Technical Report

Ref Number ***C/22312/R01***

Date ***12 November 2012***

Project

The Laboratory Determination of The Airborne Sound Transmission of Single Door Sets

Prepared for

Acoustic & Fire Door Solutions Ltd
3 Esplanade
Broughty Ferry
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By

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1.0 Summary

Tests have been done in SRL's Laboratory at Holbrook House, Sudbury, Suffolk, to determine the sound reduction index of single door sets in accordance with BS EN ISO 10140-2:2010.

From these measurements the required results have been derived and are presented in both tabular and graphic form in Data Sheets 1 to 9.

The results are given in 1/3rd octave bands over the frequency range 50Hz to 10kHz, which is beyond that required by the test standard. Measurements outside the standard frequency range are not UKAS accredited.

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Allen Smalls
Quality Manager
Signed in the absence of
Trevor Hickman
Technical Manager

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Contents

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2.0 Details of Measurements

2.1 Location

Sound Research Laboratories
Holbrook House
Little Waldingfield
Sudbury
Suffolk
CO10 OTH

2.2 Test Dates

12 October 2012

2.3 Instrumentation and Apparatus Used

Make	Description	Type
E D I	Microphone Multiplexer	
	Microphone Power Supply Unit	
Norwegian Electronics	Real Time Analyser	830
	Rotating Microphone Boom	231
Brüel & Kjaer	12mm Condenser Microphones	4166
	Windshields	UA0237
	Pre Amplifiers	2639, 2669C
	Microphone Calibrator	4231
	Omnipower Sound Source	4296
Larson Davis	12mm Condenser Microphone	2560
SRL	Voltage controller	
Celestion	Loudspeakers	100w
Douglas Curtis	Rotating Microphone Boom	
Thermo Hygro	Temperature & Humidity Probe	
TOA	Graphic Equalizer	E-1231
QSC Audio	Power Amplifier	RMX 1450

2.4 References

BS EN ISO 10140-2:2010	Laboratory measurement of airborne sound insulation of building elements
BS EN ISO 717-1:1997	Rating of sound insulation in buildings and of building elements. Airborne Sound Insulation.

2.5 Personnel Present

Chris Gough	Acoustic & Fire Door Solutions
Steffen Donath	Sauerland Spanplatte
Dan Jones	Norseal

3.0 Description of Test

3.1 Description of Sample

A single timber door, a single glazed timber door and a single timber door with overpanel were tested.

The door sets (including overpanel where applicable) measured 2.840mm high x 1.140mm wide.

Glazing (where applicable) measured 2.210m high x 0.25m wide.

The samples were screw fixed to the test aperture and the perimeter was sealed using mastic.

Sampling plan:	Enough for test only
Sample condition:	New
Details supplied by:	Acoustic & Fire Door Solutions Ltd
Sample installed by:	Acoustic & Fire Door Solutions Ltd

3.2 Sample Delivery date

10 October 2012

3.3 Test Procedures

The sample was mounted/located and tested in accordance with the relevant standard. The method and procedure is described in Appendix 1. The measurement uncertainty is given in Appendix 2.

4.0 Results

The results of the measurements and subsequent analysis are given in Data Sheets 1 to 9 and are summarised below.

Results relate only to the items tested.

SRL Test No.	Description in Brief	R_w ($C;C_{tr}$)
2	TriSound timber door within a Sapele hardwood frame Fully caulked	41(-1;-3)
3	TriSound timber door within a Sapele hardwood frame Fully caulked Door banged and re-tested	42(-1-4)
5	TriSound timber door within a Sapele hardwood frame with seals Head & jambs - NOR 710 and NOR 720 (cut away at hinges) Threshold - NOR810dB+ on a NOR 625 threshold plate	40(-1;-3)
6	TriSound timber door within a Sapele hardwood frame with seals Head & jambs - NOR 710 and NOR 720 (cut away at hinges) Threshold - NOR810dB+	39(-1;-2)
7	TriSound 62 glazed timber door within a Sapele hardwood frame with seals Head & jambs - NOR 710 and NOR 720 (cut away at hinges) Threshold - NOR810dB+ on a NOR 625 threshold plate	39(0;-2)
8	TriSound 62 glazed timber door within a Sapele hardwood frame Fully caulked	42(-1;-4)
9	TriSound 62 timber door within a Sapele hardwood frame Head & jambs - NOR 710 and NOR 720 (cut away at hinges) Threshold – Planet HS on a 625 threshold plate	38(0;-2)
10	TriSound 54 timber door with flush ovepanel within a Sapele hardwood frame with seals Head - 2x NOR720 Jambs - 1x NOR710 & 1x NOR720 (cut away at hinges) Threshold - 810dB+ on a NOR 625 threshold plate	41(-1;-5)
11	TriSound 54 timber door with flush ovepanel within a Sapele hardwood frame with seals Head - 1x NOR720 & 1x NOR 710 Jambs - 1x NOR710 & 1x NOR720 (cut away at hinges) Threshold - 810dB+ on a NOR 625 threshold plate	41(-1;-4)

End of Text

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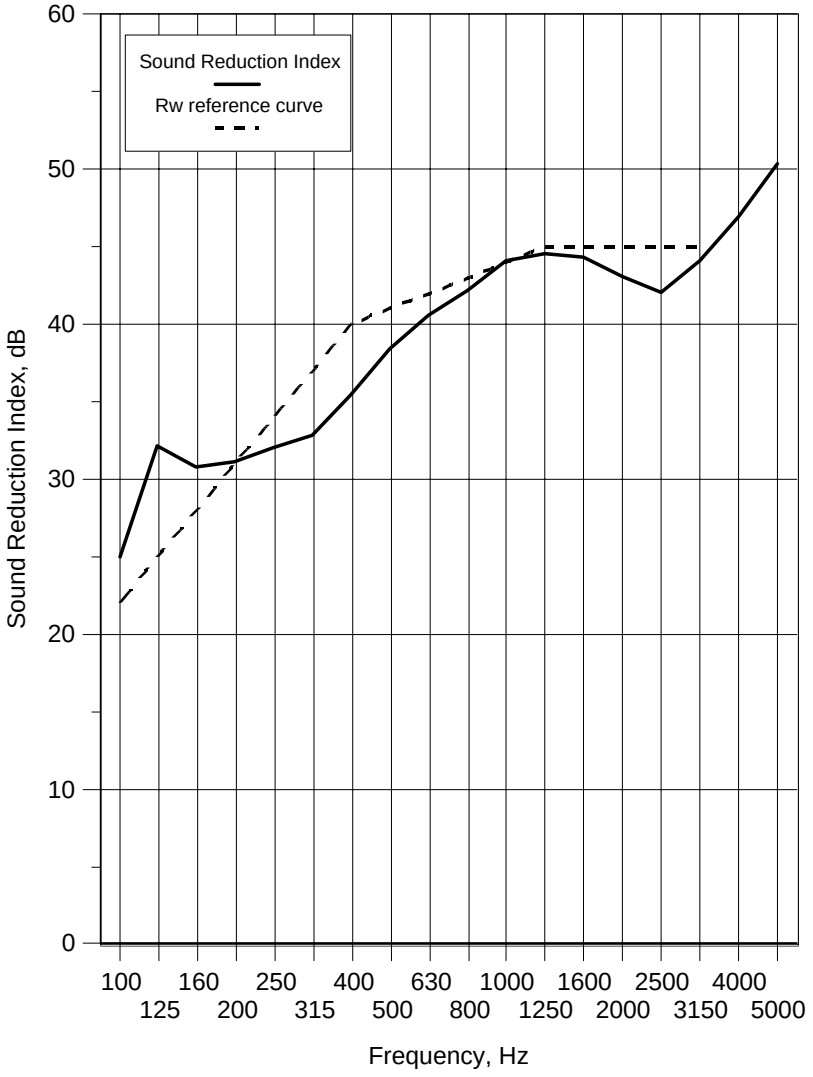
Data Sheet 1

Test Number :	2	**Test Room:**	**Source**	**Receiving**
Client:	Acoustic & Fire Door Solutions	**Air temperature:**	13.9 °C	13.9 °C
Test Date:	12/10/2012	**Air humidity:**	65 %	65 %
Sample height:	2.845 m	**Volume:**	55 m3	50 m3
Sample width:	1.14 m			
Sample weight:	41 kg/m2		**Air Pressure:**	984 mbar
Product Identification:	TriSound timber door within a Sapele hardwood frame Fully caulked			

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	29.4	
63+	31.2	28.7
80+	26.7	
100	25.0	
125	32.2	28.1
160	30.8	
200	31.1	
250	32.0	31.9
315	32.8	
400	35.5	
500	38.4	37.7
630	40.6	
800	42.2	
1000	44.1	43.5
1250	44.6	
1600	44.3	
2000	43.1	43.1
2500	42.1	
3150	44.1	
4000	47.0	46.5
5000	50.4	
6300+	53.2	
8000+	53.7	53.3
10000+	53.0 *	
Average 100-3150	37.7	Version v2.0



