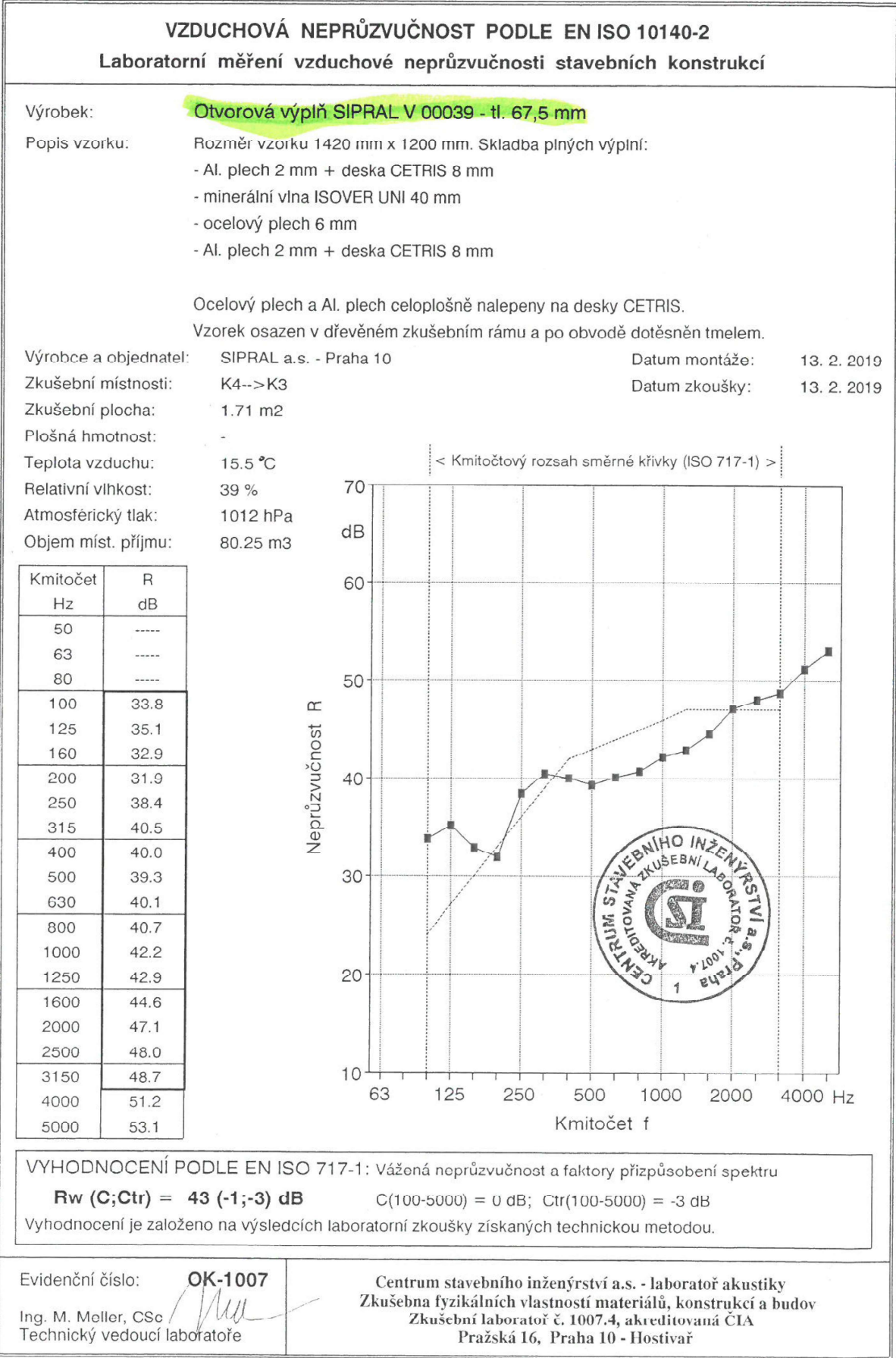
Floor Cover: Thickness 0,02 mm

freq.(Hz)	TL(dB)	TL(dB)
50	13	
63	20	17
80	26	
100	31	
125	37	34
160	39	
200	41	
250	43	43
315	45	
400	47	48
500	48	48
630	50	
800	51	
1000	53	53
1250	54	
1600	55	
2000	55	55
2500	53	
3150	54	
4000	59	57
5000	66	



- Sound insulation of COM-6

Composition was tested (Z1-SIP-G251-RP-XX-006)



Transmission loss of the overall partition EWS 101

Composite TL calculator (v9.0.4)

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- Key No. 5634

Job Name:

