AIRO

Report No. L/3290

for
Profine GmbH
Kreditorenbuchhalung
Mulheimer Str. 26
53840 Troisdorf
Germany

0483

Dated: 15 January 2014

LABORATORY MEASUREMENTS

OF THE

SOUND REDUCTION INDEX

OF

DOUBLE AND TRIPLE GLAZED

KOMMERLING WINDOW UNITS

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LABORATORY MEASUREMENTS

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SOUND REDUCTION INDEX

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DOUBLE AND TRIPLE GLAZED

KOMMERLING WINDOW UNITS

1. INTRODUCTION

This report presents the results of measurements made in the AIRO Acoustics Laboratory of the airborne sound insulation of a Kommerling Window Unit when fitted with a range of double and triple glazed units.

The measurements were made on 7 January 2014 for Profine GmbH.

Measurements of airborne sound insulation, Sound Reduction Index (R), were conducted in accordance with British Standard BS EN ISO 10140 (ref 1). Single figure ratings of sound insulation performance, known as the Weighted Sound Reduction Index (R_w) and Spectrum Adaptation Terms (C and C_{tr}), are derived from these measurements in accordance with British Standard BS EN ISO 717 (ref 2).

AIRO is a UKAS accredited testing laboratory No. 0483 and measurements to the above British Standards are included on our schedule of accreditation. UKAS is the United Kingdom Accreditation Service.

2. SUMMARY OF RESULTS

The results of the measurements presented in this report are summarised in the following table:

AIRO Test No.	Test Specimen	R_w (C;C_{tr}) dB
	Kommerling Window Unit with:	
L/3290/1	6.4/10/4/10/8.8 Triple Glazing	41 (-2;-4)
L/3290/2	4/12/4/12/8.8 Triple Glazing	42 (-1;-5)
L/3290/3	8.8/12/12.8 Double Glazing	42 (-1;-3)
L/3290/4	12/16/8.8 Double Glazing	41 (-1;-3)

Approved by: Report Author:

D L Watts M Sawyer

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Principal Consultant

M Sawyer MIOA
Laboratory Supervisor

3. TEST SPECIMEN DETAILS AND CONDITIONS

The specimen comprised a 1230 mm wide x 1480 mm high Kommerling C70 PVC framed window unit which was installed into a 1250 mm x 1500 mm test aperture. Through the frame fixings supported the specimen within the aperture, with voids between the frame and aperture filled with a foam tape which was pointed both sides with a gunned low modular silicone sealant. The window unit included a fixed light, a side-hung open-out sash, and a top-hung open-out vent. Both the sash and vent were supported on projecting friction stays and closed onto 2 synthetic rubber seals via a 2 point espagnolette locking mechanism. Measurements of the window unit were made when fitted with 4 different glazing configurations as detailed below. Drawings and further details follow on Pages 4 to 12.

3.1 Kommerling Window Unit with 6.4/10/4/10/8.8 Triple Glazing

The window unit was glazed with 39.2 mm thick sealed triple glazed units comprising 6.4 mm SGG Stadip laminated glass/10 mm Swisspacer cavity/4 mm float glass/10 mm Swisspacer cavity/ 8.8 mm SGG Stadip Silence laminated glass.

3.2 Kommerling Window Unit with 4/12/4/12/12.8 Triple Glazing

The window unit was glazed with 40.8 mm thick sealed triple glazed units comprising 4 mm float glass/12 mm Swisspacer cavity/4 mm float glass/12 mm Swisspacer/12.8 mm SGG Stadip Silence laminated glass.

3.3 Kommerling Window Unit with 8.8/12/12.8 Double Glazing

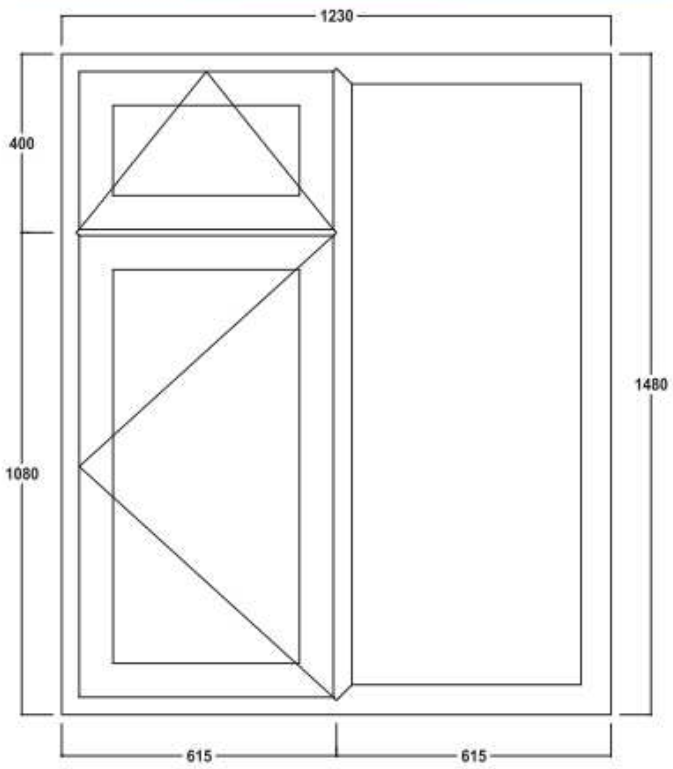
The window unit was glazed with 33.6 mm thick sealed double glazed units comprising 8.8 mm SGG Stadip Silence laminated glass/12 mm Swisspacer cavity/12.8 mm SGG Stadip Silence laminated glass.

3.4 Kommerling Window Unit with 12/16/8.8 Double Glazing

The window unit was glazed with 36.8 mm thick sealed double glazed units comprising 12 mm float glass/16 mm Swisspacer cavity/8.8 mm SGG Stadip Silence laminated glass.

