Evidence of Performance
Airborne sound insulation of building components

Test Report
No. 16-002449-PR01
(PB Z1-A01-04-en-02)

Client	Reynaers Aluminium N.V./S.A. Oude Liersbaan 266 2570 Duffel Belgium
Product	Fixed light
Designation	MasterLine 8 Functional
Overall dimensions (w x h)	1,230 mm × 1,480 mm
Material	Aluminium profile with thermal break
Type of opening	Fixed
Filling	Insulating glass unit 20 LSG-acoustic / 20 /16 LSG-acoustic , R_w = 51 (-1;-2) dB acc. to manufacture
Special features	*GLASS 1*

Weighted sound reduction index R_w
Spectrum adaptation terms C and C_{tr}

$$R_w\ (C;\ C_{tr}) = 50\ (-1;\ -2)\ \text{dB}$$

ift Rosenheim
20.10.2016

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Basis

EN ISO 10140-1: 2010
+A1: 2012 + A2:2014
EN ISO 10140-2 : 2010
EN ISO 717-1 : 2013

Replaces test report 16-002449-PR01 (PB Z1-A01-04-en-01) dated 12.09.2016

Representation

Instructions for use

This test report serves to demonstrate the airborne sound insulation of a building component.

Applicable for Germany

For Germany the following applies: the weighted sound reduction index Rw can be used for verification by calculation in accordance with DIN 4109-2:2016.

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.

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 13 pages:

1 Object
2 Procedure
3 Detailed results
4 Instructions for use
Data sheet (1 page)

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1 Object

1.1 Description of test specimen

Product	Fixed light
Product designation	MasterLine 8 Functional
Mass of window	158.0 kg
Mass per unit area m'	86.8 kg/m²
Frame member	
Frame member size (w x h)	1,230 mm × 1,480 mm
Type / Manufacturer	MasterLine 8 / Reynaers Aluminium NV
Material	Aluminium profile with thermal break , painted (colour 51)
Profile number	408.0183.XX
Profile section (w x d)	60 mm x 77 mm
Frame connectors	168.7002.00 + 168.8002.00
Drainage	3 x 3 holes diameter 8 mm
Pressure compensation/Ventilation	Interruption of outside glazing gasket for 5 cm (in the middle at the top)
Filling	Insulating glass unit
Type, Manufacturer	Glass / AGC Glass
Sound reduction of filling	R_w = 51 (-1;-2) dB (acc. to manufacture)
Glass size (w x h)	1148 x 1398 mm
Visible Size (w x h)	1110 x 1360 mm
Total Thickness on the edge	57.5 mm
Total Thickness in middle of pane	59 mm
Construction	20 LSG-acoustic / 20 /16 LSG-acoustic Thermobel - Stratophone 1010.2 / 20 / Stratophone 88.2
Gas filling in cavity	Acc. Manufacturer
Type of gas	Argon
Volume in %	90 %
Construction of laminated glass	10 mm Float – 0.76 Acoustic film – 10 mm Float 8 mm Float – 0.76 Acoustic film – 8 mm Float
Type / manufacturer of interlayer	0.38 clear PVB / AGC Stratobel Stratophone
Mounting of infill panel	
Sealing system	Dry glazing with gaskets
Internal: Type / Material / Manufacturer	180.9372.04 / EPDM / Reynaers Aluminium NV
Corner configuration	Continuous around perimeter on four sides
External: Type / Material / Manufacturer	180.9204.04 / EPDM / Reynaers Aluminim NV
Corner configuration	Continuous around perimeter on four sides
Vapour pressure equalization	Interruption of outside glazing gasket for 5 cm (in the middle at the top)

Glazing beads	
Material	Aluminium
Position internal / external	internal
Type, Manufacturer	Masterline 8 / Reynaers Aluminium NV
Profile system	Masterline 8
Profile number	030.3606.XX
Profile section (w x d)	29.2 x 19.5 mm
Fixing	Clipped

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.