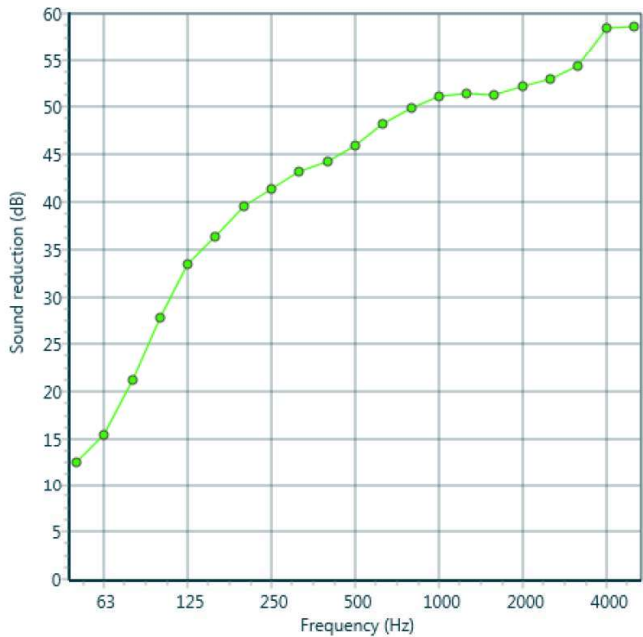
Job No.:

Date:17.10.2018

File Name:COM-3_allcomposition.ixl

Initials:Cibulkova

Notes:



Rw 49 dB
C -1 dB
Ctr -5 dB

Element	Area	Octave band centre frequency (Hz)																				Rw	C:Ctr	
		63		125		250		500		1k		2k		4k										
COM-2	0,24	21	27	31	36	40	42	44	46	48	49	51	52	54	55	56	56	54	58	60	67	69	54	-1;-4
COM-3	2,14	10	12	19	25	32	36	38	40	42	44	45	47	48	50	51	52	53	51	52	56	56	48	-1;-6
COM-5	1,9	30	30	30	35	35	37	41	43	45	45	46	50	52	53	51	50	52	57	63	68	66	51	-2;-4
Total	4,28	12	15	21	28	33	36	39	41	43	44	46	48	50	51	51	51	52	53	54	58	59	49	-1;-5

Average sound reduction index Rw (C; Ctr) 49 (-1; -5)

- Conclusion of EWS 101 – requirement Rw+Ctr 40dB

The composite transmission loss is calculated as the weighted average of the transmission coefficients of the individual elements that make up the partition.
Influence of the unit system (joints) is expected as a loss -3 dB(*).

Average sound reduction index with unit system influence is calculated
Rw (C; Ctr) 46 (-1; -5); Rw+Ctr 41 dB ≥ req. 40 dB

Rw is calculated with the INSUL software, there is a margin of error within Rw +/- 3dB.
This prediction is not a substitute for test data and design should be considered by project acoustic consultant.

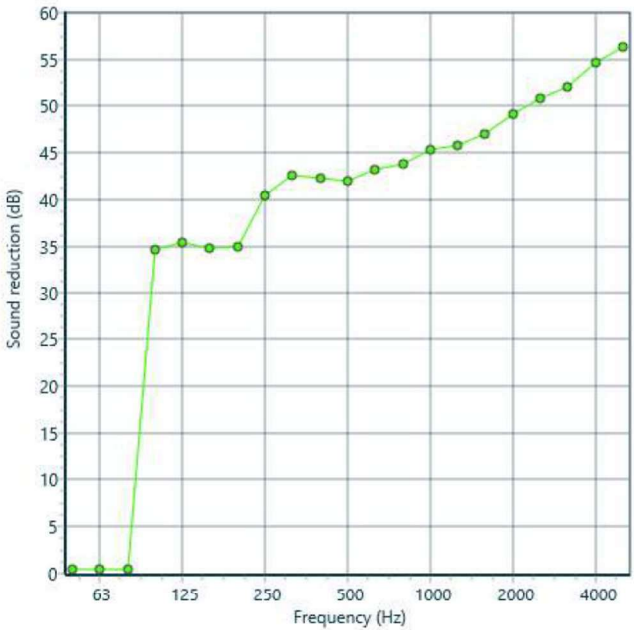
- **Transmission loss of the overall partition EWS 102**

Composite TL calculator (v9.0.8)

Program copyright Marshall Day Acoustics 2017
margin of error is generally within $R_w \pm 3$ dB
- Key No. 5634
Job Name:
Job No.: Initials:Cibulkova
Date:17.05.2019
File Name:102_40dB.cns



Notes:



R_w 46 dB
C -1 dB
Ctr -3 dB

Element	Area	Octave band centre frequency (Hz)																								Rw	C:Ctr
		63			125			250			500			1k			2k			4k							
COM-2	0,49	21	27	31	36	40	42	44	46	48	49	51	52	54	55	56	56	54	58	60	67	69	54	-1:-4			
COM-5	1,9	0	0	0	35	35	37	41	43	45	45	46	50	52	53	51	50	52	57	63	68	66	51	-2:-4			
COM-6	1,9	0	0	0	34	35	33	32	38	41	40	39	40	41	42	43	45	47	48	49	51	53	43	-1:-3			
Total	4,29	1	1	1	35	35	35	35	40	43	42	42	43	44	45	46	47	49	51	52	55	56	46	-1:-3			

Average sound reduction index R_w (C; Ctr) 46 (-1; -3)

- **Conclusion of EWS 102 – requirement $R_w + C_{tr}$ 40dB**

The composite transmission loss is calculated as the weighted average of the transmission coefficients of the individual elements that make up the partition.
Influence of the unit system (joints) is expected as a loss -3 dB(*).