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **41 (-1;-3) dB**

* shows measurement corrected for background

+ shows frequency beyond standard and not UKAS accredited

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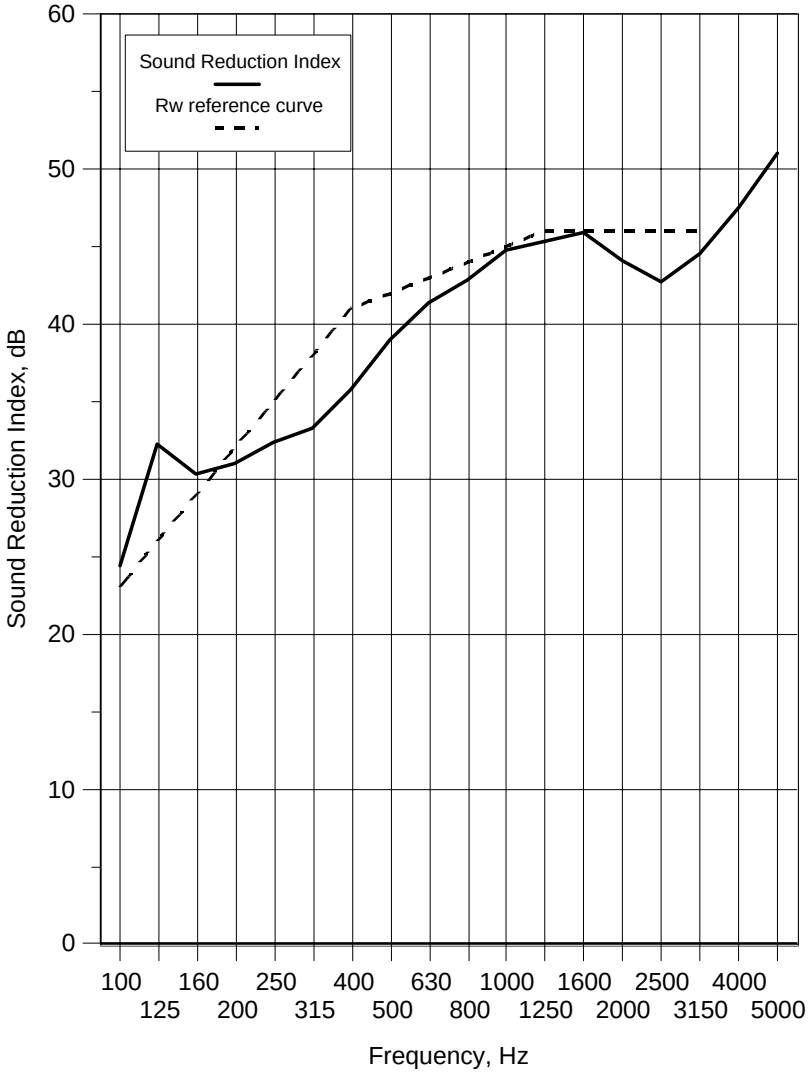
Data Sheet 2

Test Number :	3	**Test Room:**	**Source**	**Receiving**
Client:	Acoustic & Fire Door Solutions	**Air temperature:**	14.1 °C	14.1 °C
Test Date:	12/10/2012	**Air humidity:**	64 %	64 %
Sample height:	2.845 m	**Volume:**	55 m3	50 m3
Sample width:	1.14 m			
Sample weight:	41 kg/m2		**Air Pressure:**	984 mbar
Product Identification:	TriSound timber door within a Sapele hardwood frame Fully caulked Door banged and re-tested			

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	27.7	
63+	30.0	26.9
80+	24.7	
100	24.4	
125	32.3	27.6
160	30.3	
200	31.0	
250	32.4	32.1
315	33.3	
400	35.8	
500	39.0	38.1
630	41.4	
800	42.9	
1000	44.8	44.3
1250	45.4	
1600	45.9	
2000	44.1	44.1
2500	42.7	
3150	44.6	
4000	47.5	47.0
5000	51.1	
6300+	55.1	
8000+	54.7	54.5
10000+	53.9 *	
Average 100-3150	38.1	Version v2.0



Rating according to BS EN ISO 717-1:1997	* shows measurement corrected for background
Rw(C;Ctr)= **42 (-1;-4) dB**	+ shows frequency beyond standard and not UKAS accredited

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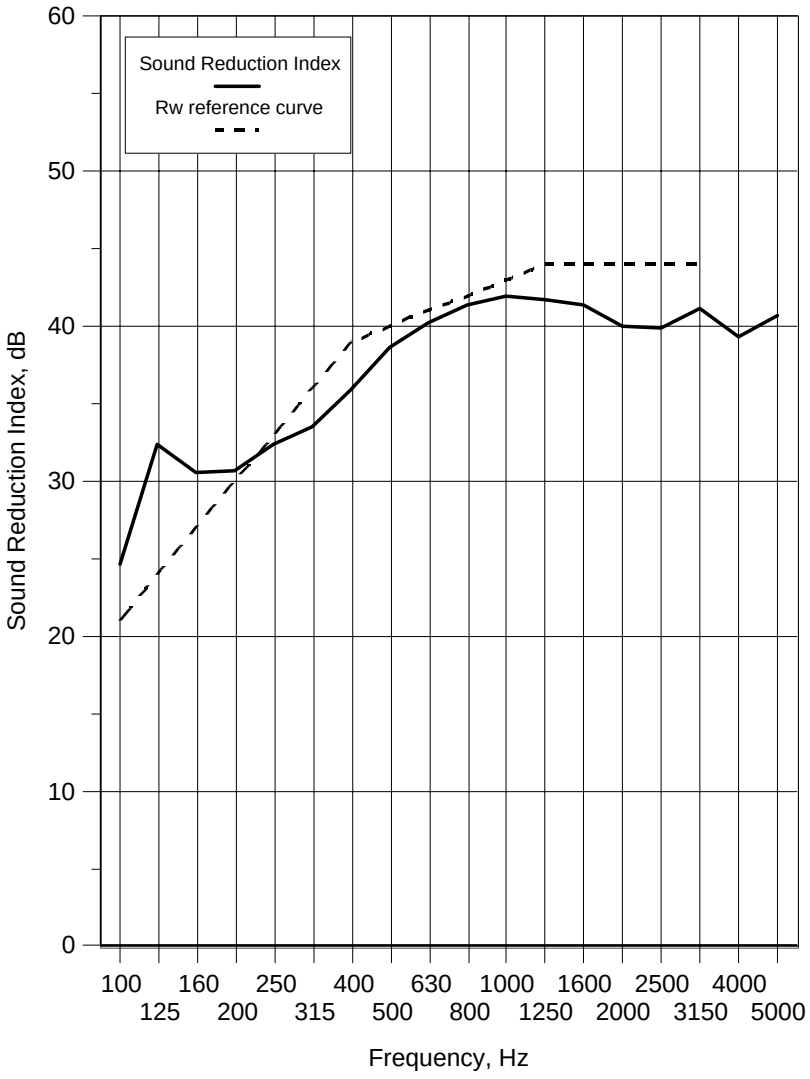
Data Sheet 3

			Source	Receiving
Test Number :	5	**Test Room:**		
Client:	Acoustic & Fire Door Solutions	**Air temperature:**	14.4 °C	14.4 °C
Test Date:	12/10/2012	**Air humidity:**	64 %	64 %
Sample height:	2.845 m	**Volume:**	55 m3	50 m3
Sample width:	1.14 m			
Sample weight:	41 kg/m2	**Air Pressure:**	984 mbar	

Product Identification: TriSound timber door within a Sapele hardwood frame with seals
Head & jambs - NOR 710 and NOR 720 (cut away at hinges)
Threshold - NOR810dB+ on a NOR 625 threshold plate

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	28.4	
63+	31.6	27.8
80+	25.4	
100	24.6	
125	32.4	27.9
160	30.6	
200	30.7	
250	32.4	32.0
315	33.5	
400	35.9	
500	38.6	37.9
630	40.3	
800	41.4	
1000	41.9	41.6
1250	41.7	
1600	41.4	
2000	40.0	40.4
2500	39.9	
3150	41.2	
4000	39.3	40.4
5000	40.7	
6300+	43.6	
8000+	45.5	45.4
10000+	48.1	
Average 100-3150	36.7	Version v2.0



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **40 (-1;-3) dB**

* shows measurement corrected for background

\+ shows frequency beyond standard and not UKAS accredited

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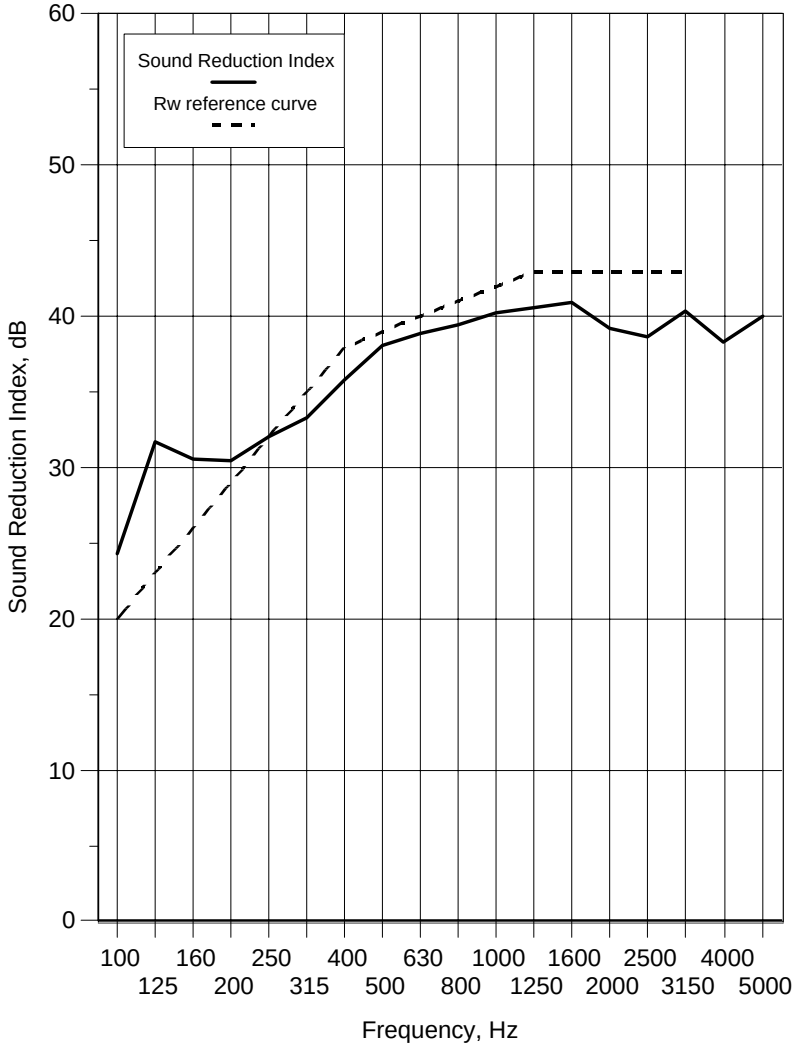
Data Sheet 4

