Bucknalls Lane, Garston
Watford, Herts WD25 9BA
Tel: 01923 665300
Fax: 01923 665301
email: clientservices@bbacerts.co.uk
website: www.bbacerts.co.uk

BRITISH BOARD OF AGRÉMENT TEST REPORT T164420

FORM & PLAST A/S – TESTS ON SLOT VENTILATORS

CONTENTS

Approved By:

Ellen Whyle
(Senior Test Technician)

Date: 27 April 2021

Authorised By:

Sean Whitehead
(Team Manager - Test)

Date: 28 April 2021

On behalf of the British Board of Agrément

Client:	Form & Plast A/S Fabriksvej 32 7600 Struer Denmark
Requested by:	Kent Schultz
Job No:	T164420
Work Period:	January to April 2021

1 REPORT CONDITIONS

1.1 This Report:

- relates only to the product/system and sample/specimen thereof named and described herein
- relates only to the specified tests and test conditions described herein
- is issued only to the company, firm, organisation or person named herein — no other company, firm, organisation or person may hold this Report or claim that it has been issued to them
- has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

1.2 No verification of any of the materials, samples, specimens, information, data or documents supplied to the BBA has been made, except where otherwise stated.
Unless otherwise stated, samples were provided by the client, and results apply to the samples as received

1.3 Publications, documents, specifications and similar matter that are referred to herein, are those that were current at the date of issue of this Report, except where otherwise stated.

1.4 The BBA has used due skill, care and diligence in preparing this Report, but no warranty is given or implied.

1.5 In issuing this Report, the BBA is not responsible; and is excluded from any liability to any company, firm, organisation or person; for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system
- individual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal.

1.6 This Report does not constitute or indicate any approval, certification or endorsement of the product/system.

2 ELEMENT-NORMALIZED LEVEL DIFFERENCE

2.1 Method

In accordance with BS EN ISO 10140-2 : 2010 *Acoustics – Laboratory measurement of sound insulation of building elements - Measurement of airborne sound insulation* and BS EN ISO 717-1 : 2013 *Acoustics – Rating of sound insulation in buildings and of building elements – Airborne sound insulation.*

2.2 Samples

Samples were delivered directly to AIRO test laboratory by the client.

AIRO Test number	Quantity	Description
L/3517/1	1	Slot Ventilator 2k3010
L/3517/2	1	Slot Ventilator 2k4010
L/3517/3	1	Slot Ventilator 0199
L/3517/4	1	Slot Ventilator 302009

2.3 Results

Testing was carried out on behalf of the BBA by Acoustical Investigation and Research Organisation Ltd, Duxons Turn, Maylands Avenue, Hemel Hempstead, Hertfordshire HP2 4SB UK. Their test report reference number L/3517 dated 27 April 2021 is attached as Appendix A of this report.

APPENDIX A - AIRO TEST REPORT

AIRO test report number L/3517 issued 27 April 2021

AIRO

Report No. L/3517

for
British Board of Agrément
Bucknalls Lane
Watford
Hertfordshire
WD25 9BA

UKAS TESTING
0483

Dated: 27 April 2021

LABORATORY MEASUREMENTS

OF THE

ELEMENT-NORMALIZED LEVEL DIFFERENCE

OF

SLOT VENTILATORS

Report Author: M Sawyer MIOA

ACOUSTICAL INVESTIGATION & RESEARCH ORGANISATION LTD

Duxons Turn
Maylands Avenue
Hemel Hempstead
Hertfordshire
HP2 4SB

Telephone: +44(0)1442 247146
E-mail: airo@airo.co.uk
Web: https://www.airo.co.uk/

LABORATORY MEASUREMENTS

OF THE

ELEMENT-NORMALIZED LEVEL DIFFERENCE

OF

SLOT VENTILATORS

1. INTRODUCTION

This report presents the results of measurements made in the AIRO Acoustics Laboratory of the airborne sound insulation of four Slot Ventilators supplied by Form & Plast A/S of Denmark.

The measurements were made on 22 and 24 March 2021 for British Board of Agrément.

Measurements of airborne sound insulation, Element-Normalized Level Difference ($D_{n,e}$), were conducted in accordance with Clause 6 of BS EN 13141-1 (ref 1) which requires that the acoustic measurements are made in accordance with British Standard BS EN ISO 10140 (ref 2). Single figure ratings of sound insulation performance, known as the Weighted Element-Normalized Level Difference ($D_{n,e,w}$) and Spectrum Adaptation Terms (C and C_{tr}), are derived from these measurements in accordance with British Standard BS EN ISO 717 (ref 3).