Average sound reduction index with unit system influence is calculated
 R_w (C; Ctr) 43 (-1; -3); $R_w + C_{tr}$ 40 dB $\geq$ req. 40 dB

Results are available from frequency 100 Hz for COM-5 and COM-6 were tested in standard frequency range 100-5000 Hz (according EN ISO 10140-2, EN ISO 10140-4, EN ISO 717-1).

- **Transmission loss of the overall partition CORNER unit**

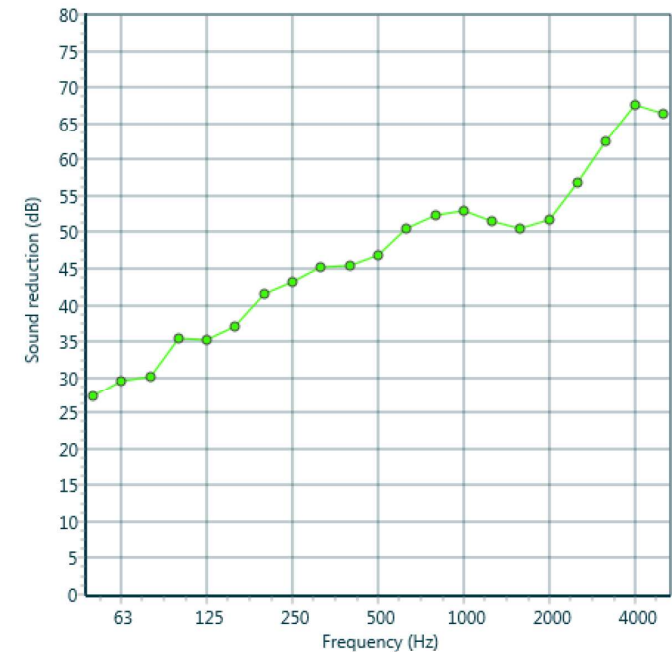
Composite TL calculator (v9.0.4)

Program copyright Marshall Day Acoustics 2017

- Key No. 5634
Job Name:
Job No.: Initials:Cibulkova
Date.:17.10.2018
File Name:COM-3_allcomposition.ixl



Notes:



Rw 51 dB
C -1 dB
Ctr -4 dB

Element	Area	Octave band centre frequency (Hz)																		Rw	C:Ctr			
		63		125		250		500		1k		2k		4k										
COM-2	0,52	21	27	31	36	40	42	44	46	48	49	51	52	54	55	56	56	54	58	60	67	69	54	-1:-4
COM-5	4,04	30	30	30	35	35	37	41	43	45	45	46	50	52	53	51	50	52	57	63	68	66	51	-2:-4
Total	4,56	27	29	30	36	35	37	41	43	45	45	47	50	52	53	52	50	52	57	62	68	66	51	-1:-4

Average sound reduction index Rw (C; Ctr) 51 (-1; -4)

- **Conclusion of CORNER unit – requirement Rw+Ctr 40dB**

The composite transmission loss is calculated as the weighted average of the transmission coefficients of the individual elements that make up the partition.
Influence of the unit system (joints) is expected as a loss –3 dB(*).

Average sound reduction index with unit system influence is calculated
Rw (C; Ctr) 48 (-1; -4); Rw+Ctr 44 dB ≥ req. 40 dB

Rw is calculated with the INSUL software, there is a margin of error within Rw +/- 3dB.
This prediction is not a substitute for test data and design should be considered by project acoustic consultant.

- * Airborne sound insulation - assessment of system influence

There were series of acoustic measuring and testing done for another project Warden in London. For a comparison with the assessed façade there were balcony doors and fixed glazing units chosen.

