The Building Test Centre
Fire Acoustics Structures

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Report Number **BTC 13505A**

AN ACOUSTIC TEST REPORT COVERING A SERIES OF LABORATORY SOUND INSULATION TESTS TO BS EN ISO 140-3:1995 ON A 142MM THICK KINGSPAN TEK PANEL WITH VARIOUS DIRECT FIX AND INDEPENDENT WALL LINING COMBINATIONS.

Test Dates: 5th, 7th, 8th & 9th July 2004

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Customer:	**Kingspan Insulation Limited** Pembridge Leominster Herefordshire HR6 9LA	**British Gypsum Limited** East Leake Loughborough Leicestershire LE12 6HX

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FOREWORD

This test report details a series of sound insulation tests conducted on a 142mm Kingspan Tek Panel consisting of a 112mm rigid urethane insulation core between a single layer of 15mm OSB each side. The partition was tested independently and with combinations of independent and dependent wall lining systems using 15mm Gyproc SoundBloc, Gypframe 48I50 Studs and 25mm Isowool APR 1200 insulation. The tests were joint sponsored by Kingspan Insulation Limited and British Gypsum Limited.

The test specimens were installed by Kingspan Insulation Limited and Alltone between the 5th and 9th July 2004.

REPORT AUTHORISATION

Report Author	Authorised by
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TEST CONSTRUCTION

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The Kingspan Tek System was assembled flat, and then lifted into position within the test frame.

Three sections of 142mm Kingspan Tek Panel were used. On each vertical edge of the central panel, nominally 100mm wide OSB spline joints were inserted behind each external 15mm OSB board and screw fixed at 100mm centres as shown in Photo 2. Urethane expanding foam was applied along each vertical edge.

Photo 1 Single 142mm Kingspan Tek Panel

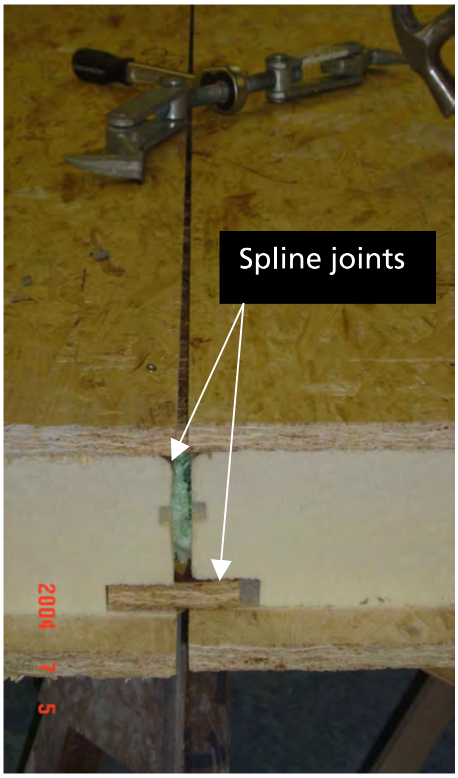

Photo 2 Spline detail showing expanding urethane foam before ratcheting panel together

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The adjoining Kingspan Tek Panels were screw fixed to the OSB splines of the central panel at 100mm centres.

Urethane expanding foam was applied around the perimeter of the partition in-between the two internal faces of the 15mm OSB board. 110mm(wide) x 51mm (deep) timber lengths were inserted around the perimeter of the partition and screw fixed as shown in photos 3 and 4.

