Technical Report

INVESTOR IN PEOPLE

Report Number C/08/5L/20428/R04

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Project

The Laboratory Determination of Airborne Sound Transmission, Of Various Door Sets

Prepared for

Moralt Tischlerplatten GmbH & Co. KG
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By

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UKAS TESTING
0444

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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 various door sets in accordance with BS EN ISO 140-3:1995.

From these measurements the required results have been derived and are presented in both tabular and graphic form in Appendix 3.

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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George Thomson
Project Engineer

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For and on behalf of
Sound Research Laboratories Ltd

S R L

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2.0 Details of Measurements

2.1 Location

Sound Research Laboratories Ltd
Holbrook House
Little Waldingfield
Sudbury
Suffolk
CO10 OTH

2.2 Test Dates

9 to 11 March 2009

2.3 Instrumentation and Apparatus Used

Make	Description	Type
E D I	Microphone Multiplexer	
	Microphone Power Supply Unit	
Norwegian	Real Time Analyser	830
Electronics	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	Power Amplifiers	
Celestion	Loudspeakers	100w

Douglas Curtis	Rotating Microphone Boom	
Thermo Hygro	Temperature & Humidity Probe	
TOA	Graphic Equalizer	E-1231
	Power Amplifier	DPA-800

2.4 References

BS EN ISO 140-3:1995	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

I Stalker	Norsound Ltd
D Jones	Norsound Ltd
T Palmer	Doortech 2000
A Wright	Norsound Ltd

3.0 Description of Test

3.1 Description of Sample

Various door sets.

See Appendix 4 for individual test details and Appendix 5 for drawings. When cross referencing the detail in Appendices 4 and 5 with the SRL datasheets use the SRL Test Number.

Where glass was used in the doors, glass size was 1662mm high x 388mm wide.

Door frame fixed to test aperture and sealed at perimeter with mineral wool and mastic.

Sampling plan: Enough for test only

Sample condition: New

Details supplied by Norsound Ltd

Sample installed by Norsound Ltd

3.2 Sample Delivery date

5 March 2009

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 Appendix 3 and summarised in Appendix 4.

End of Text

Appendix 1

Test Procedure

Measurement of Sound Transmission in accordance with BS EN ISO 140-3 : 1995 - TP15

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 115 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 is a single figure rating of sound insulation and is calculated in accordance with the relevant section of BS EN ISO 717-1:1997.

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Appendix 2

Measurement Uncertainty
BS EN ISO 140-3:1995 - TP15

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	2.6
125	2.4
160	2.1
200	2.1
250	1.5
315	1.5
400	1.2
500	1.2
800	1.0
1000	1.0
1250	1.0
1600	1.0
2000	1.0
2500	1.0
3150	1.0

Appendix 3 - Test Data

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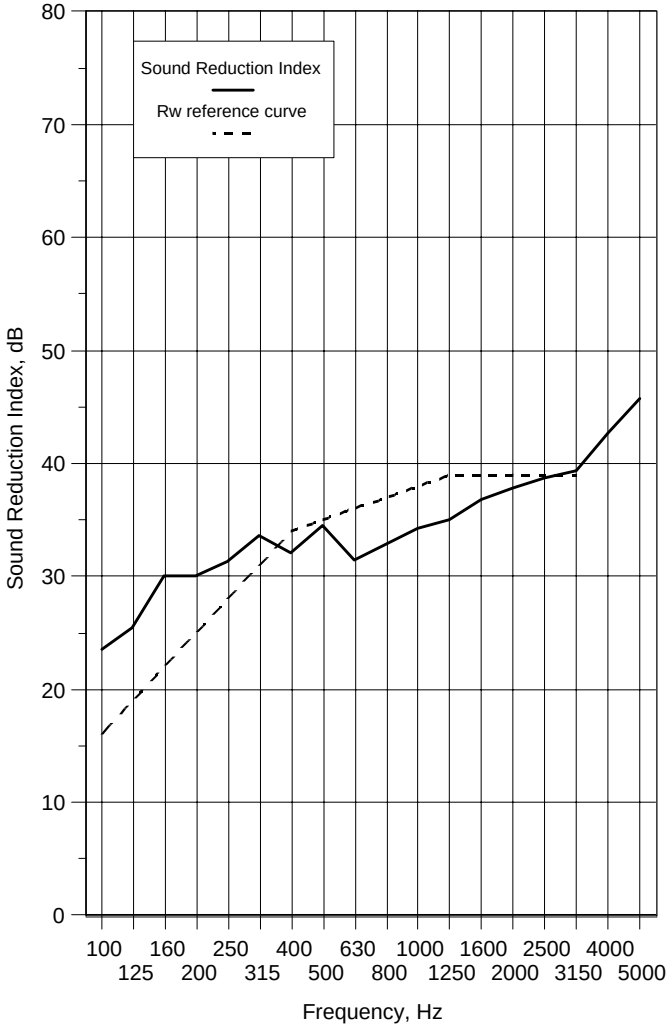
Data Sheet 1

Test Number :	31	**Air temperature:**	10.9 °C
Client:	Norsound	**Air humidity:**	53 %
Test Date:	11/03/2009	**Receiving room volume:**	300 m3
Sample height:	2.11 m	**Source room volume:**	115 m3
Sample width:	1.01 m	**Door weight:**	42 kg/m2
Product	54mm Moralt/Norsound 36 door		
Identification:	Fully caulked		

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	21.6	
63+	21.5	21.8
80+	22.3	
100	23.5	
125	25.4	25.5
160	30.1	
200	30.1	
250	31.3	31.4
315	33.6	
400	32.1	
500	34.5	32.5
630	31.5	
800	32.9	
1000	34.3	34.0
1250	35.0	
1600	36.8	
2000	37.8	37.7
2500	38.7	
3150	39.3	
4000	42.7	41.8
5000	45.7	
6300+	46.6	
8000+	48.6	48.3
10000+	50.9 *	
Average 100-3150	32.9	



