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DELTA Test Report

TEST Reg. no. 100

Laboratory Measurement of Airborne Sound Insulation of a Hansen Millennium® G30 Window with a 8/0.76/6-24-6/0.76/4 mm Argon-filled Insulating Glass Unit

Performed for HansenProfile A/S

DANAK 100/1722
Project no.: T206136
Page 1 of 8 incl.
1 graph sheet
5 annexes

30 July 2013

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Title
Laboratory Measurement of Airborne Sound Insulation of a Hansen Millennium® G30 Window with a 8/0.76/6-24-6/0.76/4 mm Argon-filled Insulating Glass Unit

Journal no.	**Project no.**	**Our ref.**	**Date of test**
DANAK 100/1722	T206136	LSS/HSO/ilk	16 July 2013

Client
HansenProfile A/S
Jernbanegade 26
DK-6940 Lem

Client ref.
Søren H. Sørensen

Laboratory
DELTA
Agro Food Park 13
8200 Aarhus N
Denmark

Test conditions
EN ISO 10140-1:2010, EN ISO 10140-2:2010, EN ISO 10140-4:2010
EN ISO 10140-5:2010, EN ISO 717-1:1996, EN ISO 717-1 Amendment 1:2006

Results
Airborne sound insulation measured in the laboratory, weighted sound reduction index according to EN ISO 717-1:1996, EN ISO 717-1 Amendment 1:2006:

$$R_w\ (C;\ C_{tr}) = 47\ (-1;\ -6)\ dB$$

Graph Sheet no. 1 shows the sound reduction index of every one-third octave band in the frequency range 50-5000 Hz together with the shifted reference curve corresponding to the measured weighted sound reduction index. The one-third octave band values are shown both in tabular form and graphically. Additionally the one octave band values are calculated from the one-third octave band values and are shown in tabular form.

Remarks

Description of the test specimen:	See Annex 1 and 2
Mounting in the laboratory:	See Annex 1
Measuring conditions and procedure:	See Annex 3
Measurements at low frequencies:	See Annex 4
Measuring equipment:	See Annex 5

The test result applies to the tested specimen only.

Aarhus, 30 July 2013
DELTA

Lars S. Søndergaard

Lars S. Søndergaard
Consultant, Acoustics

TEST Reg. no. 100

Laboratory measurement of sound reduction index according to EN ISO 10140:2010 part 1, 2, 4 and 5

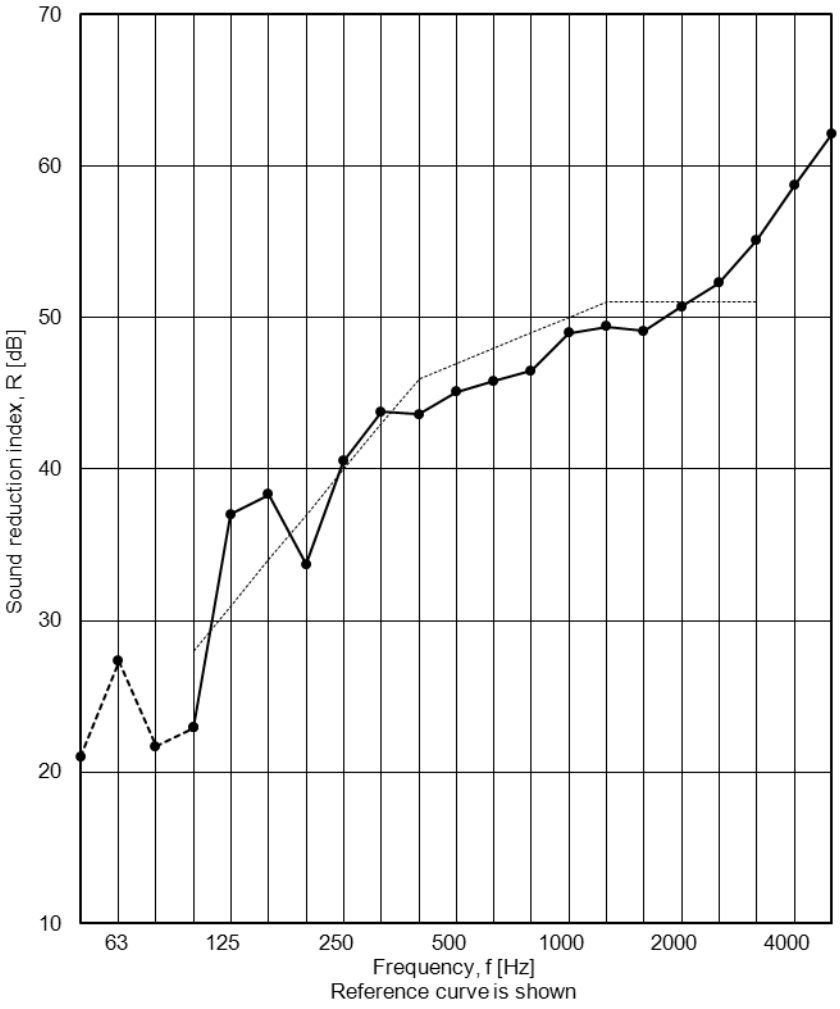
Client: HansenProfile A/S, Jernbanegade 26, DK-6940 Lem
Date of test: 16 July 2013