AIRO is a UKAS accredited testing laboratory No. 0483 with BS EN ISO 10140 and BS EN ISO 717 included on our scheduled of accreditation. BS EN 13141-1 is not however included on our UKAS schedule. 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	$D_{n,e,w}$ (C;C_{tr}) dB
L/3517/1	Slot Ventilator 2k3010	35 (-1;-2)
L/3517/2	Slot Ventilator 2k4010	33 (-1;-1)
L/3517/3	Slot Ventilator 0199	34 (-1;0)
L/3517/4	Slot Ventilator 302009	34 (-1;-2)

Approved by:

D L Watts

Eur Ing D L Watts BEng CEng FIOA
Principal Consultant

Report Author:

M Sawyer

M Sawyer MIOA
Laboratory Manager

3. TEST SPECIMEN DETAILS AND CONDITIONS

It shall be noted that the results in this report relate only to the specimens as received for test.

The specimens for test were supplied by Form & Plast A/S of Denmark on 20 January 2021 and were installed for test by AIRO. In accordance with the requirements of BS EN 13141-1 the ventilators were installed for test into a 60 mm thick panel and tested in their open position.

AIRO has had no involvement in the selection of the specimen or the components which make-up the specimen.

AIRO has produced the following specimen descriptions from its own observations.

3.1 Slot Ventilator 2k3010

AIRO Test No. L/3517/1

The test specimen comprised Slot Ventilator 2k3010 of plastic construction with overall face dimensions of 268 mm x 27 mm. The ventilator depth was 21 mm when closed and 30 mm when open. The ventilator cover operated on a push-to-open push-to-close basis. The ventilator was installed into a 264 x 23 mm cut-out within the panel and retained in place by a pair of spring clips.

For testing purposes 3 ventilators were installed, the following results however relate to a single ventilator. The 3 ventilators were installed by AIRO and tested in their open position on 22 March 2021.

Page 4 shows a drawing taken from the Form & Plast A/S website and a photograph of the supplied ventilator.

3.2 Slot Ventilator 2k4010

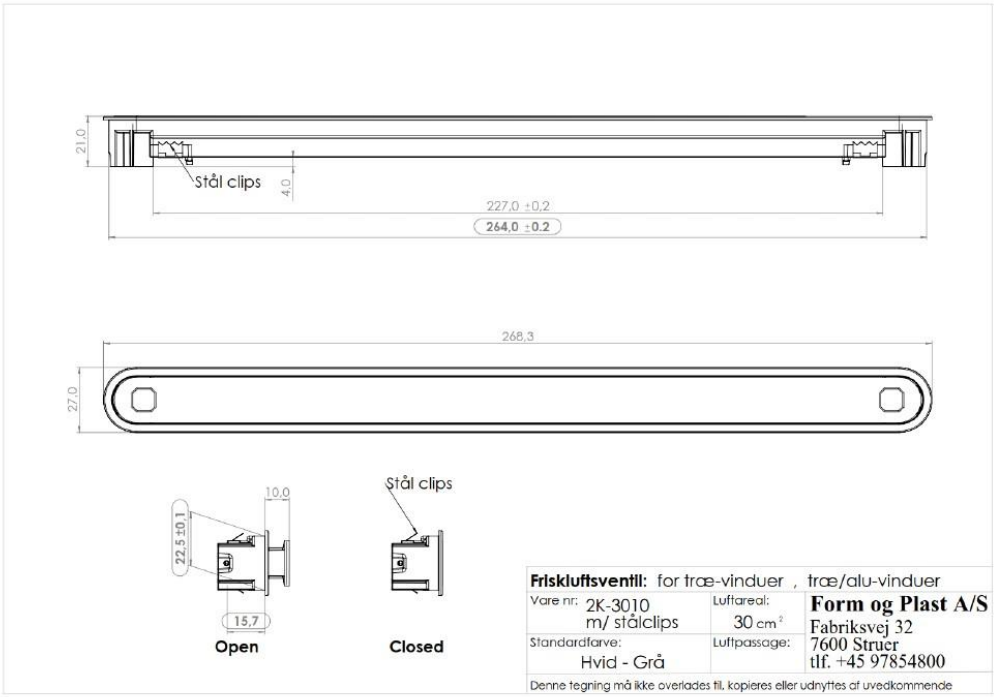
AIRO Test No. L/3517/2

The test specimen comprised Slot Ventilator 2k4010 of plastic construction with overall face dimensions of 343 mm x 27 mm. The ventilator depth was 21 mm when closed and 30 mm when open. The ventilator cover operated on a push-to-open push-to-close basis. The ventilator was installed into a 339 x 23 mm cut-out within the panel and retained in place by a pair of spring clips.