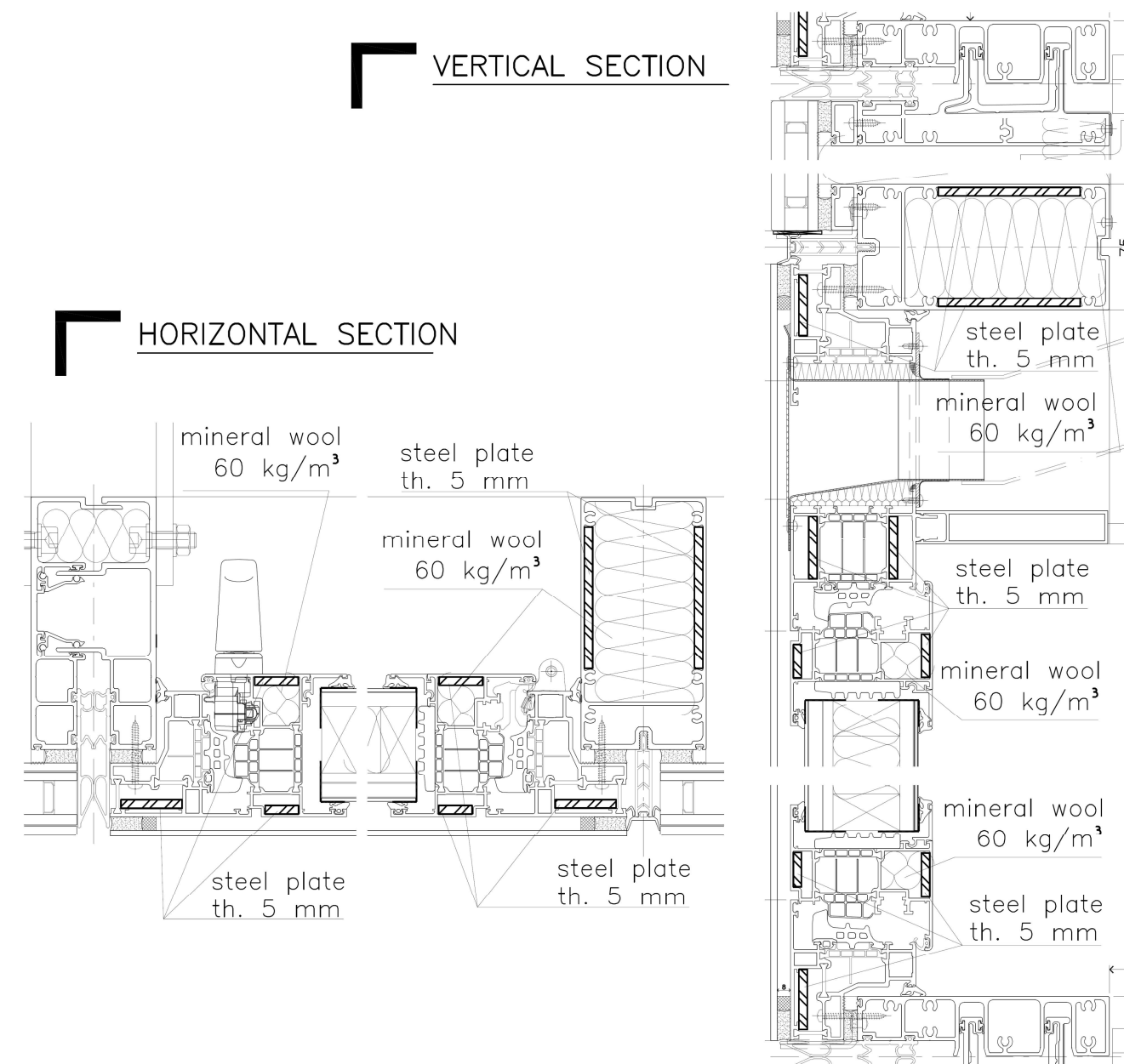
Table of comparison of R_w (C;Ctr) of the glazing itself and tested R_w (C;Ctr) of the mock-ups:

Measured mock-up	test results R_w 45 (C;Ctr) (dB)	comparing to values of glazing itself by AGC calculation	difference R_w	difference Ctr
balcony door with glazing 6-16-64.4	40 (-2;-4)	39(-1;-4); (6-16-55.4)	1	0
balcony door with glazing 8-16-64.4	39 (-1;-2)	41(-2;-4); (8-16-55.4)	-2	2
balcony door with glazing 88.4 SC-15-66.4 SC	45 (0;-2)	51 (-1; -4); (88.2 SC-15- 66.2 SC)	-6	2
fixed glazing 8-16-64.4	41 (-2;-5)	41(-2;-4); (8-16-55.4)	0	-1
fixed glazing 88.4 SC-15- 66.4 SC	46 (-1;-5)	51 (-1; -4); (88.2 SC-15- 66.2 SC)	-5	-1

Based on experience of testing doors and fixed glazing units the influence of system is supposed as approximate average to be – 3dB.
It needs to be considered as well that tested system is not the same as on Manchester project, the loss depends on many details and exact data can be proved by testing only.
Details of relevant tests are attached in appendixes A, B, C.

- **Measures used for system improvement**

For the requirement $R_w + C_{tr}$ 40 dB there are ballasting of profiles applied to improve sound insulation performance of the system. Horizontal and vertical profiles are ballasted with steel plates of thickness 5 mm (fully bonded to profile) and filled with mineral wool.