Photo 3 Applying the urethane expanding foam

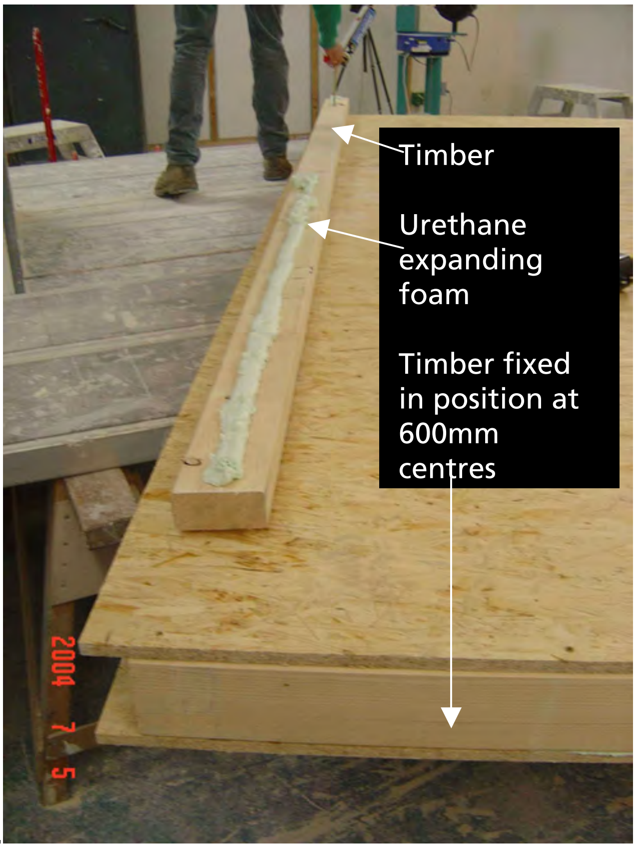

Photo 4 Preparing the perimeter timber

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Once the partition was assembled as in photo 5, it was lifted into position within the test frame.

Photo 5 Assembled Kingspan Tek Partition

Urethane expanding foam was applied around the perimeter between the test frame and the partition. Once set, the foam was cut flush with the partition and the perimeter was sealed with acoustic tape and Gyproc Sealant on each side.

Photo 6 Kingspan Tek Panel System within test frame

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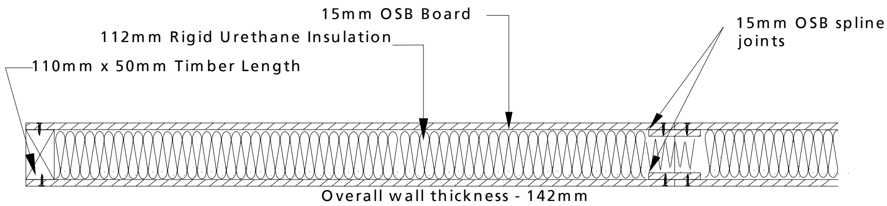

Figure 1 Plan view of Kingston Tek Partition

The Kingspan Tek System for this test was also used in all the following tests.

The descriptions of individual components making up the test specimen were provided by the customer and were checked for accuracy wherever possible.

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A single layer of 15mm Gyproc SoundBloc was screw fixed directly to the Kingspan Tek partition on each side, using 25mm drywall screws at 300mm centres around the perimeter of the board and vertical centre.
The perimeter of the test specimen was sealed with acoustic tape and Gyproc Sealant on each side.

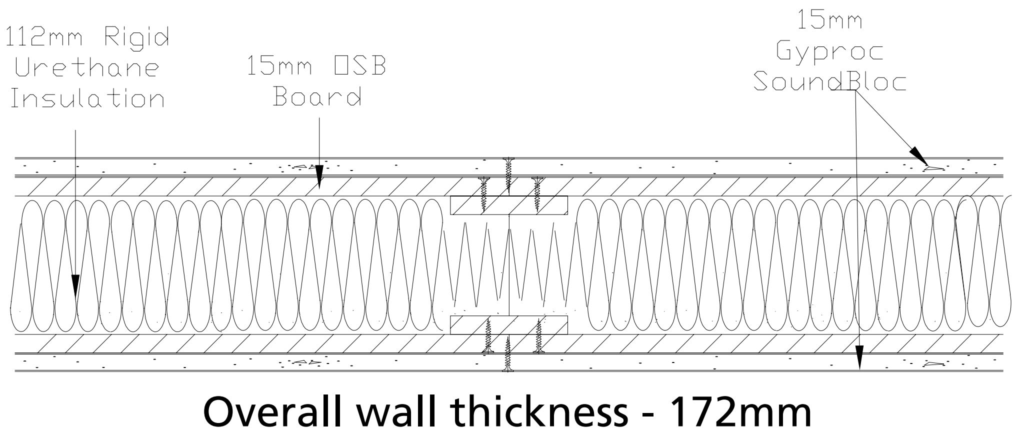

Figure 10 H13516A Plan Cross Section of specimen construction.