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **35 (0;-2)** dB

Notes :* designates measurement corrected for background

designates limit of measurement due to background

+ designates frequency beyond standard and not UKAS accredited

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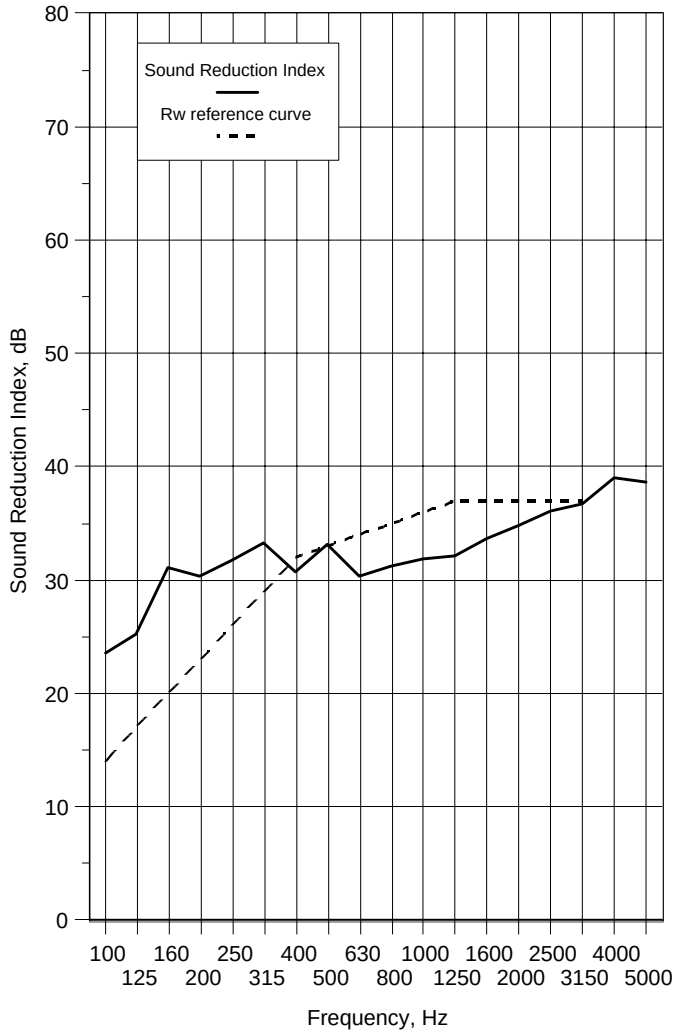
Data Sheet 2

Test Number :	32	**Air temperature:**	10.8 °C
Client:	Norsound	**Air humidity:**	60 %
Test Date:	11/03/2009	**Receiving room volume:**	300 m3
Sample height:	2.11 m	**Source room volume:**	115 m3
Sample width:	1.01 m	**Door weight:**	42 kg/m2
Product Identification:	54mm Moralt/Norsound 36 door Head and Jambs - Norsound 710 Threshold Seal - Norsound 650		

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	21.7	
63+	20.7	21.2
80+	21.2	
100	23.6	
125	25.3	25.7
160	31.1	
200	30.3	
250	31.7	31.6
315	33.3	
400	30.7	
500	33.2	31.2
630	30.3	
800	31.2	
1000	31.9	31.7
1250	32.2	
1600	33.7	
2000	34.8	34.8
2500	36.1	
3150	36.7	
4000	39.1	38.0
5000	38.6	
6300+	41.3	
8000+	44.3	43.8
10000+	48.1 *	
Average 100-3150	31.6	



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **33 (0;-1)** dB

Notes :* designates measurement corrected for background

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+ designates frequency beyond standard and not UKAS accredited

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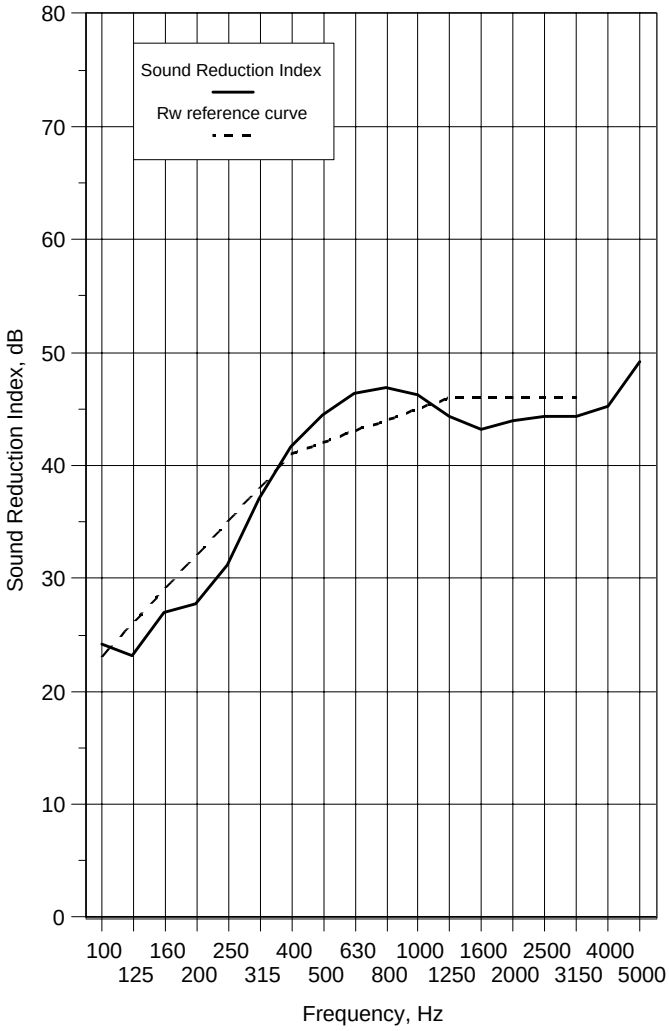
Data Sheet 3

Test Number :	33	**Air temperature:**	10.8 °C
Client:	Norsound	**Air humidity:**	60 %
Test Date:	11/03/2009	**Receiving room volume:**	300 m3
Sample height:	2.11 m	**Source room volume:**	115 m3
Sample width:	1.01 m	**Door weight:**	42.7 kg/m2
Product	54mm Moralt/Norsound 40 door		
Identification:	Fully caulked		

Freq f Hz	Sound Reduction Index, dB 1/3 Oct		1/1 Oct
50+	29.2		
63+	27.5		25.7
80+	22.9		
100	24.2		
125	23.1		24.5
160	27.0		
200	27.7		
250	31.2		30.5
315	37.1		
400	41.7		
500	44.5		43.8
630	46.4		
800	46.9		
1000	46.3		45.7
1250	44.4		
1600	43.2		
2000	43.9		43.8
2500	44.4		
3150	44.3		
4000	45.2		45.8
5000	49.2		
6300+	54.1		
8000+	56.8	*	55.3
10000+	55.5	#	
Average 100-3150	38.5		