Description of the test specimen: Hansen Millennium® G30 Window with a 8/0.76/6-24-6/0.76/4 mm Argon-filled Insulating Glass Unit
Test specimen mounted by: The client

Area of test opening: 2.10 m^2
Mass per unit area: 65.5 kg/m^2
Air temperature: 22.8 °C
Air humidity: 55 % RH
Source room volume: 117.7 m^3
Receiving room volume: 64.8 m^3

Frequency f [Hz]	R 1/3 octave [dB]	R Octave [dB]
50*)	21.0	
63*)	27.3	22.6
80*)	21.7	
100	22.9	
125	37.0	27.4
160	38.3	
200	33.7	
250	40.5	37.3
315	43.8	
400	43.6	
500	45.1	44.7
630	45.8	
800	46.5	
1000	49.0	48.1
1250	49.4	
1600	49.1	
2000	50.7	50.5
2500	52.3	
3150	55.1	
4000	58.7	57.7
5000	62.1	

*) See Annex 4



Weighted sound reduction index according to EN ISO 717-1:1996 and EN ISO 717-1 Amendment 1:2006 :

$R_w (C; C_{tr}) = 47 (-1; -6)$ dB

Evaluation based on laboratory measurement results obtained by an engineering method series: EN ISO 10140:2010

DELTA, 30 July 2013

Lars S. Søndergaard

Lars S. Søndergaard, Acoustics

Description of the Test Specimen

Hansen Millennium® window system thermally broken aluminium profile system.

Frame (G30) 421703 and 422583, sash 423223

Gaskets of TPE

Color: Bronze anodised

Glazing: Saint-Gobain:

- 86.2 SGG Stadip Silence (outside)

- 24 mm Swisspacer, black

- 64.2 SGG Stadip Silence Ultra N (inside)

The outer frame dimensions were 1.0015 m x 2.0427 m.

The description above and the drawing in Annex 2 have been provided by the client.

The drawing in Annex 2 has been reduced in size by DELTA and is not in scale.

Mounting in the Laboratory

The dimensions of the test opening were 1020 mm x 2120 mm as seen from the source room side and 1140 mm x 2180 mm as seen from the receiving room side. The height was reduced 60 mm by 4 Knauf Fiberboards in the source room side, where all joints were sealed with putty (Perennator TX 2001 S Grau).