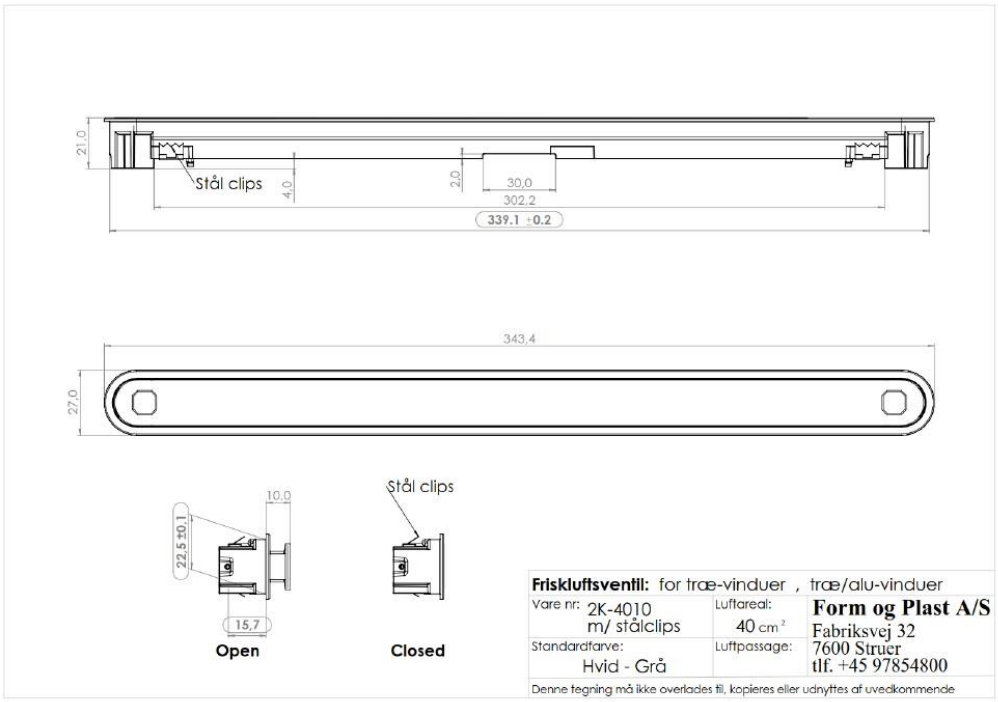
For testing purposes 3 ventilators were installed, the following results however relate to a single ventilator. The 3 ventilators were installed by AIRO and tested in their open position on 22 March 2021.

Page 5 shows a drawing taken from the Form & Plast A/S website and a photograph of the supplied ventilator.

Slot Ventilator 2k3010



Slot Ventilator 2k4010



3.3 Slot Ventilator 0199

AIRO Test No. L/3517/3

The test specimen comprised Slot Ventilator 0199 of plastic construction with an aluminium vent cover backed by a foam seal, with overall face dimensions of 337 mm x 22 mm. The ventilator depth was 75 mm when closed and 89 mm when open. The ventilator cover operated on a push-to-open push-to-close basis. The ventilator was installed into a 331 x 16 mm cut-out within the panel.

For testing purposes 3 ventilators were installed, the following results however relate to a single ventilator. The 3 ventilators were installed by AIRO and tested in their open position on 24 March 2021.

Page 7 shows a drawing taken from the Form & Plast A/S website and a photograph of the supplied ventilator.