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **42 (-1;-5)** dB

Notes :* designates measurement corrected for background

designates limit of measurement due to background

+ designates frequency beyond standard and not UKAS accredited

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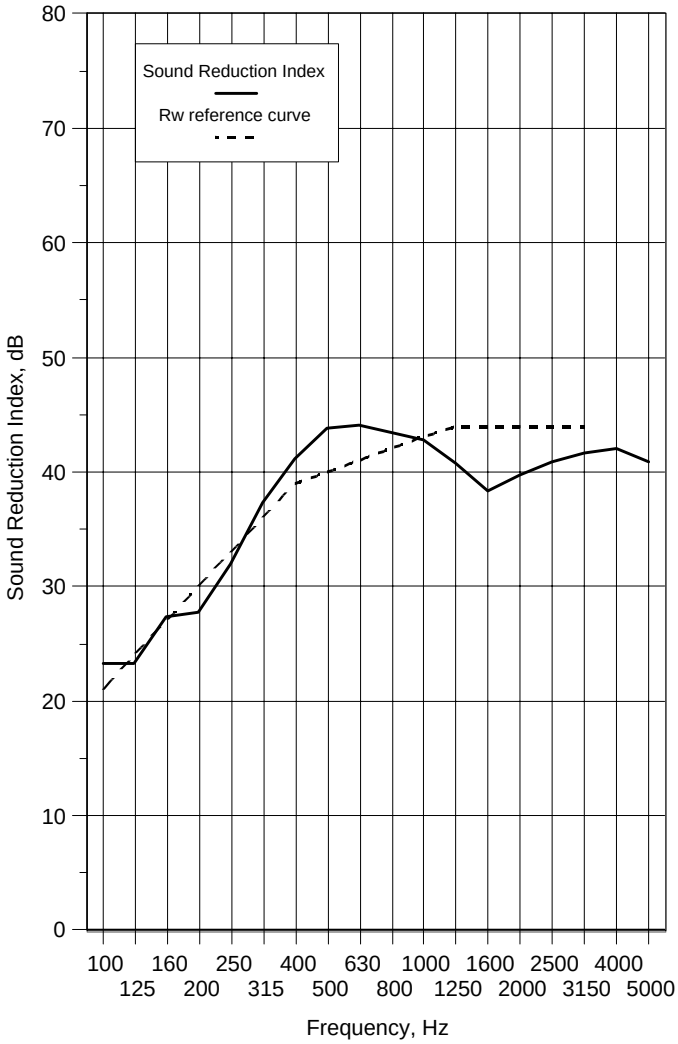
Data Sheet 4

Test Number :	34	**Air temperature:**	10.9 °C
Client:	Norsound	**Air humidity:**	61 %
Test Date:	11/03/2009	**Receiving room volume:**	300 m3
Sample height:	2.11 m	**Source room volume:**	115 m3
Sample width:	1.01 m	**Door weight:**	42.7 kg/m2
Product Identification:	54mm Moralt/Norsound 40 door Head and Jambs - Norsound 710 Threshold Seal - Norsound 650		

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	29.2	
63+	26.4	25.8
80+	23.6	
100	23.3	
125	23.3	24.3
160	27.4	
200	27.8	
250	32.0	30.9
315	37.3	
400	41.1	
500	43.8	42.8
630	44.1	
800	43.4	
1000	42.8	42.2
1250	40.8	
1600	38.4	
2000	39.7	39.6
2500	40.9	
3150	41.6	
4000	42.1	41.5
5000	40.9	
6300+	44.3	
8000+	47.5	46.7
10000+	50.8 *	
Average 100-3150	36.7	



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **40 (-1;-4)** dB

Notes :* designates measurement corrected for background

designates limit of measurement due to background

+ designates frequency beyond standard and not UKAS accredited

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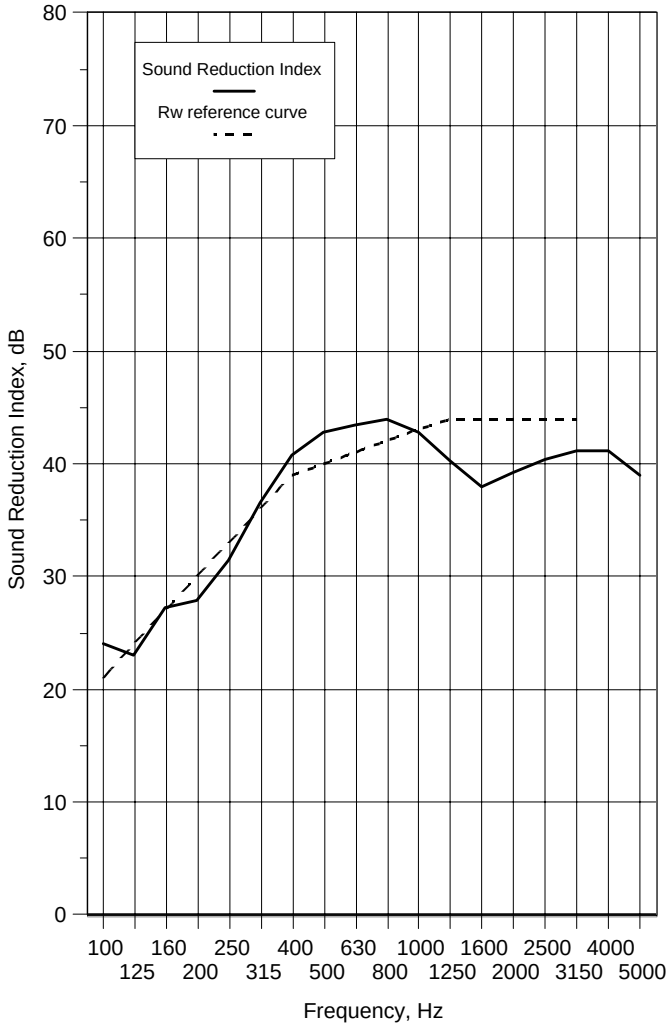
Data Sheet 5

Test Number :	35	**Air temperature:**	10.9 °C
Client:	Norsound	**Air humidity:**	61 %
Test Date:	11/03/2009	**Receiving room volume:**	300 m3
Sample height:	2.11 m	**Source room volume:**	115 m3
Sample width:	1.01 m	**Door weight:**	42.7 kg/m2
Product Identification:	54mm Moralt/Norsound 40 door - seals adjusted Head and Jambs - Norsound 710 Threshold Seal - Norsound 650		