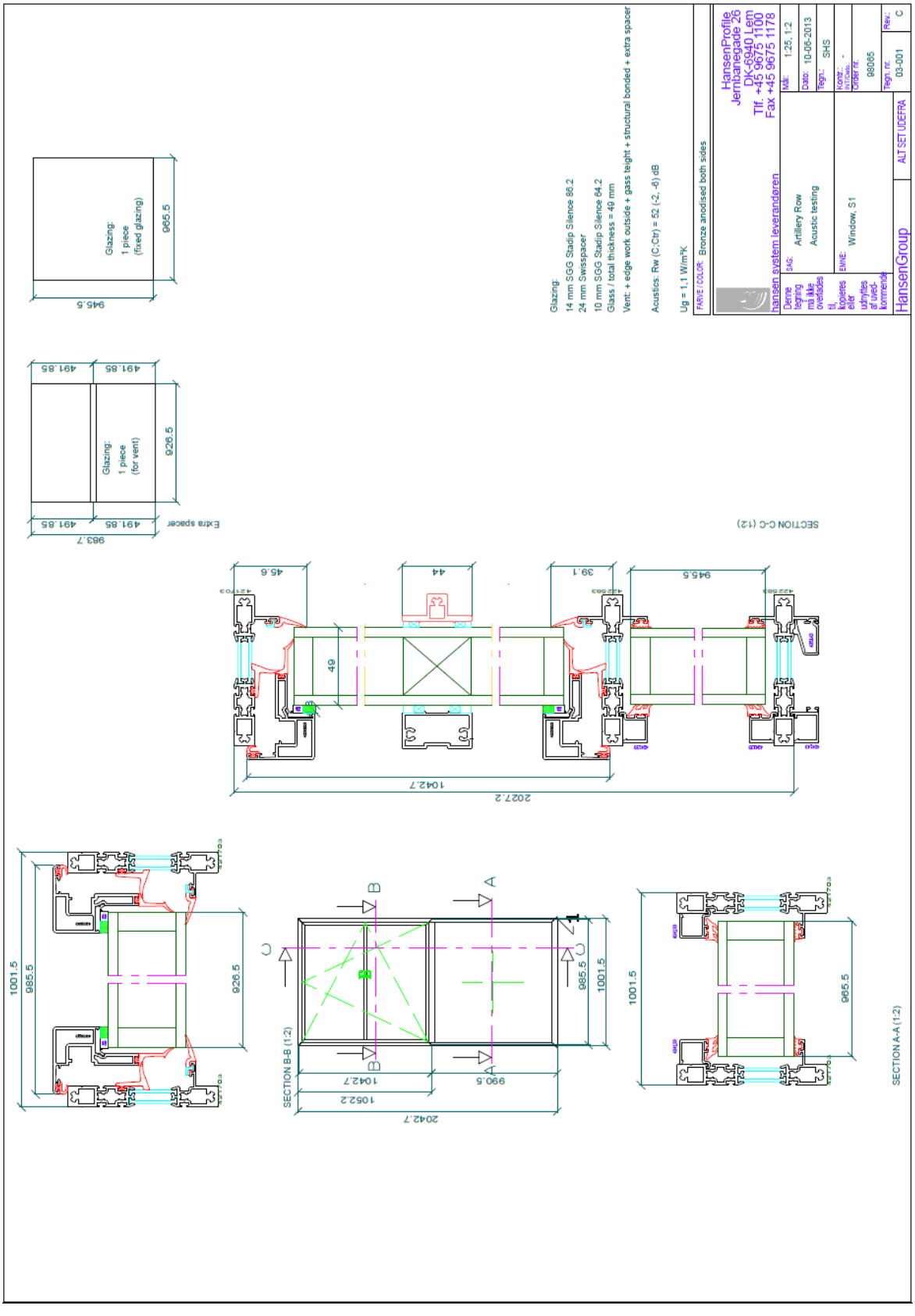
The window was fixed in the test opening with four screws in each vertical side of the frame, and the joint between the frame and the test opening was filled with mineral wool. From both sides a foam strip was fitted, and the joint was sealed with joint filler of the type ms 20 polymeric.

The niche depth from the surface of the window against the source room was approx. 70 mm.

The mounting was carried out by the client.

Annex 2

Notice: The drawing is reduced in size by DELTA and is not in scale.



Measuring Conditions and Test Procedure in the Frequency Range 100-5000 Hz

Source room:	Volume = 117.7 m^3 7 diffusing elements, 1.0 m × 1.2 m Reverberation time ≤ 1.4 s
Receiving room:	Volume = 64.8 m^3 5 diffusing elements, 1.0 m × 1.2 m Reverberation time ≤ 2.0 s
Test opening:	1.02 m × 2.06 m (source room side) 1.14 m × 2.18 m (receiving room side)
Depth of test opening:	0.45 m
Total partition wall area:	16.2 m^2
Loudspeaker system:	Dodecahedron loudspeaker moving along a traverse for measurements of sound pressure levels. Cycle time approx. 128 s. Open loudspeaker in one position for measurement of reverberation time.
Microphone system:	Rotating (32 s/rotation). Integration time: 256 s for measurements of sound pressure levels. The reverberation time is measured in 20 microphone positions distributed on the microphone path.
Sound signal:	Wideband pink noise
Filters:	One-third octave band filters with centre frequencies within the frequency range 100-5000 Hz

The sound reduction indices in Graph Sheet no. 1 have been corrected for sound transmission around the test specimen (flanking transmission). The correction value must not exceed 1.3 dB corresponding to a transmission ratio of 1:3. The calculated correction value was less than 1.3 dB for every one-third octave band.