3.4 Slot Ventilator 302009

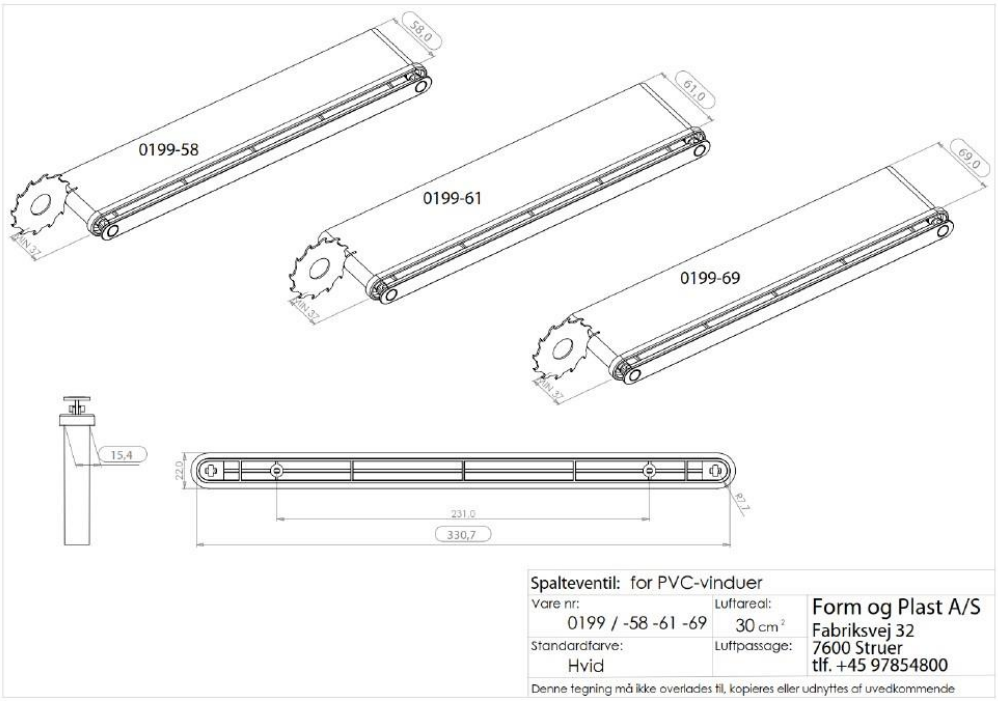
AIRO Test No. L/3517/4

The test specimen comprised Slot Ventilator 302009 of plastic construction with an aluminium vent cover backed by a foam seal, with overall face dimensions of 341 mm x 25 mm. The ventilator depth was 43 mm when closed and 53 mm when open. The ventilator cover operated on a push-to-open push-to-close basis. The ventilator was installed into a 336 x 20 mm cut-out within the panel and retained in place by four spring clips.

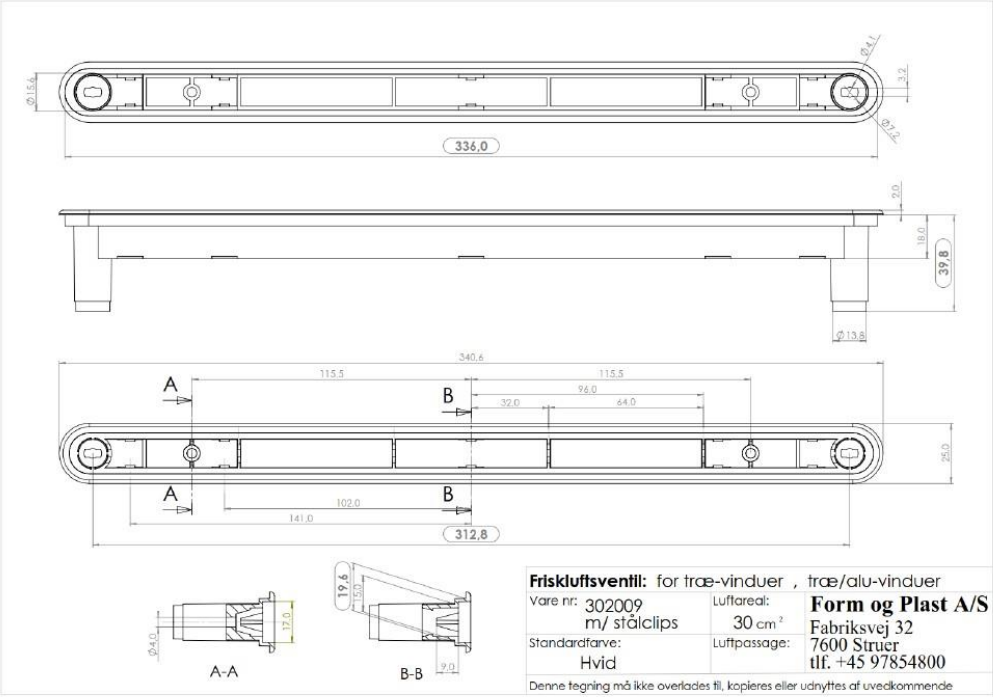
For testing purposes 3 ventilators were installed, the following results however relate to a single ventilator. The 3 ventilators were installed by AIRO and tested in their open position on 24 March 2021.

Page 8 shows a drawing taken from the Form & Plast A/S website and a photograph of the supplied ventilator.