1.2 Mounting in test rig

Test rig	Window test rig „Z“ with suppressed flanking transmission acc. to EN ISO 10140-5: 2010+A1:2014; 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	Test specimen mounted by **ift** Laboratory for Building Acoustics.
Mounting conditions	Mounting in test opening, connecting joints stuffed with foam and sealed on both sides with plastic sealant (window putty).
Mounting position	At the rate of 1/3 to 2/3 in the test opening.
Opening direction	none, fixed light
Preparation	none

1.3 Representation of test specimen

The structural details were examined solely on the basis of the characteristics to be classified. The illustrations are based on unchanged documentation provided by the client.

fig 1 Photo(s) of the mounted element, taken by **ift** Laboratory for Building Acoustics

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Client Reynaers Aluminium N.V./S.A.; 2570 Duffel (Belgium)

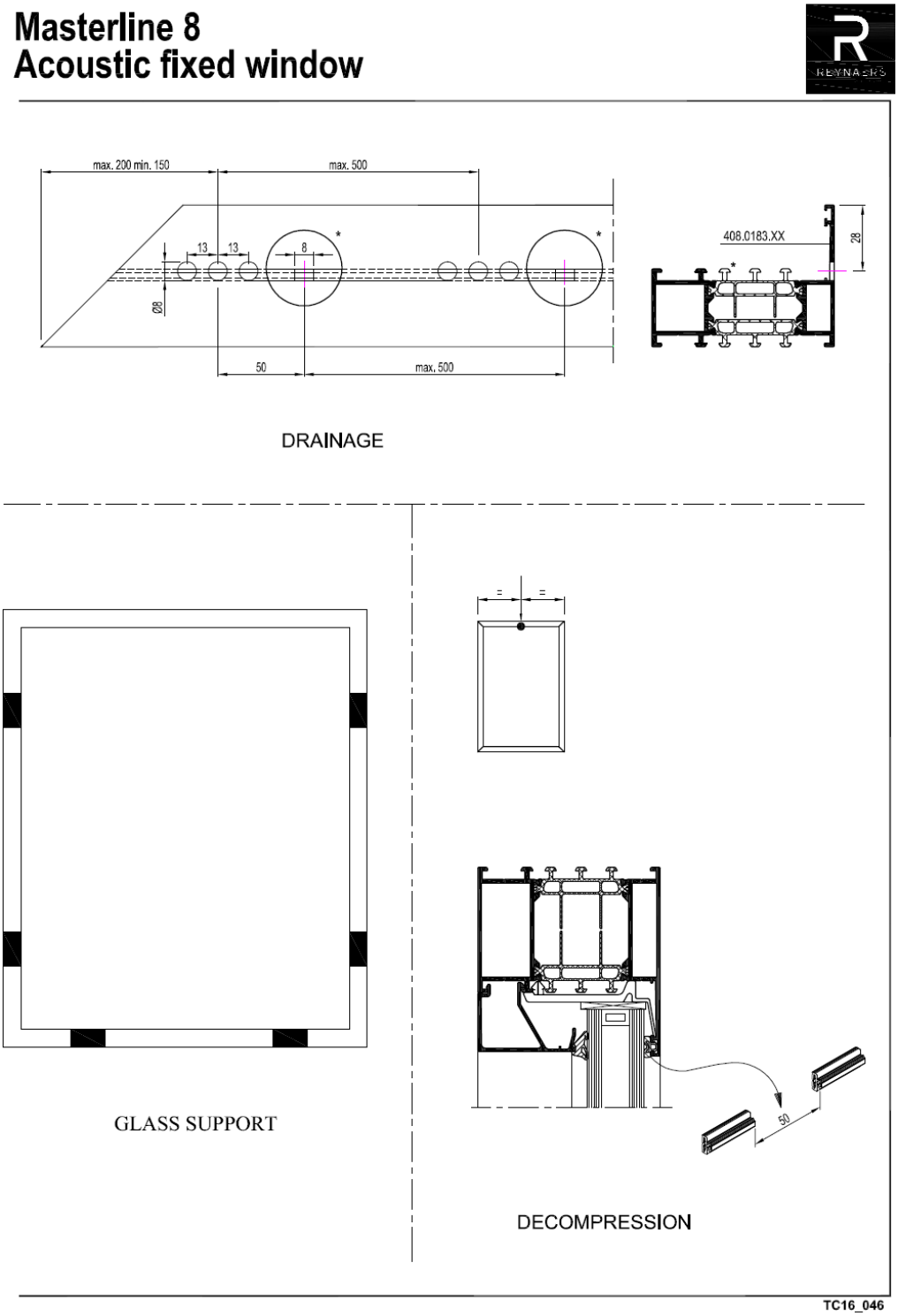

fig 2 Drainage and Glass support

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Masterline 8
Acoustic fixed window

		#	
168.7002.00		4	19H.F. ...
168.8002.00		4	19H.F. ...
160.8750.--		4	19H.F. ...
169.8748.04		6	19H.F. ...
169.8700.04		6	19H.F. ...
069.6831.XX		3	19H.F. ...
180.9372.04		5092	19H.F. ...
180.9204.04		5092	19H.F. ...

