


1262

University of Salford MANCHESTER

Acoustic Testing Laboratory
College of Science & Technology

# Air Handling Units Acoustic Insulation Performance Tests

To **BS EN ISO 10140-2 (2010)**

**Report No. 1429**
**Report No. 2060**

Carried out by Salford University
Acoustic Testing Laboratory
For Air Handlers Northern


air HANDLERS

# SOUND REDUCTION INDEX FRAME & PANEL TESTS

Carried out by: - The University of Salford Acoustic Testing Laboratory

Personnel: - Daniel McCaul – Technical Manager
Ian Rattigan – Laboratory Manager
David Pinchbeck – Air Handlers Northern

Report No 1429 and 2060

## OBJECTIVE

To obtain the true casework noise breakout from Mechanical Ventilation Plant. It is only possible to achieve this if the frame and panel assembly is tested with a large enough area sample to give a true representation of an Air Handling System.

In Practice the framework can leak sound which will flank the panels; therefore our testing programme includes various frame insulation arrangements.

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**TEST REPORT No : 1429-A** **DATE OF ISSUE : 7 November 2013**

# BS EN ISO 10140-2 : 2010
# INTERNATIONAL STANDARD METHOD FOR MEASUREMENT OF AIRBORNE SOUND INSULATION OF BUILDING ELEMENTS

| | |
|---|---|
| **CLIENT:** | Air Handlers Northern<br>Bute Street<br>Weaste, Salford<br>M50 1DU |
| **JOB NUMBER:** | ACOUS/01429 |
| **MANUFACTURER:** | Air Handlers Northern |
| **TEST SAMPLE:** | Various panel enclosure systems |
| **DATE RECEIVED:** | 19 July 2013 |
| **DATE OF TEST:** | 26 September - 1 October 2013 |

Signed: ..... Approved: .....

I G Rattigan
Laboratory Manager

D J McCaul
Technical Manager

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**TEST REPORT No : 2060-1** **DATE OF ISSUE : 19 February 2015**

# INTERNATIONAL STANDARD METHOD FOR MEASUREMENT OF AIRBORNE SOUND INSULATION OF BUILDING ELEMENTS BS EN ISO 10140-2 : 2010

| | |
|---|---|
| **CLIENT:** | Air Handlers Northern<br>Bute Street<br>Weaste<br>Salford<br>M50 1DU |
| **JOB NUMBER:** | ACOUS/02060 |
| **TEST SAMPLE:** | Various Acoustic Enclosure Panels |
| **MANUFACTURER:** | Client |
| **DATE RECEIVED:** | 5 November 2014 |
| **DATE OF TEST:** | 7 – 9 & 12 January 2015 |

Signed:..... Approved:.....

I G Rattigan
Laboratory Manager

C Lomax
Quality Manager

## Test Samples

### Description of Test Samples

The following panel enclosure systems built and tested in the 3600mm x 2400mm aperture in the transmission suite. A hollow aluminium pentapost frame was installed within the aperture and fixed in place with clamping bolts. The frame contained a recess nominally 45mm deep with a 6mm foam seal fitted to the closing edge of the open frame section.

FRAME DETAILS

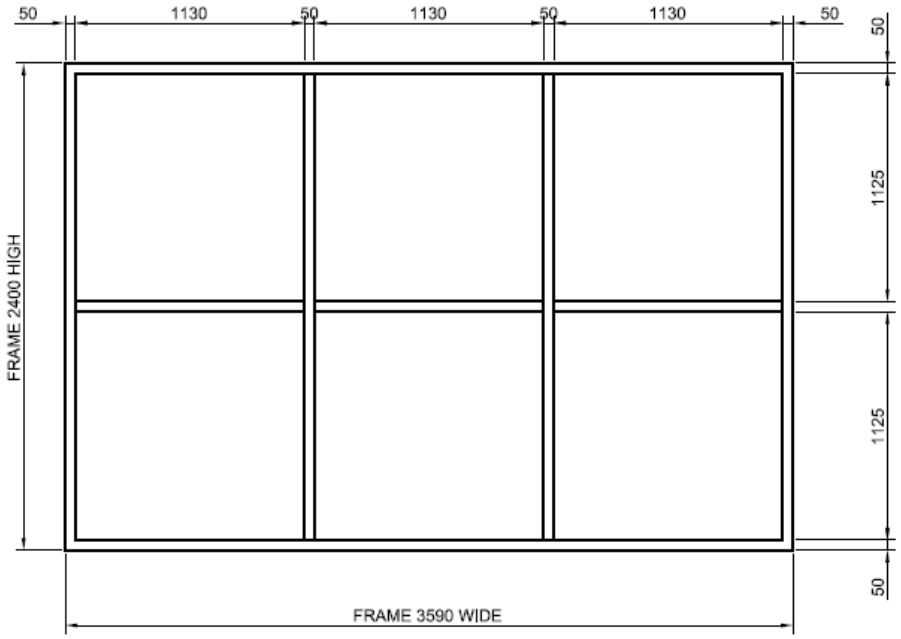


Illustration 30

50mm PANEL FIXING METHODS

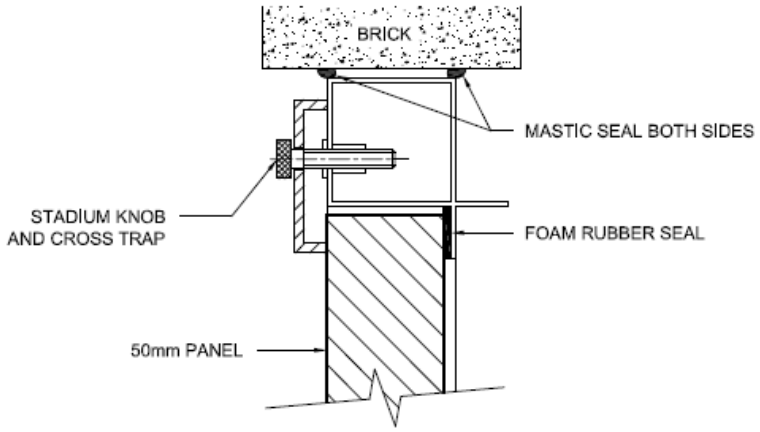


Illustration 31

## 25mm PANEL FIXING METHODS

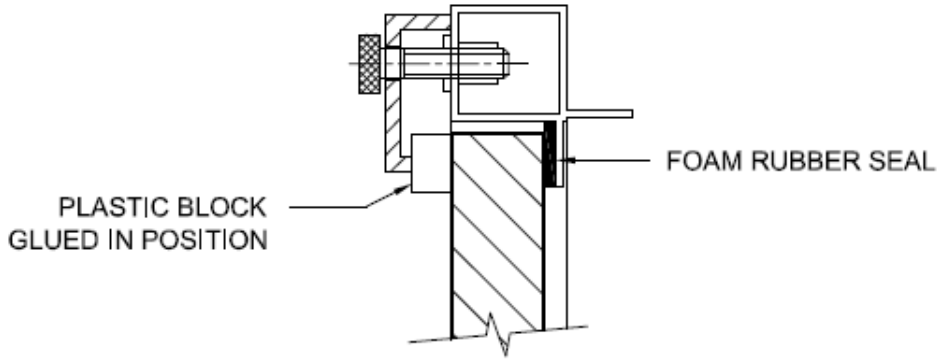


Illustration 32

## LIFTING HANDLES

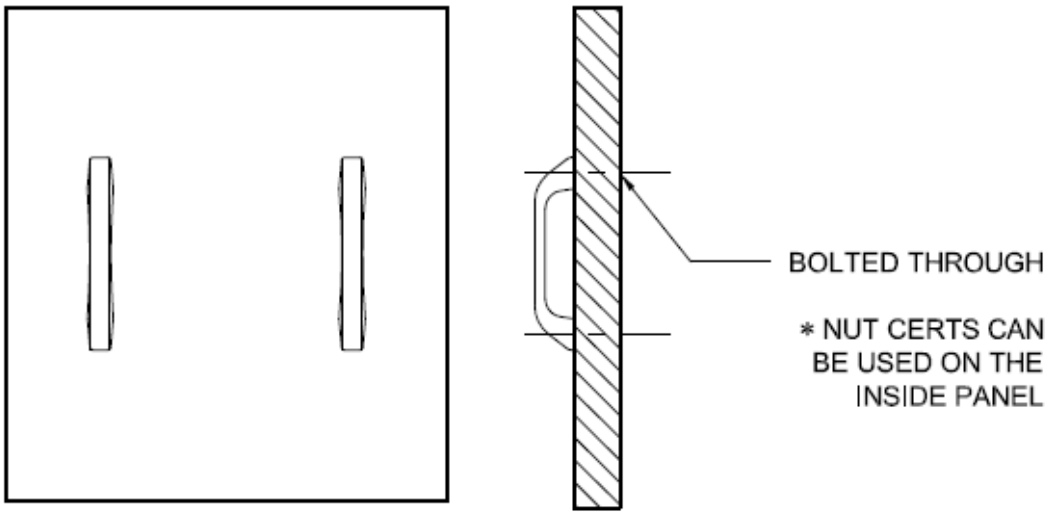


Illustration 33

FIXING METHODS FOR PENTAPOST

FRAME TO BRICK WALL CHAMBER

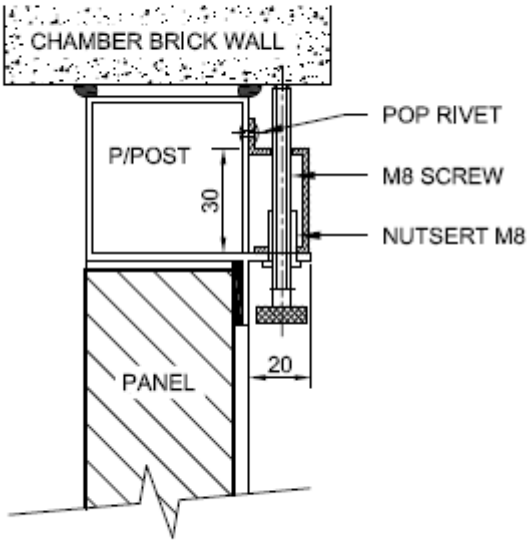


Illustration 34

**DESCRIPTION OF TEST PROCEDURE**

The test procedure adopted follows that detailed in BS EN ISO 10140: Part: 2010, “Acoustics – Laboratory measurements of sound insulation of building elements; Part 2: Measurement of airborne sound insulation”.

The measurements are performed in the large transmission suite at the University of Salford. The suite comprises two structurally isolated reverberant rooms with a test opening between them in which the test specimen is inserted. The vertical sides of the test aperture and the base are made from dense brick, whilst the soffit is made from reinforced concrete. Both rooms have been designed with hard surfaces and non-parallel walls. The smaller source room has 6 plywood diffusers and the larger receiving room has 11 plywood diffusers, to increase the diffusivity of the sound field in these areas.

The test involves producing a known sound field in the source room and measuring the resultant sound level difference between the source room and the receiving room with the specimen installed in the test aperture. This level difference is then corrected so as to take into account the equivalent absorption area of the receiving room.

The Sound Reduction Index, R (dB), is defined in BS EN SIO 10140 – Part 2: 2010 as:

$$R = L_1 - L_2 + 10\ log_{10}\ \frac{S}{A} \quad (1)$$

Where:
$L_1$ is the average sound pressure level in the source room (dB)
$L_2$ is the average sound pressur level in the receiving room (dB)
S is the area of the rest specimen ($m^2$)
A is the equivalent absorption area of the receiving room ($m^2$)

**Generation of Sound Field in the Source Room**

Wide band, random noise from the generator in the real time analyser was amplified and reproduced in the source room using alternately one of two fixed loudspeaker systems, (La, Lb and Lc). Omni-directional loudspeakers were used. The output of the generator was set with the intention that the sound pressure level in the receiving room was at least 15dB higher than the background level in any frequency band. The loudspeakers were positioned in the corners of the room and at such a distance from the test specimen that the direct radiation upon it was not dominant.

**Frequency Range of Measurements**

The sound pressure levels were measured using one-third octave band filters. Measurements covered all the one-third octave bands having centre frequencies in the range from 50Hz to 5000Hz. At the request of the client, measurements were also taken at the one-third octave band frequencies 6.3 kHz, 8 kHz and 10 kHz. The sound reduction indices at these additional frequencies are presented in Appendix A.