Airo Test Window C70

KÖMMERLING



Scale 1 : 10

C70 Casement Profiles

Art No: 7507	Outer Frame
Art No: 7533	Transom
Art No: 7588	Mullion
Art No: 7581	Sash
Art No's: 070.02 & 006	Glazing Beads

Hardware

Locking mechanisms	Kenrick Easy Fit Espagnolettes
Hinges	10" Cotswold Top Hung Std
	16" Cotswold HS90 Extreme Side Hung

Glazing Options

(1) 8.8mm Silence / 12mm Swiss / 12.8mm Silence
(2) 4mm Float / 12mm Swiss / 4mm Float / 12mm Swiss / 8.8mm Silence
(3) 6.4mm / 10mm Swiss / 4mm Float / 10mm Swiss / 8.8mm Silence
(4) 12mm Float / 16mm Swiss / 8.8mm silence
All warm edge Swisspacer

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Airo Test Window 07/01/14

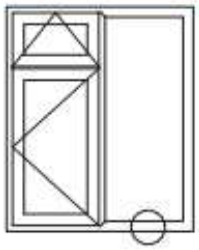
1

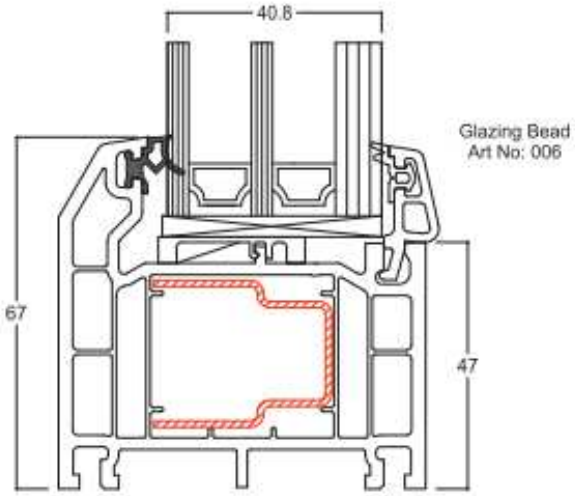
C70 Triple Glazed

KÖMMERLING®

C70 Outward Opening Casement

Art No: 7507 Outer Frame
Art No: 006 Glazing Bead





Art No: 7507

profine