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	28.2	
63+	26.3	25.3
80+	23.1	
100	24.1	
125	23.0	24.5
160	27.3	
200	27.9	
250	31.5	30.7
315	36.5	
400	40.8	
500	42.8	42.2
630	43.5	
800	43.9	
1000	42.8	42.1
1250	40.3	
1600	38.0	
2000	39.2	39.1
2500	40.4	
3150	41.1	
4000	41.1	40.3
5000	39.0	
6300+	41.9	
8000+	45.1	44.4
10000+	48.3 *	
Average 100-3150	36.4	



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **40 (-1;-4)** dB

Notes :* designates measurement corrected for background

\# designates limit of measurement due to background

\+ designates frequency beyond standard and not UKAS accredited

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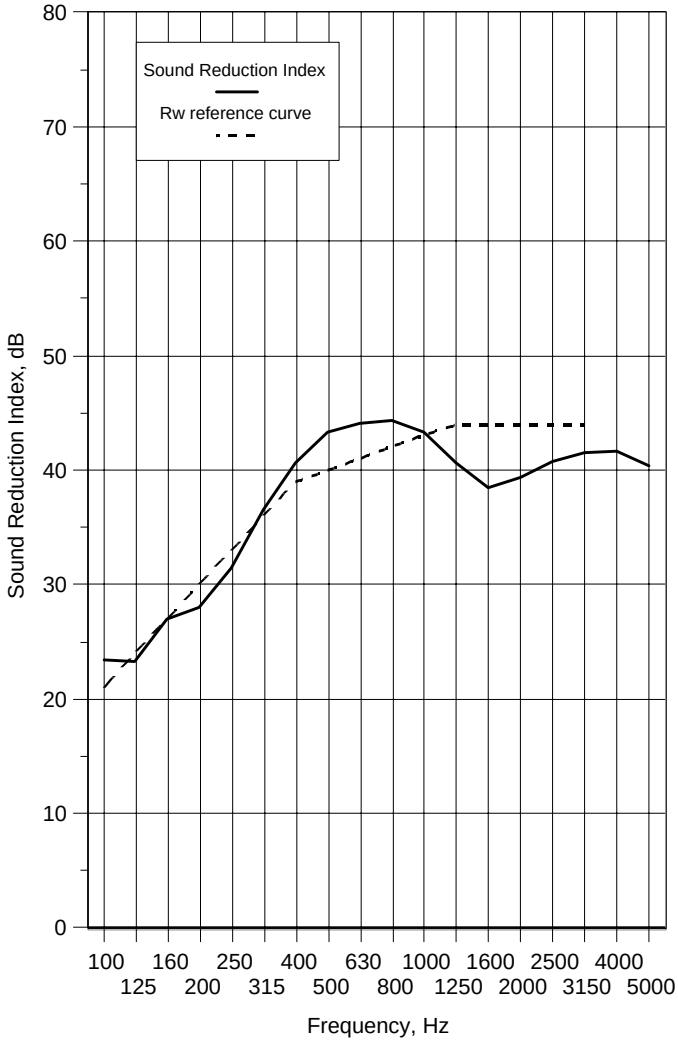
Data Sheet 6

Test Number :	36	**Air temperature:**	10.9 °C
Client:	Norsound	**Air humidity:**	61 %
Test Date:	11/03/2009	**Receiving room volume:**	300 m3
Sample height:	2.11 m	**Source room volume:**	115 m3
Sample width:	1.01 m	**Door weight:**	42.7 kg/m2
Product	54mm Moralt/Norsound 40 door - seals changed		
Identification:	Head and Jambs - Norsound 710		
	Threshold Seal - Norsound 650		

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	28.9	
63+	25.9	24.4
80+	21.6	
100	23.4	
125	23.3	24.2
160	27.0	
200	28.0	
250	31.5	30.8
315	36.6	
400	40.7	
500	43.3	42.4
630	44.1	
800	44.4	
1000	43.3	42.5
1250	40.7	
1600	38.5	
2000	39.4	39.5
2500	40.8	
3150	41.5	
4000	41.6	41.1
5000	40.4	
6300+	44.4	
8000+	47.7	46.8
10000+	50.5 *	
Average 100-3150	36.7	



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **40 (-1;-4)** dB

Notes :* designates measurement corrected for background

designates limit of measurement due to background

+ designates frequency beyond standard and not UKAS accredited

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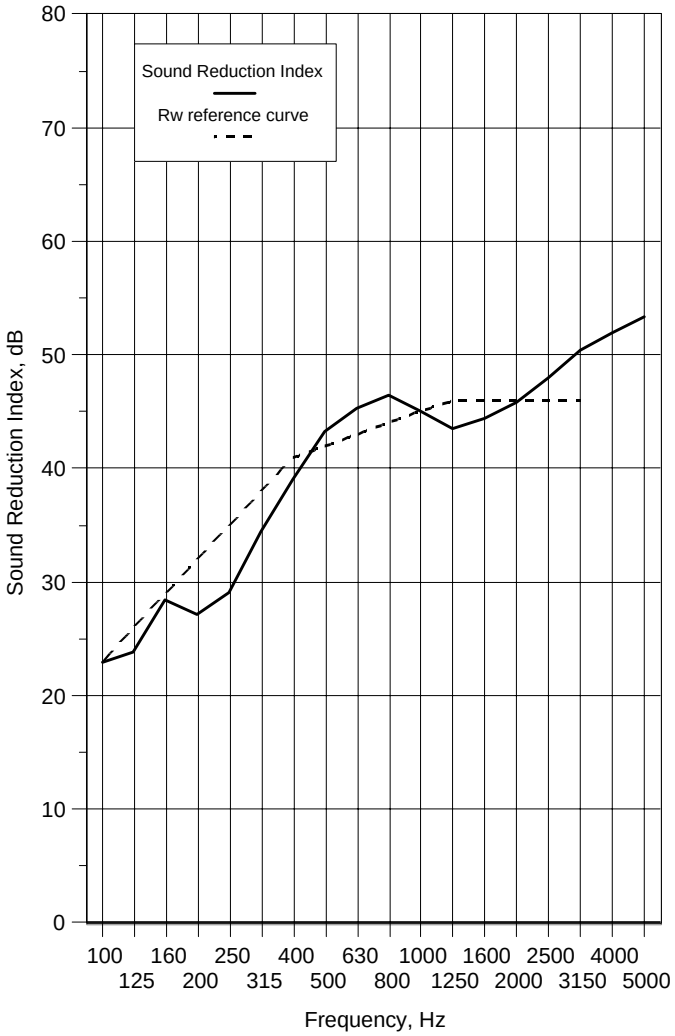
Data Sheet 7