Test Number :	6	**Test Room:**	**Source**	**Receiving**
Client:	Acoustic & Fire Door Solutions	**Air temperature:**	14.4 °C	14.4 °C
Test Date:	12/10/2012	**Air humidity:**	64 %	64 %
Sample height:	2.845 m	**Volume:**	55 m3	50 m3
Sample width:	1.14 m			
Sample weight:	41 kg/m2		**Air Pressure:**	984 mbar

Product Identification: TriSound timber door within a Sapele hardwood frame with seals
Head & jambs - NOR 710 and NOR 720 (cut away at hinges)
Threshold - NOR810dB+

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	29.0	27.5
63+	31.4	
80+	24.7	
100	24.3	27.6
125	31.7	
160	30.6	
200	30.5	31.8
250	32.1	
315	33.3	
400	35.8	37.4
500	38.1	
630	38.9	
800	39.5	40.1
1000	40.2	
1250	40.6	
1600	40.9	39.4
2000	39.2	
2500	38.6	
3150	40.4	39.5
4000	38.3	
5000	40.0	
6300+	43.1	44.7
8000+	44.7	
10000+	47.3	
Average 100-3150	35.9	Version v2.0



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **39 (-1;-2) dB**

* shows measurement corrected for background

+ shows frequency beyond standard and not UKAS accredited

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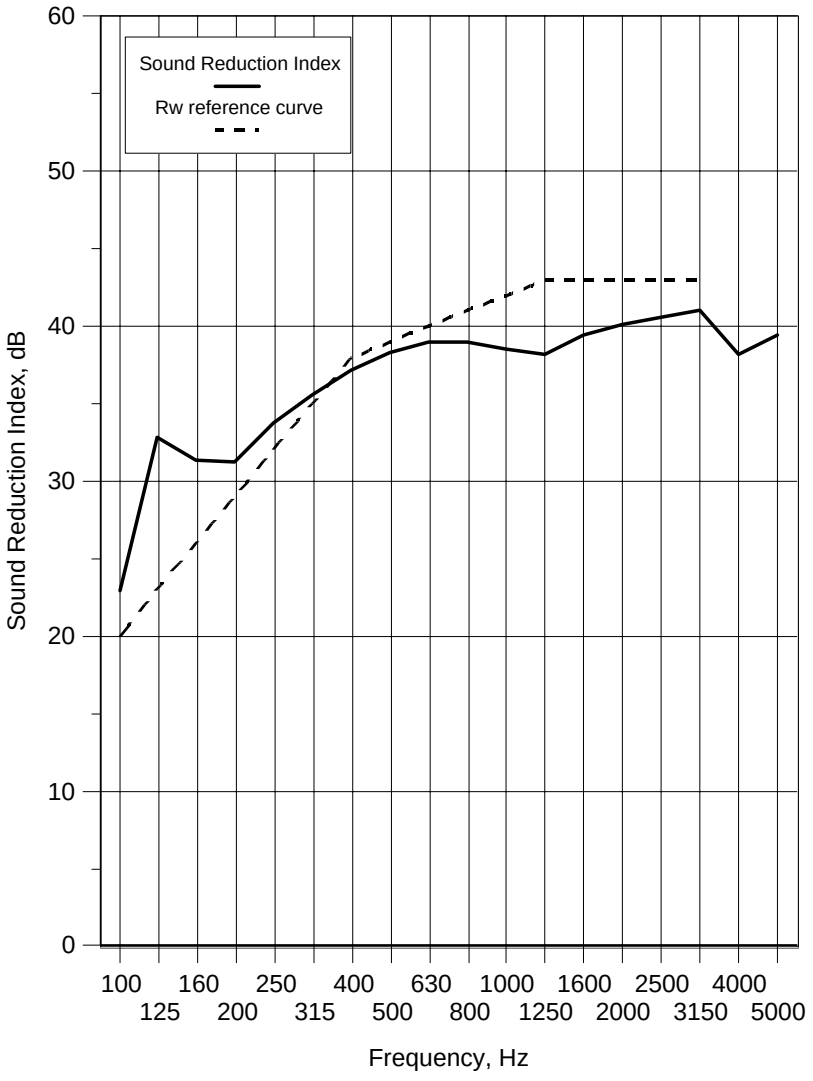
Data Sheet 5

Test Number :	7	**Test Room:**	**Source**	**Receiving**
Client:	Acoustic & Fire Door Solutions	**Air temperature:**	14.6 °C	14.6 °C
Test Date:	12/10/2012	**Air humidity:**	64 %	64 %
Sample height:	2.845 m	**Volume:**	55 m3	50 m3
Sample width:	1.14 m			
Sample weight:	41 kg/m2		**Air Pressure:**	984 mbar

Product Identification: TriSound 62 glazed timber door within a Sapele hardwood frame with seals
Head & jambs - NOR 710 and NOR 720 (cut away at hinges)
Threshold - NOR810dB+ on a NOR 625 threshold plate

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	28.8	
63+	33.1	27.1
80+	24.0	
100	22.9	
125	32.8	26.7
160	31.4	
200	31.3	
250	33.8	33.2
315	35.6	
400	37.2	
500	38.3	38.1
630	39.0	
800	39.0	
1000	38.5	38.6
1250	38.2	
1600	39.4	
2000	40.1	40.0
2500	40.6	
3150	41.1	
4000	38.2	39.4
5000	39.5	
6300+	43.0	
8000+	44.9	44.8
10000+	47.7	
Average 100-3150	36.2	Version v2.0



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **39 (0;-2) dB**

* shows measurement corrected for background

\+ shows frequency beyond standard and not UKAS accredited

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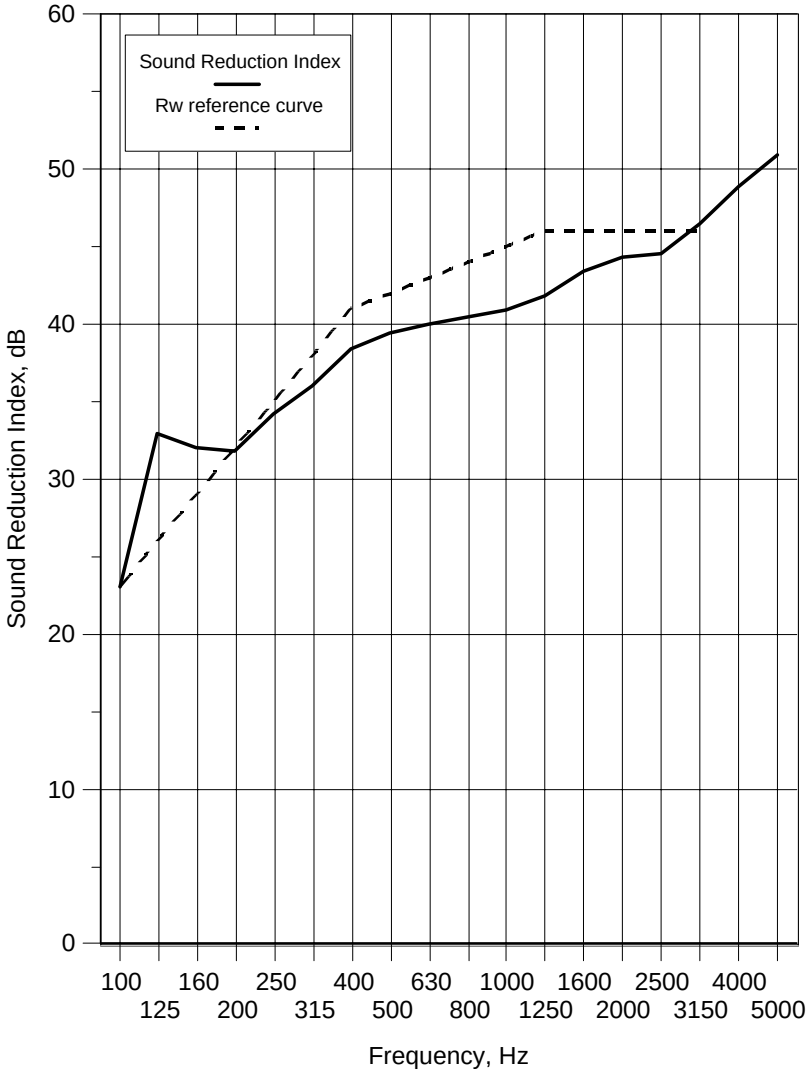
Data Sheet 6

Test Number :	8	**Test Room:**	**Source**	**Receiving**
Client:	Acoustic & Fire Door Solutions	**Air temperature:**	14.6 °C	14.6 °C
Test Date:	12/10/2012	**Air humidity:**	63 %	63 %
Sample height:	2.845 m	**Volume:**	55 m3	50 m3
Sample width:	1.14 m			
Sample weight:	41 kg/m2		**Air Pressure:**	984 mbar
Product Identification:	TriSound 62 glazed timber door within a Sapele hardwood frame Fully caulked			