Airo Teal Window 07/01/14

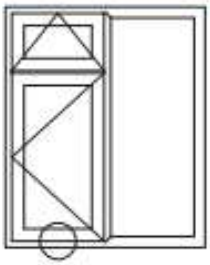
2

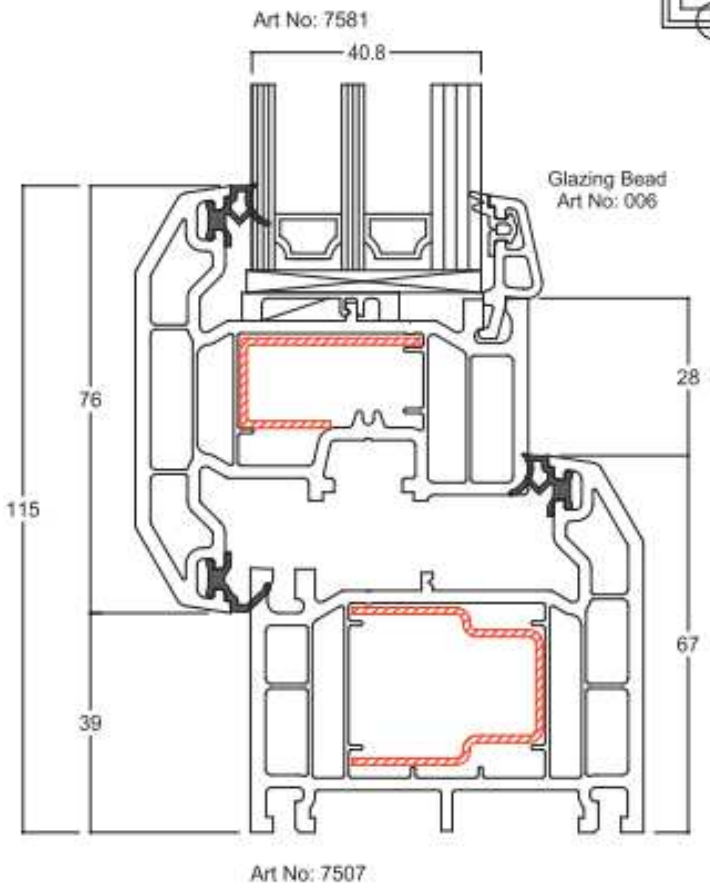
C70 Triple Glazed

KÖMMERLING®

C70 Outward Opening Casement

Art No: 7507 Outer Frame
Art No: 7581 Sash
Art No: 006 Glazing Bead





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Airo Teal Window 07/01/14

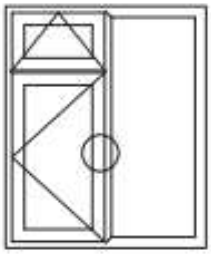
3

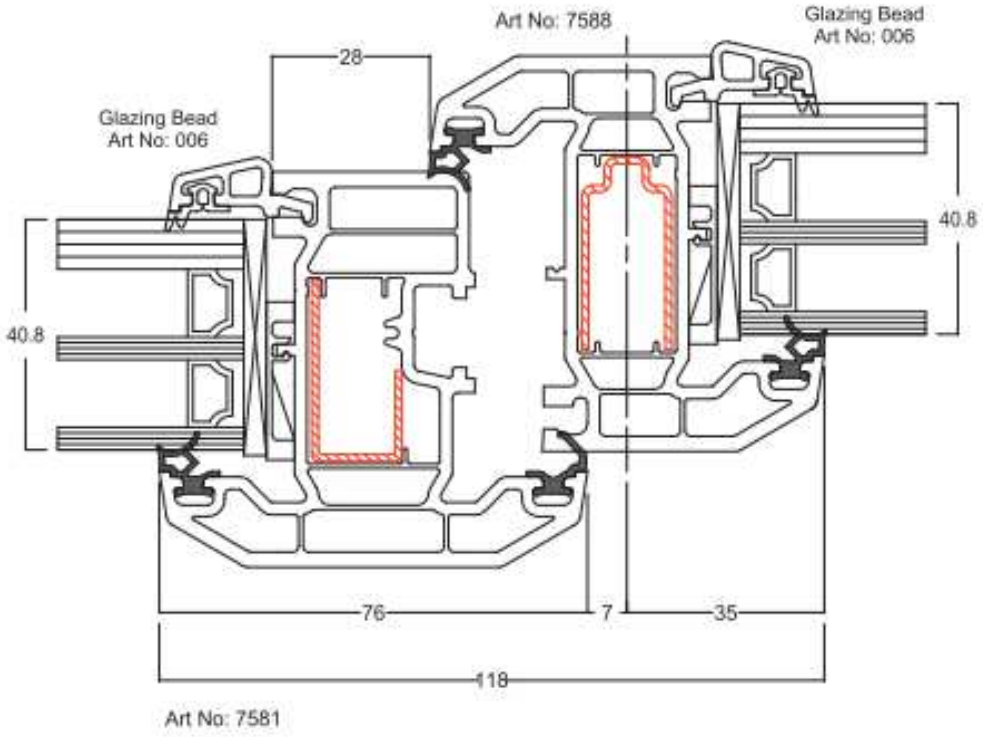
C70 Triple Glazed

KÖMMERLING

C70 Outward Opening Casement

Art No: 7588 Mullion
Art No: 7581 Sash
Art No: 006 Glazing Bead





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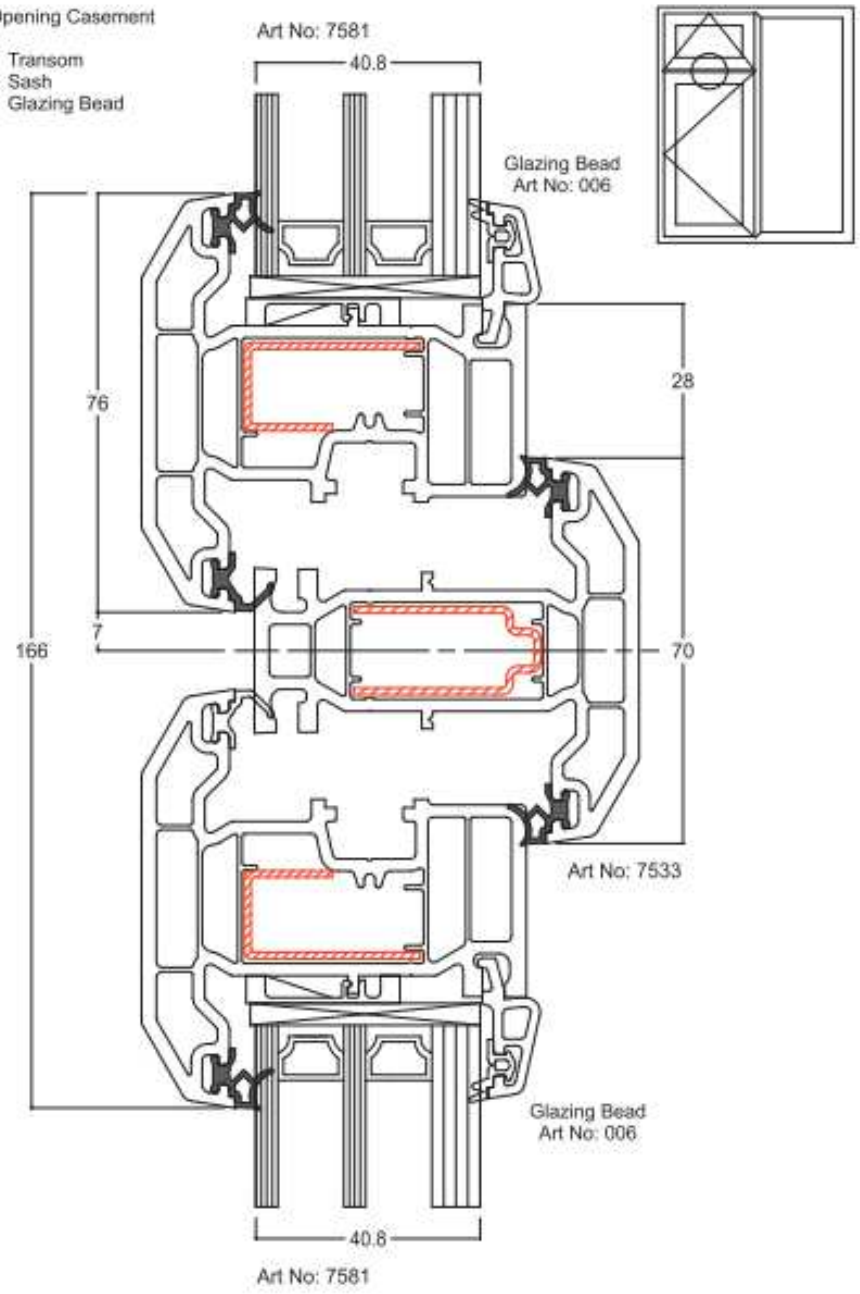
C70 Triple Glazed

KÖMMERLING

C70 Outward Opening Casement

Art No: 7533 Transom
Art No: 7581 Sash
Art No: 006 Glazing Bead



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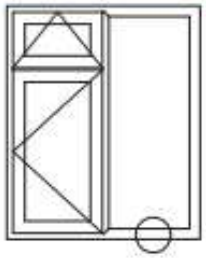
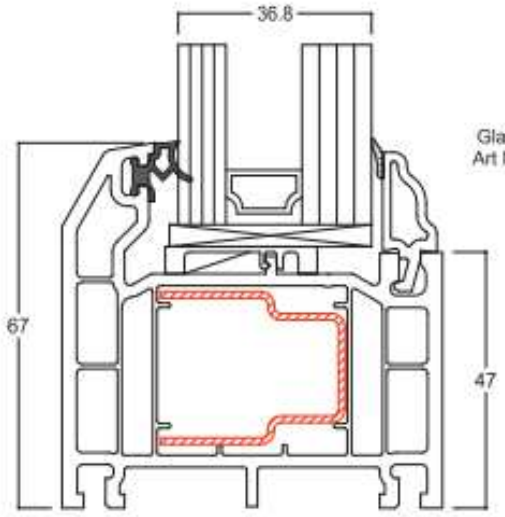
C70 Double Glazed