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An independent wall lining was erected on one side of the Kingspan Tek partition. Gypframe 50C50 channels were offset by 50mm from the face of the Kingspan Tek partition and screw fixed at 600mm centres to the head, base and vertical sides of the test frame on one side. Gypframe 48I50 studs were positioned at 600 mm within the channel. A single layer of 25mm Isowool APR 1200 was positioned between the studs.
A single layer of 15mm Gyproc SoundBloc was screw fixed at 300mm centres around the perimeter of the board and at intermediate studs using 25mm drywall screws.
On the other side, the Kingspan Tek partition was exposed. The perimeter of the test specimen was sealed with acoustic tape and Gyproc Sealant on each side.

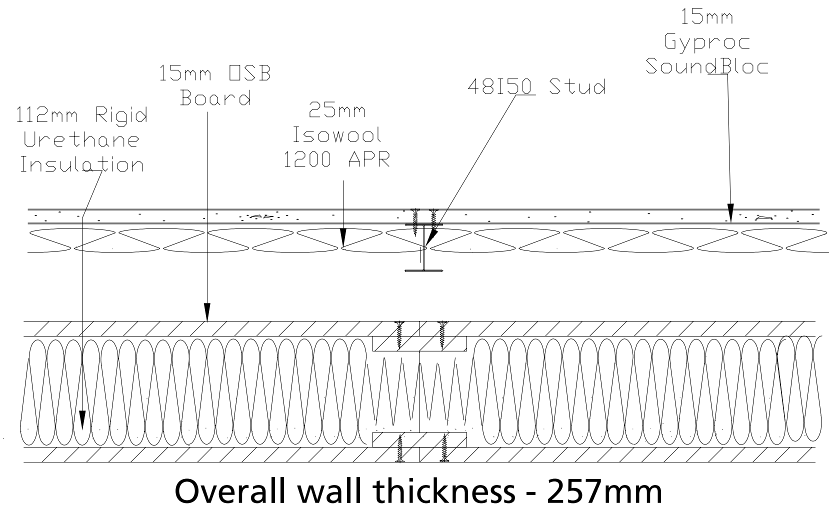

Figure 17 H13523A Plan Cross Section of specimen construction

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TEST MATERIALS

Kingspan Tek Panel

Nominally 142mm (thick) Kingspan Tek Panel, consisting of a single layer of 15mm OSB either side of 112mm rigid urethane insulation core. Supplied by Kingspan Insulation Limited.

Actual Dimensions:	2395mm(long) x 1219mm(wide) x 142mm(thick)
Surface Density:	21.75 kg/m^2

Timber

Timber length supplied by Kingspan Insulation Limited.:

Actual Dimensions:	3578mm(long) x 110mm(wide) x 51mm(deep)
Weight:	9.110kg
Weight Per Meter:	2.55kg/m

OSB Length (Spline) supplied by Kingspan Insulation Limited:

Actual Dimensions:	2442mm(long) x 95mm(wide) x 15mm(thick)
Surface Density:	9.55kg/m^2

Gyproc SoundBloc

Nominally 2400mm (long) x 1200mm (wide) x 15mm (thick) Gyproc SoundBloc, manufactured by British Gypsum, ex East Leake Works.

Average surface density:	12.57 kg/m^2
Average thickness:	15.09 mm
Board code:	16 078 4 20:02

The surface density was calculated using the actual weight and size of a selection of the boards used in the test specimen.

Metal components

i) GypFrame 50C50 channel, nominally 0.5mm thick, manufactured from galvanised mild steel using the “Ultrasteel” process.
ii) GypFrame 48I50 studs, nominally 0.5mm thick, manufactured from galvanised mild steel using the “Ultrasteel” process.