- **Appendixes**

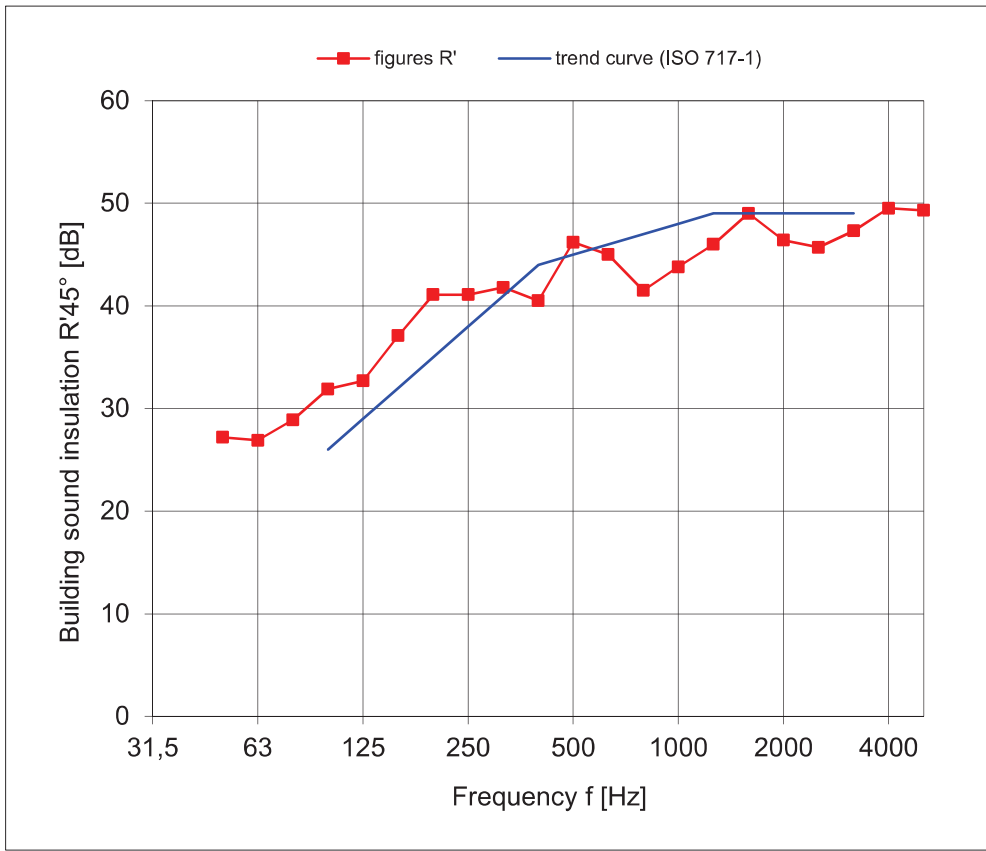
Appendix A: Test reports of airborne sound insulation (project Wardian, London)

Appendix B: Drawings of the mock-ups (project Wardian, London)

Appendix C: AGC glass producer technical data sheets

Building sound insulation under ISO 140-5																																																		
Field measurements of airborne sound insulation of facade elements and facades																																																		
Measured object:	Testing building of the Sipral a.s. (JSC) in Jirny																																																	
Description of assessable component:	The part of facade: balcony door, glass structure: 6-16-64.4																																																	
Client:	SIPRAL a.s. Třebohostická 3165/5a 100 00 Praha 10																																																	
Surface S of assessable component:	2,9 m ²																																																	
Volume V of audience room:	39,2 m ³																																																	
<table><tr><th>Frequency f [Hz]</th><th>R'45° (third octaves) [dB]</th></tr><tr><td>50</td><td>16,8</td></tr><tr><td>63</td><td>20,1</td></tr><tr><td>80</td><td>30,7</td></tr><tr><td>100</td><td>30,7</td></tr><tr><td>125</td><td>19,9</td></tr><tr><td>160</td><td>28,3</td></tr><tr><td>200</td><td>30,4</td></tr><tr><td>250</td><td>35,3</td></tr><tr><td>315</td><td>41,1</td></tr><tr><td>400</td><td>39,4</td></tr><tr><td>500</td><td>40,8</td></tr><tr><td>630</td><td>39,0</td></tr><tr><td>800</td><td>39,8</td></tr><tr><td>1000</td><td>37,7</td></tr><tr><td>1250</td><td>39,6</td></tr><tr><td>1600</td><td>43,1</td></tr><tr><td>2000</td><td>42,2</td></tr><tr><td>2500</td><td>38,2</td></tr><tr><td>3150</td><td>40,0</td></tr><tr><td>4000</td><td>45,2</td></tr><tr><td>5000</td><td>46,7</td></tr></table>	Frequency f [Hz]	R'45° (third octaves) [dB]	50	16,8	63	20,1	80	30,7	100	30,7	125	19,9	160	28,3	200	30,4	250	35,3	315	41,1	400	39,4	500	40,8	630	39,0	800	39,8	1000	37,7	1250	39,6	1600	43,1	2000	42,2	2500	38,2	3150	40,0	4000	45,2	5000	46,7	<table><tr><td>—■—</td><td>figures R'</td></tr><tr><td>—</td><td>trend curve (ISO 717-1)</td></tr></table>		—■—	figures R'	—	trend curve (ISO 717-1)
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Assessment under ISO 717-1: R'45°,w (C;Ctr) = 40 (-2;-4) dB The results are determined on the basis of in the building measurement by method of technical. Worthy building sound insulation and factors of spectrum adaptation 100 - 3150 Hz																																																		
Job number:	3-0817-2561	Ing. David Kail - AKUSTICKÉ CENTRUM Bělohorská č.131/210, 169 00, Praha 6																																																
Date of protocol compilation:	13.10.2017	tel.: 603 525620, 235315094-5, fax.: 235315096 e-mail: kail@akustickecentrum.cz																																																

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4000	44,9																																																	
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—■—	figures R'																																																	
—	trend curve (ISO 717-1)																																																	
Assessment under ISO 717-1: R'45°,w (C;Ctr) = 39 (-1;-2) dB Worthy building sound insulation and factors of spectrum adaptation 100 - 3150 Hz The results are determined on the basis of in the building measurement by method of technical.																																																		
Job number:	3-0817-2561	Ing. David Kail - AKUSTICKÉ CENTRUM Bělohorská č.131/210, 169 00, Praha 6																																																
Date of protocol compilation:	13.10.2017	tel.: 603 525620, 235315094-5, fax.: 235315096 e-mail: kail@akustickecentrum.cz																																																