KÖMMERLING

C70 Outward Opening Casement

Art No: 7507 Frame
Art No: 070.2a Glazing Bead





Art No: 7507

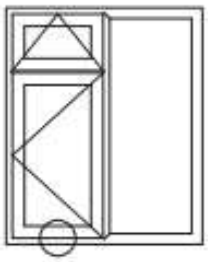
profine

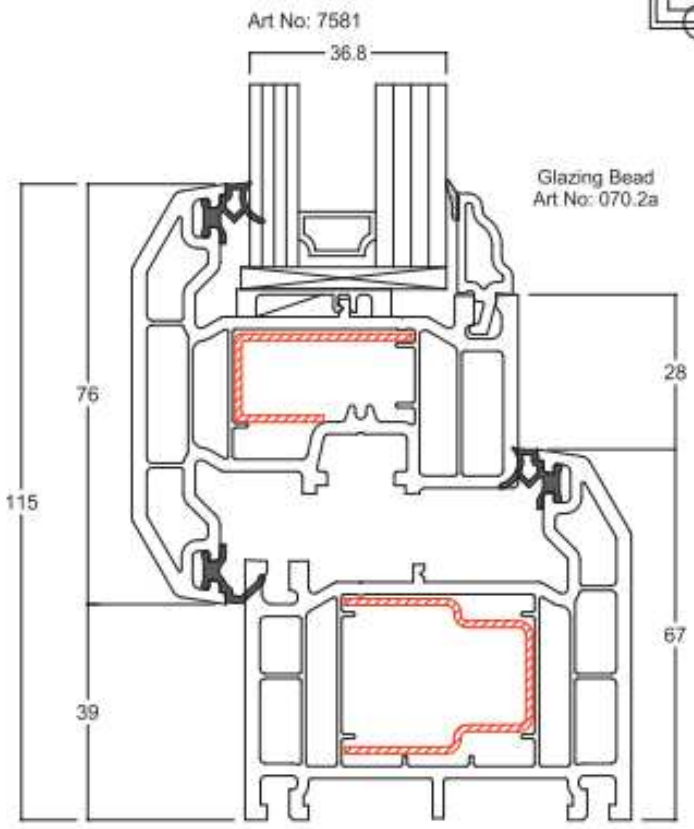
C70 Double Glazed

KÖMMERLING

C70 Outward Opening Casement

Art No: 7507 Frame
Art No: 7581 Sash
Art No: 070.2a Glazing Bead





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Airo Teal Window 07/01/14

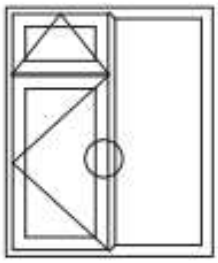
7

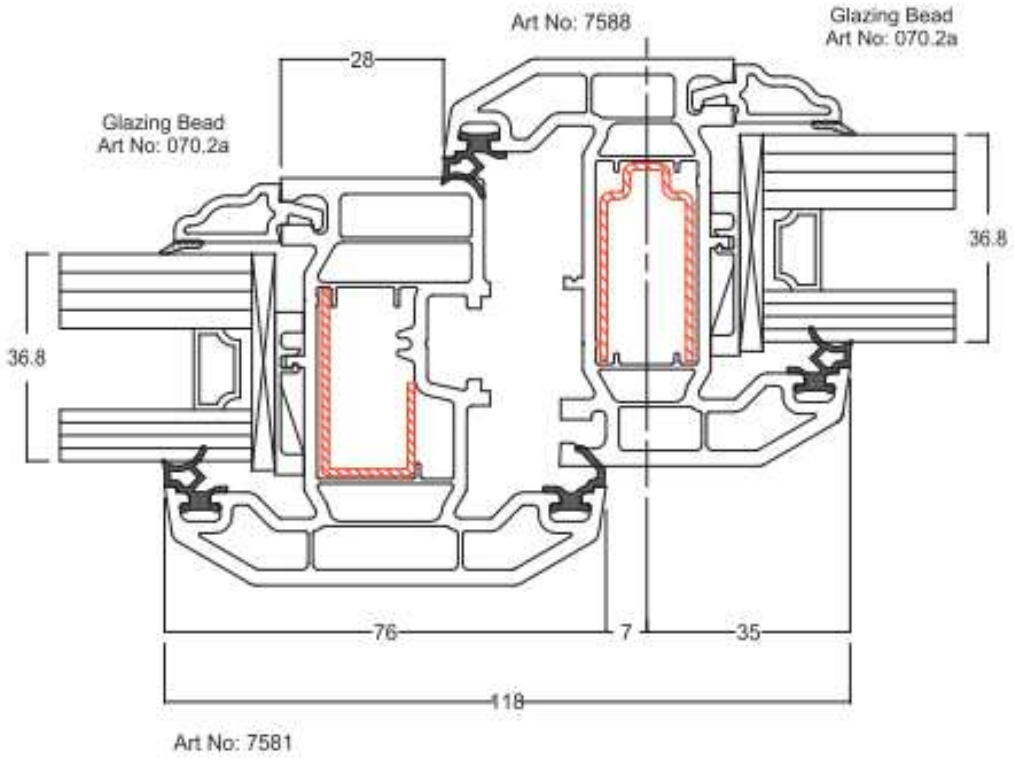
C70 Double Glazed

KÖMMERLING

C70 Outward Opening Casement

Art No: 7588 Mullion
Art No: 7581 Sash
Art No: 070.2a Glazing Bead





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Aero Teal Window 07/01/14

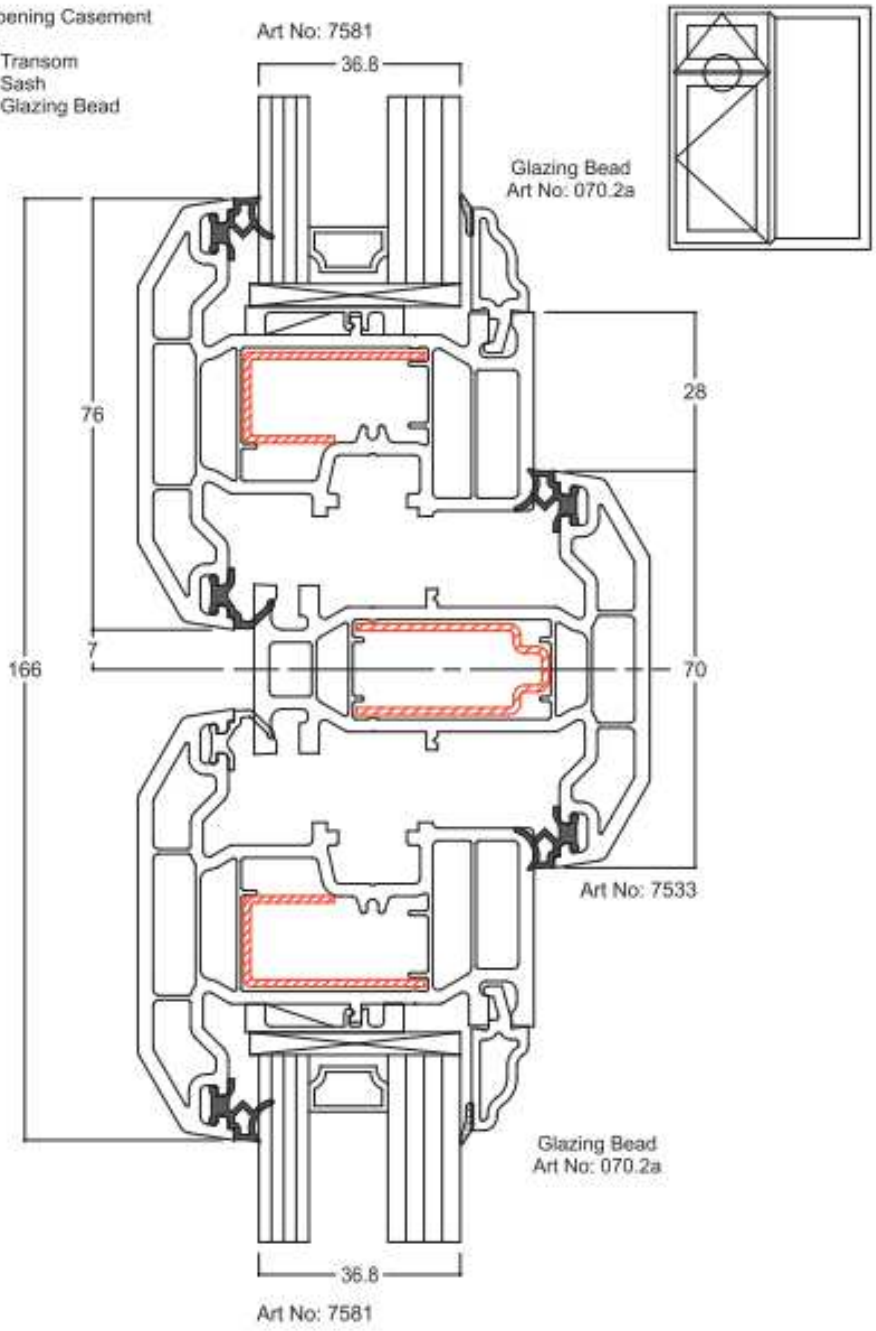
8

C70 Double Glazed

KÖMMERLING

C70 Outward Opening Casement

Art No: 7533 Transom
Art No: 7581 Sash
Art No: 070.2a Glazing Bead



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Airo Test Window 07/01/14

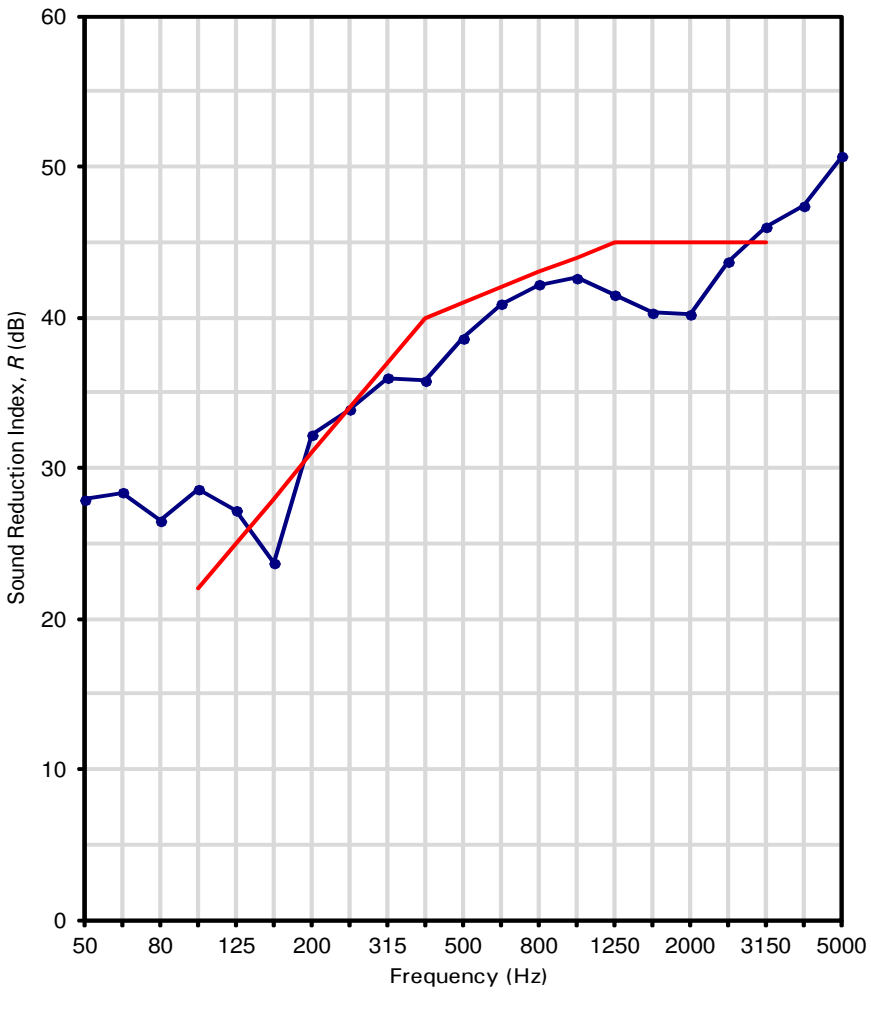
9

Sound Reduction Index (*R*) according to BS EN ISO 10140-2:2010

Test No. L/3290/1 Date of Test: 7 January 2014
Client: Profine GmbH