All metal components supplied by British Gypsum Limited.

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Insulation

Nominally 25mm thick Isowool 1200 APR glass mineral wool manufactured and supplied by British Gypsum - Isover Limited.

Average Surface Density:	0.47kg/m^2
Average Density:	18.7kg/m^3

The surface density and density were calculated using the weight of one roll, its nominal surface area and nominal thickness.

Fasteners

25mm Gyproc Drywall screws supplied by British Gypsum Limited.
41mm Gyproc Drywall screws supplied by British Gypsum Limited.

Urethane Expanding Foam

Urethane Expanding Foam manufactured by Siroflex and supplied by Kingspan Insulation Limited.

Where measurements could not be taken then weight and dimensions were provided by the customer or the manufacturer e.g. from material labelling. Material information was recorded according to procedure MAT/1.

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TEST PROCEDURE

The test specimen (3.6 m x 2.4 m) was constructed in a wall dividing two reverberant rooms of approximately 98m^3 and 62m^3. The accuracy of the test method conforms to BS EN 20140-2:1993, the test procedure used was 140/3 issue 5. Broad-band white noise was used to measure the level differences and broad-band pink noise was used to measure the reverberation times. Third octave band pass filters were used in real time mode. See appendix B for further information.
Where serial measurements were taken, Band Pass noise was used for individual third octave frequencies.

LIMITATIONS

The results only relate to the behaviour of the element of construction under the particular conditions of test; they are not intended to be the sole criteria for assessing the potential acoustic performance of the element in use nor do they reflect the actual behaviour.

The specification and interpretation of test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over 5 years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

LABORATORY AIRBORNE SOUND INSULATION TEST - BS EN ISO 140-3:1995

Test Code: **H13516A** Test Date: **08/07/04**

Specimen Area, S = **8.64** m^2

	Room T2	Room T1
Room Volume, m^3:	**98**	**59.51**
Temperature, deg.C:	**17.8**	**18.6**
Rel. Humidity, %RH:	**64.4**	**61.1**

	Test Room T2 to Test Room T1								R
Freq Hz	Source dB	Rec. (uc) dB	Bgrnd dB	Rec. (corr) dB	Rev.time Sec	Corr. dB	**R dB**	U.Dev. dB	1/1Oct dB
50	61.3	29.0	14.4	**28.8**	0.65	-2.3	**30.2**		
63	65.0	41.3	13.4	41.3	0.86	-1.1	**22.6**		22.8
80	70.6	48.9	11.9	48.9	0.79	-1.4	**20.3**		
100	75.8	46.3	24.5	46.3	1.12	0.1	**29.6**		
125	78.9	50.2	11.7	50.2	1.21	0.4	**29.1**		28.3
160	85.9	58.8	10.4	58.8	1.00	-0.4	**26.7**	0.3	
200	92.4	63.7	17.5	63.7	1.39	1.0	**29.7**	0.3	
250	94.5	67.6	16.7	67.6	1.08	-0.1	**26.8**	6.2	28.2
315	94.4	66.3	16.0	66.3	1.21	0.4	**28.5**	7.5	
400	93.1	63.2	20.4	63.2	1.18	0.3	**30.2**	8.8	
500	91.3	56.9	20.1	56.9	1.12	0.1	**34.5**	5.5	33.2
630	90.2	51.7	18.9	51.7	1.24	0.5	**39.0**	2.0	
800	90.9	48.0	16.3	48.0	1.50	1.3	**44.2**		
1 000	90.4	42.3	16.1	42.3	1.51	1.4	**49.5**		47.7
1 250	91.1	36.3	13.8	36.3	1.64	1.7	**56.5**		
1 600	94.1	35.4	18.3	35.4	1.65	1.8	**60.5**		
2 000	95.7	36.9	16.1	36.9	1.67	1.8	**60.6**		58.2
2 500	94.2	40.2	16.8	40.2	1.55	1.5	**55.5**		
3 150	93.2	38.3	15.5	38.3	1.43	1.1	**56.0**		
4 000	91.9	33.1	13.8	33.1	1.43	1.1	**59.9**		58.8
5 000	89.6	26.4	14.3	**26.1**	1.29	0.7	**64.2**		
6 300									
8 000									
10 000									