Test Number :	37	**Air temperature:**	10.9 °C
Client:	Norsound	**Air humidity:**	61 %
Test Date:	11/03/2009	**Receiving room volume:**	300 m3
Sample height:	2.11 m	**Source room volume:**	115 m3
Sample width:	1.01 m	**Door weight:**	39.1 kg/m2
Product	Moralt/Norsound 41 door		
Identification:	Fully caulked		

Freq f Hz	Sound Reduction Index, dB 1/3 Oct		1/1 Oct
50+	32.5		
63+	28.5		27.6
80+	24.9		
100	22.9		
125	23.8		24.5
160	28.4		
200	27.1		
250	29.1		29.3
315	34.5		
400	39.1		
500	43.2		41.8
630	45.3		
800	46.4		
1000	45.1		44.8
1250	43.5		
1600	44.4		
2000	45.8		45.8
2500	48.0		
3150	50.4		
4000	52.0		51.8
5000	53.4		
6300+	56.4		
8000+	57.8	*	56.4
10000+	55.4	#	
Average 100-3150	38.6		



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **42 (-2;-6)** dB

Notes :* designates measurement corrected for background

designates limit of measurement due to background

+ designates frequency beyond standard and not UKAS accredited

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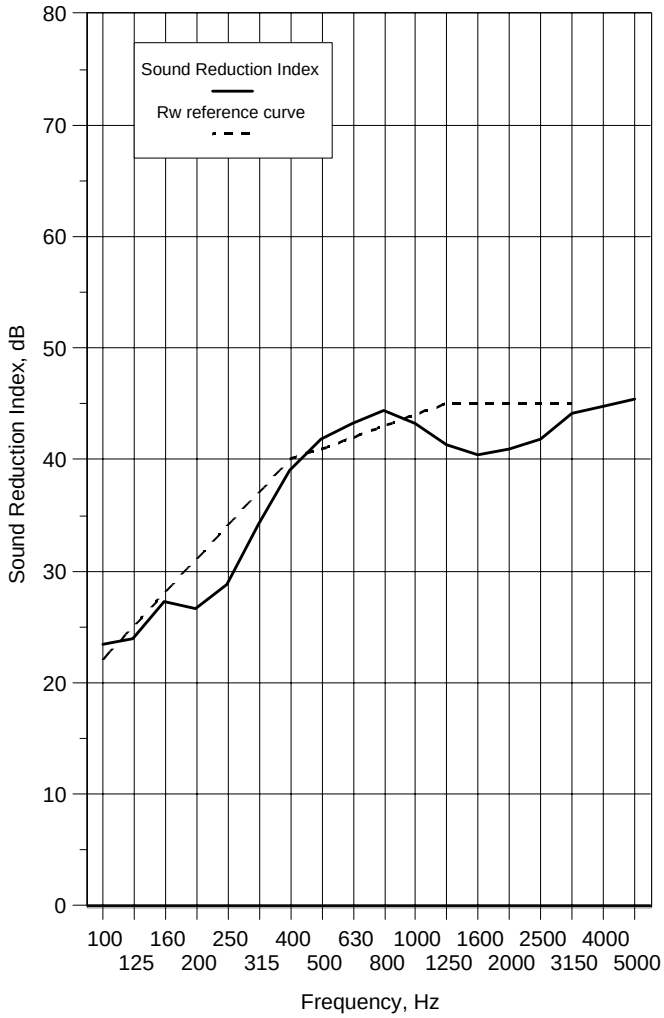
Data Sheet 8

Test Number :	38	**Air temperature:**	10.9 °C
Client:	Norsound	**Air humidity:**	61 %
Test Date:	11/03/2009	**Receiving room volume:**	300 m3
Sample height:	2.11 m	**Source room volume:**	115 m3
Sample width:	1.01 m	**Door weight:**	39.1 kg/m2
Product Identification:	Moralt/Norsound 41 door Head and Jambs - 2x Norsound 710 Threshold Seal - Norsound 650		

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	29.5	
63+	28.3	25.7
80+	22.6	
100	23.4	
125	24.0	24.6
160	27.3	
200	26.6	
250	28.8	28.9
315	34.2	
400	39.0	
500	41.9	41.0
630	43.2	
800	44.4	
1000	43.2	42.8
1250	41.4	
1600	40.5	
2000	40.9	41.1
2500	41.9	
3150	44.2	
4000	44.8	44.8
5000	45.4	
6300+	48.7	
8000+	50.4	50.1
10000+	51.9 *	
Average 100-3150	36.6	



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **41 (-2;-6)** dB

Notes :* designates measurement corrected for background

designates limit of measurement due to background

+ designates frequency beyond standard and not UKAS accredited

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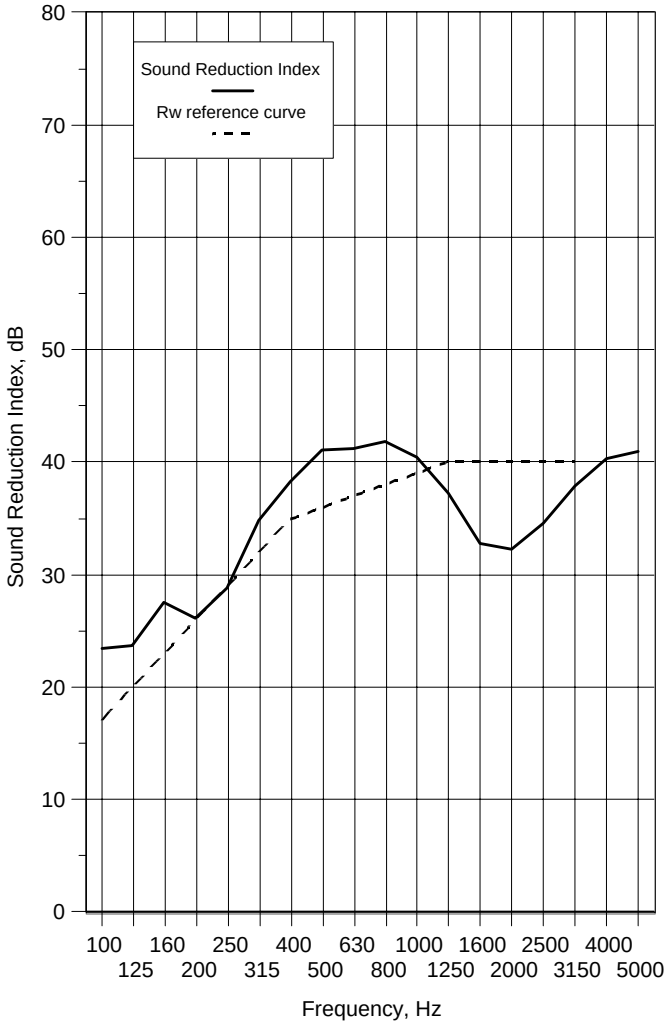
Data Sheet 9