Slot Ventilator 0199



Slot Ventilator 302009



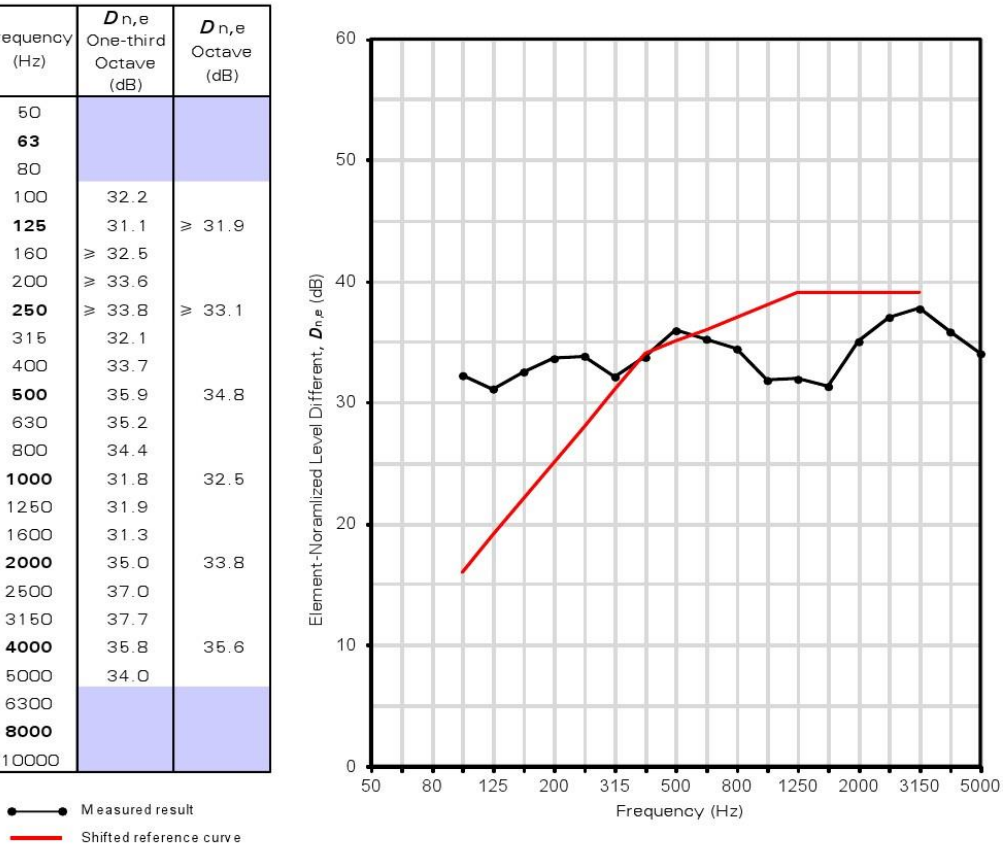
End of specimen descriptions

Element-Normalized Level Difference ($D_{n,e}$) according to BS EN ISO 10140-2:2010

Test No. L/3517/1 Date of Test: 22 March 2021
Client: British Board of Agrément
Specimen: Slot Ventilator 2k3010
Installed by: AIRO

Chamber Conditions	Volume	Air Temperature	Relative Humidity	Air Pressure
Source Chamber	94 m³	10°C	75%	1010 hPa
Receiving Chamber	221 m³	10°C	80%	1010 hPa

Frequency (Hz)	$D_{n,e}$ One-third Octave (dB)	$D_{n,e}$ Octave (dB)
50		
63		
80		
100	32.2	
125	31.1	≥ 31.9
160	≥ 32.5	
200	≥ 33.6	
250	≥ 33.8	≥ 33.1
315	32.1	
400	33.7	
500	35.9	34.8
630	35.2	
800	34.4	
1000	31.8	32.5
1250	31.9	
1600	31.3	
2000	35.0	33.8
2500	37.0	
3150	37.7	
4000	35.8	35.6
5000	34.0	
6300		
8000		
10000		