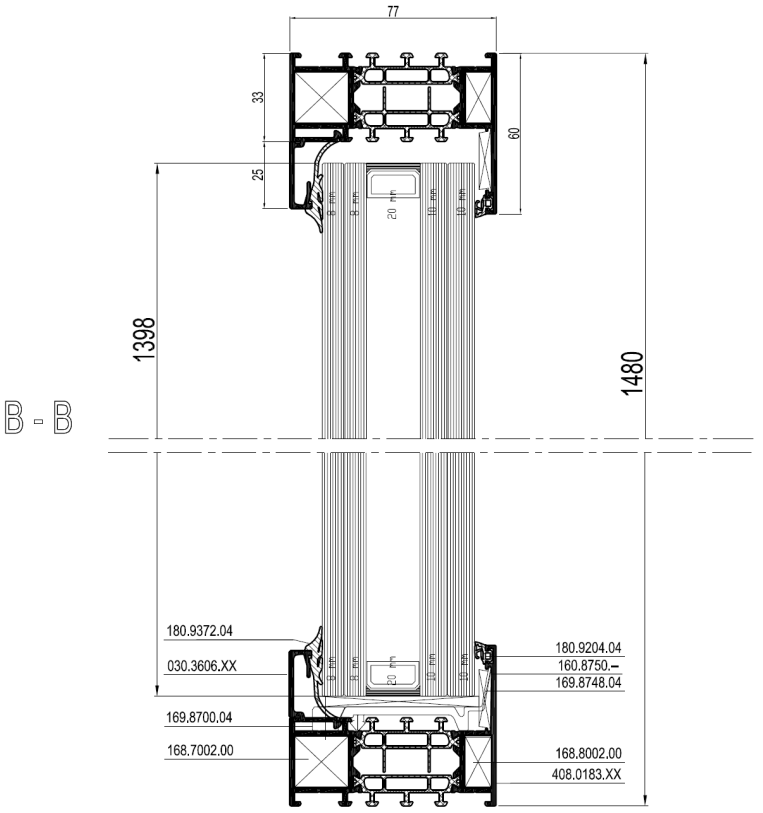

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fig 3 vertical section drawing

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Client Reynaers Aluminium N.V./S.A.; 2570 Duffel (Belgium)