**Measurement of Sound Pressure Levels**

Sound pressure levels were measured simultaneously in the source and receiving rooms using loudspeaker **La** as the sound source. Measurements were recorded at a minimum of 5 fixed microphone positions in each room, using an averaging time of 32 seconds and the average level in each room was calculated on an energy basis in each one-third octave frequency band. The procedure was then repeated with loudspeaker **Lb** and **Lc** as the sound source. The overall average level difference in each frequency band was then calculated as the arithmetic average of the two sets of results.

For each set of microphone/loudspeaker positions, the distances separating microphones from other microphones, room boundaries and diffusers, were greater than 0.7m and the distances separating microphones from the sound source and the test specimen were greater than 1m.

**Measurement and Evaluation of the Equivalent Absorption Areas**

The correction term of equation (1) containing the equivalent absorption area, *A*, was evaluated from the reverberation time and calculated using Sabine's formula:

$$A = \frac{\mathbf{0.16\ V}}{\mathbf{T}} \quad \mathbf{(2)}$$

Where:
V is the volume of the receiving room ($m^3$)
T is the reverberation time (s)

The reverberation time of the receiving room was measured using a decay technique. The decays were produced by exciting the room with wide band random noise and stopping the excitation once the room became saturated. The resulting decaying sound field was monitored at 6 fixed microphone positions using a one-third octave band real time analyser. The sound spectrum was sampled at 32 millisecond intervals and stored in memory. Five decays were measured at each microphone position and averaged. The time taken for the sound to decay by 20dB was measured and multiplied by three to give the reverberation time. The measurements were repeated using an alternative sound source. The results from each set of position were averaged (ie 60 reverberation decays at each frequency).

**EQUIPMENT**

| | **Departmental Record No** |
|---|---|
| Norwegian Electronics 1/3 octave band real time analyser type 840 with in-built random noise generator | RTA2 |
| Quad 510 power amplifier | PA7 |
| 2 of omni-directional broadband loudspeakers (source room) | LS10-LS11 |
| 2 of broadband loudspeakers (receiving room) | LS3-LS4 |
| 3 of Bruel & Kjaer random incidence condenser microphones type 4166 in the source room | M2-M4 |
| 3 of G.R.A.S. random incidence condenser microphones type 40AP in the source room | M21,M22,M25 |
| 5 of Brunel & Kjaer random incidence condenser microphone type 4166 in the receiving room | M7-M9 M18, M19 |
| 1 if G.R.A.S. random incidence condenser microphones type 40AP in the receiving room | M20 |
| 2 of Norsonic Multiplexers type 834A | MP1-MP2 |
| HP Brio Pentium personal computer and related peripheral equipment (printer, plotter, monitor etc.) | COM6 |
| Yamaha GQ1031BII graphic equalizer | GEQ1 |

**RESULTS**

The sound reduction indices at one-third octave band intervals, *R,* are given in the tables overleaf.

Source room volume: 136m$^3$

Receiving room volume: 220m$^3$

Sample sizes: 2400mm x 3600mm

Source Room


Receiving Room

Fitting Frame and Panels into Test Aperture

Checking Panel Thickness

Recording Test Results
in the Control Room

Microphone Positions
in Receiving Room

Sound Source Positions


Plywood Diffusers
Receiving Room

## SALFORD UNIVERSITY TEST REPORT 1429

The following enclosure panels, consisting of a layered core (described from receiver to source room) contained within two 0.7mm steel cassettes of a number of thicknesses; were then installed into the open sections and fixed in place using toggles located on the frame on the receiving room side of the system. All units reported are nominal unless otherwise stated.

### Test A

Test Reference: 1429-1197
Sample Reference: "PB50"
Sample Description: 45mm thick panel with a core consisting of four layers. The mass per unit area of one panel was measured to be equal to 34.2kg/$m^{2.}$

### Test B

Test Reference: 1429-1199
Sample Reference: "ASPB50"
Sample Description: 45mm thick panel with a core consisting of three layers. The mass per unit area of one panel was measured to be equal to 35.2kg/$m^2$.

### Test C

Test Reference: 1429-1200
Sample Reference: "ASTSAS50"
Sample Description: 45mm thick panel with a core consisting of three layers. The mass per unit area of one panel was measured to be equal to 45.6kg/$m^2$.

### Test D

Test Reference: 1429-1201
Sample Reference: "ASTSFG50"
Sample Description: 45mm thick panel with a core consisting of three layers. The mass per unit area of one panel was measured to be equal to 38.1 kg/$m^2$.

### Test E

Test Reference: 1429-1203
Sample Reference: "ASTSPB50"
Sample Description: Modifications were made by fixing Acoustic Barrier Insulation to the source room side of the frame.

**Test F**

Test Reference: 1429-1206
Sample Reference: "PBFG50 with 1.2mm plastisol"
Sample Description: 45mm thick panel with a core consisting of three layers. The steel cassette on the source side of the system under test was replaced by a 1.2mm plastisol cassette. The mass per unit area of one panel was measured to be equal to 29.7kg/m$^2$.

**Test G**

Test Reference: 1429-1208
Sample Reference: "PB25"
Sample Description: 25mm thick panel with a core consisting of two layers. Profile sections were used to provide secure fitting between the panel and the frame toggles. The mass per unit area of one panel was measured to be equal to 22.2kg/m$^2$.

**TEST RESULTS**
**TO BS EN ISO 10140-2(2010)**

**Certified by: Salford University Acoustic Testing Laboratory**

Also given in the attached tables and computed from the one-third octave band sound reduction indices, is the weighted sound reduction index, $R_w$, calculated according to ISO 717/1-1996. This evaluation is based on laboratory measurement results obtained by an engineering method.

**APPENDIX A**

At the client's request, the sound reduction index was measured at the additional frequencies of 6.3 kHz, 8 kHz and 10 kHz, the results of which are presented below.

| Test Reference | Sound Reduction Index, *R* [dB] | | |
|---|---|---|---|
| | 6.3 kHz | 8 kHz | 10 kHz |
| 1429-1197 | 39.8[1] | 40.1[1] | 32.6[2] |
| 1429-1199 | 40.0[1] | 40.2[1] | 32.9[2] |
| 1429-1200 | 34.5 | 24.3 | 7.4 |
| 1429-1201 | 39.9 | 40.1 | 35.5[1] |
| 1429-1203 | 48.2[1] | 46.9[1] | 37.1[2] |
| 1429-1206 | 48.3[1] | 47.4[1] | 36.3[2] |
| 1429-1208 | 46.3[1] | 45.4[1] | 35.2[2] |

[1] Correction for background applied to the result
[2] Background levels too high – minimum value for *R*.

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### Test H

Test Reference: 2060-1673
Sample Reference: "PB18 Double Skin"
Sample Description: 18mm nominally thick panel.
The measured thickness and mass per unit area of one panel was measured to be equal to 18.0mm and 27.5kg/$m^2$ respectively.

### Test I

Test Reference: 2060-1678
Sample Reference: "PB/TS/PB25 Triple Skin"
Sample Description: 25mm nominally thick panel.
The measured thickness and mass per unit area of one panel was measured to be equal to 45.0mm and 41.0kg/$m^2$ respectively.

### Test J

Test Reference: 2060-1679
Sample Reference: "AS/TS/SBP50 Triple Skin"
Sample Description: 50mm nominally thick panel.
The measured thickness and mass per unit area of one panel was measured to be equal to 45.0mm and 53.6kg/$m^2$ respectively.

### Test K

Test Reference: 2060-1680
Sample Reference: "PB/SPB25 Double Skin"
Sample Description: 25mm nominally thick panel.
The measured thickness and mass per unit area of one panel was measured to be equal to 25.0mm and 34.2kg/$m^2$ respectively

### Test L

Test Reference: 2060-1681
Sample Reference: "SBP18 Double Skin"
Sample Description: 18mm nominally thick panel.
The measured thickness and mass per unit area of one panel was measured to be equal to 18.6mm and 30.6kg/$m^2$ respectively.

**Test M**

Test Reference: 2060-1683
Sample Reference: "AS/TS/FG50 Triple Skin"
Sample Description: 50mm nominally thick panel.
The measured thickness and mass per unit area of one panel was measured to be equal to 45.0mm and 39.9kg/$m^2$ respectively.

**Test N**

Test Reference: 2060-1684
Sample Reference: "AS/TS/PB50 Triple Skin"
Sample Description: 50mm nominally thick panel.
The measured thickness and mass per unit area of one panel was measured to be equal to 45mm and 49.9kg/$m^2$ respectively.

**Test O**

Test Reference: 2060-1685
Sample Reference: "FG/TS/PB50 Triple Skin"
Sample Description: 50mm nominally thick panel.
The measured thickness and mass per unit area of one panel was measured to be equal to 45mm and 40.0kg/$m^2$ respectively.

**Test P**

Test Reference: 2060-1686
Sample Reference: "FG25 Double Skin"
Sample Description: 25mm nominally thick panel.
The measured thickness and mass per unit area of one panel was measured to be equal to 45mm and 21.3kg/$m^2$ respectively.

**Test Q**

Test Reference: 2060-1686
Sample Reference: "FG50 Double Skin"
Sample Description: 50mm nominally thick panel.
The measured thickness and mass per unit area of one panel was measured to be equal to 45mm and 23.3kg/$m^2$ respectively.

**Test R**

Test Reference: 2060-1689
Sample Reference: "AS/QS/PB50 Quadruple Skin"
Sample Description: 50mm nominally thick panel.
The measured thickness and mass per unit area of one panel was measured to be equal to 45mm and 62.9 kg/$m^2$ respectively.

**Test S**

| | |
|---|---|
| Test Reference: | 2060-1675 |
| Sample Reference: | “FG18 Double Skin” |
| Sample Description: | 18mm nominally thick panel.<br>The measured thickness and mass per unit area of one panel was measured to be equal to 18.0mm and 20.9kg/$m^2$ respectively. |

**Test T**

| | |
|---|---|
| Test Reference: | 2060-1676 |
| Sample Reference: | “FG/TS/SBP50 Triple Skin” |
| Sample Description: | 50mm nominally thick panel.<br>The measured thickness and mass per unit area of one panel was measured to be equal to 45mm and 43.3kg/$m^2$ respectively. |

**Test U**

| | |
|---|---|
| Test Reference: | 2060-1674 |
| Sample Reference: | “AS25 Double Skin” |
| Sample Description: | 25mm nominally thick panel.<br>The measured thickness and mass per unit area of one panel was measured to be equal to 30.3mm and 31.3kg/$m^2$ respectively. |

## APPENDIX A

At the client's request, the sound reduction index was measured at the additional octave band frequency of 8 kHz, the results of which are presented below.

| Test Reference | Sound Reduction Index, *R* [dB] 8 kHz |
|---|---|
| 2060-1673 | 39.6 |
| 2060-1674 | 40.8 |
| 2060-1675 | 39.9 |
| 2060-1676 | 41.5 |
| 2060-1678 | 40.1 |
| 2060-1679 | 39.6 |
| 2060-1680 | 39.6 |
| 2060-1681 | 39.2 |
| 2060-1685 | 40.3 |
| 2060-1686 | 39.7 |
| 2060-1687 | 40.4 |
| 2060-1689 | 43.7 |

AIR HANDLING UNIT CASEWORK SRI VALUES

| Reference | 63Hz | 125 Hz | 250 Hz | 500 Hz | 1K Hz | 2K Hz | 4K Hz | 8K Hz |
|---|---|---|---|---|---|---|---|---|
| FG18 | 18.3 | 18.1 | 24 | 38.8 | 39.9 | 34.5 | 33.1 | 39.9 |
| FG25 | 16.5 | 16.6 | 26.6 | 38.1 | 39.2 | 33.4 | 32.1 | 39.7 |
| FG50 | 15.7 | 18.4 | 33.7 | 36.2 | 37.5 | 32.4 | 35 | 40.4 |
| PB18 | 21 | 25.9 | 28.2 | 29.3 | 33.1 | 34.5 | 33.7 | 39.8 |
| SBP18 | 21.6 | 24.9 | 27.9 | 28 | 34.8 | 35.5 | 33.6 | 39.2 |
| PB25 | 20.4 | 23.0 | 22.9 | 23.3 | 33.6 | 37 | 37.7 | 45.5 |
| PBSBP25 | 22.5 | 26.2 | 29.4 | 30 | 36.4 | 35.2 | 33.6 | 39.6 |
| PB50 | 21.8 | 23.8 | 22.1 | 26 | 35.6 | 35.2 | 32.0 | 40.1 |
| AS25 | 19.9 | 23.5 | 29.4 | 36 | 39.1 | 34.1 | 34.5 | 40.8 |
| ASPB50 | 20.8 | 21.3 | 29.6 | 39 | 41.4 | 34.8 | 32.8 | 40.2 |
| PBFG50 | 19.6 | 18.3 | 33.3 | 39.8 | 38.6 | 36.1 | 39.3 | 46.8 |
| **TRIPLE SKIN** | | | | | | | | |
| PB/TS/PB25 | 23.8 | 26.6 | 29 | 30.6 | 36.7 | 35.6 | 33.3 | 40.1 |
| PB/TS/FG50 | 21.1 | 21.0 | 36.3 | 39.2 | 41.7 | 34.7 | 32.9 | 40.2 |
| SPB/TS/SPB50 | 21.7 | 24.2 | 36.4 | 37.3 | 37.6 | 33.4 | 35.7 | 41.5 |
| AS/TS/FG50 | 21 | 23.7 | 34.2 | 36.1 | 37 | 32.7 | 36.2 | 40.3 |
| AS/TS/PB50 | | | | | | | | |
| AS/TS/SBP50 | 24.1 | 27.1 | 34.8 | 37 | 37.2 | 33.5 | 36.2 | 39.6 |
| AS/TS/AS50 | 21.6 | 25.6 | 32 | 37 | 40.8 | 33.6 | 32.9 | 24.3 |
| **QUADRUPLE SKIN** | | | | | | | | |
| AS/QS/PB50 | 24.1 | 36.6 | 34.7 | 39.8 | 40.7 | 37.8 | 39.7 | 43.7 |