Rating according to BS EN ISO 717-1:2013

$D_{n,e,w}$ (C;C_{tr}) = 35 (-1;-2) dB

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

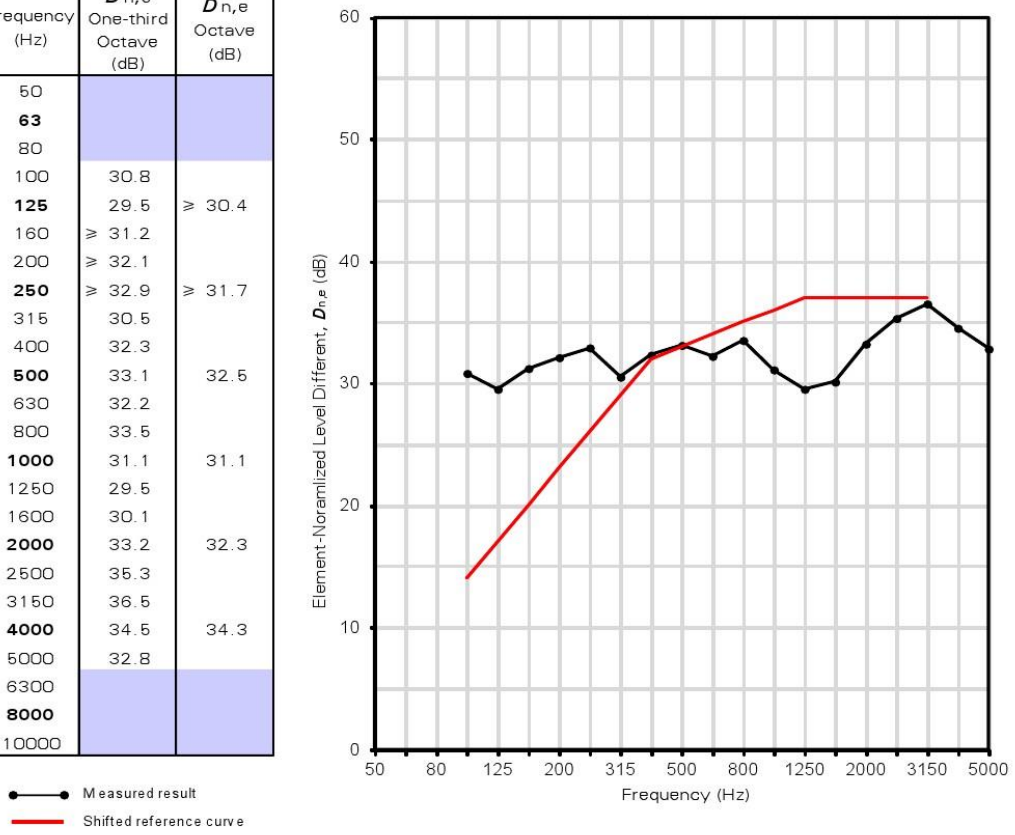
M Sawyer MIOA
Laboratory Manager

Element-Normalized Level Difference ($D_{n,e}$) according to BS EN ISO 10140-2:2010

Test No. L/3517/2 Date of Test: 22 March 2021
Client: British Board of Agrément
Specimen: Slot Ventilator 2k4010
Installed by: AIRO

Chamber Conditions	Volume	Air Temperature	Relative Humidity	Air Pressure
Source Chamber	94 m³	10°C	75%	1010 hPa
Receiving Chamber	221 m³	10°C	80%	1010 hPa

Frequency (Hz)	$D_{n,e}$ One-third Octave (dB)	$D_{n,e}$ Octave (dB)
50		
63		
80		
100	30.8	
125	29.5	⩾ 30.4
160	⩾ 31.2	
200	⩾ 32.1	
250	⩾ 32.9	⩾ 31.7
315	30.5	
400	32.3	
500	33.1	32.5
630	32.2	
800	33.5	
1000	31.1	31.1
1250	29.5	
1600	30.1	
2000	33.2	32.3
2500	35.3	
3150	36.5	
4000	34.5	34.3
5000	32.8	
6300		
8000		
10000		



Rating according to BS EN ISO 717-1:2013

$D_{n,e,w}$ ($C;C_{tr}$) = 33 (-1;-1) dB

$C_{50\text{-}3150}$ = -- dB $C_{50\text{-}5000}$ = -- dB $C_{100\text{-}5000}$ = -1 dB
$C_{tr,50\text{-}3150}$ = -- dB $C_{tr,50\text{-}5000}$ = -- dB $C_{tr,100\text{-}5000}$ = -1 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