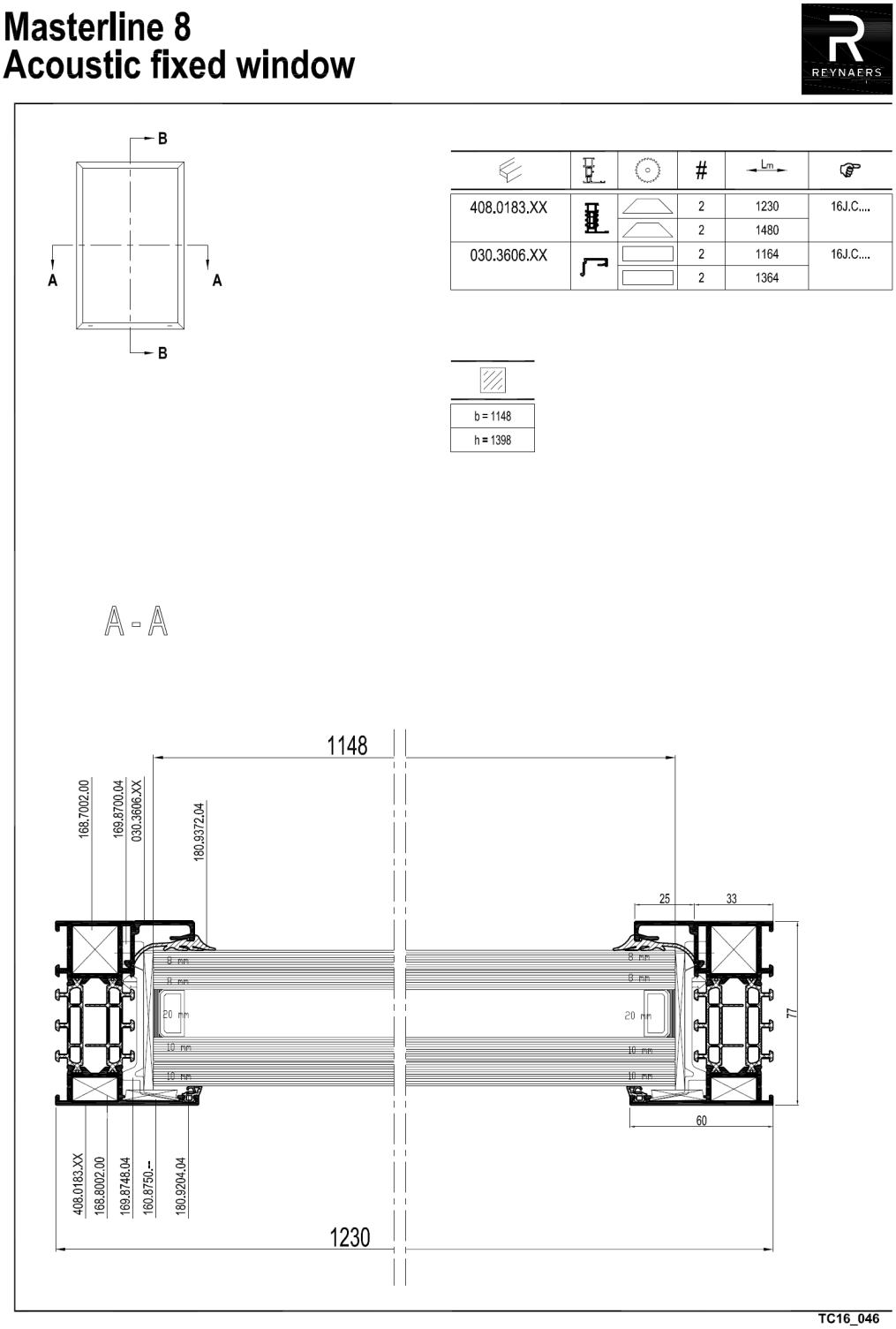


fig 4 horizontal section drawing

2 Procedure

2.1 Sampling

Sampling	The samples were selected by the client
Quantity	1
Manufacturer	Reynaers Aluminium N.V/ S.A. Oude Liersebaan 266 B-2570, Duffel
Manufacturing plant	Reynaers Aluminium Test Centre, Duffel, Belgium
Date of manufacture /	**12/08/16 9u15** /
date of sampling	25.08.2016
Production line	-/-
Responsible for sampling	Joris Brusseleers
Delivery at **ift**	2nd of September 2016 by the client via forwarding agency
ift registration number	42090/1

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

Procedure and scope of measurement are in conformity with the principles of the Working Group of sound insulation testing bodies approved by the national building supervisory authorities in cooperation with the standardization committee NA 005-55-75-AA (subcommittee UA 1 - DIN 4109).

Boundary conditions	As specified by the standard
Deviation	There are no deviations from the test method/s and/or test conditions.
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 ISO 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. They were not corrected by calculation.
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	$R = L_1 - L_2 + 10 \cdot \lg \frac{S}{A}$ dB

KEY

A	Equivalent absorption area in m²
L_1	Sound pressure level source room in dB
L_2	Sound pressure level receiving room in dB
R	Sound reduction index in dB
T	Reverberation time in s
V	Volume of receiving room in m³
S	Testing area of the specimen in m²

2.3 Test apparatus

Device	Type	Manufacturer
Integrating sound meter	Type Nortronic 840	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 2016. The sound level meter used, Series No. 31423, was DKD calibrated by the company Norsonic Tippkemper (DKD - Deutscher Kalibrierdienst “German Calibration Service”) on 23nd of January 2015.