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	29.8	
63+	34.0	26.3
80+	22.5	
100	23.0	
125	33.0	26.9
160	32.1	
200	31.8	
250	34.2	33.7
315	36.0	
400	38.4	
500	39.5	39.3
630	40.0	
800	40.5	
1000	40.9	41.0
1250	41.8	
1600	43.4	
2000	44.4	44.1
2500	44.6	
3150	46.5	
4000	48.9	48.4
5000	51.0	
6300+	54.3	
8000+	55.5	54.1
10000+	52.9 *	
Average 100-3150	38.1	Version v2.0



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **42 (-1;-4) dB**

* shows measurement corrected for background

+ shows frequency beyond standard and not UKAS accredited

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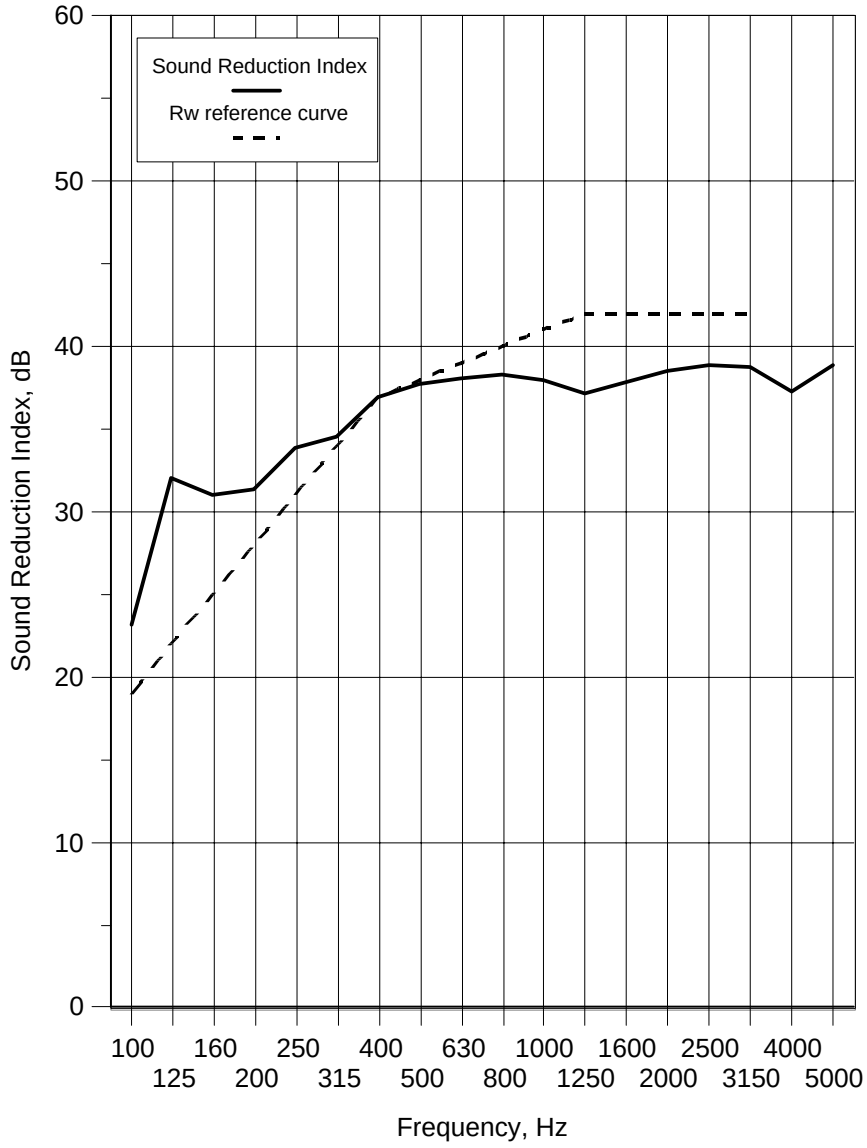
Data Sheet 7

Test Number :	9	**Test Room:**	**Source**	**Receiving**
Client:	Acoustic & Fire Door Solutions	**Air temperature:**	14.6 °C	14.6 °C
Test Date:	12/10/2012	**Air humidity:**	63 %	63 %
Sample height:	2.845 m	**Volume:**	55 m3	50 m3
Sample width:	1.14 m			
Sample weight:	41 kg/m2		**Air Pressure:**	984 mbar

Product Identification: TriSound62 timber door within a Sapele hardwood frame
Head & jambs - NOR710 and NOR720 (cut away at hinges)
Threshold - Planet HS on a 625 threshold plate

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	29.9	
63+	33.9	26.7
80+	23.0	
100	23.2	
125	32.1	26.8
160	31.0	
200	31.4	
250	33.9	33.1
315	34.6	
400	36.9	
500	37.7	37.6
630	38.1	
800	38.3	
1000	38.0	37.8
1250	37.2	
1600	37.8	
2000	38.5	38.4
2500	38.9	
3150	38.8	
4000	37.3	38.3
5000	38.9	
6300+	42.5	
8000+	45.2	44.6
10000+	47.3	
Average 100-3150	35.4	Version v2.0



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **38 (0;-2) dB**

* shows measurement corrected for background

\+ shows frequency beyond standard and not UKAS accredited

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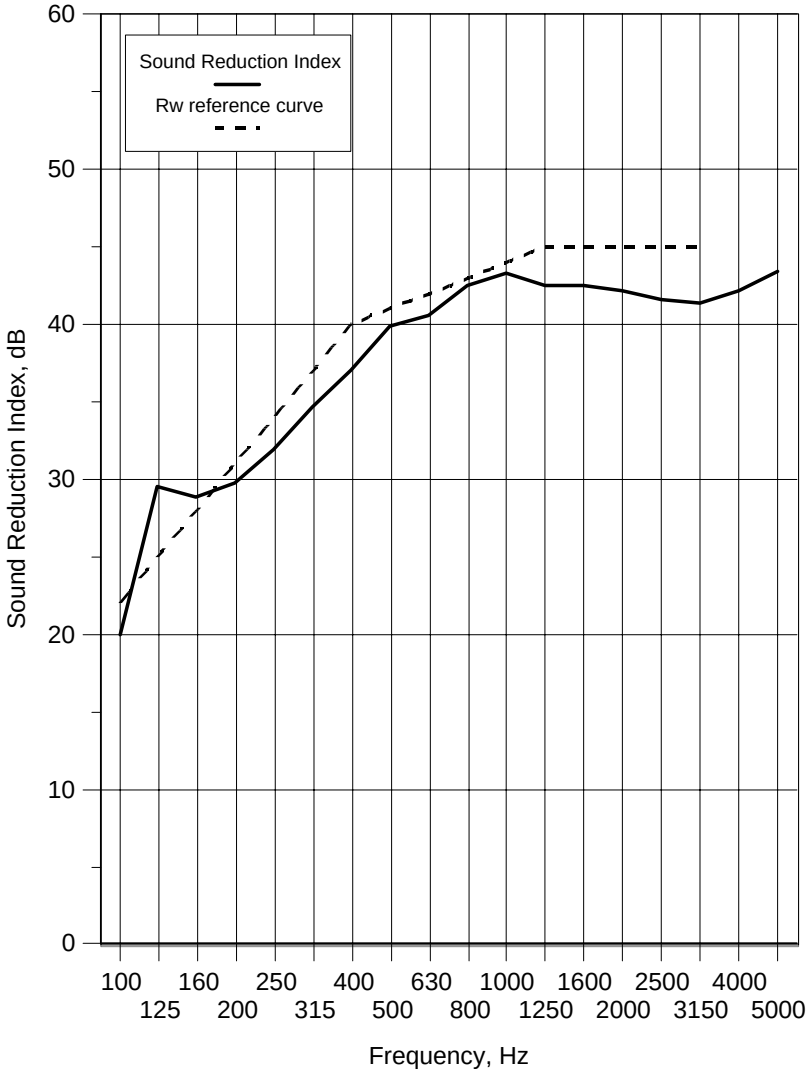
Data Sheet 8

			Source	Receiving
Test Number :	10	**Test Room:**		
Client:	Acoustic & Fire Door Solutions	**Air temperature:**	14.4 °C	14.4 °C
Test Date:	12/10/2012	**Air humidity:**	63 %	63 %
Sample height:	2.845 m	**Volume:**	55 m3	50 m3
Sample width:	1.14 m			
Sample weight:	34 kg/m2	**Air Pressure:**	984 mbar	

Product Identification: TriSound 54 timber door with flush ovepanel within a Sapele hardwood frame with seals
Head - 2x NOR720 Jambs - 1x NOR710 & 1x NOR720 (cut away at hinges)
Threshold - 810dB+ on a NOR 625 threshold plate

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	28.0	
63+	30.0	24.7
80+	21.2	
100	20.0	
125	29.5	23.9
160	28.9	
200	29.8	
250	31.9	31.7
315	34.7	
400	37.1	
500	39.9	39.0
630	40.6	
800	42.5	
1000	43.3	42.8
1250	42.5	
1600	42.5	
2000	42.2	42.1
2500	41.6	
3150	41.4	
4000	42.2	42.2
5000	43.4	
6300+	44.5	
8000+	45.6	45.7
10000+	47.5	
Average 100-3150	36.8	Version v2.0