## Insertion Loss Graph's

The following graphs relate to the Test Reports 1429 & 2060. The test range for these graphs is 63KHz to 4K Hz, results for 8K Hz are given in Appendix 'A'

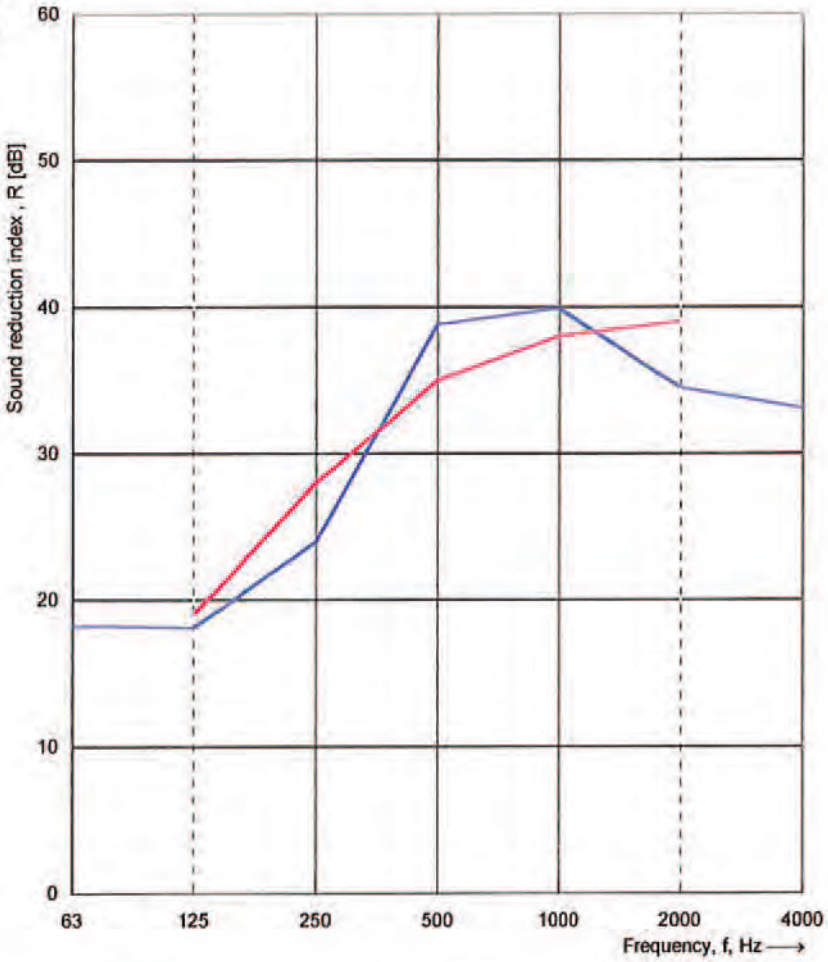
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 07/01/15 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | FG18 DOUBLE SKIN | | |
| Description of the specimen: | Acoustic Panel System<br>Please refer to Section 1 for a full description of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 101.2 ± 0.0 kPa | | |
| Air temperature: | 19.9 ± 0.3 °C | | |
| Relative air humidity: | 38.7 ± 3.0 % | | |
| Mass per unit area: | 19.4 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

THE FREQUENCY 63HZ IS NOT UKAS ACCREDITED

| Frequency f [Hz] | R 1/1 octave [dB] |
|---|---|
| 63 | 18.3 |
| 125 | 18.1 |
| 250 | 24.0 |
| 500 | 38.8 |
| 1000 | 39.9 |
| 2000 | 34.5 |
| 4000 | 33.1 |




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr})$ = 35 ( -2 ; -6 ) dB

$C_{63\text{-}2000}$ = -2 dB $C_{63\text{-}4000}$ = -2 dB $C_{125\text{-}4000}$ = -2 dB

$C_{tr,63\text{-}2000}$ = -6 dB $C_{tr,63\text{-}4000}$ = -7 dB $C_{tr,125\text{-}4000}$ = -6 dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

| | |
|---|---|
| Name of test institute: | The University of Salford, Acoustic Test Laboratory |
| **Test Reference:** | 2060-1675 |
| Date: 07/01/15 | Signature: |

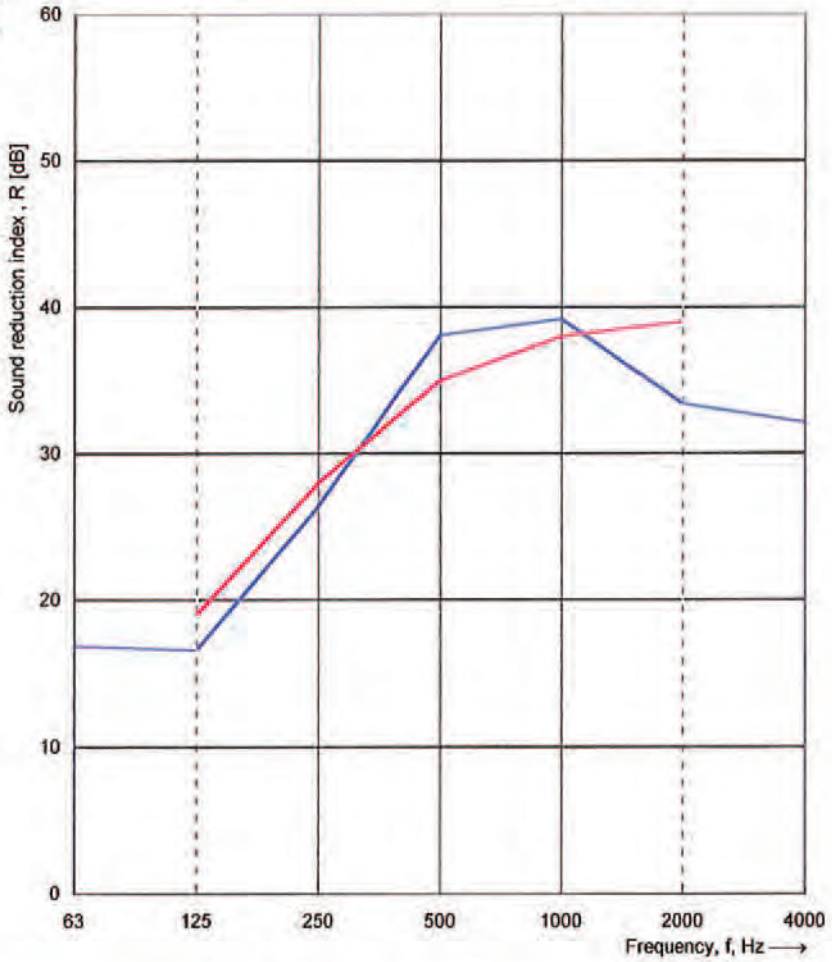
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 09/01/15 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | FG25 DOUBLE SKIN | | |
| Description of the specimen: | Acoustic Panel System<br>Please refer to Section 1 for a full description of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 100.8 ± 0.0 kPa | | |
| Air temperature: | 19.7 ± 0.3 °C | | |
| Relative air humidity: | 40.6 ± 3.0 % | | |
| Mass per unit area: | 21.3 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

THE FREQUENCY 63HZ IS NOT UKAS ACCREDITED

| Frequency f [Hz] | R 1/1 octave [dB] |
|---|---|
| 63 | 16.9 |
| 125 | 16.6 |
| 250 | 26.4 |
| 500 | 38.1 |
| 1000 | 39.2 |
| 2000 | 33.4 |
| 4000 | 32.1 |




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr})$ = 35 ( -2 ; -6 ) dB

$C_{63\text{-}2000}$ = -2 dB $C_{63\text{-}4000}$ = -3 dB $C_{125\text{-}4000}$ = -3 dB

$C_{tr,63\text{-}2000}$ = -7 dB $C_{tr,63\text{-}4000}$ = -7 dB $C_{tr,125\text{-}4000}$ = -7 dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

| | |
|---|---|
| Name of test institute: | The University of Salford, Acoustic Test Laboratory |
| **Test Reference:** | 2060-1686 |
| Date: 09/01/15 | Signature: |

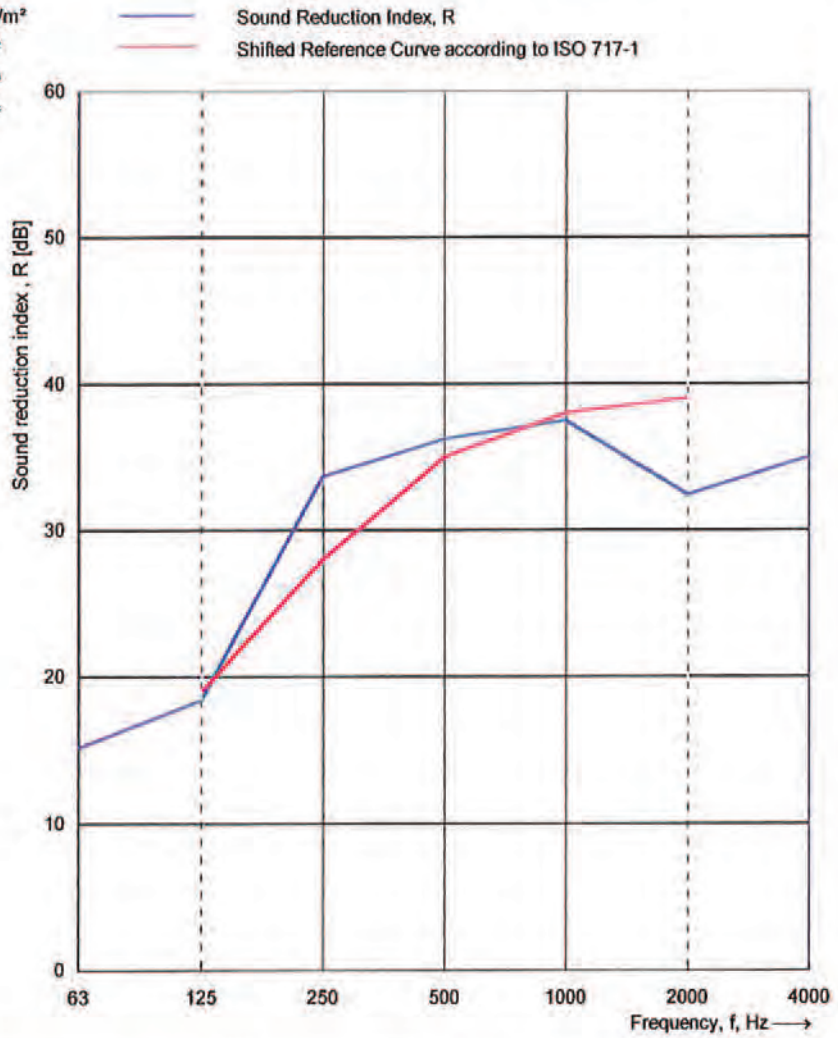
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 09/01/15 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | FG50 DOUBLE SKIN | | |
| Description of the specimen: | Acoustic Panel System<br>Please refer to Section 1 for a full description of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 100.8 ± 0.0 kPa | | |
| Air temperature: | 20.2 ± 0.3 °C | | |
| Relative air humidity: | 41.6 ± 3.0 % | | |
| Mass per unit area: | 23.3 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