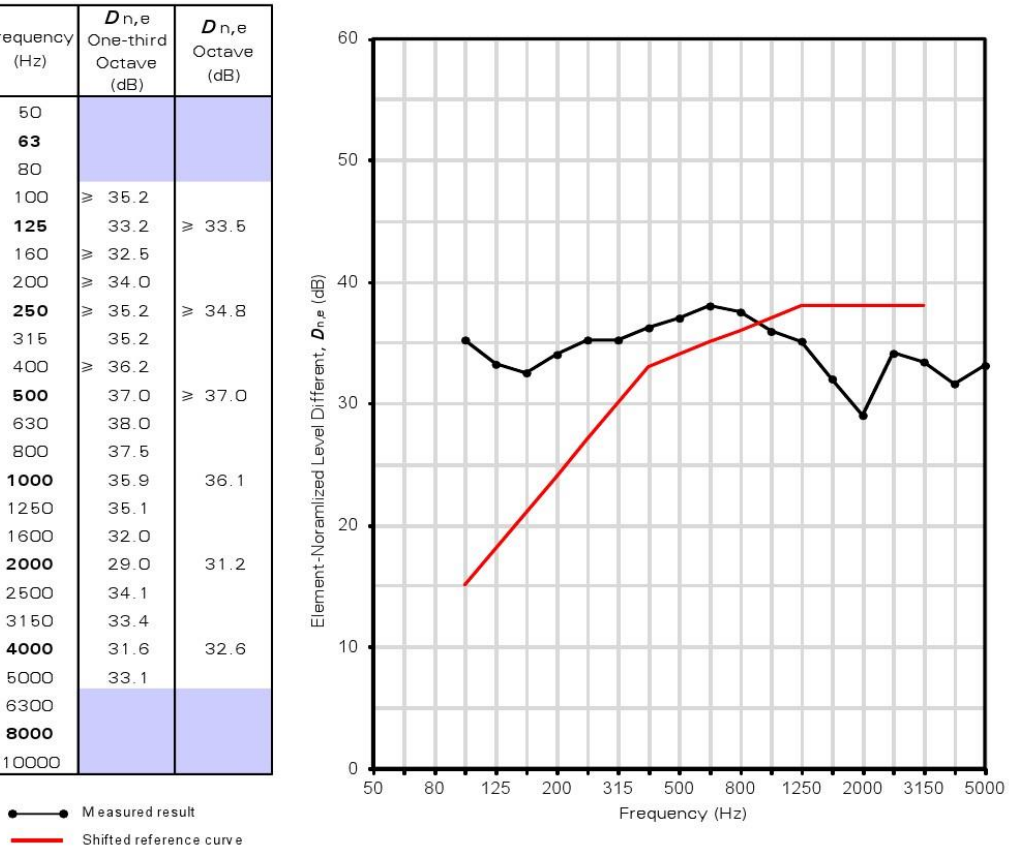
M Sawyer MIOA
Laboratory Manager

Element-Normalized Level Difference ($D_{n,e}$) according to BS EN ISO 10140-2:2010

Test No. L/3517/3 Date of Test: 24 March 2021
Client: British Board of Agrément
Specimen: Slot Ventilator 0199
Installed by: AIRO

Chamber Conditions	Volume	Air Temperature	Relative Humidity	Air Pressure
Source Chamber	94 m³	10°C	85%	1005 hPa
Receiving Chamber	221 m³	10°C	80%	1005 hPa

Frequency (Hz)	$D_{n,e}$ One-third Octave (dB)	$D_{n,e}$ Octave (dB)
50		
63		
80		
100	≥ 35.2	
125	33.2	≥ 33.5
160	≥ 32.5	
200	≥ 34.0	
250	≥ 35.2	≥ 34.8
315	35.2	
400	≥ 36.2	
500	37.0	≥ 37.0
630	38.0	
800	37.5	
1000	35.9	36.1
1250	35.1	
1600	32.0	
2000	29.0	31.2
2500	34.1	
3150	33.4	
4000	31.6	32.6
5000	33.1	
6300		
8000		
10000		