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **41 (-1;-5) dB**

* shows measurement corrected for background

\+ shows frequency beyond standard and not UKAS accredited

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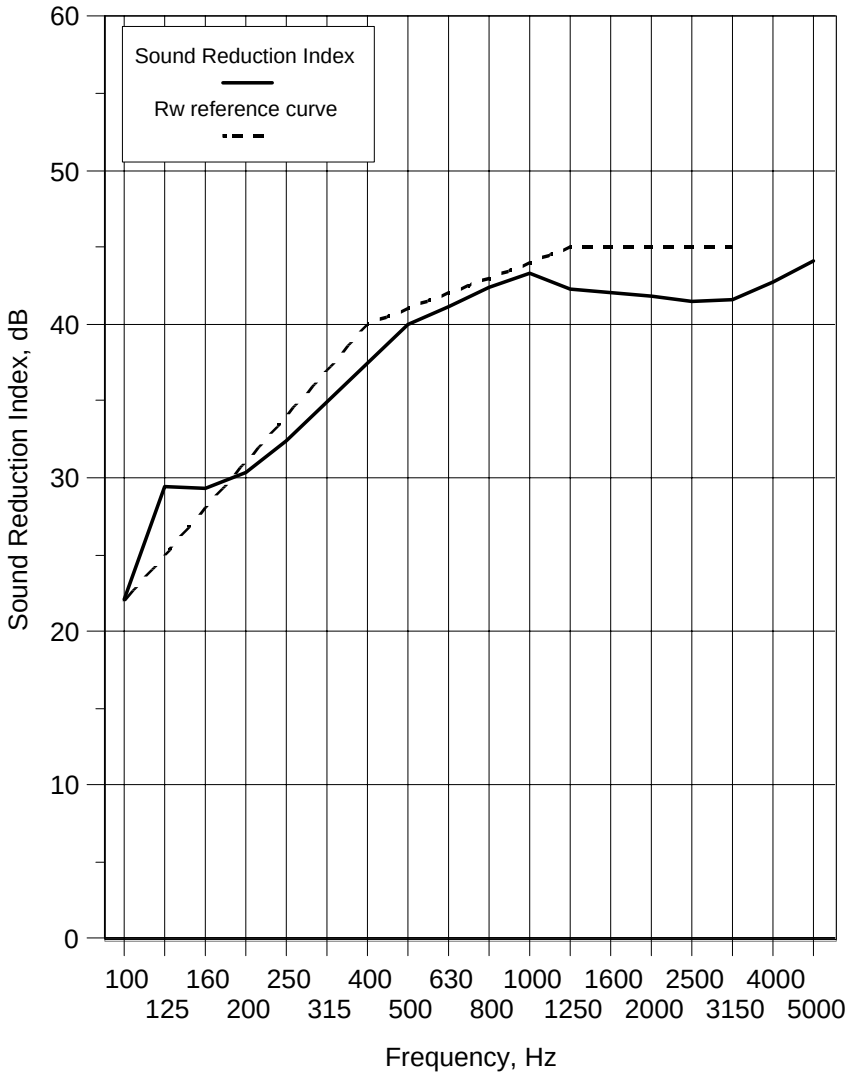
Data Sheet 9

			Source	Receiving
Test Number :	11	**Test Room:**		
Client:	Acoustic & Fire Door Solutions	**Air temperature:**	14.3 °C	14.3 °C
Test Date:	12/10/2012	**Air humidity:**	63 %	63 %
Sample height:	2.845 m	**Volume:**	55 m3	50 m3
Sample width:	1.14 m			
Sample weight:	34 kg/m2	**Air Pressure:**	984 mbar	

Product Identification: TriSound 54 timber door with flush ovepanel within a Sapele hardwood frame with seals
Head - 1x NOR720 & 1xNOR710 Jambs - 1x NOR710 & 1x NOR720 (cut away at hinges)
Threshold - 810dB+ on a NOR 625 threshold plate

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	26.7	25.8
63+	29.6	
80+	23.4	
100	22.1	25.4
125	29.4	
160	29.3	
200	30.4	32.2
250	32.4	
315	34.9	
400	37.5	39.3
500	40.0	
630	41.1	
800	42.4	42.6
1000	43.3	
1250	42.3	
1600	42.1	41.8
2000	41.8	
2500	41.5	
3150	41.6	42.7
4000	42.7	
5000	44.1	
6300+	45.2	46.4
8000+	46.2	
10000+	48.5	
Average 100-3150	37.0	Version v2.0



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **41 (-1;-4) dB**

* shows measurement corrected for background

\+ shows frequency beyond standard and not UKAS accredited

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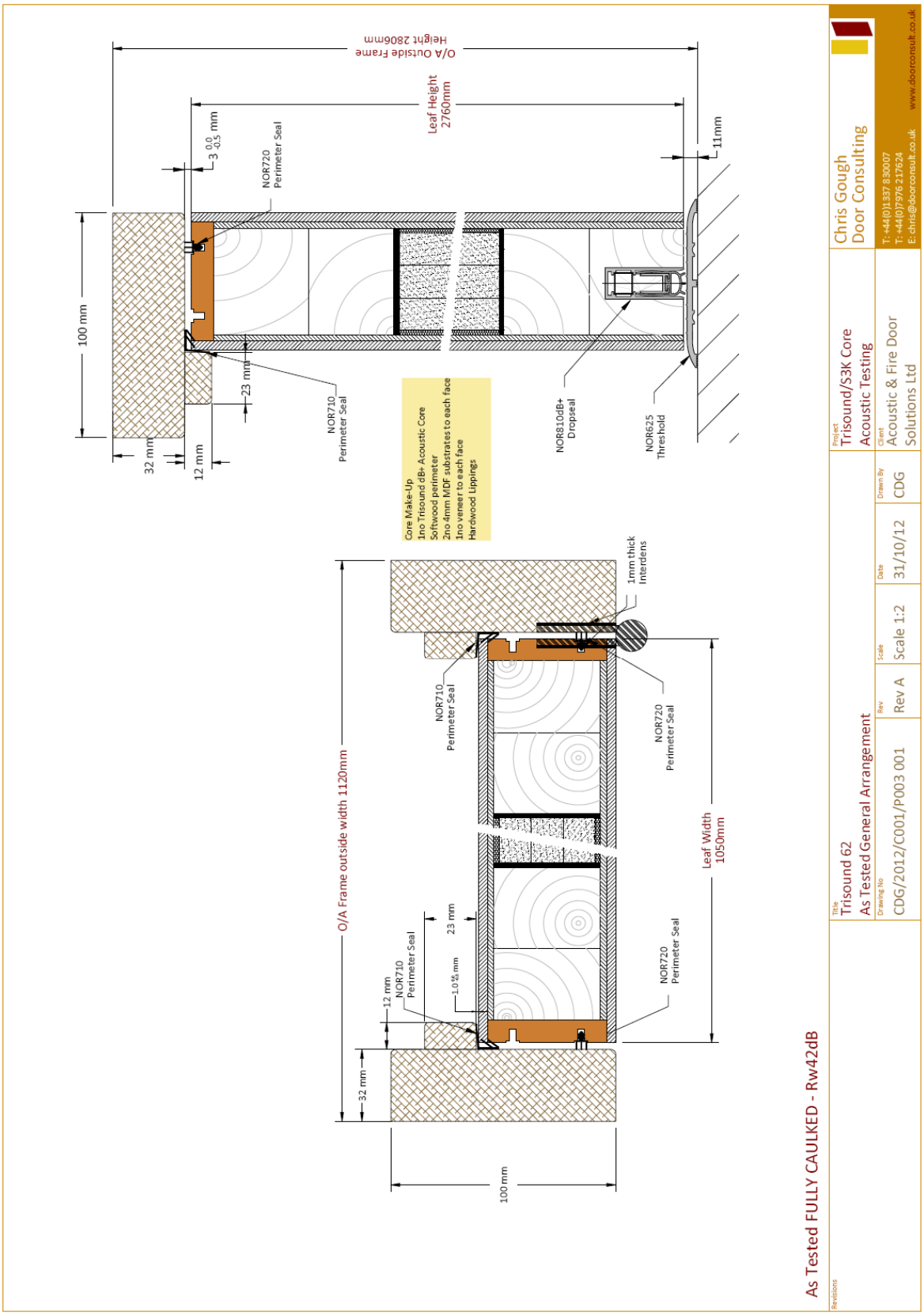
Drawing 1