Total U. Dev., dB **30.6**

Single Figure Ratings	**Rw**	**C**	**Ctr**
BS EN ISO 717-1: 1997	**dB**	**dB**	**dB**
	40	**-1**	**-5**
	(100-5000)	**0**	**-5**
Background Corrected			
	(50-3150)	**-2**	**-6**
	(50-5000)	**-1**	**-6**

Test Procedure: 140/3/issue 5

Worksheet: 140_3_1.XLS

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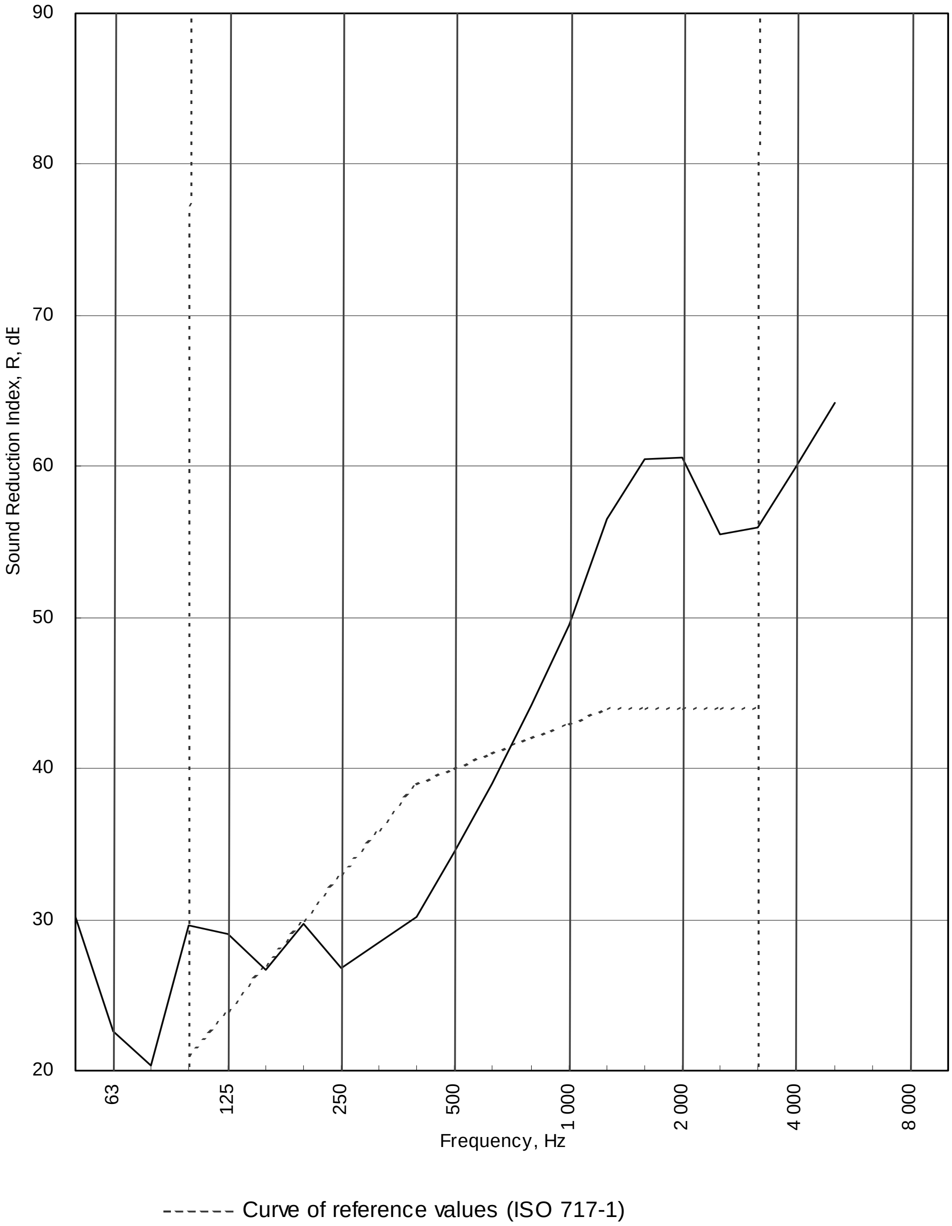
Customer: Kingspan Insulation Limited & British Gypsum Limited