Specimen: Kommerling Window Unit with 6.4/10/4/10/8.8 Triple Glazing
Installed by: Profine UK Ltd
Specimen area: 1.88 m² Glazing mass per unit area: 48 kg/m²

Chamber Conditions	Volume	Air Temperature	Relative Humidity	Air Pressure
Source Chamber	94 m³	7°C	90%	985 hPa
Receiving Chamber	221 m³	7°C	90%	985 hPa

Frequency (Hz)	*R* One-third Octave (dB)	*R* Octave (dB)
50	27.9	
63	28.4	27.5
80	26.5	
100	28.6	
125	27.2	26.0
160	23.7	
200	32.2	
250	33.9	33.8
315	36.0	
400	35.8	
500	38.6	37.9
630	40.9	
800	42.2	
1000	42.6	42.1
1250	41.5	
1600	40.3	
2000	40.2	41.1
2500	43.7	
3150	46.0	
4000	47.4	47.6
5000	50.7	
6300		
8000		
10000		



Measured result
Shifted R_w reference curve

Rating according to BS EN ISO 717-1:2013

R_w (C;C_{tr}) = 41 (-2;-4) dB $C_{50\text{-}3150}$ = -2 dB $C_{50\text{-}5000}$ = -1 dB $C_{100\text{-}5000}$ = -1 dB
$C_{tr,50\text{-}3150}$ = -5 dB $C_{tr,50\text{-}5000}$ = -5 dB $C_{tr,100\text{-}5000}$ = -4 dB

Evaluation based on laboratory measurement results obtained by an engineering method

Approved by:

D L Watts

Eur Ing D L Watts BEng CEng FIOA
Principal Consultant

Report Author:

M Sawyer

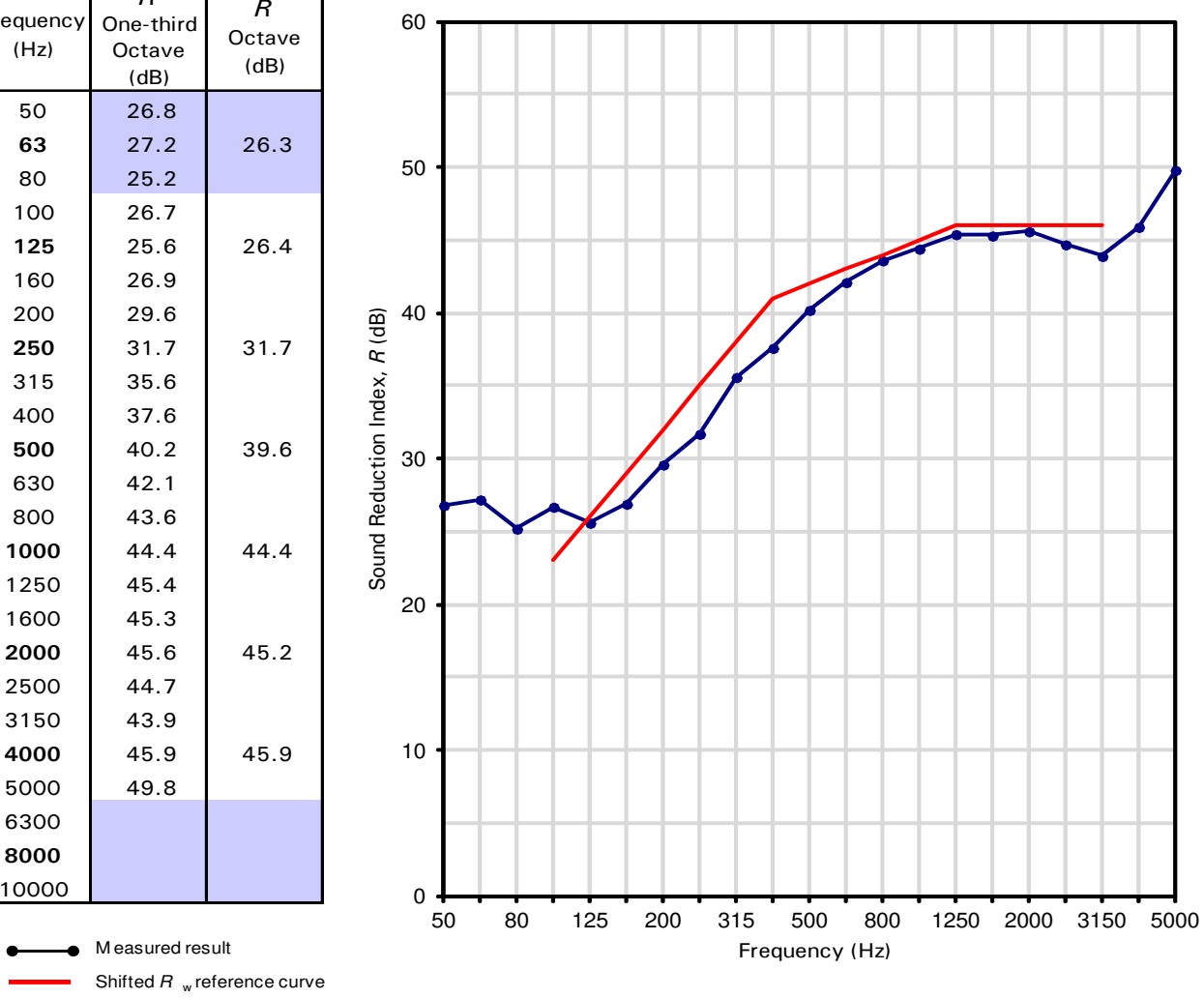
M Sawyer MIOA
Laboratory Supervisor

Sound Reduction Index (*R*) according to BS EN ISO 10140-2:2010

Test No. L/3290/2 Date of Test: 7 January 2014
Client: Profine GmbH
Specimen: Kommerling Window Unit with 4/12/4/12/8.8 Triple Glazing
Installed by: Profine UK Ltd
Specimen area: 1.88 m² Glazing mass per unit area: 42 kg/m²

Chamber Conditions	Volume	Air Temperature	Relative Humidity	Air Pressure
Source Chamber	94 m³	7°C	90%	985 hPa
Receiving Chamber	221 m³	7°C	90%	985 hPa

Frequency (Hz)	*R* One-third Octave (dB)	*R* Octave (dB)
50	26.8	
63	27.2	26.3
80	25.2	
100	26.7	
125	25.6	26.4
160	26.9	
200	29.6	
250	31.7	31.7
315	35.6	
400	37.6	
500	40.2	39.6
630	42.1	
800	43.6	
1000	44.4	44.4
1250	45.4	
1600	45.3	
2000	45.6	45.2
2500	44.7	
3150	43.9	
4000	45.9	45.9
5000	49.8	
6300		
8000		
10000		



Rating according to BS EN ISO 717-1:2013

R_w (C;C_{tr}) = 42 (-1;-5) dB $C_{50\text{-}3150}$ = -1 dB $C_{50\text{-}5000}$ = -1 dB $C_{100\text{-}5000}$ = 0 dB
$C_{tr,50\text{-}3150}$ = -5 dB $C_{tr,50\text{-}5000}$ = -5 dB $C_{tr,100\text{-}5000}$ = -5 dB

Evaluation based on laboratory measurement results obtained by an engineering method

Approved by:

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Principal Consultant

Report Author:

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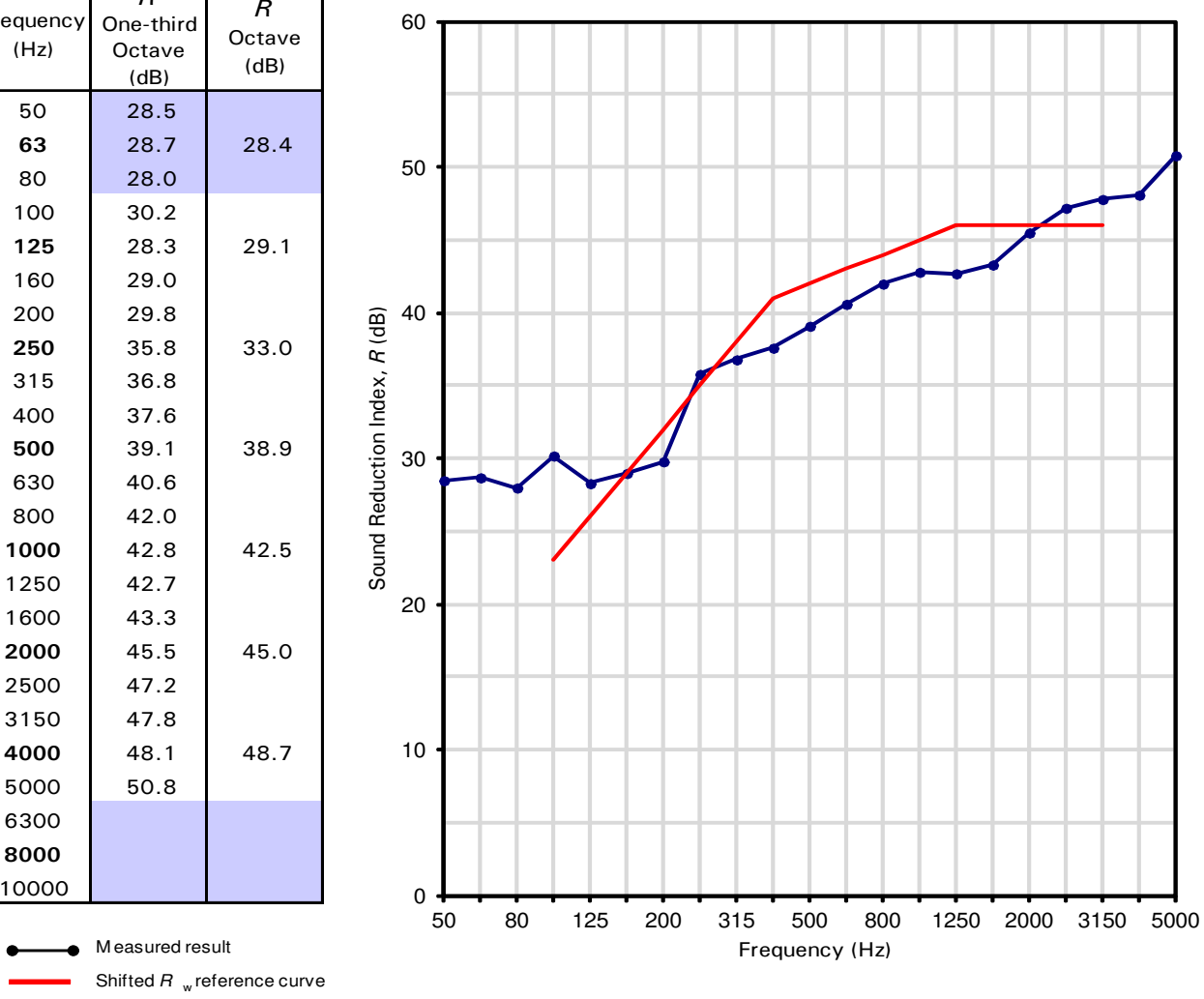
M Sawyer MIOA
Laboratory Supervisor

Sound Reduction Index (*R*) according to BS EN ISO 10140-2:2010

Test No. L/3290/3 Date of Test: 7 January 2014
Client: Profine GmbH
Specimen: Kommerling Window Unit with 8.8/12/12.8 Double Glazing
Installed by: Profine UK Ltd
Specimen area: 1.88 m² Glazing mass per unit area: 54 kg/m²

Chamber Conditions	Volume	Air Temperature	Relative Humidity	Air Pressure
Source Chamber	94 m³	7°C	90%	985 hPa
Receiving Chamber	214 m³	7°C	90%	985 hPa

Frequency (Hz)	*R* One-third Octave (dB)	*R* Octave (dB)
50	28.5	
63	28.7	28.4
80	28.0	
100	30.2	
125	28.3	29.1
160	29.0	
200	29.8	
250	35.8	33.0
315	36.8	
400	37.6	
500	39.1	38.9
630	40.6	
800	42.0	
1000	42.8	42.5
1250	42.7	
1600	43.3	
2000	45.5	45.0
2500	47.2	
3150	47.8	
4000	48.1	48.7
5000	50.8	
6300		
8000		
10000		



Rating according to BS EN ISO 717-1:2013

R_w (C;C_{tr}) = 42 (-1;-3) dB $C_{50\text{-}3150}$ = -1 dB $C_{50\text{-}5000}$ = 0 dB $C_{100\text{-}5000}$ = 0 dB
$C_{tr,50\text{-}3150}$ = -4 dB $C_{tr,50\text{-}5000}$ = -4 dB $C_{tr,100\text{-}5000}$ = -3 dB

Evaluation based on laboratory measurement results obtained by an engineering method

Approved by:

D L Watts

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Principal Consultant

Report Author:

M Sawyer

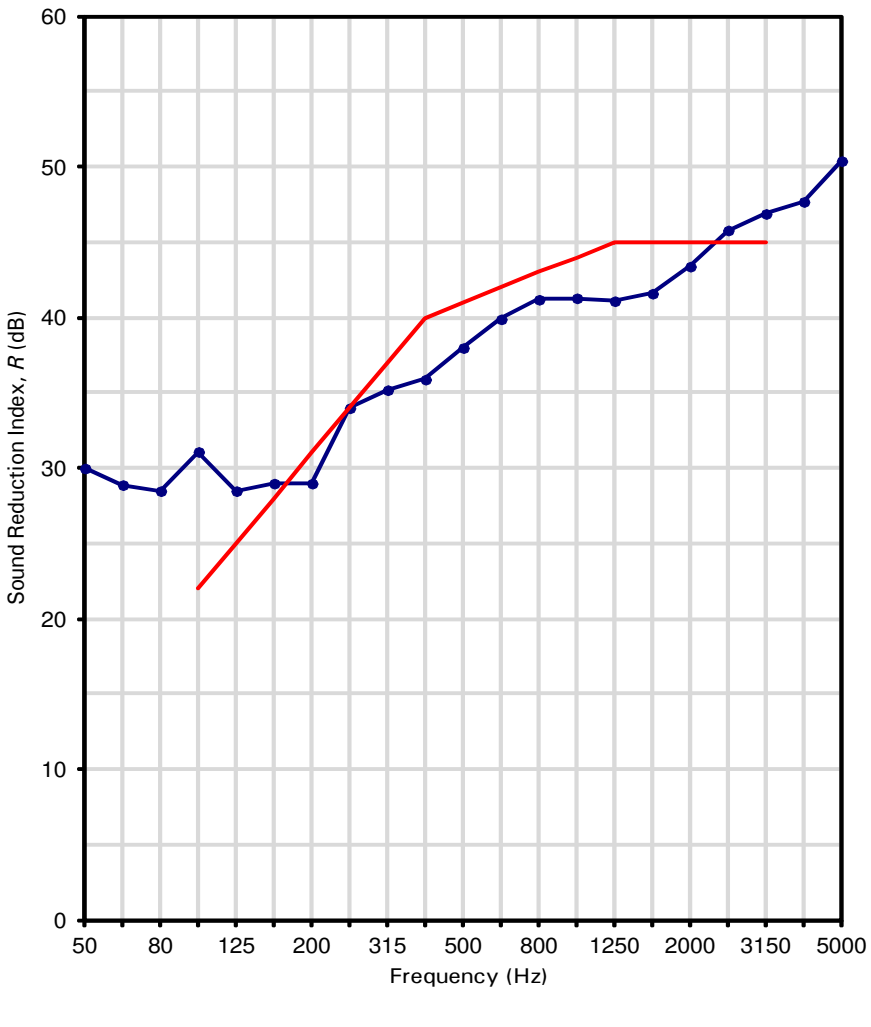
M Sawyer MIOA
Laboratory Supervisor

Sound Reduction Index (*R*) according to BS EN ISO 10140-2:2010

Test No. L/3290/4 Date of Test: 7 January 2014
Client: Profine GmbH
Specimen: Kommerling Window Unit with 12/16/8.8 Double Glazing
Installed by: Profine UK Ltd
Specimen area: 1.88 m² Glazing mass per unit area: 52 kg/m²