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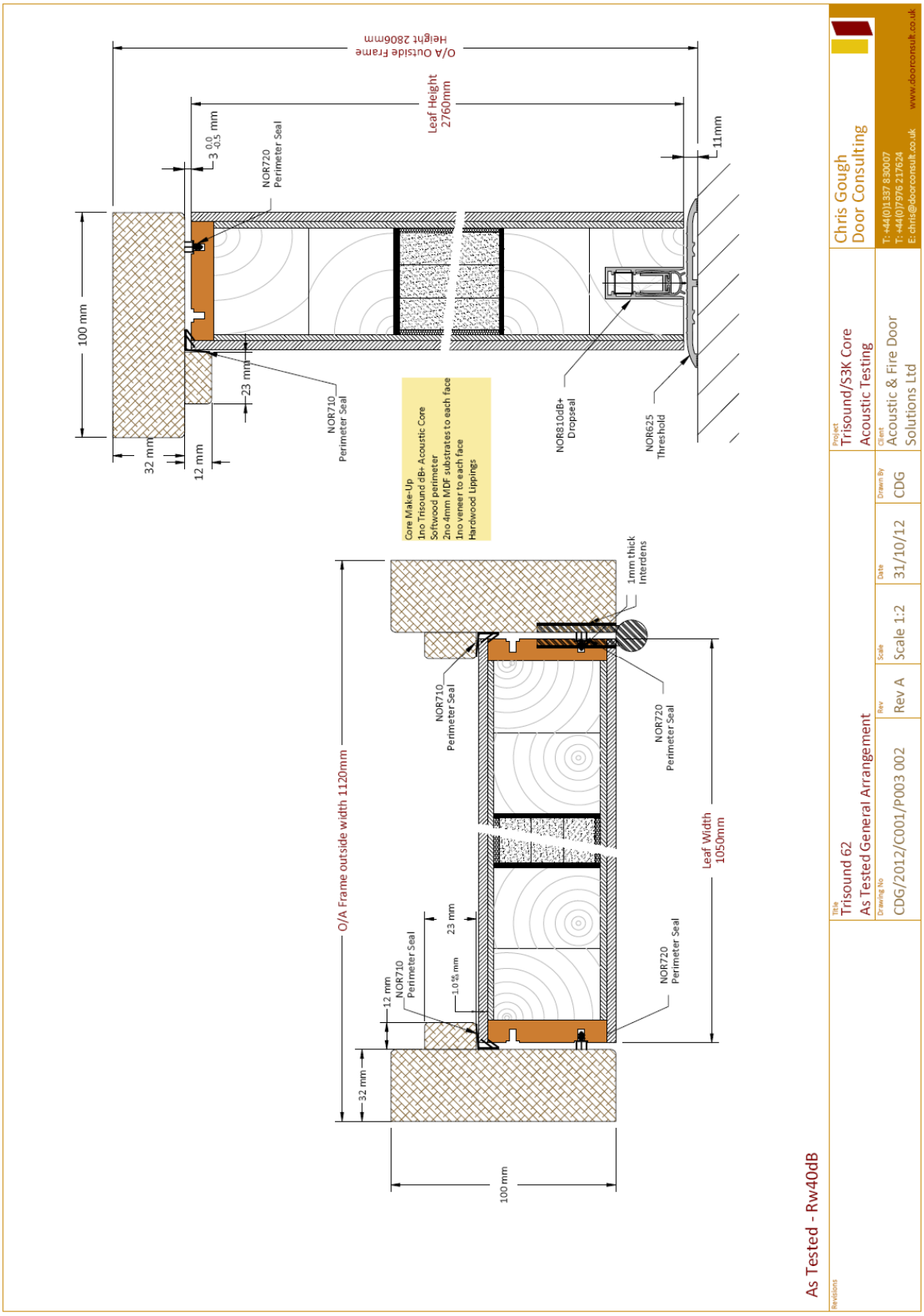
Drawing 2



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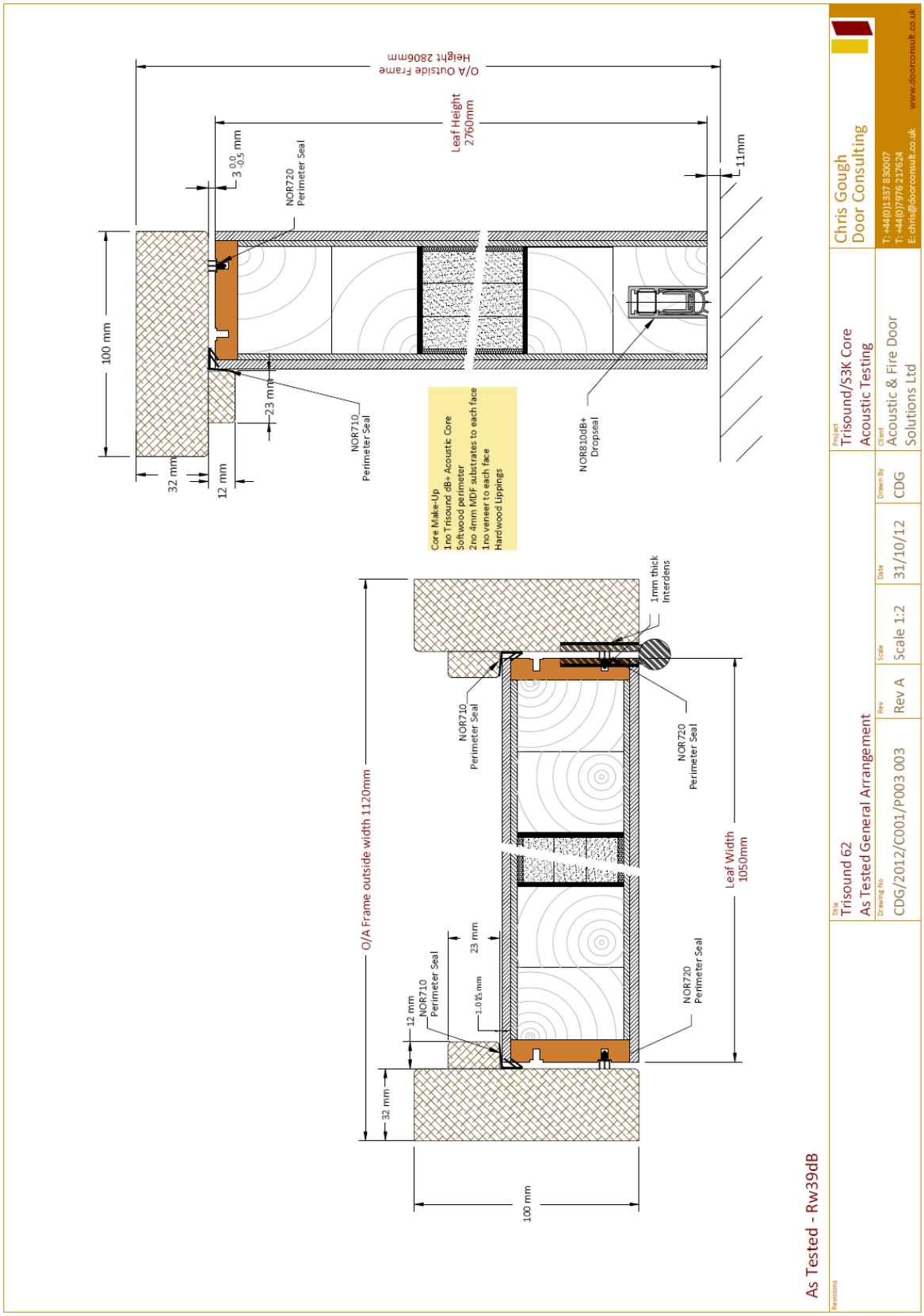

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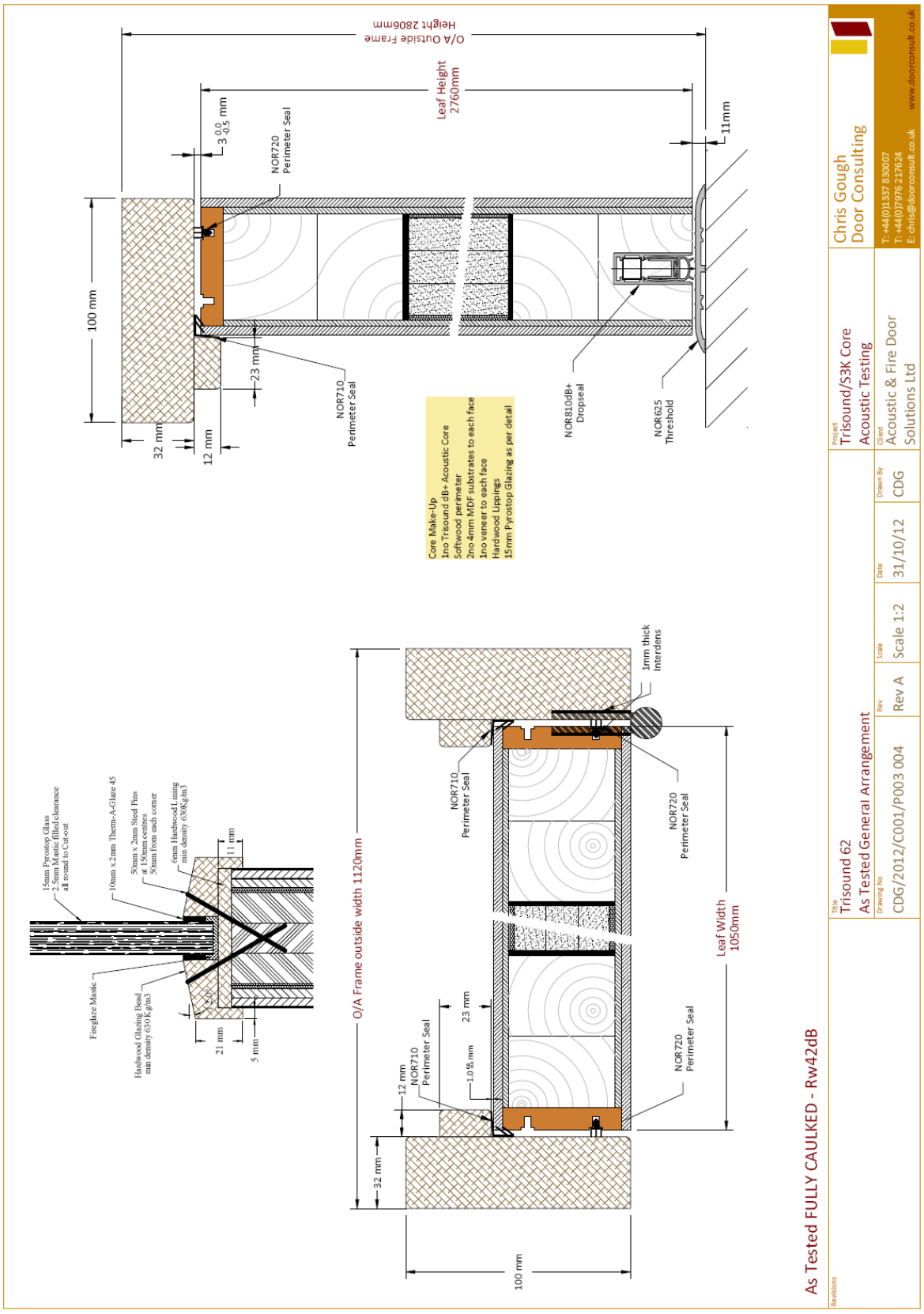
Drawing 4