THE FREQUENCY 63HZ IS NOT UKAS ACCREDITED

| Frequency f [Hz] | R 1/1 octave [dB] |
|---|---|
| 63 | 15.2 |
| 125 | 18.4 |
| 250 | 33.7 |
| 500 | 36.2 |
| 1000 | 37.5 |
| 2000 | 32.4 |
| 4000 | 35.0 |




Rating according to BS EN ISO 717-1

$R_w(C;C_{tr})$ = 35 ( -2 ; -4 ) dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

$C_{63\text{-}2000}$ = -2 dB $C_{63\text{-}4000}$ = -2 dB $C_{125\text{-}4000}$ = -2 dB

$C_{tr,63\text{-}2000}$ = -6 dB $C_{tr,63\text{-}4000}$ = -6 dB $C_{tr,125\text{-}4000}$ = -5 dB

Name of test institute: The University of Salford, Acoustic Test Laboratory

**Test Reference:** 2060-1687

Date: 09/01/15 Signature:

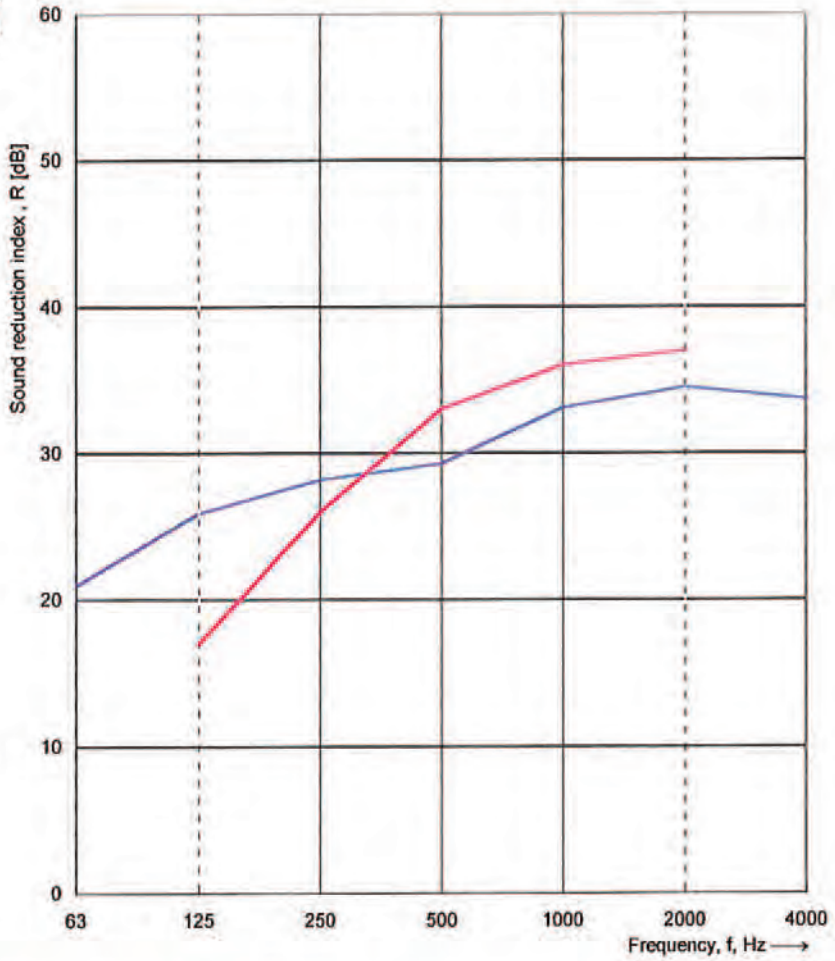
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 07/01/15 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | PB18 DOUBLE SKIN | | |
| Description of the specimen: | Acoustic Panel System<br>Please refer to Section 1 for a full description of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 101.2 ± 0.0 kPa | | |
| Air temperature: | 23.1 ± 0.3 °C | | |
| Relative air humidity: | 30.0 ± 3.0 % | | |
| Mass per unit area: | 18.0 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

THE FREQUENCY 63HZ IS NOT UKAS ACCREDITED

| Frequency f [Hz] | R 1/1 octave [dB] |
|---|---|
| 63 | 21.0 |
| 125 | 25.9 |
| 250 | 28.2 |
| 500 | 29.3 |
| 1000 | 33.1 |
| 2000 | 34.5 |
| 4000 | 33.7 |




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr}) =$ 33 ( -1 ; -2 ) dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

$C_{63\text{-}2000} =$ -1 dB $C_{63\text{-}4000} =$ -1 dB $C_{125\text{-}4000} =$ -1 dB

$C_{tr,63\text{-}2000} =$ -3 dB $C_{tr,63\text{-}4000} =$ -3 dB $C_{tr,125\text{-}4000} =$ -3 dB

Name of test institute: The University of Salford, Acoustic Test Laboratory

**Test Reference:** 2060-1673

Date: 07/01/15 Signature:

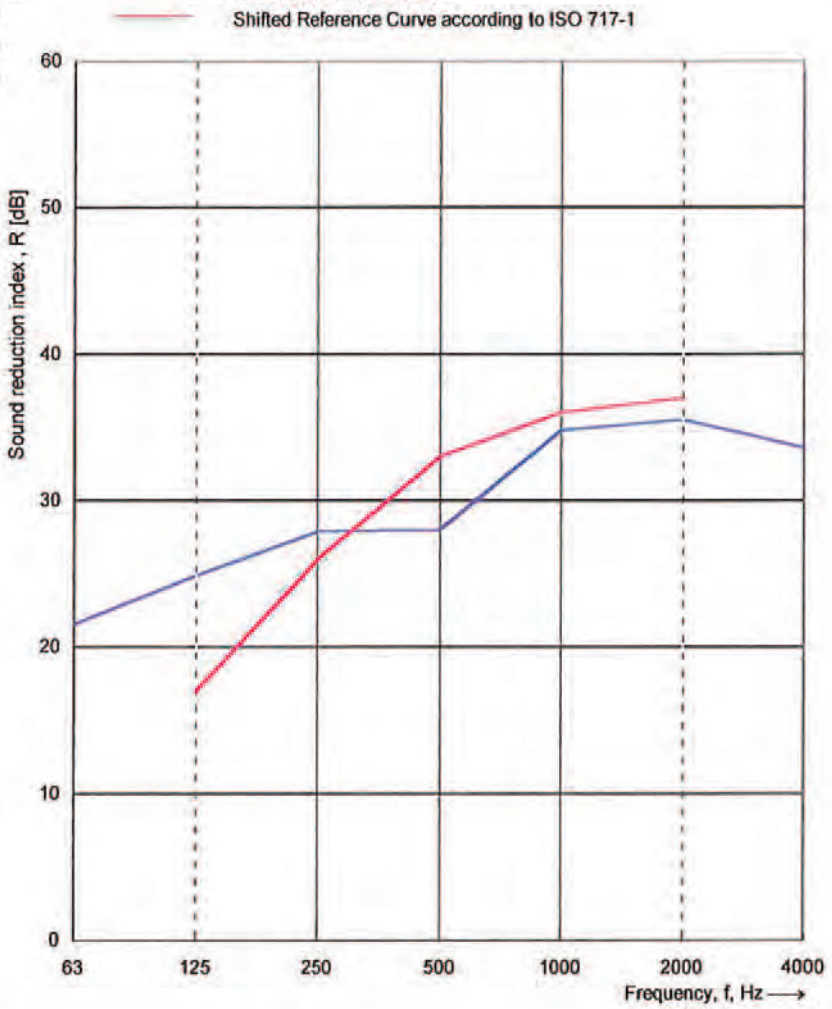
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 08/01/15 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | SBP18 DOUBLE SKIN | | |
| Description of the specimen: | Acoustic Panel System<br>Please refer to Section 1 for a full description of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 101.3 ± 0.0 kPa | | |
| Air temperature: | 19.6 ± 0.3 °C | | |
| Relative air humidity: | 37.0 ± 3.0 % | | |
| Mass per unit area: | 30.6 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

THE FREQUENCY 63HZ IS NOT UKAS ACCREDITED

| Frequency f [Hz] | R 1/1 octave [dB] |
|---|---|
| 63 | 21.6 |
| 125 | 24.9 |
| 250 | 27.9 |
| 500 | 28.0 |
| 1000 | 34.8 |
| 2000 | 35.5 |
| 4000 | 33.6 |




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr}) =$ 33 ( 0 ; -2 ) dB

$C_{63\text{-}2000} =$ -1 dB $C_{63\text{-}4000} =$ -1 dB $C_{125\text{-}4000} =$ -1 dB

$C_{tr,63\text{-}2000} =$ -3 dB $C_{tr,63\text{-}4000} =$ -3 dB $C_{tr,125\text{-}4000} =$ -3 dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

Name of test institute: The University of Salford, Acoustic Test Laboratory

**Test Reference:** 2060-1681

Date: 08/01/15 Signature:

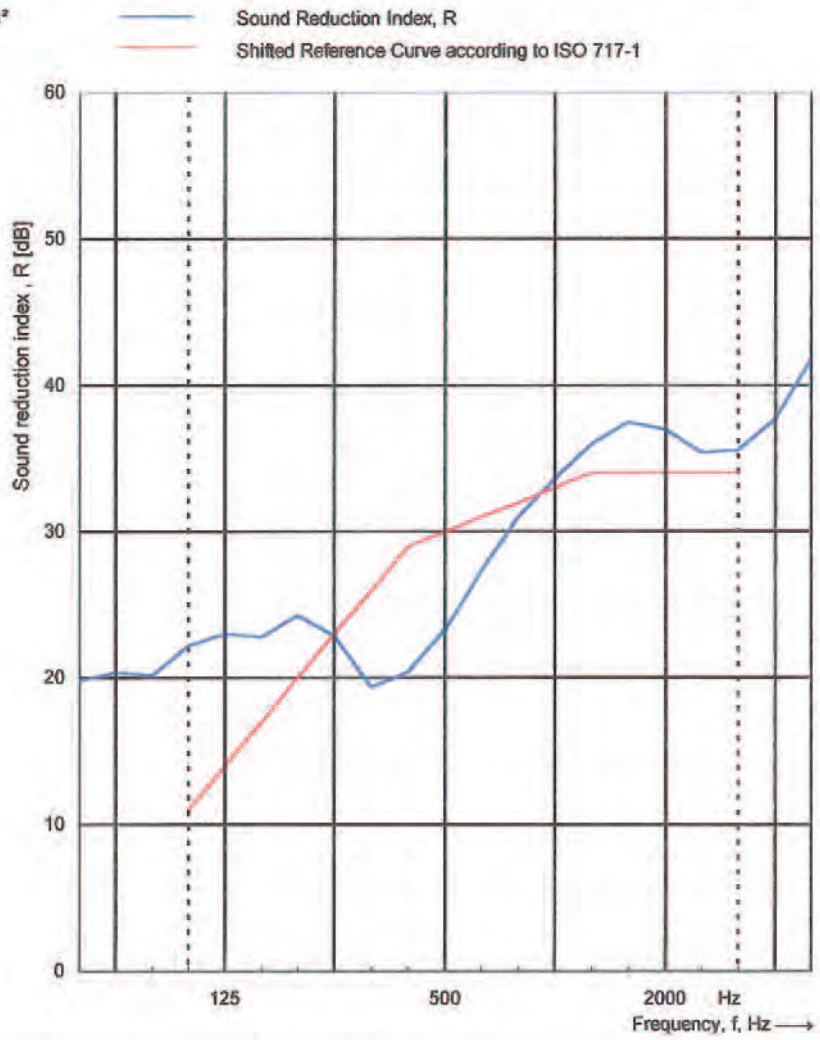
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 01/10/13 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | "PB25" Panel Enclosure System | | |
| Description of the specimen: | Please refer to Section 1 for a full description of the test object<br>Frame capped using "AcousticShield" on the source room side of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 100.8 kPa | | |
| Air temperature: | 21.4 °C | | |
| Relative air humidity: | 51.6 % | | |
| Mass per unit area: | 22.2 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

| Frequency f [Hz] | R 1/3 octave [dB] |
|---|---|
| 50 | 19.8 |
| 63 | 20.4 |
| 80 | 20.2 |
| 100 | 22.2 |
| 125 | 23.0 |
| 160 | 22.8 |
| 200 | 24.3 |
| 250 | 22.9 |
| 315 | 19.4 |
| 400 | 20.4 |
| 500 | 23.3 |
| 630 | 27.3 |
| 800 | 31.0 |
| 1000 | 33.6 |
| 1250 | 36.0 |
| 1600 | 37.5 |
| 2000 | 37.0 |
| 2500 | 35.4 |
| 3150 | 35.6 |
| 4000 | 37.7 |
| 5000 | 41.8 |