Building sound insulation under ISO 140-5																																														
Field measurements of airborne sound insulation of facade elements and facades																																														
Measured object:	Testing building of the Sipral a.s. (JSC) in Jirny																																													
Description of assessable component:	The part of facade: balcony door, glass structure: 88.4 SC-15-66.4 SC																																													
Client:	SIPRAL a.s. Třebohostická 3165/5a 100 00 Praha 10																																													
Surface S of assessable component:	2,9 m ²																																													
Volume V of audience room:	39,2 m ³																																													
<table><tr><th>Frequency f [Hz]</th><th>R'45° (third octaves) [dB]</th></tr><tr><td>50</td><td>27,2</td></tr><tr><td>63</td><td>26,9</td></tr><tr><td>80</td><td>28,9</td></tr><tr><td>100</td><td>31,9</td></tr><tr><td>125</td><td>32,7</td></tr><tr><td>160</td><td>37,1</td></tr><tr><td>200</td><td>41,1</td></tr><tr><td>250</td><td>41,1</td></tr><tr><td>315</td><td>41,8</td></tr><tr><td>400</td><td>40,5</td></tr><tr><td>500</td><td>46,2</td></tr><tr><td>630</td><td>45,0</td></tr><tr><td>800</td><td>41,5</td></tr><tr><td>1000</td><td>43,8</td></tr><tr><td>1250</td><td>46,0</td></tr><tr><td>1600</td><td>49,0</td></tr><tr><td>2000</td><td>46,4</td></tr><tr><td>2500</td><td>45,7</td></tr><tr><td>3150</td><td>47,3</td></tr><tr><td>4000</td><td>49,5</td></tr><tr><td>5000</td><td>49,3</td></tr></table>	Frequency f [Hz]	R'45° (third octaves) [dB]	50	27,2	63	26,9	80	28,9	100	31,9	125	32,7	160	37,1	200	41,1	250	41,1	315	41,8	400	40,5	500	46,2	630	45,0	800	41,5	1000	43,8	1250	46,0	1600	49,0	2000	46,4	2500	45,7	3150	47,3	4000	49,5	5000	49,3		
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Assessment under ISO 717-1:																																														
R'45°,w (C;Ctr) = 45 (0;-2) dB		Worthy building sound insulation and factors of spectrum adaptation 100 - 3150 Hz																																												
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Job number:	3-0817-2561	Ing. David Kail - AKUSTICKÉ CENTRUM Bělohorská č.131/210, 169 00, Praha 6																																												
Date of protocol compilation:	25.10.2017	tel.: 603 525620, 235315094-5, fax.: 235315096 e-mail: kail@akustickecentrum.cz																																												

Building sound insulation under ISO 140-5																																														
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Measured object:	Testing building of the Sipral a.s. (JSC) in Jirny																																													
Description of assessable component:	The part of facade: fix frame, glass structure: 8-16-64.4																																													
Client:	SIPRAL a.s. Třebohostická 3165/5a 100 00 Praha 10																																													
Surface S of assessable component:	2,9 m ²																																													
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Job number:	3-0817-2561	Ing. David Kail - AKUSTICKÉ CENTRUM Bělohorská č.131/210, 169 00, Praha 6																																												
Date of protocol compilation:	18.10.2017	tel.: 603 525620, 235315094-5, fax.: 235315096 e-mail: kail@akustickecentrum.cz																																												