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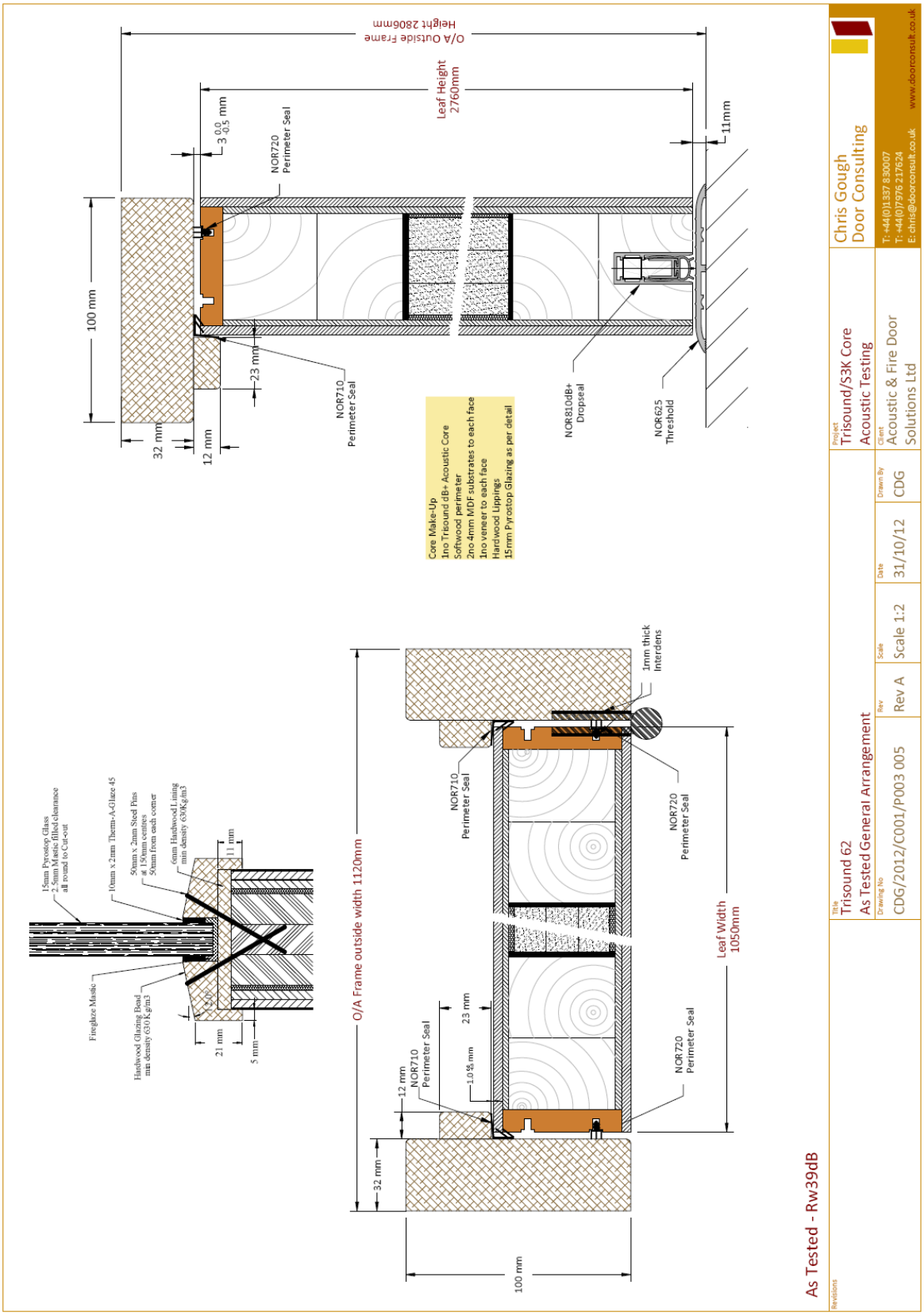
Drawing 5



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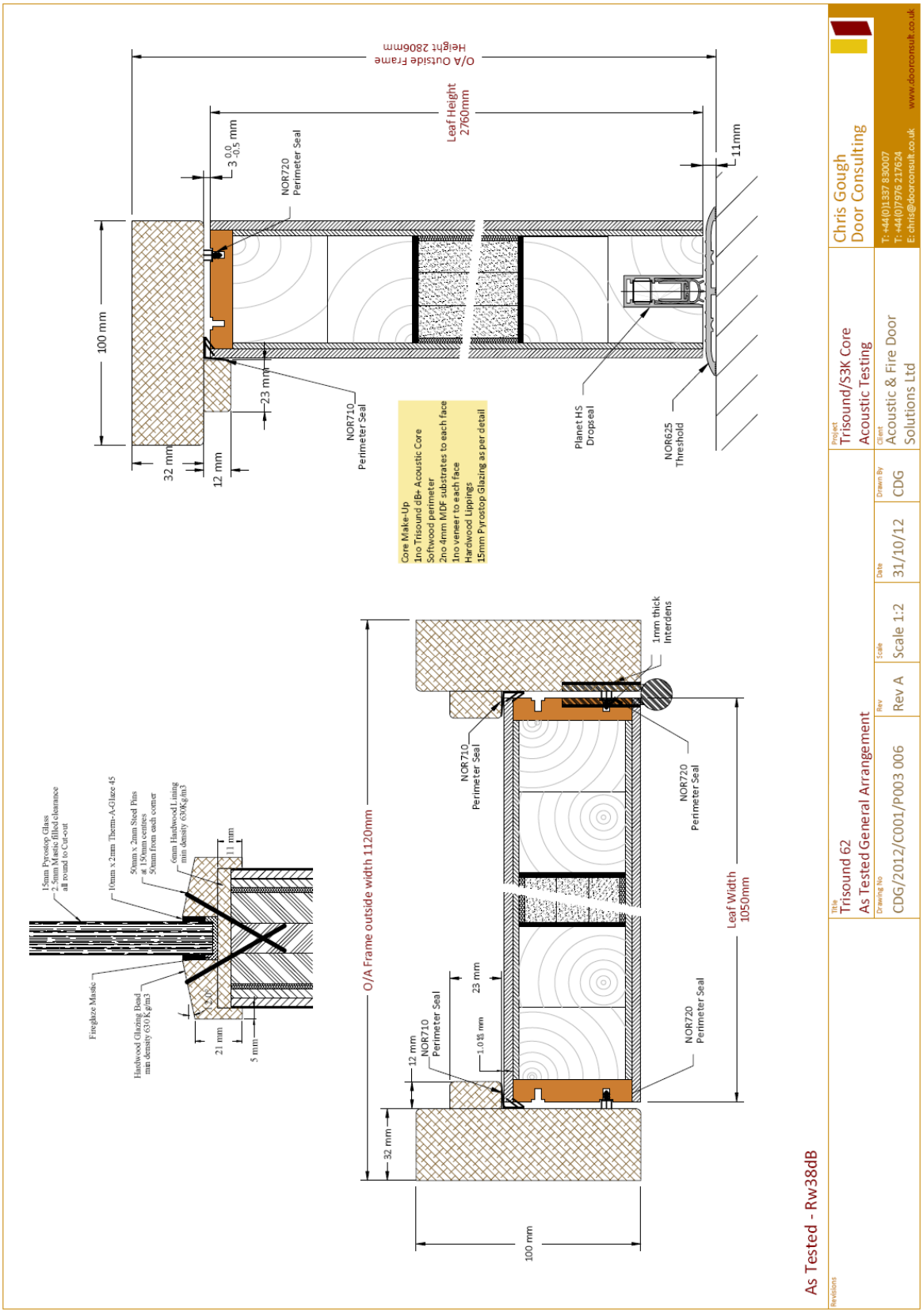
Drawing 6