FREQUENCIES 50HZ, 63HZ AND 80HZ ARE NOT UKAS ACCREDITED




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr}) =$ 30 ( -1 ; -3 ) dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

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

$C_{tr,50\text{-}3150} =$ -3 dB $C_{tr,50\text{-}5000} =$ -3 dB $C_{tr,100\text{-}5000} =$ -3 dB

Name of test institute: The University of Salford, Acoustic Test Laboratory

**No. of test report:** 1429-1208

Date: 01/10/13 Signature:

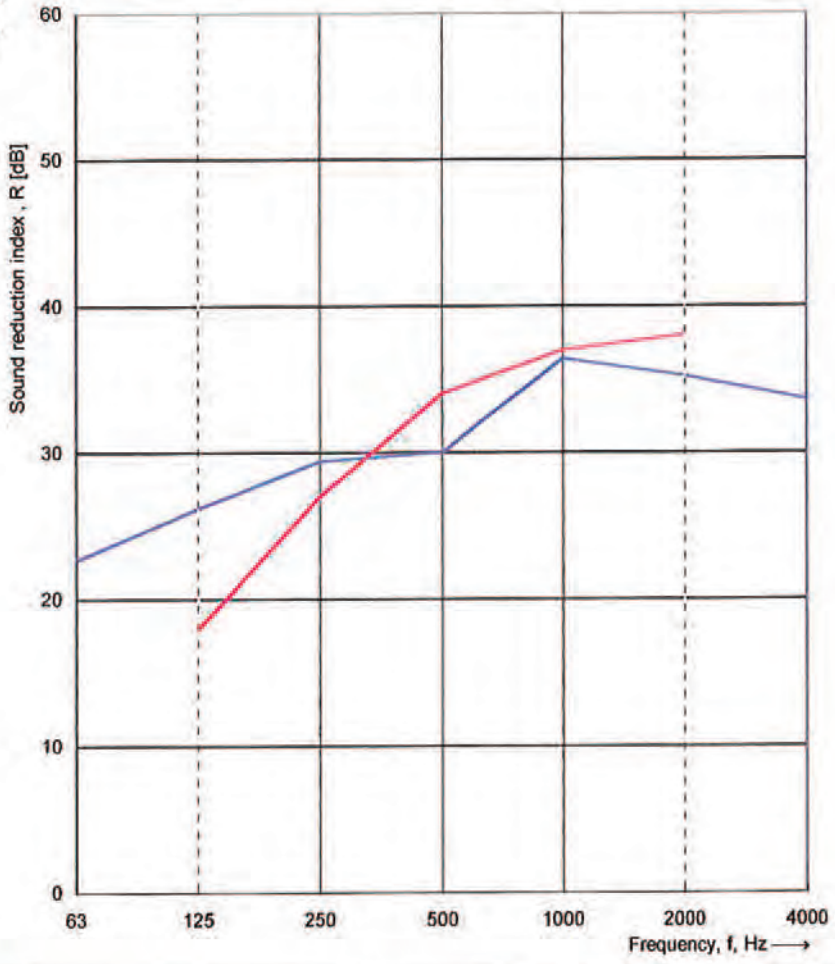
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 08/01/15 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | PB/SBP50 DOUBLE SKIN | | |
| Description of the specimen: | Acoustic Panel System<br>Please refer to Section 1 for a full description of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 101.3 ± 0.0 kPa | | |
| Air temperature: | 19.7 ± 0.3 °C | | |
| Relative air humidity: | 37.3 ± 3.0 % | | |
| Mass per unit area: | 34.2 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

THE FREQUENCY 63HZ IS NOT UKAS ACCREDITED

| Frequency f [Hz] | R 1/1 octave [dB] |
|---|---|
| 63 | 22.7 |
| 125 | 26.2 |
| 250 | 29.4 |
| 500 | 30.0 |
| 1000 | 36.4 |
| 2000 | 35.2 |
| 4000 | 33.6 |




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr}) =$ 34 ( 0 ; -2 ) dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

$C_{63\text{-}2000} =$ 0 dB $C_{63\text{-}4000} =$ -1 dB $C_{125\text{-}4000} =$ -1 dB

$C_{tr,63\text{-}2000} =$ -2 dB $C_{tr,63\text{-}4000} =$ -2 dB $C_{tr,125\text{-}4000} =$ -3 dB

Name of test institute: The University of Salford, Acoustic Test Laboratory

**Test Reference:** 2060-1680

Date: 08/01/15 Signature:

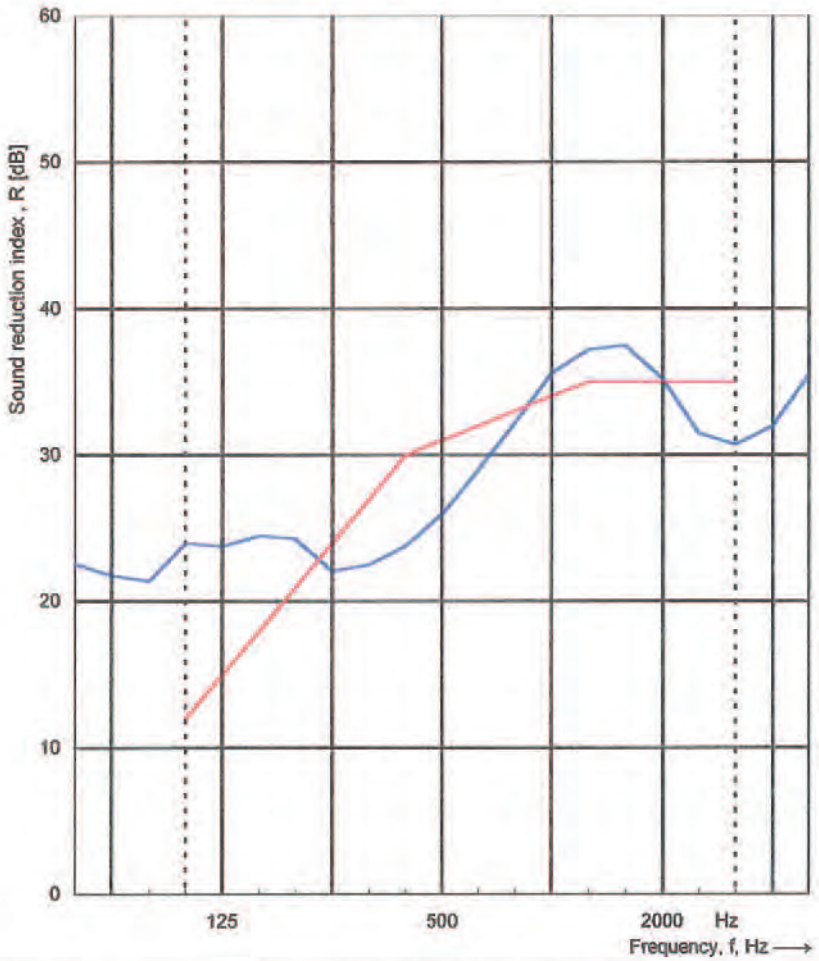
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 26/09/13 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | "PB50" Panel Enclosure System | | |
| Description of the specimen: | Please refer to Section 1 for a full description of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 101.7 kPa | | |
| Air temperature: | 21.1 °C | | |
| Relative air humidity: | 43.1 % | | |
| Mass per unit area: | 34.2 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

FREQUENCIES 50HZ, 63HZ AND 80HZ ARE NOT UKAS ACCREDITED

| Frequency f [Hz] | R 1/3 octave [dB] |
|---|---|
| 50 | 22.6 |
| 63 | 21.8 |
| 80 | 21.4 |
| 100 | 24.0 |
| 125 | 23.8 |
| 160 | 24.5 |
| 200 | 24.3 |
| 250 | 22.1 |
| 315 | 22.5 |
| 400 | 23.8 |
| 500 | 26.0 |
| 630 | 29.0 |
| 800 | 32.2 |
| 1000 | 35.6 |
| 1250 | 37.2 |
| 1600 | 37.5 |
| 2000 | 35.2 |
| 2500 | 31.5 |
| 3150 | 30.7 |
| 4000 | 32.0 |
| 5000 | 35.5 |




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr}) =$ 31 ( -1 ; -2 ) dB

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

$C_{tr,50\text{-}3150} =$ -3 dB $C_{tr,50\text{-}5000} =$ -3 dB $C_{tr,100\text{-}5000} =$ -2 dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

Name of test institute: The University of Salford, Acoustic Test Laboratory

**No. of test report:** 1429-1197

Date: 26/09/13 Signature:

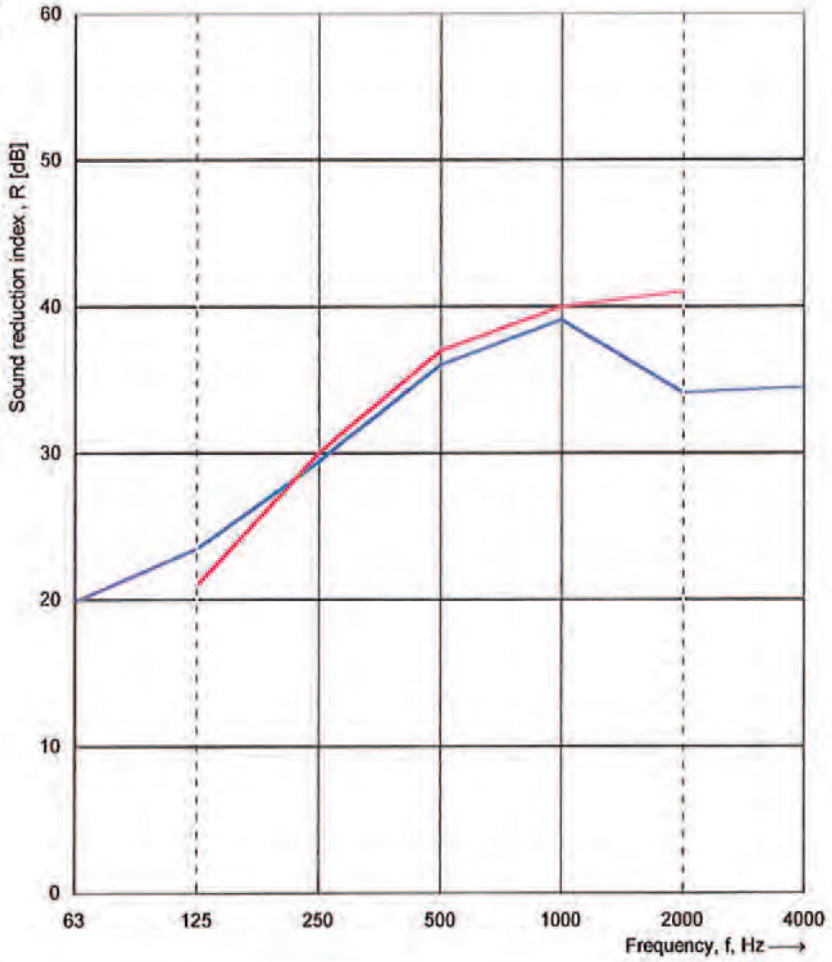
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 07/01/15 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | AS25 DOUBLE SKIN | | |
| Description of the specimen: | Acoustic Panel System<br>Please refer to Section 1 for a full description of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 101.2 ± 0.0 kPa | | |
| Air temperature: | 20.0 ± 0.3 °C | | |
| Relative air humidity: | 37.3 ± 3.0 % | | |
| Mass per unit area: | 31.3 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

THE FREQUENCY 63HZ IS NOT UKAS ACCREDITED

| Frequency f [Hz] | R 1/1 octave [dB] |
|---|---|
| 63 | 19.9 |
| 125 | 23.5 |
| 250 | 29.4 |
| 500 | 36.0 |
| 1000 | 39.1 |
| 2000 | 34.1 |
| 4000 | 34.5 |




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr})$ = 37 ( -2 ; -4 ) dB

$C_{63\text{-}2000}$ = -2 dB $C_{63\text{-}4000}$ = -3 dB $C_{125\text{-}4000}$ = -3 dB

$C_{tr,63\text{-}2000}$ = -5 dB $C_{tr,63\text{-}4000}$ = -5 dB $C_{tr,125\text{-}4000}$ = -5 dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

| | |
|---|---|
| Name of test institute: | The University of Salford, Acoustic Test Laboratory |
| **Test Reference:** | 2060-1674 |
| Date: 07/01/15 | Signature: |