2.4 Testing

Date	7th of September 2016
Operating Testing Officer	Markus Schramm

3 Detailed results

The values of the measured sound reduction index of the tested window are plotted as a function of frequency in the annexed data sheet and tabled.
As per EN ISO 717-1 the weighted sound reduction index R_w and the spectrum adaptation terms C and C_{tr} for the frequency range 100 Hz to 3150 Hz obtained by calculation are as follows:

$$\mathbf{R_w\ (C;\ C_{tr}) = 50\ (-1;\ -2)\ dB}$$

According to EN ISO 717-1 the following additional spectrum adaptation terms are obtained

$C_{50\text{-}3,150}$	= -1 dB	$C_{100\text{-}5,000}$	= 0 dB	$C_{50\text{-}5,000}$	= 0 dB
$C_{tr,50\text{-}3,150}$	= -6 dB	$C_{tr,100\text{-}5,000}$	= -2 dB	$C_{tr,50\text{-}5,000}$	= -6 dB

4 Instructions for use

4.1 Application for DIN 4109: 2016-07

Basis

DIN 4109-1: 2016-07	Sound insulation in buildings - Part 1: Minimum requirements
DIN 4109-2: 2016-07	Sound insulation in buildings - Part 2: Verification of compliance with the requirements by calculation

The weighted sound reduction index determined in accordance with Section 3 can be directly used for verification of sound insulation by calculation in accordance with DIN 4109-2.

For calculation of the total weighted apparent sound reduction index $R'_{w,ges}$ in accordance with DIN 4109-2 Clause 4, the input data obtained from laboratory measurements must be stated in $^1/_{10}$ dB. The resulting weighted sound reduction index can then be applied directly to the sound insulation of the i-th-component of the building envelope if there is no influence by installation joints. This gives:

$$R_{i,w} = 50.4 \text{ dB}$$

Note: Unlike the predecessor standard DIN 4109:1989-11, the tolerance is not deducted from the component parameters. The final result of calculation in accordance with DIN 4109-2 takes account of uncertainties by including the safety factor u_{prog}.

4.2 Uncertainty of measurement, single number ratings in $^1/_{10}$ dB

Basis

EN ISO 12999-1: 2014	Acoustics; Determination and application of measurement uncertainties in building acoustics, part 1: sound insulation (ISO 12999-1: 2014)

The resulting weighted sound reduction index (in $^1/_{10}$ dB with measurement uncertainty), determined on the basis of EN ISO 717-1:2013-06 is:

$$R_w = 50.4 \text{ dB} \pm 1.2 \text{ dB}$$

The specified measurement uncertainty is the average standard deviation of laboratory measurements (standard measurement uncertainty σ_R for measurement situation A: Characterisation of a building component by laboratory measurements as per EN ISO 12999-1: 2014, Table 3 $\sigma_R = 1.2$ dB).

The product declaration for CE marking must use the integer value of the sound reduction index and the spectrum adaptation terms as given in Section 3:

$$R_w (C;C_{tr}) = 50 (-1; -2) \text{ dB}$$

4.3 Calculated value as per DIN 4109:1989

Basis

DIN 4109:1989-11	Sound insulation in buildings; requirements and testing

Verification of sound insulation in accordance with Building Codes for the transitional period, may require the indication of a calculated value of the weighted sound reduction index in accordance with the previous DIN 4109: 1989 -11 (withdrawn as of July 2016). As set out in DIN 4109-11:1989-11, the weighted sound reduction index R_w corresponds to the test value $R_{w,P}$. Including a tolerance of 2 dB, this gives the calculated value $R_{w,R}$.

$R_{w,R}$ = 48 dB

4.4 Laminated glass

The sound reduction of laminated glass depends on the temperature of the environment. If the temperature is lower than the test temperature the sound reduction index may be reduced.

ift Rosenheim
Laboratory for Building Acoustics
20.10.2016

Sound reduction index according to ISO 10140 - 2

Laboratory measurements of airborne sound insulation of building components

Client: Reynaers Aluminium N.V./S.A., 2570 Duffel (Belgium)

Product designation MasterLine 8 Functional

Design of test specimen

Fixed light GLASS 1

Overall dimensions	1,230 mm × 1,480 mm
Material	Aluminium profile with thermal break
Type of opening	none
Filling	Insulating glass unit
Pane configuration	20 LSG-acoustic / 20 /16 LSG-acoustic
Gas filling in cavity	Argon