In Annex 5 the maximum obtainable sound reduction index, R'_{max}, that can be measured in the laboratory is listed together with the corrections which are included in the results in Graph Sheet no. 1.

The octave band values in Graph Sheet no. 1 are calculated from the one-third octave band values in accordance with EN ISO 10140-2, clause 5.3.

Measurement Uncertainty

According to EN ISO 140-2:1992 precision of laboratory measurements expressed as the reproducibility of single-number quantities, including R_w, will normally be in the range of 1 dB to 3 dB.

Measurements in the Low Frequency Range 50-80 Hz

Additional measurements in the frequency range 50-80 Hz were carried out. The measurement uncertainty of these measurements is larger than in the normal frequency range for building acoustic measurements 100-5000 Hz.

Generally, the measurements performed in the low-frequency range follow the procedure given for frequencies above 100 Hz (see previous annex).

For measurements in the 63 Hz and the 80 Hz one-third octave bands, the test procedure is identical to the procedure used for frequencies above 100 Hz.

Measurement in the 50 Hz one-third octave band is carried out using the reverse direction of measurement (source- and receiving room interchanged). Two corner positions (opposite the test wall) of a dodecahedron loudspeaker are used. Investigations have shown that in DELTA's test rooms, this procedure leads to measured sound reduction indices at 50 Hz, which are in good agreement with expected values. Details of the test procedure are given below.

The description and evaluation of the test procedure is reported in internal procedure DQP 87002.

Loudspeaker system:	Dodecahedron loudspeaker at two corner positions for measurements of sound pressure levels. Dodecahedron loudspeaker in one position for measurement of reverberation time.
Microphone system:	Rotating (32 s/rotation). Integration time: 2 × 64 s for measurements of sound pressure levels. The reverberation time is measured in twenty microphone positions distributed on the microphone path.
Sound signal:	Wideband pink noise
Filter:	One-third octave band filter with centre frequency 50 Hz

The sound reduction indices have not been corrected for sound transmission around the test specimen (flanking transmission) in the frequency range 50-80 Hz.

Spectrum Adaptation Terms for an Enlarged Frequency Range

The spectrum adaptation terms given below are determined according to EN ISO 717-1:1996, Annex B.

$C_{50\text{-}3150}$	-2 dB	$C_{tr,50\text{-}3150}$	-9 dB
$C_{50\text{-}5000}$	-1 dB	$C_{tr,50\text{-}5000}$	-9 dB
$C_{100\text{-}5000}$	0 dB	$C_{tr,100\text{-}5000}$	-6 dB

Correction for Flanking Transmission

Frequency [Hz]	R'_{max} [dB]	Correction [dB]
100	41.4	0.9
125	43.3	0.6
160	46.7	0.0
200	48.9	0.3
250	51.4	0.2
315	56.3	0.0
400	59.6	0.0
500	61.3	0.0
630	66.8	0.0
800	69.9	0.0
1000	72.6	0.0
1250	76.1	0.0
1600	79.5	0.0
2000	83.4	0.0
2500	88.5	0.0
3150	91.5	0.0
4000	92.5	0.0
5000	92.5	0.0

Measuring Equipment

Instrument	Manufacturer	Type	Serial no.
Dual channel frequency analyzer	Norsonic	RTA 840-2	18751
Power amplifier	Master	DL 1800	DLB 69670698
Equalizer	dbx	2031	–
Sound level calibrator	Brüel & Kjær	4231	2326064
Microphone, source room	Brüel & Kjær	4166	1440622
Microphone, receiving room	Brüel & Kjær	4166	1072077
Microphone preamplifier, source room	Brüel & Kjær	2669	2025403
Microphone preamplifier, receiving room	Brüel & Kjær	2619	855256
Rotating microphone boom, source room	Brüel & Kjær	3923	1357259
Rotating microphone boom, receiving room	Brüel & Kjær	3923	983339
Dodecahedron loudspeaker	Norsonic	229	20712
Open loudspeaker cabinet	DELTA	–	–
Loudspeaker unit	Celestion	G12H-100	–