Test Number :	39	**Air temperature:**	10.9 °C
Client:	Norsound	**Air humidity:**	61 %
Test Date:	11/03/2009	**Receiving room volume:**	300 m3
Sample height:	2.11 m	**Source room volume:**	115 m3
Sample width:	1.01 m	**Door weight:**	39.1 kg/m2
Product	Moralt/Norsound 41 door		
Identification:	Head and Jambs - Norsound 710		
	Threshold Seal - Norsound 650		

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	29.0	
63+	27.3	25.0
80+	21.9	
100	23.4	
125	23.7	24.5
160	27.5	
200	26.1	
250	28.8	28.6
315	34.8	
400	38.3	
500	41.1	40.0
630	41.2	
800	41.9	
1000	40.4	39.4
1250	37.2	
1600	32.8	
2000	32.3	33.1
2500	34.6	
3150	37.9	
4000	40.3	39.5
5000	41.0	
6300+	43.4	
8000+	45.6	45.3
10000+	47.9 *	
Average 100-3150	33.9	



Rating according to BS EN ISO 717-1:1997

Rw(C;Ctr)= **36 (-1;-2)** dB

Notes :* designates measurement corrected for background

designates limit of measurement due to background

+ designates frequency beyond standard and not UKAS accredited

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Appendix 4 - Test Details

Doortech 2000

Norsound Acoustic Testing - SRL March 2009 AS TESTED

MORALT / NORSOUND 36

Item No.	NORSOUND Test Ref.	SRL Test No.	Dwg. Ref	Door Configuration	Door Type	Height	Width	Tcks.	Head	Hanging Jamb	Closing Jamb	Threshold	Meeting Stiles	GLAZING	Fully Caulked	Measured Performance Rw.	% Efficiency	NOTES
Moralt / Norsound 36 - Single Leaf - Single Action																		
28	52	31	T045	Single leaf	Moralt / Norsound 36	2040	926	54	FULLY CAULKED					NIL	YES	Rw.35dB	Reference	
29	56	32	T048	Single leaf	Moralt / Norsound 36	2040	926	54	NOR710	NOR710	NOR710	NOR650	n/a	NIL	NO	Rw.33dB	94%	