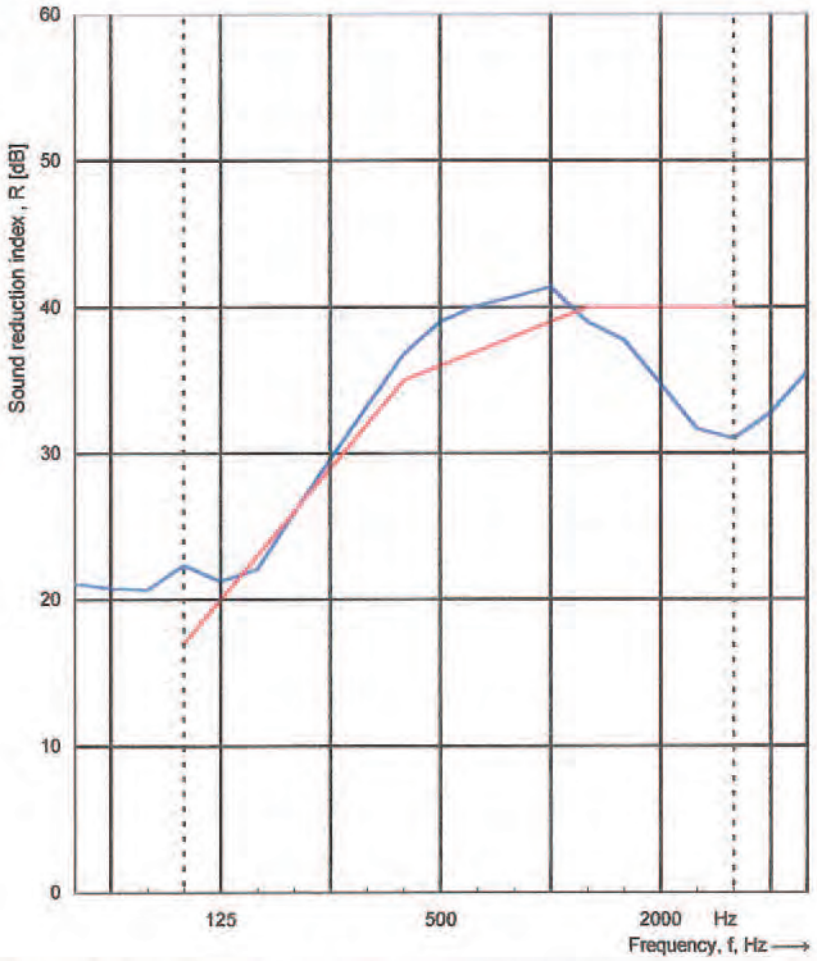
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 26/09/13 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | "ASPB50" Panel Enclosure System | | |
| Description of the specimen: | Please refer to Section 1 for a full description of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 101.7 kPa | | |
| Air temperature: | 21.6 °C | | |
| Relative air humidity: | 48.0 % | | |
| Mass per unit area: | 35.2 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

FREQUENCIES 50HZ, 63HZ AND 80HZ ARE NOT UKAS ACCREDITED

| Frequency f [Hz] | R 1/3 octave [dB] |
|---|---|
| 50 | 21.1 |
| 63 | 20.8 |
| 80 | 20.7 |
| 100 | 22.4 |
| 125 | 21.3 |
| 160 | 22.1 |
| 200 | 25.9 |
| 250 | 29.6 |
| 315 | 33.2 |
| 400 | 36.8 |
| 500 | 39.0 |
| 630 | 40.1 |
| 800 | 40.7 |
| 1000 | 41.4 |
| 1250 | 39.0 |
| 1600 | 37.8 |
| 2000 | 34.8 |
| 2500 | 31.7 |
| 3150 | 31.0 |
| 4000 | 32.8 |
| 5000 | 35.6 |




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr})$ = 36 ( -2 ; -3 ) dB

$C_{50\text{-}3150}$ = -2 dB $C_{50\text{-}5000}$ = -2 dB $C_{100\text{-}5000}$ = -2 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 in one-third-octave bands by an engineering method.

Name of test institute: The University of Salford, Acoustic Test Laboratory

**No. of test report:** 1429-1199

Date: 26/09/13 Signature:

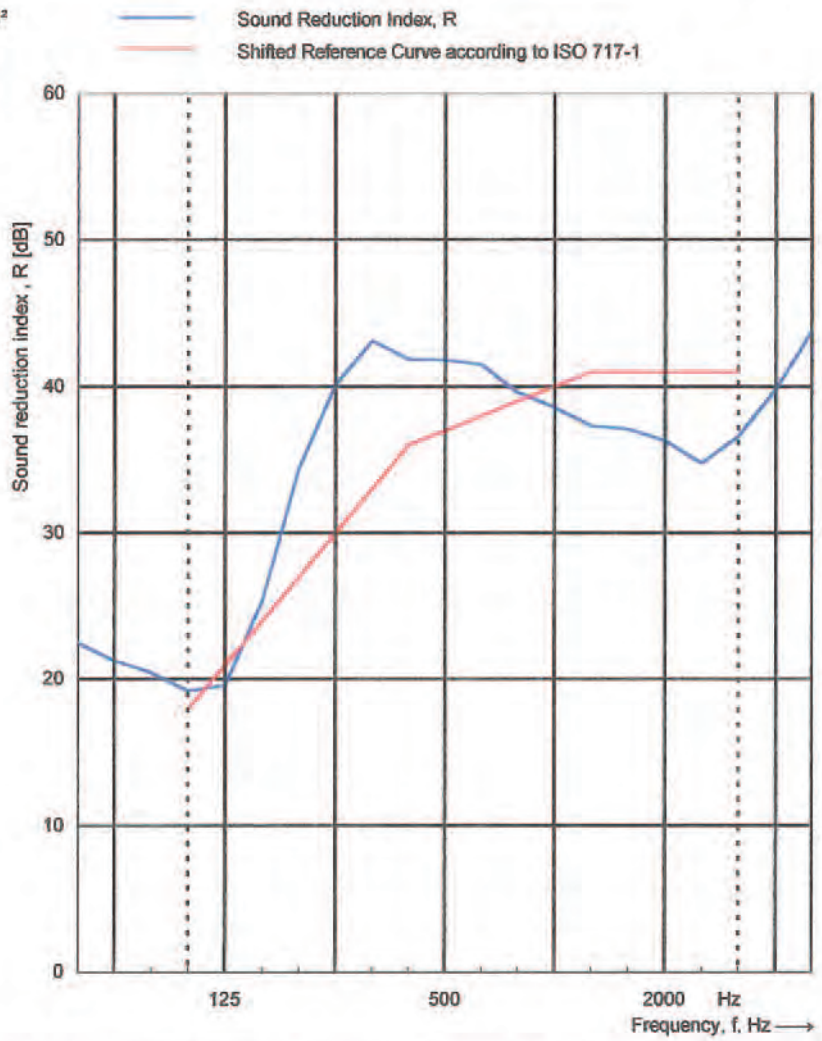
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 01/10/13 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | "PBFG50 with 1.2mm plastisol" Panel Enclosure System | | |
| Description of the specimen: | Please refer to Section 1 for a full description of the test object<br>Frame capped using "AcousticShield" on the source room side of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 100.8 kPa | | |
| Air temperature: | 21.2 °C | | |
| Relative air humidity: | 49.6 % | | |
| Mass per unit area: | 29.7 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

| Frequency f [Hz] | R 1/3 octave [dB] |
|---|---|
| 50 | 22.5 |
| 63 | 21.3 |
| 80 | 20.5 |
| 100 | 19.2 |
| 125 | 19.6 |
| 160 | 25.4 |
| 200 | 34.4 |
| 250 | 40.1 |
| 315 | 43.1 |
| 400 | 41.9 |
| 500 | 41.8 |
| 630 | 41.5 |
| 800 | 39.6 |
| 1000 | 38.6 |
| 1250 | 37.3 |
| 1600 | 37.1 |
| 2000 | 36.3 |
| 2500 | 34.8 |
| 3150 | 36.6 |
| 4000 | 39.8 |
| 5000 | 43.8 |

FREQUENCIES 50HZ, 63HZ AND 80HZ ARE NOT UKAS ACCREDITED




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr})$ = 37 ( -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 in one-third-octave bands by an engineering method.

Name of test institute: The University of Salford, Acoustic Test Laboratory

**No. of test report:** 1429-1206

Date: 01/10/13 Signature:

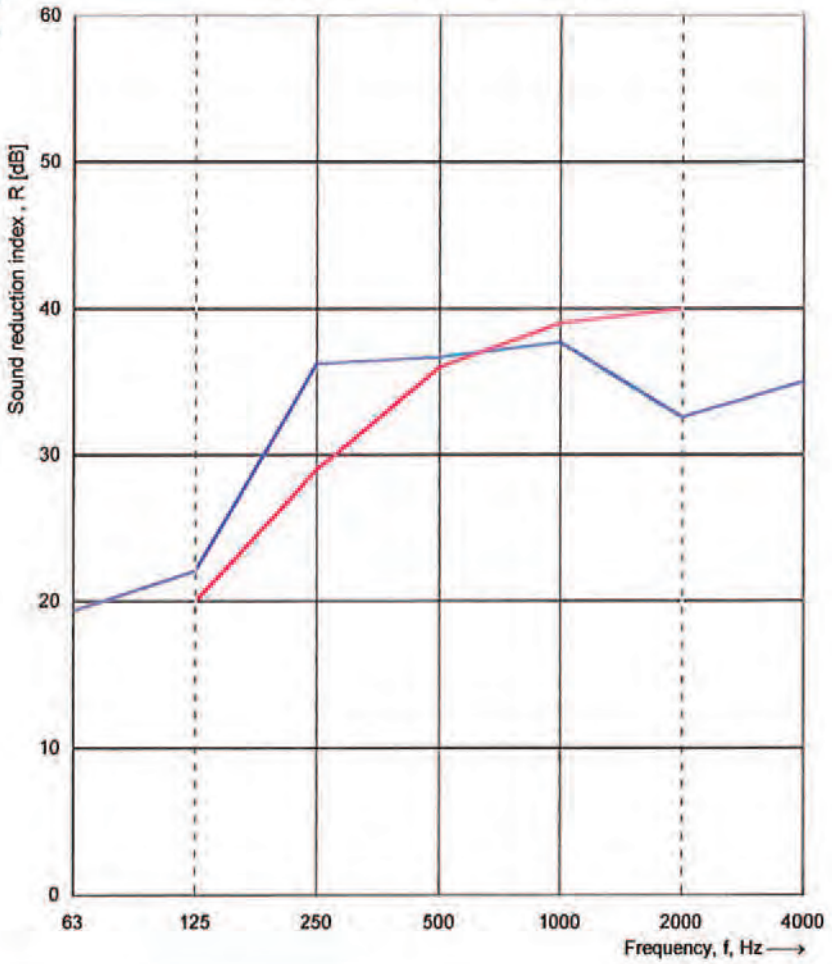
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 09/01/15 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | FG/TS/PB50 TRIPLE SKIN | | |
| Description of the specimen: | Acoustic Panel System<br>Please refer to Section 1 for a full description of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 100.8 ± 0.0 kPa | | |
| Air temperature: | 20.1 ± 0.3 °C | | |
| Relative air humidity: | 39.9 ± 3.0 % | | |
| Mass per unit area: | 40.0 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

THE FREQUENCY 63HZ IS NOT UKAS ACCREDITED

| Frequency f [Hz] | R 1/1 octave [dB] |
|---|---|
| 63 | 19.4 |
| 125 | 22.1 |
| 250 | 36.2 |
| 500 | 36.7 |
| 1000 | 37.7 |
| 2000 | 32.6 |
| 4000 | 35.0 |




Rating according to BS EN ISO 717-1

$R_w(C;C_{tr})$ = 36 ( -2 ; -3 ) dB

$C_{63\text{-}2000}$ = -2 dB $C_{63\text{-}4000}$ = -2 dB $C_{125\text{-}4000}$ = -2 dB

$C_{tr,63\text{-}2000}$ = -4 dB $C_{tr,63\text{-}4000}$ = -5 dB $C_{tr,125\text{-}4000}$ = -4 dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

| | |
|---|---|
| Name of test institute: | The University of Salford, Acoustic Test Laboratory |
| **Test Reference:** | 2060-1685 |
| Date: 09/01/15 | Signature: |