Rating according to BS EN ISO 717-1:2013

$D_{n,e,w}$ (C;C_{tr}) = 34 (-1;0) dB

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

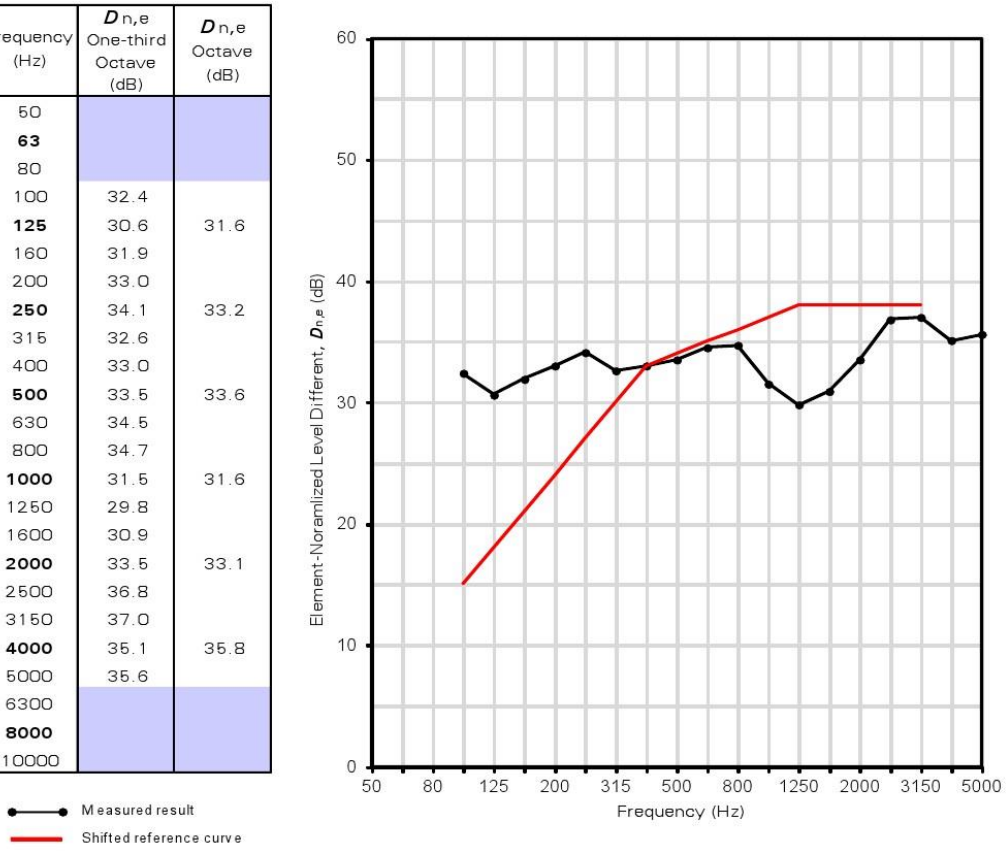
M Sawyer MIOA
Laboratory Manager

Element-Normalized Level Difference ($D_{n,e}$) according to BS EN ISO 10140-2:2010

Test No. L/3517/4 Date of Test: 24 March 2021
Client: British Board of Agrément
Specimen: Slot Ventilator 302009
Installed by: AIRO

Chamber Conditions	Volume	Air Temperature	Relative Humidity	Air Pressure
Source Chamber	94 m³	10°C	85%	1005 hPa
Receiving Chamber	221 m³	10°C	80%	1005 hPa

Frequency (Hz)	$D_{n,e}$ One-third Octave (dB)	$D_{n,e}$ Octave (dB)
50		
63		
80		
100	32.4	
125	30.6	31.6
160	31.9	
200	33.0	
250	34.1	33.2
315	32.6	
400	33.0	
500	33.5	33.6
630	34.5	
800	34.7	
1000	31.5	31.6
1250	29.8	
1600	30.9	
2000	33.5	33.1
2500	36.8	
3150	37.0	
4000	35.1	35.8
5000	35.6	
6300		
8000		
10000		



Rating according to BS EN ISO 717-1:2013

$D_{n,e,w}$ (C;C_{tr}) = 34 (-1;-2) dB

$C_{50\text{-}3150}$ = -- dB $C_{50\text{-}5000}$ = -- dB $C_{100\text{-}5000}$ = -1 dB
$C_{tr,50\text{-}3150}$ = -- dB $C_{tr,50\text{-}5000}$ = -- dB $C_{tr,100\text{-}5000}$ = -2 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 Manager

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 2). 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 Element-Normalized Level Difference ($D_{n,e}$) in decibels (dB) is calculated in each frequency band using the equation:

$$D_{n,e} = L_1 - L_2 + 10 \lg \frac{nA_o}{A} \quad \text{dB} \quad \text{Equation (i)}$$

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)

n is the number of installed elements

A_o is the reference area = 10 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 4) and the value of 'A' determined using Sabine's formula:

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

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

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

The Weighted Element-Normalized Level Difference ($D_{n,e,w}$) 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 3) by comparison of the sixteen values of Element-Normalized Level Difference from 100 Hz to 3150 Hz with the relevant curves.

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 Element-Normalized Level Difference 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 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 13141
Ventilation for buildings – Performance testing of components/products for residential ventilation

BS EN 1314-1:2019
Externally and internally mounted air transfer devices

2. 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

3. 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

4. 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	Nor850 Multi Channel Analyser	8501193
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
	NEAS 212 Rotating Microphone Boom	12172
	NEAS 265 Rotating Microphone Boom	29465
Calibration	B&K 4228 Pistonphone	1704324

APPENDIX A5 - WALL PERFORMANCE

The measured performance of the plasterboard stud partition wall and associated cavity masonry wall in which the specimens were installed is given in the following table.

Frequency Hz	Element-Normalized Level Difference $D_{n,e}$ (dB)	
	One-third Octave	Octave
100	37.3	
125	37.9	36.8
160	35.6	
200	34.6	
250	37.3	36.9
315	40.7	
400	40.7	
500	43.9	43.1
630	46.8	
800	48.9	
1000	51.6	50.7
1250	52.6	
1600	54.1	
2000	52.7	52.6
2500	51.3	
3150	50.0	
4000	51.5	51.9
5000	56.7	

End of AIRO Report No. L/3517 dated 27 April 2021