Chamber Conditions	Volume	Air Temperature	Relative Humidity	Air Pressure
Source Chamber	94 m³	7°C	90%	985 hPa
Receiving Chamber	214 m³	7°C	90%	985 hPa

Frequency (Hz)	*R* One-third Octave (dB)	*R* Octave (dB)
50	30.0	
63	28.9	29.1
80	28.5	
100	31.1	
125	28.5	29.4
160	29.0	
200	29.0	
250	34.0	31.9
315	35.2	
400	35.9	
500	38.0	37.6
630	39.9	
800	41.2	
1000	41.3	41.2
1250	41.1	
1600	41.6	
2000	43.4	43.3
2500	45.8	
3150	46.9	
4000	47.7	48.1
5000	50.4	
6300		
8000		
10000		



Rating according to BS EN ISO 717-1:2013

R_w (C;C_{tr}) = 41 (-1;-3) dB $C_{50\text{-}3150}$ = -1 dB $C_{50\text{-}5000}$ = 0 dB $C_{100\text{-}5000}$ = 0 dB
$C_{tr,50\text{-}3150}$ = -4 dB $C_{tr,50\text{-}5000}$ = -4 dB $C_{tr,100\text{-}5000}$ = -3 dB

Evaluation based on laboratory measurement results obtained by an engineering method

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Report Author:

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M Sawyer MIOA
Laboratory Supervisor

APPENDIX A1 - METHOD OF MEASUREMENT TO BS EN ISO 10140-2:2010

The insulation of a specimen against airborne sound is measured under reverberant sound conditions in which sound is incident on one side of the specimen from all directions.

The test specimen is erected in an aperture of approximately 9 square metres between two horizontally adjacent reverberant chambers which have been constructed to suppress the transmission of sound by flanking paths. To improve the diffusion of the sound fields, both chambers are irregularly shaped and contain several reflecting diffuser panels.

If the test specimen is smaller than the test aperture, the test specimen is installed within a highly insulating infill partition, purpose built within the test aperture. When the test specimen is intended to be openable, then it is opened and closed five times immediately prior to testing.

A steady sound source with a continuous spectrum in the frequency bands of interest is used to drive an omnidirectional loudspeaker which is located sequentially in two positions in the source chamber. Measurements of the sound levels are made simultaneously in both chambers at the one-third octave intervals from 100 Hz to 5000 Hz as prescribed in the Standard (ref 1). The measurements are made with a microphone attached to a rotating microphone boom to obtain a good average of the sound pressure levels in each chamber. Measurements are also made of the noise level in the receiving chamber in the absence of the noise source in order that corrections for background noise may be made if appropriate.

The Sound Reduction Index (R) in decibels (dB) is calculated in each frequency band using the equation:

$$R = L_1 - L_2 + 10 \lg \frac{S}{A} \quad \text{dB} \qquad \text{Equation (i)}$$

where: L_1 is the average sound pressure level in the source chamber (dB)

L_2 is the average sound pressure level in the receiving chamber (dB)

S is the area of the test specimen (m²)

A is the equivalent absorption area in the receiving chamber (m²)

The equivalent absorption area in the receiving chamber is determined from twelve sets of reverberation time measurements using a microphone connected to a rotating microphone boom. The measurements are made in accordance with International Standard ISO 3382-2:2008 (ref 3) and the value of 'A' determined using Sabine's formula:

$$A = \frac{0.16\,V}{T} \quad \text{m}^2 \qquad \text{Equation (ii)}$$

where: V is the volume of the receiving chamber (m³)

T is the reverberation time of the receiving chamber (seconds)

The Weighted Sound Reduction Index (R_w) in decibels (dB) and the Spectrum Adaptation Terms (C and C_{tr}), also in decibels, are calculated in accordance with British Standard BS EN ISO 717-1:2013 (ref 2) by comparison of the sixteen values of Sound Reduction Index from 100 Hz to 3150 Hz with the relevant curves.

In this instance the measurement range was extended to include the 50 Hz to 5000 Hz one-third octaves.

The calibration of all equipment is traceable via an unbroken chain to National Standards.

APPENDIX A2 - PRACTICAL APPLICATION OF TEST RESULTS

It should be noted that the Sound Reduction Index is a property of the test specimen alone. When the test specimen forms part of an enclosure, the sound insulation obtained will depend on additional factors such as the relative surface areas involved and the nature and acoustic characteristics of the receiving space. Also, in buildings and other structures the transmission of sound via alternative paths may not be negligible in comparison with transmission through the test specimen alone, particularly when the sound insulation of the test specimen is high. Such indirect sound transmission would result in a lower effective insulation.

APPENDIX A3 - REFERENCES

1. British Standard BS EN ISO 10140
Acoustics – Laboratory measurement of sound insulation of building elements

BS EN ISO 10140-2:2010
Measurement of airborne sound insulation

2. British Standard BS EN ISO 717
Acoustics - Rating of sound insulation in buildings and of building elements

BS EN ISO 717-1:2013
Airborne sound insulation

3. International Standard ISO 3382
Acoustics - Measurement of room acoustic parameters

ISO 3382-2:2008
Reverberation time in ordinary rooms

APPENDIX A4 - SCHEDULE OF EQUIPMENT

Use	Type	Serial No.
Measuring	Norsonic 840 Real Time Analyzer	16009
System	B&K 4165 ½" Condenser Microphone	1042002
	B&K 4165 ½" Condenser Microphone	1471398
	B&K 2669 Microphone Pre-Amplifier	1856926
	B&K 2669 Microphone Pre-Amplifier	2221217
	B&K 3923 Rotating Microphone Boom	1113618
	NEAS 212 Rotating Microphone Boom	12172
Calibration	B&K 4228 Pistonphone	1756569