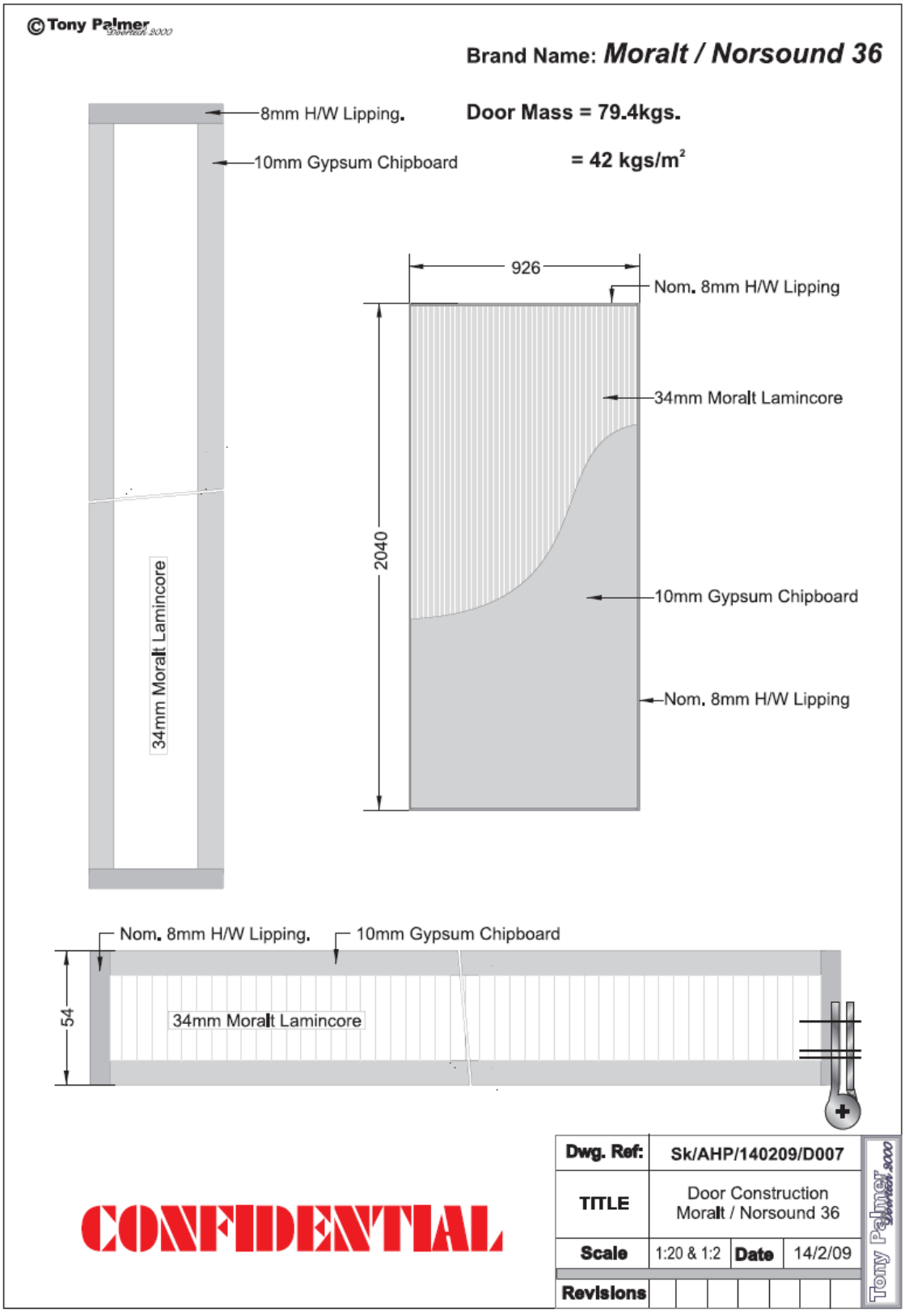
MORALT / NORSOUND 40

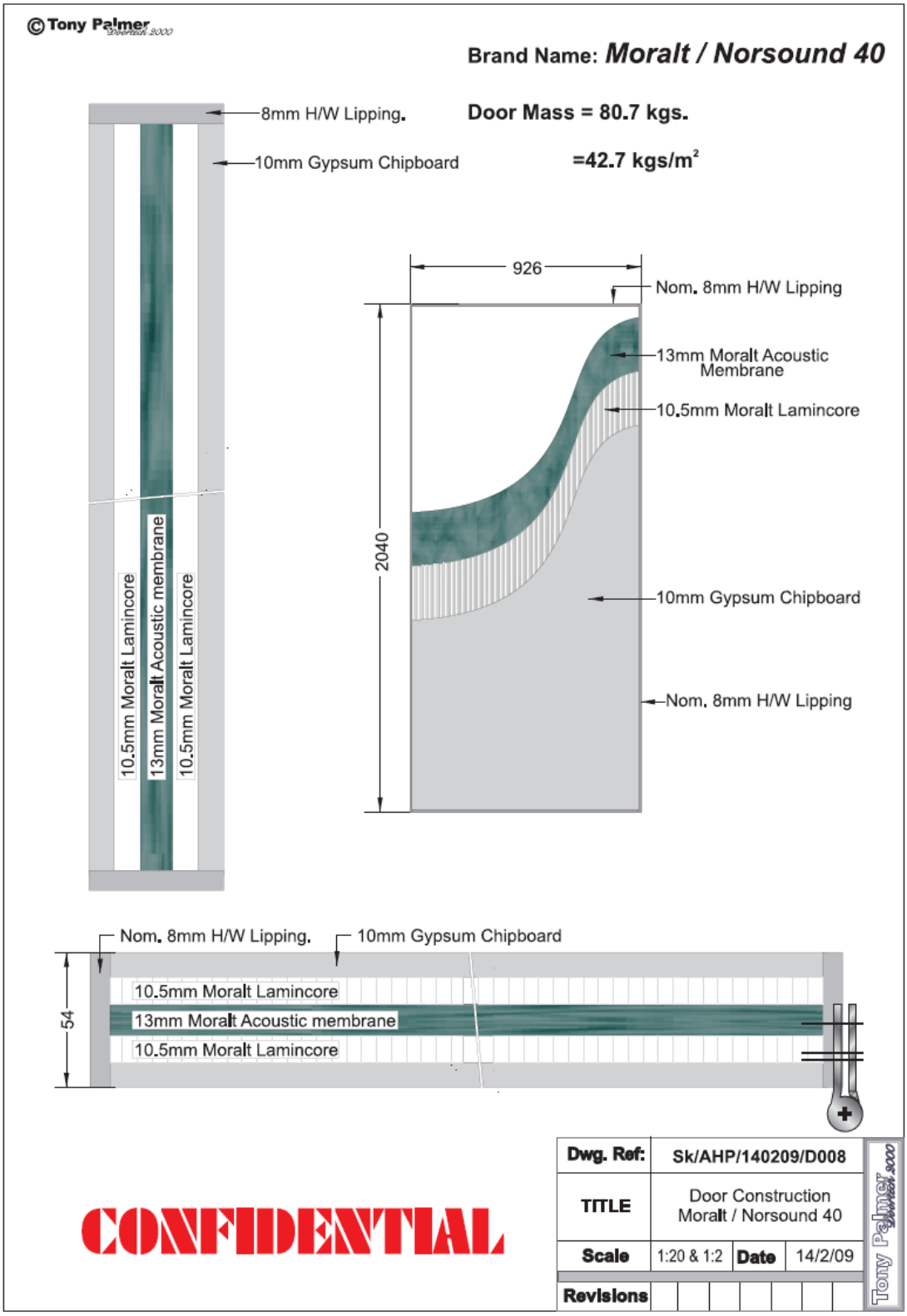
Item No.	NORSOUND Test Ref.	SRL Test No.	Dwg. Ref	Door Configuration	Door Type	Height	Width	Tcks.	Head	Hanging Jamb	Closing Jamb	Threshold	Meeting Stiles	GLAZING	Fully Caulked	Measured Performance Rw.	% Efficiency	NOTES
Moralt / Norsound 40 - Single Leaf - Single Action																		
30	57	33	T049	Single leaf	Moralt / Norsound 40	2040	926	54	FULLY CAULKED					NIL	YES	Rw.42dB	Reference	
31	58	34	T049	Single leaf	Moralt / Norsound 40	2040	926	54	NOR710	NOR710	NOR710	NOR 650	n/a	NIL	NO	Rw.40dB	95%	
32	59	35	T050	Single leaf	Moralt / Norsound 40	2040	926	54	NOR710	NOR710	NOR710	NOR 650	n/a	NIL	NO	Rw.40dB	95%	SRL Test 36 = repeat Test 35
33	59	36	T050	Single leaf	Moralt / Norsound 40	2040	926	54	NOR710	NOR710	NOR710	NOR 650	n/a	NIL	NO	Rw.40dB	95%	SRL Test 36 = repeat Test 35