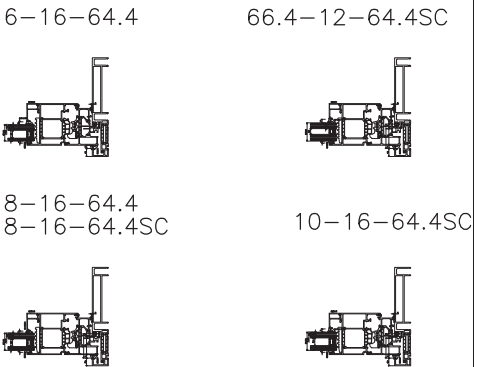
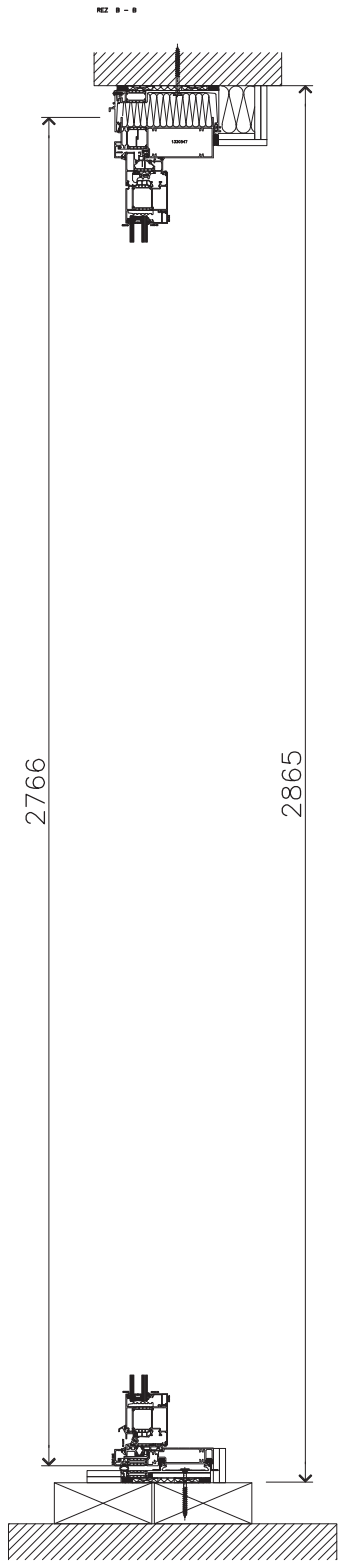
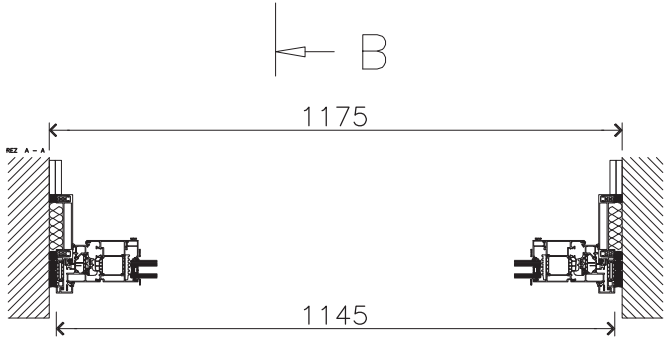
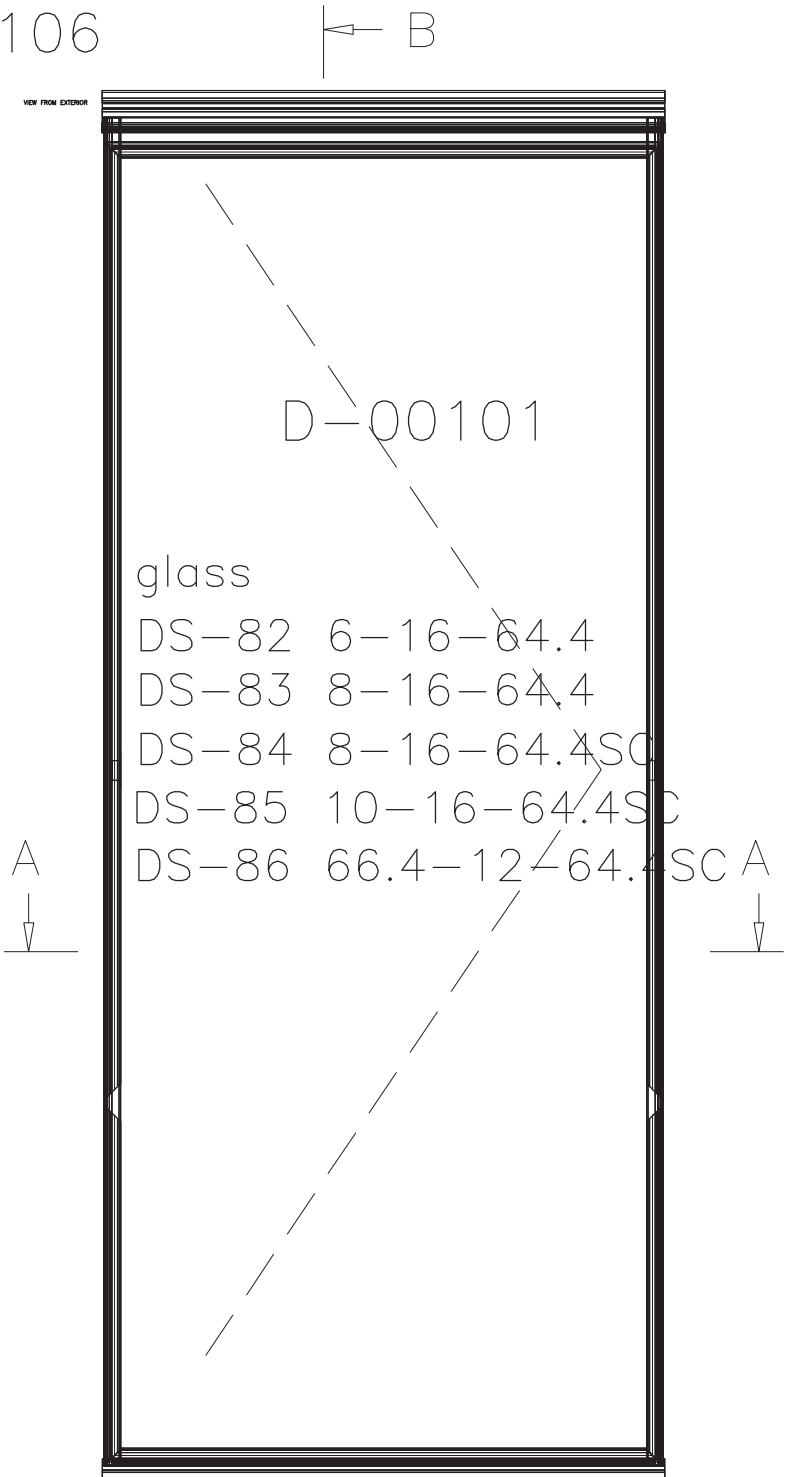
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Job number:	3-0817-2561	Ing. David Kail - AKUSTICKÉ CENTRUM Bělohorská č.131/210, 169 00, Praha 6																																																														
Date of protocol compilation:	24.10.2017	tel.: 603 525620, 235315094-5, fax.: 235315096 e-mail: kail@akustickecentrum.cz																																																														