Test Code:
H13516A
Test Date:
08/07/04

Freq. Hz	R dB
50	30.2
63	22.6
80	20.3
100	29.6
125	29.1
160	26.7
200	29.7
250	26.8
315	28.5
400	30.2
500	34.5
630	39.0
800	44.2
1 000	49.5
1 250	56.5
1 600	60.5
2 000	60.6
2 500	55.5
3 150	56.0
4 000	59.9
5 000	64.2
6 300	
8 000	
10 000	



Rating according to BS EN ISO 717-1:1997	**Rw (C;Ctr) = 40 (-1;-5) dB** Max dev. 8.8 dB at 400 Hz		
Evaluation based on laboratory measurement results obtained by an engineering method:	$C_{50\text{-}3150}$= **-2 dB**	$C_{50\text{-}5000}$= **-1 dB**	$C_{100\text{-}5000}$= **0 dB**
	$C_{tr,50\text{-}3150}$= **-6 dB**	$C_{tr,50\text{-}5000}$= **-6 dB**	$C_{tr,100\text{-}5000}$= **-5 dB**

Customer: Kingspan Insulation Limited & British Gypsum Limited

UKAS TESTING 0296

LABORATORY AIRBORNE SOUND INSULATION TEST - BS EN ISO 140-3:1995

Test Code: **H13523A** | Test Date: **09/07/04**

		Room T2	Room T1
Specimen Area, S = **8.64** m^2	Room Volume, m^3:	**98**	**58.8**
	Temperature, deg.C:	**18.1**	**18.6**
	Rel. Humidity, %RH:	**50.2**	**48.5**

Freq	Test Room T2 to Test Room T1						R	U.Dev.	R 1/1Oct
Hz	Source dB	Rec. (uc) dB	Bgrnd dB	Rec. (corr) dB	Rev.time Sec	Corr. dB	dB	dB	dB
50	87.6	63.2	16.6	63.2	0.58	-2.7	**21.7**		
63	87.8	67.9	16.4	67.9	0.85	-1.1	**18.8**		19.6
80	92.4	71.1	13.9	71.1	0.64	-2.3	**19.0**		
100	96.7	67.2	22.4	67.2	0.85	-1.1	**28.4**	8.6	
125	100.7	68.1	10.8	68.1	0.94	-0.6	**32.0**	8.0	31.3
160	107.0	68.9	8.4	68.9	1.04	-0.2	**37.9**	5.1	
200	112.2	69.7	16.9	69.7	1.54	1.5	**44.0**	2.0	
250	113.8	67.7	13.9	67.7	1.44	1.2	**47.3**	1.7	46.6
315	112.8	62.0	16.8	62.0	1.24	0.6	**51.4**	0.6	
400	110.3	56.5	20.5	56.5	1.11	0.1	**53.9**	1.1	
500	106.9	50.6	19.6	50.6	1.18	0.3	**56.6**		53.9
630	105.3	53.2	18.2	53.2	1.11	0.1	**52.2**	4.8	
800	104.3	46.0	16.8	46.0	1.41	1.1	**59.4**		
1 000	103.1	44.1	15.1	44.1	1.48	1.3	**60.3**		60.9
1 250	102.2	39.1	13.6	39.1	1.60	1.7	**64.8**		
1 600	104.6	38.8	17.5	38.8	1.58	1.6	**67.4**		
2 000	105.2	38.1	15.2	38.1	1.51	1.4	**68.5**		67.4
2 500	103.1	37.8	16.0	37.8	1.46	1.3	**66.6**		
3 150	101.0	35.6	14.9	35.6	1.36	1.0	**66.4**		
4 000	98.5	26.5	12.8	**26.3**	1.36	1.0	**73.2**		70.0
5 000	96.5	21.5	13.5	**20.8**	1.21	0.5	**76.2**		
6 300									
8 000									
10 000									