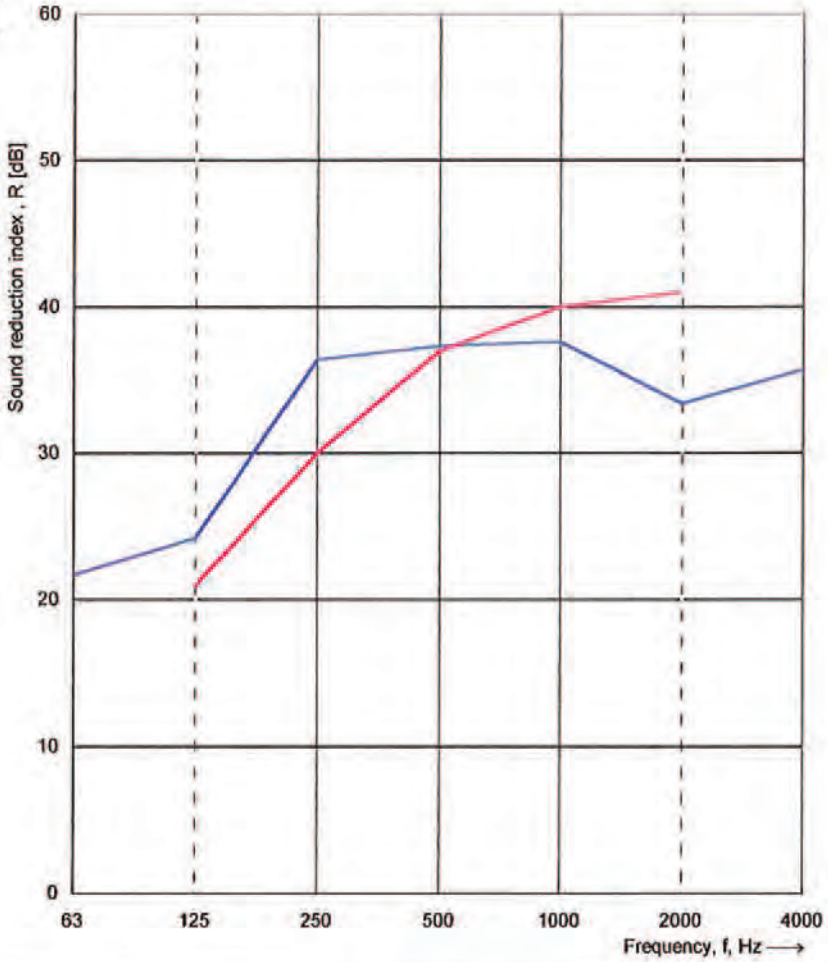
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 07/01/15 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | FG/TS/SBP50 TRIPLE SKIN | | |
| Description of the specimen: | Acoustic Panel System<br>Please refer to Section 1 for a full description of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 101.2 ± 0.0 kPa | | |
| Air temperature: | 21.2 ± 0.3 °C | | |
| Relative air humidity: | 36.9 ± 3.0 % | | |
| Mass per unit area: | 43.3 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

THE FREQUENCY 63HZ IS NOT UKAS ACCREDITED

| Frequency f [Hz] | R 1/1 octave [dB] |
|---|---|
| 63 | 21.7 |
| 125 | 24.2 |
| 250 | 36.4 |
| 500 | 37.3 |
| 1000 | 37.6 |
| 2000 | 33.4 |
| 4000 | 35.7 |




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr})$ = 37 ( -2 ; -3 ) dB

$C_{63\text{-}2000}$ = -2 dB $C_{63\text{-}4000}$ = -2 dB $C_{125\text{-}4000}$ = -2 dB

$C_{tr,63\text{-}2000}$ = -4 dB $C_{tr,63\text{-}4000}$ = -4 dB $C_{tr,125\text{-}4000}$ = -4 dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

| | |
|---|---|
| Name of test institute: | The University of Salford, Acoustic Test Laboratory |
| **Test Reference:** | 2060-1676 |
| Date: 07/01/15 | Signature: |

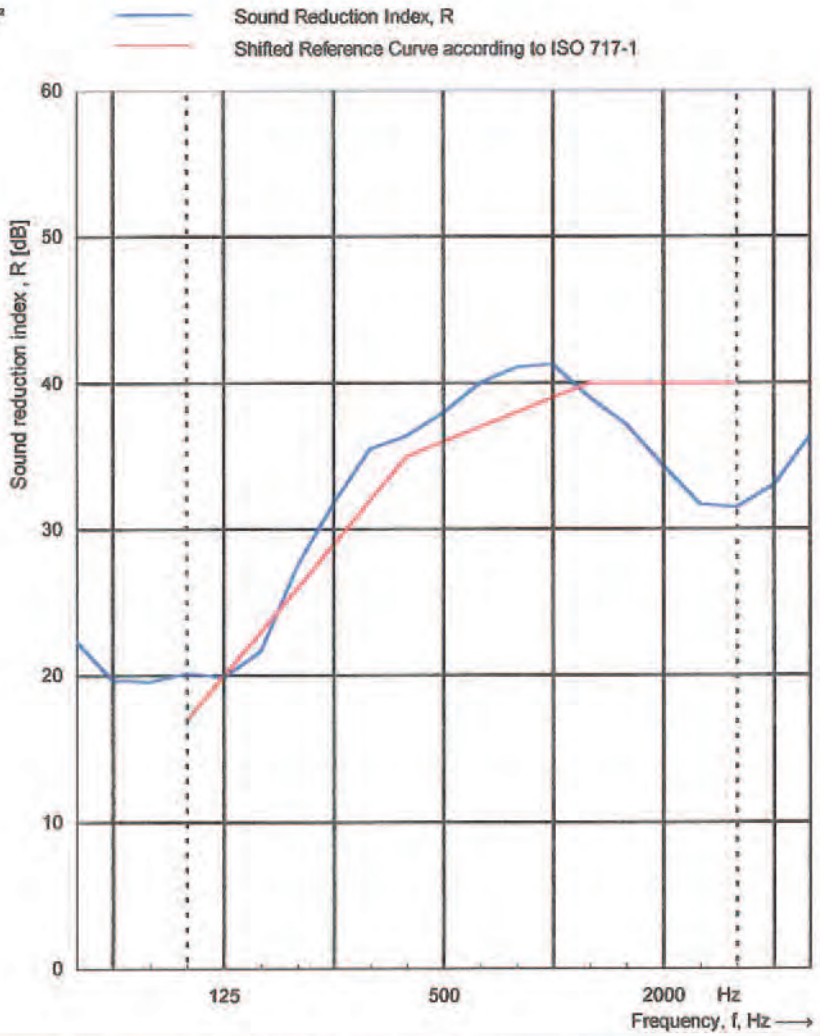
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 27/09/13 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | "ASTSFG50" Panel Enclosure System | | |
| Description of the specimen: | Please refer to Section 1 for a full description of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 101.6 kPa | | |
| Air temperature: | 21.6 °C | | |
| Relative air humidity: | 49.3 % | | |
| Mass per unit area: | 38.1 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

| Frequency f [Hz] | R 1/3 octave [dB] |
|---|---|
| 50 | 22.4 |
| 63 | 19.7 |
| 80 | 19.6 |
| 100 | 20.2 |
| 125 | 19.9 |
| 160 | 21.7 |
| 200 | 27.5 |
| 250 | 31.8 |
| 315 | 35.5 |
| 400 | 36.4 |
| 500 | 38.0 |
| 630 | 40.0 |
| 800 | 41.1 |
| 1000 | 41.3 |
| 1250 | 39.0 |
| 1600 | 37.2 |
| 2000 | 34.3 |
| 2500 | 31.7 |
| 3150 | 31.5 |
| 4000 | 33.0 |
| 5000 | 36.4 |

FREQUENCIES 50HZ, 63HZ AND 80HZ ARE NOT UKAS ACCREDITED




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr})$ = 36 ( -2 ; -3 ) dB

$C_{50-3150}$ = -2 dB $C_{50-5000}$ = -2 dB $C_{100-5000}$ = -2 dB

$C_{tr,50-3150}$ = -5 dB $C_{tr,50-5000}$ = -5 dB $C_{tr,100-5000}$ = -4 dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

| | |
|---|---|
| Name of test institute: | The University of Salford, Acoustic Test Laboratory |
| **No. of test report:** | 1429-1201 |
| Date: 27/09/13 | Signature: |

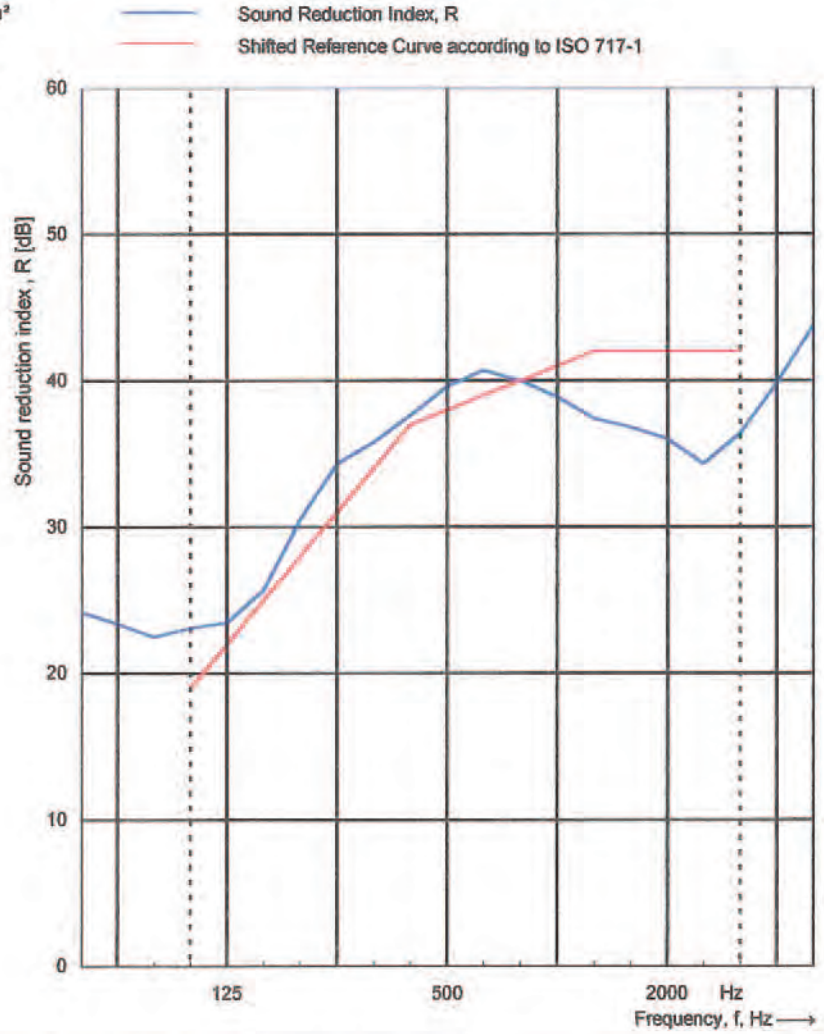
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 27/09/13 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | "ASTSPB50" Panel Enclosure System | | |
| Description of the specimen: | Please refer to Section 1 for a full description of the test object<br>Frame capped using "AcousticShield" on the source room side of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 101.6 kPa | | |
| Air temperature: | 22.2 °C | | |
| Relative air humidity: | 45.1 % | | |
| Mass per unit area: | 45.8 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

| Frequency f [Hz] | R 1/3 octave [dB] |
|---|---|
| 50 | 24.2 |
| 63 | 23.4 |
| 80 | 22.5 |
| 100 | 23.1 |
| 125 | 23.5 |
| 160 | 25.7 |
| 200 | 30.5 |
| 250 | 34.3 |
| 315 | 35.8 |
| 400 | 37.6 |
| 500 | 39.6 |
| 630 | 40.7 |
| 800 | 40.0 |
| 1000 | 38.9 |
| 1250 | 37.4 |
| 1600 | 36.8 |
| 2000 | 36.0 |
| 2500 | 34.3 |
| 3150 | 36.4 |
| 4000 | 39.8 |
| 5000 | 43.8 |

FREQUENCIES 50HZ, 63HZ AND 80HZ ARE NOT UKAS ACCREDITED




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr})$ = 38 ( -2 ; -3 ) dB

$C_{50\text{-}3150}$ = -2 dB $C_{50\text{-}5000}$ = -1 dB $C_{100\text{-}5000}$ = -1 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 in one-third-octave bands by an engineering method.

| | |
|---|---|
| Name of test institute: | The University of Salford, Acoustic Test Laboratory |
| **No. of test report:** | 1429-1203 |
| Date: 27/09/13 | Signature: |