OPENING DOORS

Rw+Ctr 32dB and 35dB

1pcs

M-00106



ACOUSTICAL TEST

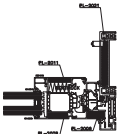
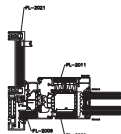
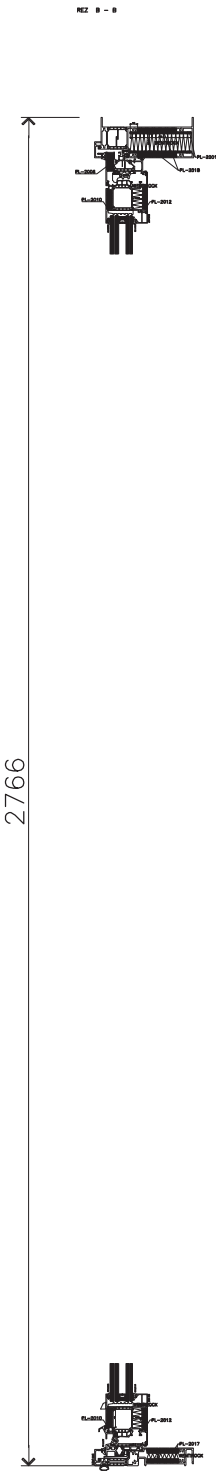
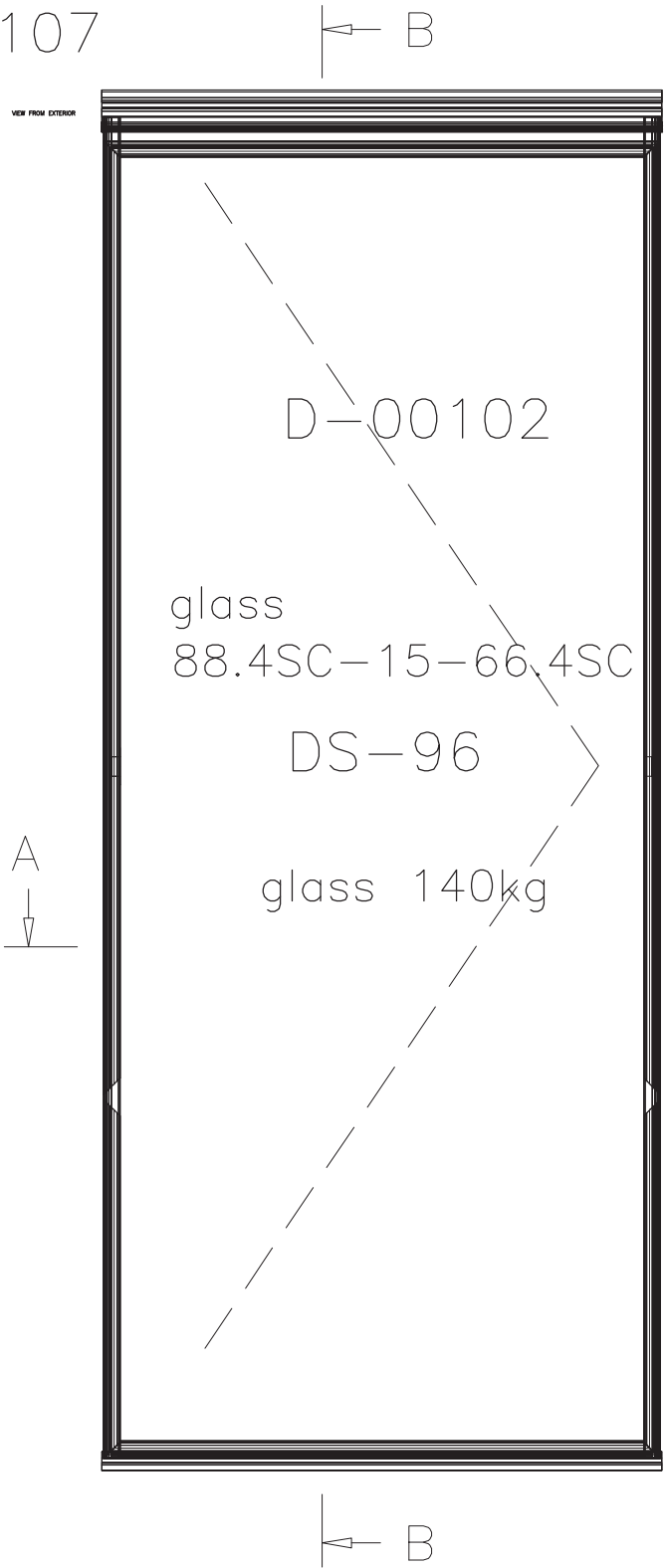
OPENING DOORS

1pcs

M-00107

Rw+Ctr 41dB

ACOUSTICAL TEST



88.4SC-15-66.4SC