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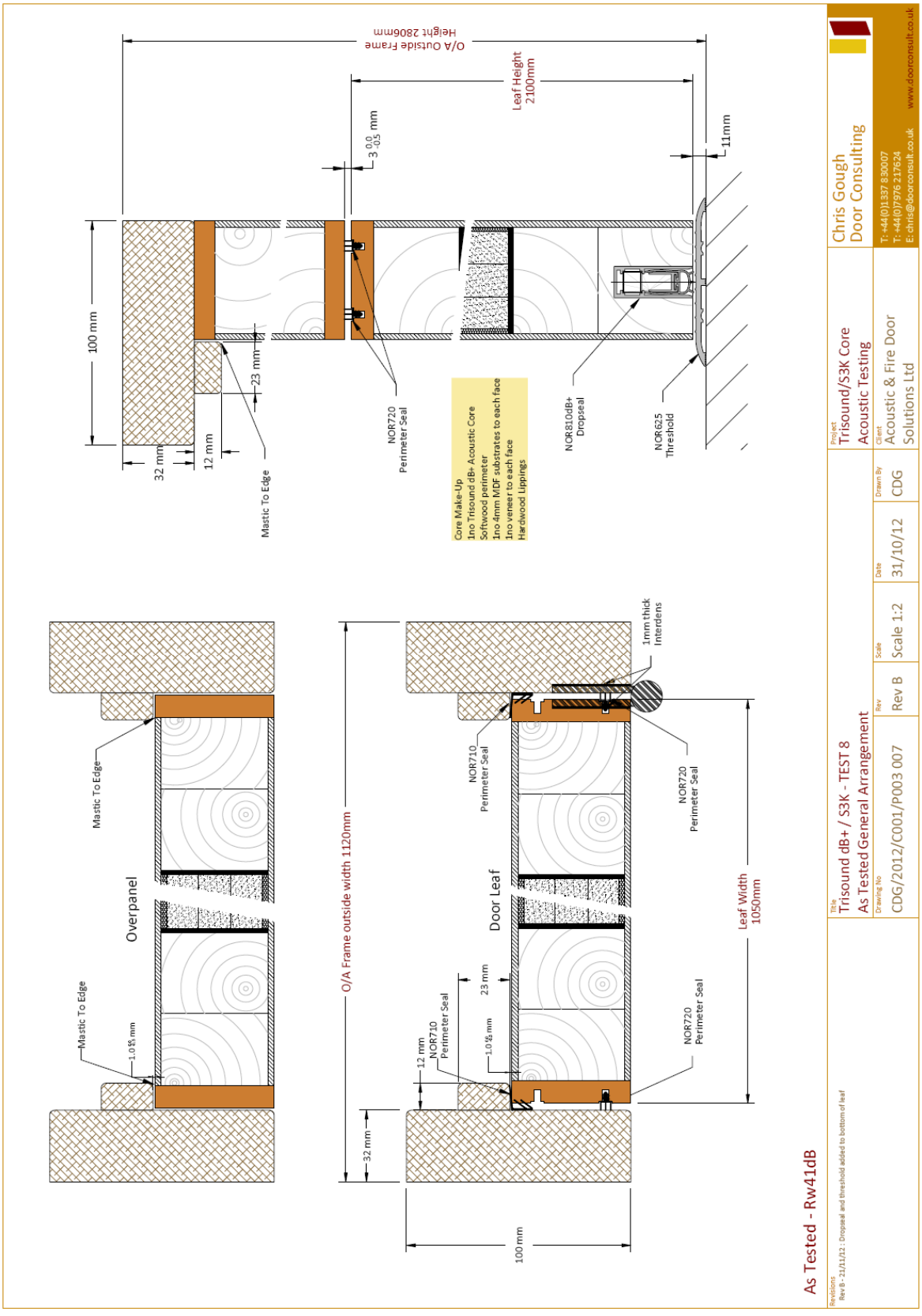
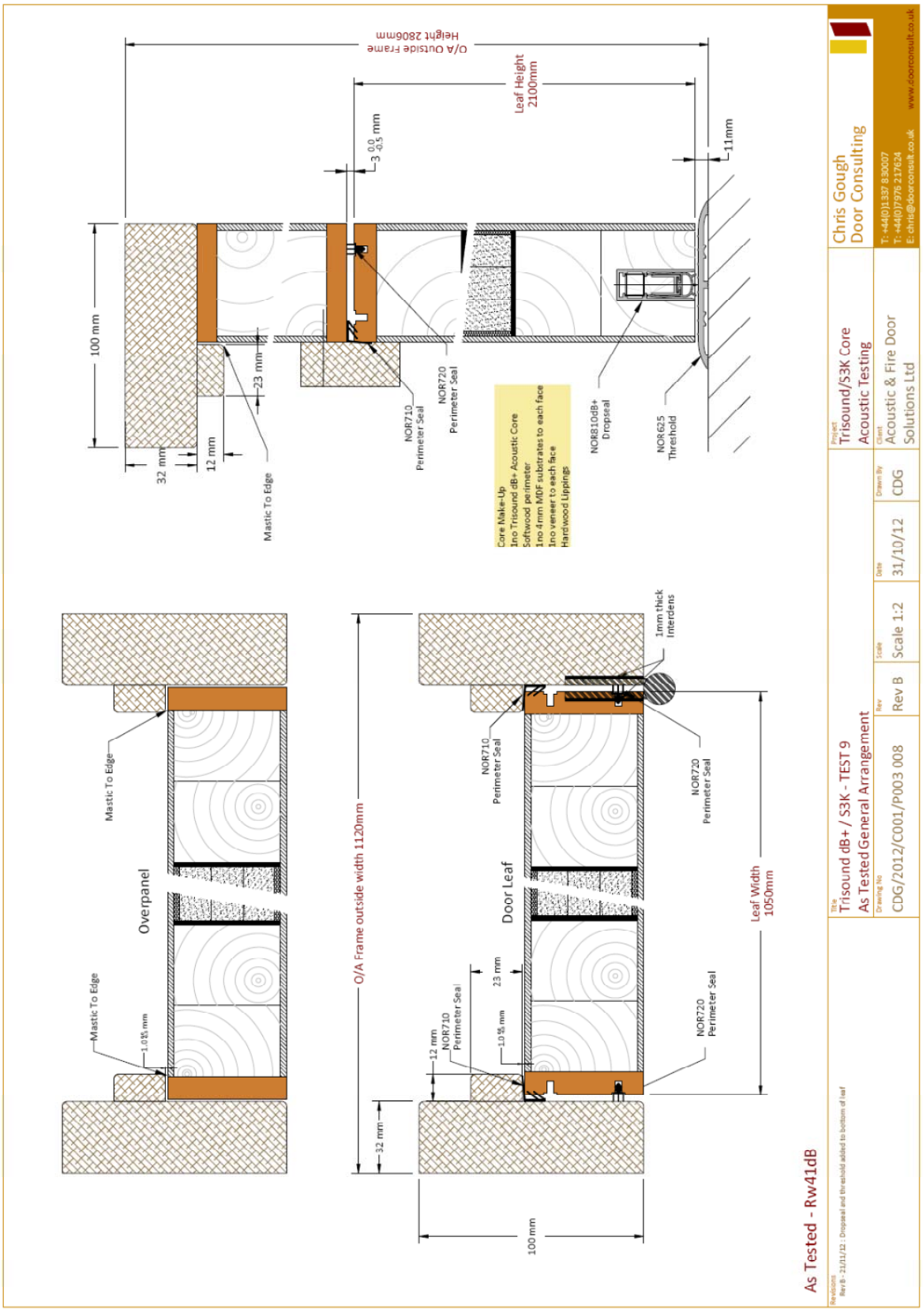
Drawing 7



SRL

Drawing 8



Appendix 1

Test Procedure

Measurement of Sound Transmission in accordance with BS EN ISO 10140-2: 2010 – TP33

In the laboratory, airborne sound transmission is determined from the difference in sound pressure levels measured across a test sample installed between two reverberant rooms. The difference in measured sound pressure levels is corrected for the amount of absorption in the receiving room. The test is done under conditions which restrict the transmission of sound by paths other than directly through the sample. The source sound field is randomly incident on the sample.

The test sample is located and sealed in an aperture within the brick dividing wall between the two rectangular reverberant (i.e. acoustically "live") room, both of which are constructed from 215mm brick with reinforced concrete floors and roofs. The brick wall has dimensions of 4.8m wide x 3.1m high and 550mm nominal thickness and forms the whole of the common area between the two rooms.

One of the rooms is used as the receiving room and has a volume of 300 cubic metres. It is isolated from the surrounding structure and the adjoining room by the use of resilient mountings and seals ensuring good acoustic isolation. The adjoining source room has a volume of 55 cubic metres.

Broad band noise is produced in the source room from an electronic generator, power amplifier and loudspeaker. The resulting sound pressure levels in both rooms are sampled using a microphone mounted on an oscillating boom and connected to a real time analyser. The signal is filtered into one third octave band widths, integrated and averaged. The value obtained at each frequency is known as the average sound pressure level for either the source or the receiving room. The change in level across the test sample is termed the sound pressure level difference, i.e.

$$D = L_1 - L_2$$

where

D is the equivalent Sound Pressure level difference in dB

L_1 is the equivalent Sound Pressure level in the source room in dB

L_2 is the equivalent Sound Pressure level in the receiving room in dB

The Sound Reduction Index (R), also known by the American terminology Sound Transmission Loss, is defined as the number of decibels by which sound energy randomly incident on the test sample is reduced in transmitting through it and is given by the formula:

$$R = D + 10\log_{10} \frac{S}{A} \text{..... in decibels}$$

Where

S is the area of the sample

A is the total absorption in the receiving room

both dimensions being in consistent units

The Sound Reduction Index is an expression of the laboratory sound transmission performance of a particular element or construction. It is a function of the mass, thickness, sealing, method of mounting etc. and is independent of the overall area of the sample.

However, when an example of this construction is installed on site, the sound insulation obtained will depend upon its surface area, as well as the absorption in the receiving room. The larger the area the greater the sound energy transmitted. Also, the overall sound insulation is affected by the sound transmission through other building elements, some of which may have an inferior performance to the sample tested. In practice, therefore, the potential sound reduction index of a construction is not fully realised on site. Furthermore, the sound reduction index of a particular sample of that construction can only be measured accurately in a laboratory, because only under such controlled conditions can the sound transmission path be limited to the sample under test.

R_w, C and C_{tr} have been calculated in accordance with the relevant section of BS EN ISO 717-1:1997 from the results of laboratory tests carried out in accordance with BS EN ISO 10140-2:2010.

Appendix 2

Measurement Uncertainty
BS EN ISO 10140-2: 2010 – TP33

The following values of uncertainty are based on a standard uncertainty multiplied by a coverage factor of k = 2, which provides a level of confidence of approximately 95%.

Frequency, Hz	Uncertainty, ± dB
100	3.2
125	2.9
160	2.5
200	2.5
250	1.8
315	1.8
400	1.5
500	1.5
630	1.2
800	1.2
1000	1.2
1250	1.2
1600	1.2
2000	1.2
2500	1.2
3150	1.2

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