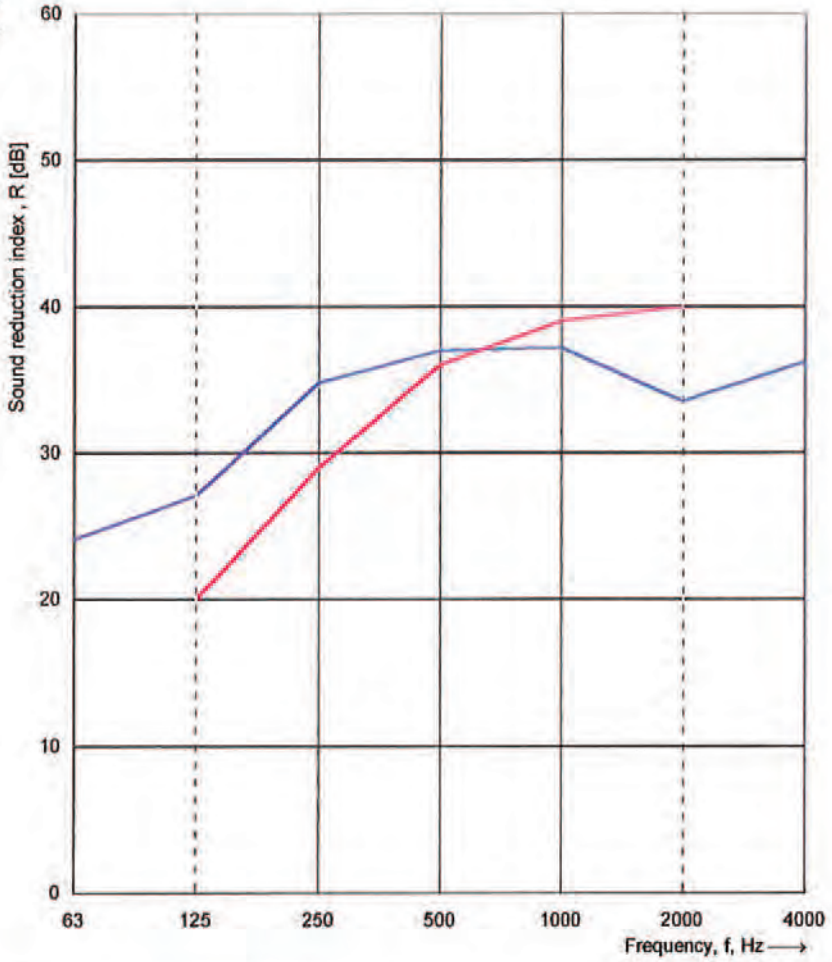
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 08/01/15 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | AS/TS/SBP50 TRIPLE SKIN | | |
| Description of the specimen: | Acoustic Panel System<br>Please refer to Section 1 for a full description of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 101.3 ± 0.0 kPa | | |
| Air temperature: | 19.8 ± 0.3 °C | | |
| Relative air humidity: | 36.7 ± 3.0 % | | |
| Mass per unit area: | 53.6 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

THE FREQUENCY 63HZ IS NOT UKAS ACCREDITED

| Frequency f [Hz] | R 1/1 octave [dB] |
|---|---|
| 63 | 24.1 |
| 125 | 27.1 |
| 250 | 34.8 |
| 500 | 37.0 |
| 1000 | 37.2 |
| 2000 | 33.5 |
| 4000 | 36.2 |




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr})$ = 36 ( -1 ; -1 ) dB

$C_{63\text{-}2000}$ = -1 dB $C_{63\text{-}4000}$ = -1 dB $C_{125\text{-}4000}$ = -1 dB

$C_{tr,63\text{-}2000}$ = -2 dB $C_{tr,63\text{-}4000}$ = -2 dB $C_{tr,125\text{-}4000}$ = -2 dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

| | |
|---|---|
| Name of test institute: | The University of Salford, Acoustic Test Laboratory |
| **Test Reference:** | 2060-1679 |
| Date: 08/01/15 | Signature: |

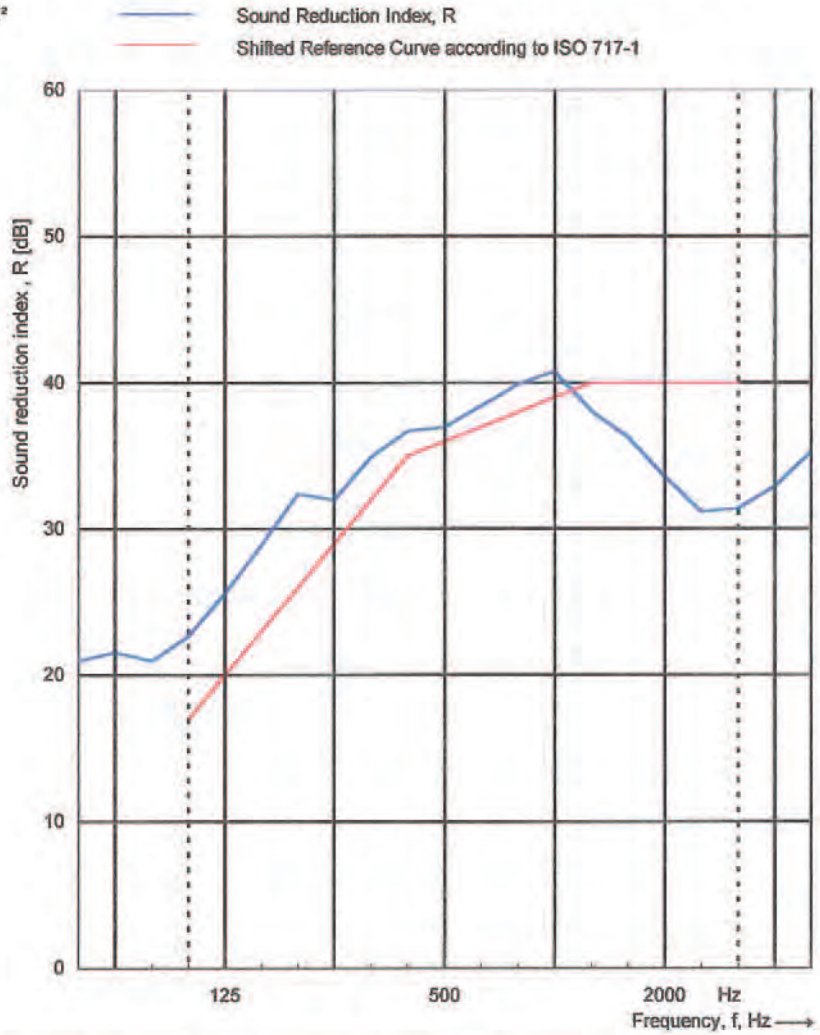
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 26/09/13 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | "ASTSAS50" Panel Enclosure System | | |
| Description of the specimen: | Please refer to Section 1 for a full description of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 101.7 kPa | | |
| Air temperature: | 21.9 °C | | |
| Relative air humidity: | 48.2 % | | |
| Mass per unit area: | 45.6 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

| Frequency f [Hz] | R 1/3 octave [dB] |
|---|---|
| 50 | 21.0 |
| 63 | 21.6 |
| 80 | 21.0 |
| 100 | 22.7 |
| 125 | 25.6 |
| 160 | 28.9 |
| 200 | 32.4 |
| 250 | 32.0 |
| 315 | 34.9 |
| 400 | 36.7 |
| 500 | 37.0 |
| 630 | 38.4 |
| 800 | 39.9 |
| 1000 | 40.8 |
| 1250 | 38.1 |
| 1600 | 36.3 |
| 2000 | 33.6 |
| 2500 | 31.2 |
| 3150 | 31.4 |
| 4000 | 32.9 |
| 5000 | 35.3 |

FREQUENCIES 50HZ, 63HZ AND 80HZ ARE NOT UKAS ACCREDITED




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr})$ = 36 ( -2 ; -1 ) dB

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

$C_{tr,50\text{-}3150}$ = -3 dB $C_{tr,50\text{-}5000}$ = -3 dB $C_{tr,100\text{-}5000}$ = -2 dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

Name of test institute: The University of Salford, Acoustic Test Laboratory

**No. of test report:** 1429-1200

Date: 26/09/13 Signature:

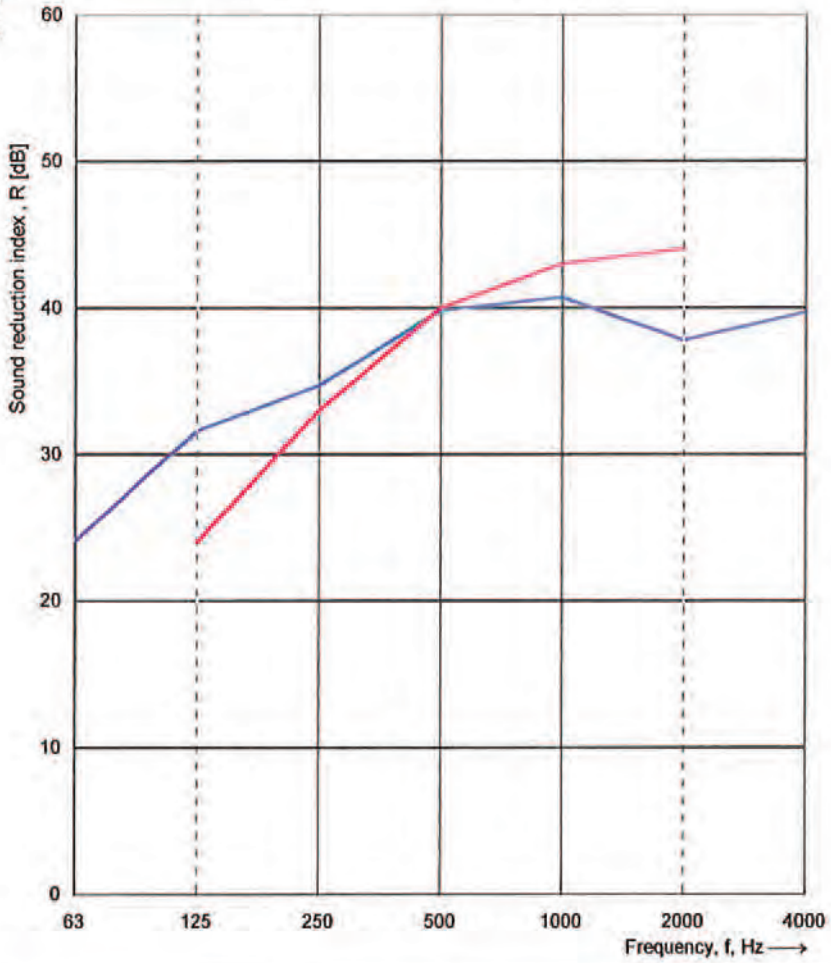
# Sound reduction index according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

| | | | |
|---|---|---|---|
| Client: | Air Handlers Northern | Date of test: | 12/01/15 |
| Manufacturer: | Client | | |
| Test room identification: | Acoustic Transmission Suite | | |
| Test specimen mounted by: | Client | | |
| Product identification: | AS/QS/PB50 QUADRUPLE SKIN | | |
| Description of the specimen: | Acoustic Panel System - FULLY SEALED<br>Please refer to Section 1 for a full description of the test object | | |
| Curing time: | NAP | | |
| Static pressure: | 99.6 ± 0.0 kPa | | |
| Air temperature: | 20.0 ± 0.3 °C | | |
| Relative air humidity: | 39.2 ± 3.0 % | | |
| Mass per unit area: | 62.9 kg/m² | | |
| Area, S, of the test sample: | 8.64 m² | | |
| Source room volume: | 136 m³ | | |
| Receiving room volume: | 220 m³ | | |

THE FREQUENCY 63HZ IS NOT UKAS ACCREDITED

| Frequency f [Hz] | R 1/1 octave [dB] |
|---|---|
| 63 | 24.1 |
| 125 | 31.6 |
| 250 | 34.7 |
| 500 | 39.8 |
| 1000 | 40.7 |
| 2000 | 37.8 |
| 4000 | 39.7 |




Rating according to BS EN ISO 717-1

$R_w (C ; C_{tr}) =$ 40 ( -1 ; -2 ) dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

$C_{63\text{-}2000} =$ -1 dB $C_{63\text{-}4000} =$ -1 dB $C_{125\text{-}4000} =$ -1 dB

$C_{tr,63\text{-}2000} =$ -3 dB $C_{tr,63\text{-}4000} =$ -4 dB $C_{tr,125\text{-}4000} =$ -3 dB

Name of test institute: The University of Salford, Acoustic Test Laboratory

**Test Reference:** 2060-1689

Date: 12/01/15 Signature:

## Notes

## Notes