Total U. Dev., dB **31.9**

Single Figure Ratings BS EN ISO 717-1: 1997	**Rw dB**	**C dB**	**Ctr dB**
	56	**-4**	**-10**
	(100-5000)	**-3**	**-10**
Background Corrected			
	(50-3150)	**-8**	**-19**
	(50-5000)	**-7**	**-19**

Test Procedure: 140/3/issue 5
Worksheet: 140_3_1.XLS

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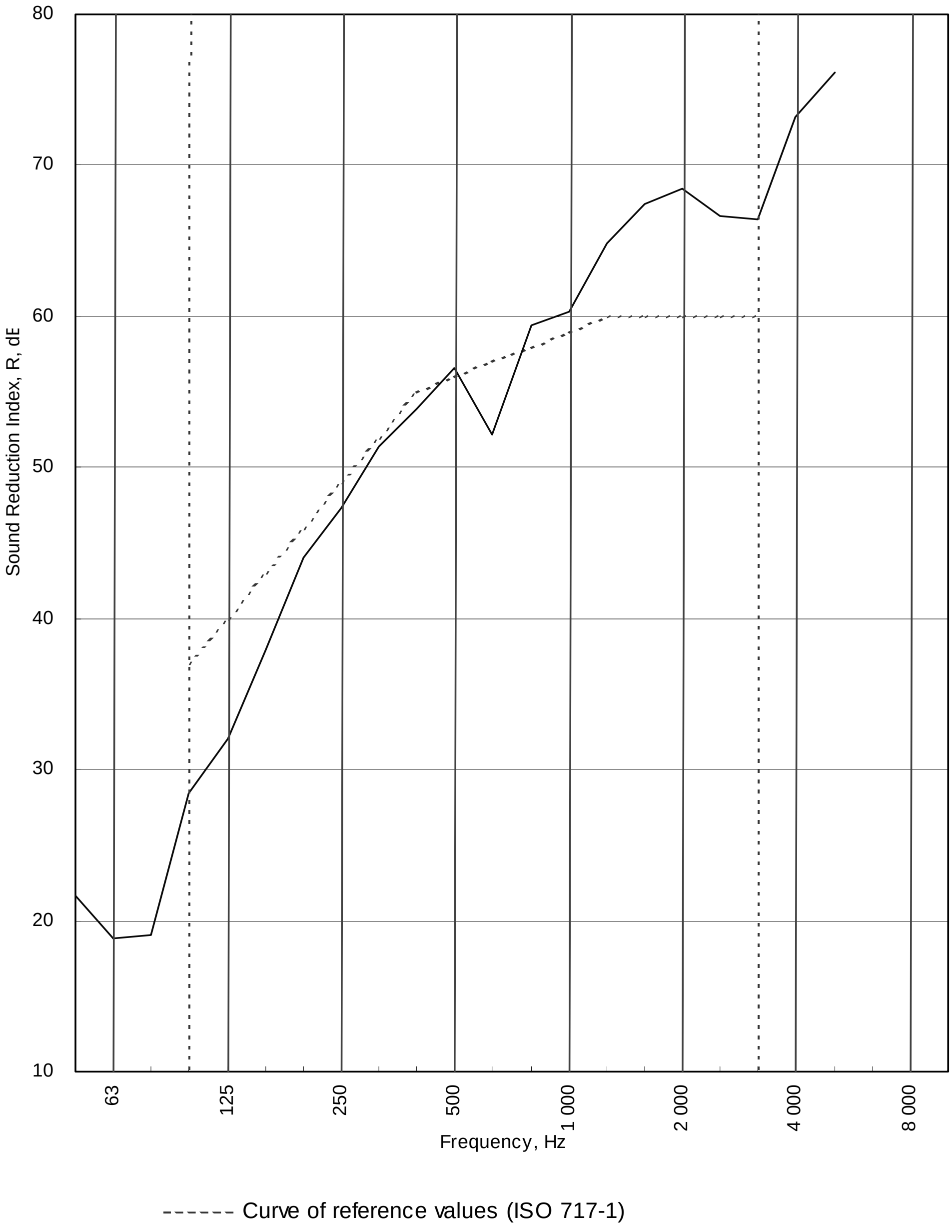
Test Code:
H13523A
Test Date:
09/07/04