Test date	7th of September 2016
Test surface S	1.25 m × 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

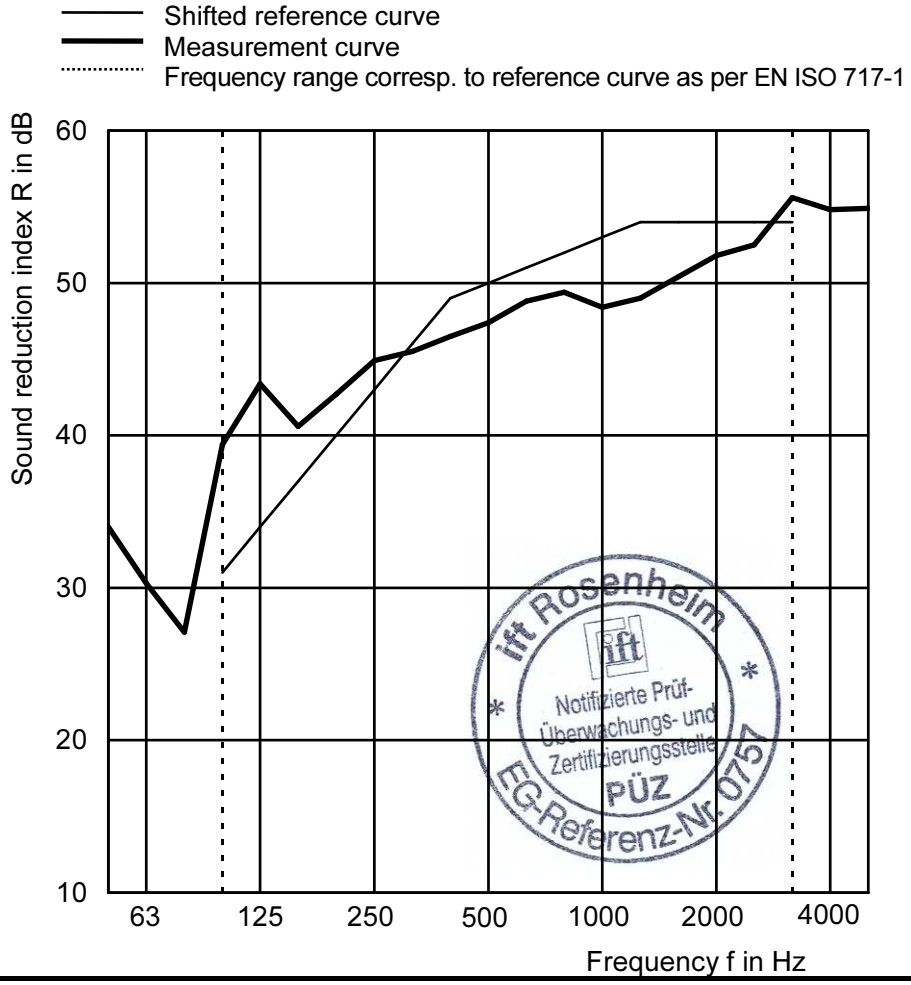
Maximum sound reduction index
$R_{w,max}$ = 62 dB (related to test surface)

Mounting conditions
Element butt-mounted in test opening and wedged in. Connecting joints filled with foam and sealed with plastic sealant on both sides

Climate in test rooms 21 °C / 57 % RH

Static air pressure 965 hPa

f in Hz	R in dB
50	34.0
63	30.3
80	27.1
100	39.4
125	43.4
160	40.6
200	42.7
250	44.9
315	45.5
400	46.5
500	47.4
630	48.8
800	49.4
1,000	48.4
1,250	49.0
1,600	50.4
2,000	51.8
2,500	52.5
3,150	55.6
4,000	54.8
5,000	54.9



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

R_w (C;C_{tr}) = 50 (-1; -2) dB $C_{50\text{-}3,150}$ = -1 dB; $C_{100\text{-}5,000}$ = 0 dB; $C_{50\text{-}5,000}$ = 0 dB

$C_{tr,50\text{-}3,150}$ = -6 dB; $C_{tr,100\text{-}5,000}$ = -2 dB; $C_{tr,50\text{-}5,000}$ = -6 dB

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Laboratory for Building Acoustics
20. October 2016

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Operating testing officer