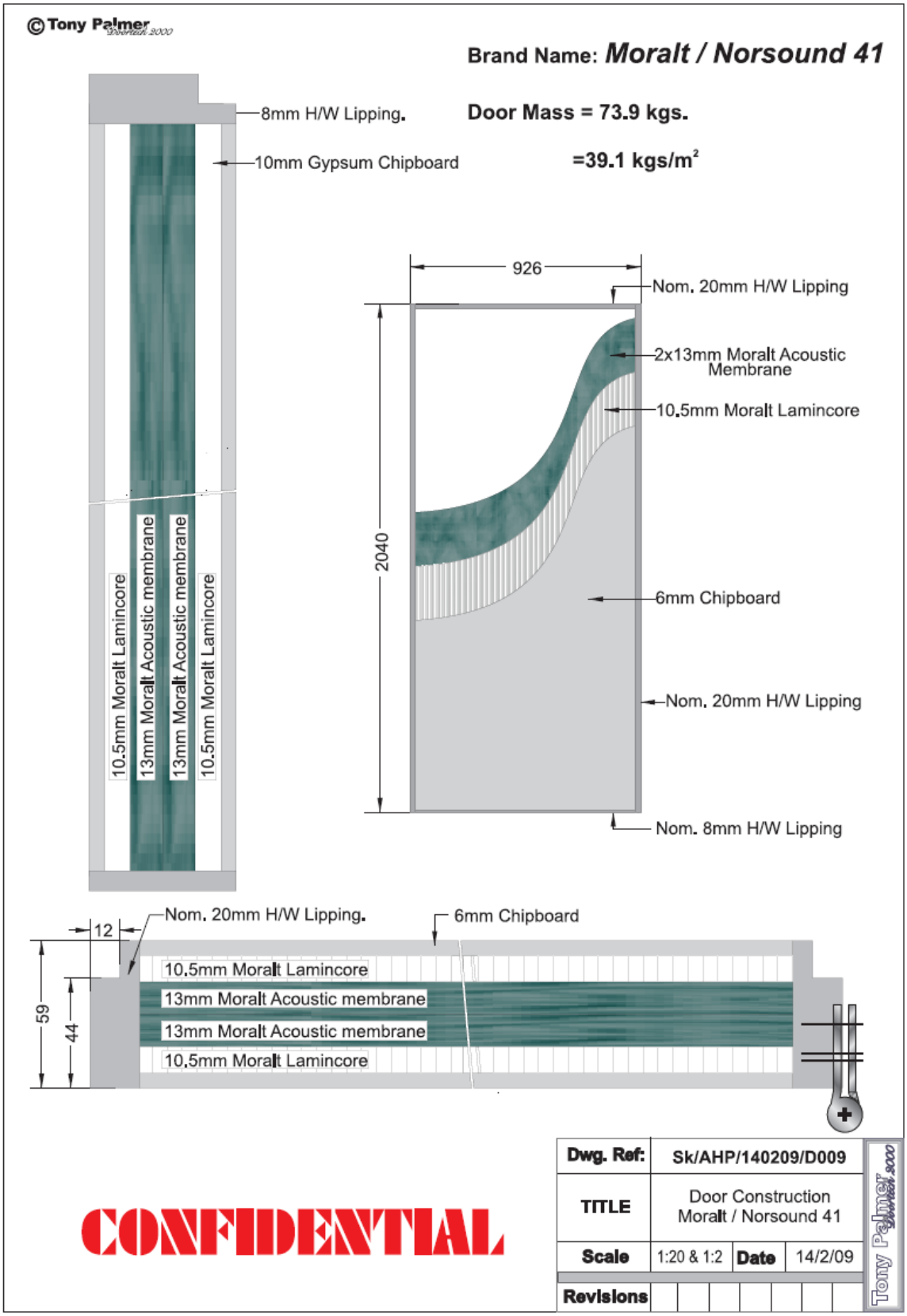
MORALT / NORSOUND 41

Item No.	NORSOUND Test Ref.	SRL Test No.	Dwg. Ref	Door Configuration	Door Type	Height	Width	Tcks.	Head	Hanging Jamb	Closing Jamb	Threshold	Meeting Stiles	GLAZING	Fully Caulked	Measured Performance Rw.	% Efficiency	NOTES
Moralt / Norsound - Single Leaf - Single Action																		
34	62	37	T053	Single leaf	Moralt / Norsound 41	2040	926	59	FULLY CAULKED					NIL	YES	Rw.42dB	Reference	
35	69a	38	T059a	Single leaf	Moralt / Norsound 41	2040	926	59	2xNOR710	2xNOR710	2xNOR710	NOR 650	n/a	NIL	NO	Rw.41dB	98%	
36	69b	39	T059a	Single leaf	Moralt / Norsound 41	2040	925	59	NOR710	NOR710	NOR710	NOR 650	n/a	NIL	NO	Rw.36dB	86%	This was a quick test by simply removing 1No. Strip NOR710 without adjustment of seals. Threshold needed adjustment.

Appendix 5 - Drawings


© Tony Palmer
Brand Name: Moralt / Norsound 36
8mm H/W Lipping.
10mm Gypsum Chipboard
Door Mass = 79.4kgs.
= 42 kgs/m²
926
Nom. 8mm H/W Lipping
34mm Moralt Lamincore
2040
10mm Gypsum Chipboard
Nom. 8mm H/W Lipping
34mm Moralt Lamincore
Nom. 8mm H/W Lipping.
10mm Gypsum Chipboard
54
34mm Moralt Lamincore
CONFIDENTIAL
Dwg. Ref: Sk/AHP/140209/D007
TITLE Door Construction Moralt / Norsound 36
Scale 1:20 & 1:2
Date 14/2/09
Revisions
Tony Palmer


©Tony Palmer
Brand Name: Moralt / Norsound 40
8mm H/W Lipping.
10mm Gypsum Chipboard
Door Mass = 80.7 kgs.
=42.7 kgs/m²
10.5mm Moralt Lamincore
13mm Moralt Acoustic membrane
10.5mm Moralt Lamincore
926
Nom. 8mm H/W Lipping
13mm Moralt Acoustic Membrane
10.5mm Moralt Lamincore
2040
10mm Gypsum Chipboard
Nom. 8mm H/W Lipping
Nom. 8mm H/W Lipping.
10mm Gypsum Chipboard
54
10.5mm Moralt Lamincore
13mm Moralt Acoustic membrane
10.5mm Moralt Lamincore
CONFIDENTIAL
Dwg. Ref: Sk/AHP/140209/D008
TITLE Door Construction Moralt / Norsound 40
Scale 1:20 & 1:2 Date 14/2/09
Revisions
Tony Palmer


©Tony Palmer
Brand Name: Moralt / Norsound 41
8mm H/W Lipping.
10mm Gypsum Chipboard
Door Mass = 73.9 kgs.
=39.1 kgs/m²
10.5mm Moralt Lamincore
13mm Moralt Acoustic membrane
13mm Moralt Acoustic membrane
10.5mm Moralt Lamincore
926
Nom. 20mm H/W Lipping
2x13mm Moralt Acoustic Membrane
10.5mm Moralt Lamincore
2040
6mm Chipboard
Nom. 20mm H/W Lipping
Nom. 8mm H/W Lipping
12
Nom. 20mm H/W Lipping.
6mm Chipboard
10.5mm Moralt Lamincore
13mm Moralt Acoustic membrane
13mm Moralt Acoustic membrane
10.5mm Moralt Lamincore
59
44
CONFIDENTIAL
Dwg. Ref: Sk/AHP/140209/D009
TITLE Door Construction Moralt / Norsound 41
Scale 1:20 & 1:2
Date 14/2/09
Revisions
Tony Palmer