Freq. Hz	R dB
50	21.7
63	18.8
80	19.0
100	28.4
125	32.0
160	37.9
200	44.0
250	47.3
315	51.4
400	53.9
500	56.6
630	52.2
800	59.4
1 000	60.3
1 250	64.8
1 600	67.4
2 000	68.5
2 500	66.6
3 150	66.4
4 000	73.2
5 000	76.2
6 300	
8 000	
10 000	



Rating according to BS EN ISO 717-1:1997	**Rw (C;Ctr) = 56 (-4;-10) dB** **Max dev. 8.6 dB at 100 Hz**		
Evaluation based on laboratory measurement results obtained by an engineering method:	$C_{50-3150}$= **-8 dB**	$C_{50-5000}$= **-7 dB**	$C_{100-5000}$= **-3 dB**
	$C_{tr,50-3150}$= **-19 dB**	$C_{tr,50-5000}$= **-19 dB**	$C_{tr,100-5000}$= **-10 dB**

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Customer: Kingspan Insulation Limited & British Gypsum Limited

APPENDIX B - TEST METHOD AND CONDITIONS

The source room (T2) was treated with six perspex diffusers of approximately 900mm x 1220mm. An omni-directional loudspeaker sound source is placed near a back corner of the source room (T2), rotating at 1 rpm and at least 0.7m from any room boundary to satisfy Annex C of BS EN ISO 140-3: 1995. A stationary loudspeaker sound source is placed in the corner of the receiving room (T1) opposite the test specimen.

The average sound pressure level in each 1/3 octave band is measured using a rotating microphone boom, positioned such that the minimum distance between microphone and sound source is 1m and between microphone and room boundaries is 0.7m.The rotating microphone has a sweep radius of at least 1m and is inclined in relation to the boundaries at an angle of at least 30° to the horizontal. The microphone has a traverse time of 32 seconds, and the sound pressure levels are averaged over 64 seconds which is equivalent to two complete sweeps of the microphone boom.

The equivalent absorption area of the receiving room is determined by producing the arithmetic average of six reverberation times and applying this to the Sabine formula.

The test specimen is installed in the aperture so that it finishes flush with the first independent timber in room T2 side to eliminate indirect transmission between rooms. The specimen is not installed so that the aperture depth ratio 2:1 is met as recommended in section 5.2.1 of BS EN ISO 140-3:1995. Laboratory tests have been carried out to prove the insignificance of this installation position on the test results.

The laboratory limit for measurement due to flanking is (BTC 11709A)

Freq Hz	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R'max	45.0	46.9	56.3	61.8	58.5	60.6	62.5	66.3	74.1	79.5	85.0	90.4	93.8	95.0	95.3	98.3	100.4	98.5	96.3	93.9	91.1

The figure below show flanking and isolation treatments in the test chamber.

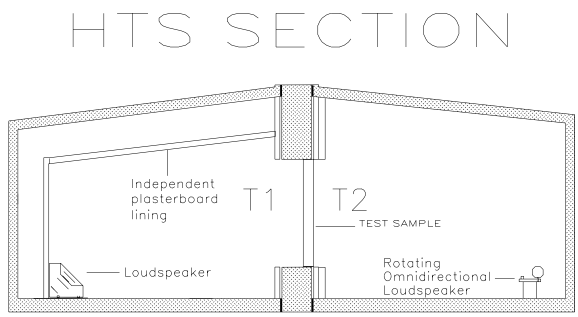

Figure 19 Chamber Layout