Dubai Acoustic Research Laboratory
ISO Acoustic Physical & Mechanical Testing Laboratory

ACOUSTIC TEST REPORT

Customer:	**Gulf Walls System** Alrayyan Building, St. 34, 1st Industrial City, Alahsa, KSA
Report Number:	**177T01**
Test Standard:	BS EN ISO 10140-2:2021
Classification Standard:	BS EN ISO 717-1:2020 ASTM E413-16
Test Specimen:	ICF Wall System
Test date:	17th January 2025

LB-TEST-162

REPORT REGISTER

The following report register documents the development and issue of this and any subsequent report as undertaken by our office, in accordance with the *Quality Assurance* policy of DARL.

Our Reference	Remarks	Issue Date
177T01	Sound Insulation Test Report	7th February 2025

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Prepared by	Jishnu Puran Acoustic Testing Engineer	31.01.2025
Reviewed by	Paul Schwarz Laboratory Director	31.01.2025

Revision	Notes	Date
00		07.02.2025

1.0 INTRODUCTION

General

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Purpose of Report

DARL has undertaken laboratory airborne sound insulation testing of a ICF Wall at the DARL testing facilities, Jebel Ali Industries 3, Dubai.

It is understood that samples are required to be tested according to the BS EN ISO 10140-2:2021.

To achieve that DARL will conduct a Sound Transmission Test according to EIAC accredited BS EN ISO 10140 "Laboratory measurement of sound insulation of building elements Part 2: Measurement of airborne sound insulation" standard which is equivalent to ASTM E90'"Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements'.

The calculation for the Sound Transmission Class (STC) rating, based on the ASTM E413 "*Classification for Rating of Sound Insulation*" will be referenced within the report.

The Weighted Sound Reduction Index (R_w) was determined in accordance with the BS EN ISO 717-1:2020 "Acoustics – Rating of sound insulation in buildings and of building element – Part 1: Airborne sound insulation".

Construction/mounting of the ICF Wall were carried out on the 16th January 2025 and measurements were undertaken on the 17th January 2025 under controlled conditions.

2.0 RESULTS SUMMARY

Fully tabulated measurement data and plotted results can be found towards the end of this report. In summary, the specimens submitted for sound insulation testing achieved the following result:

ICF Wall
Weighted Sound Reduction Index: **R_w (C; C_{tr}) = 45 (-1;-3) dB**
Sound Transmission Class **(STC): 45 dB**

The result applies to the sample as received and is related only to the tested item and laboratory conditions as described in the report. The laboratory can make no judgment about the representativity of the tested sample. The test report ahead is valid as long as the tested constructions and/or materials are unchanged.

The Weighted Sound Reduction Index (R_w) was determined in accordance with the BS EN ISO 717-1:2020 "Acoustics – Rating of sound insulation in buildings and of building element – Part 1: Airborne sound insulation", Sound Transmission Class (STC) has been calculated in accordance with ASTM E413 – 16 and is based on a result obtained by laboratory measurements.

The laboratory certificate can be found in Appendix A.

3.0 MEASUREMENT & METHODOLOGY CRITERIA

Measurements were undertaken in accordance with BS EN ISO 10140-2:2021 "*Acoustics – Laboratory measurement of sound insulation of building elements – part 2: Measurement of airborne sound insulation*" standard which is equivalent to ASTM E90'"Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements' and calculations undertaken and rated in accordance with ASTM E413-16, "*Classification for Rating Sound Insulation*" will be referenced within the report, making full allowance for current acoustic industry discussions surrounding measurement methodology and accuracy with respect to laboratory sound insulation testing and equipment configurations.

Laboratory conditions and construction details are presented in Appendix B.

4.0 TEST EQUIPMENT AND PROCEDURES

Measurements were undertaken with the following calibrated equipment –

Equipment	Type	DARL Ref	Serial No.	Calibration Due Date
Type 1 professional Sound Level Meter	NTi XL2 Analyzer	DARL – NTi – XL2 – S4i1	A2A-05713-E0	23-July-26
Microphone	Nti Audio MA220	DARL–NTiMA220-6348-S4i4	6348	23-July-26
Calibrator	Castle GA607	DARL–Castle GA607-S6i2	044739	24-Feb-26
Nti/Neutrik	Minirator MR Pro	DARL- MR-RAHSQ-S3i3	G2P- RAHSQ–G0	-
Loudspeaker	6 x Yamaha DSR115	-	n/a	-
Loudspeaker	Yamaha DSR118W	-	n/a	-

Table 1: Test equipment details.

Calibrations of the XL2 Type 1 sound level meters were undertaken before and after each measurement session. It was noted that no significant level of calibration drift have occurred (less than 0.1dB).

Testing Methodology

Sound insulation testing was undertaken in accordance with BS EN ISO 10140-2:2021 *"Acoustics – Laboratory measurement of sound insulation of building elements – part 2: Measurement of airborne sound insulation", the reverberation time measured, as described in BS EN ISO 10140-4:2021 "Acoustics - Laboratory measurement of sound insulation of building elements - Part 4: Measurement procedures and requirements"* which is equivalent to ASTM E90'"Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements'.

The testing and data collection procedures were arranged to satisfy the following requirements of the testing standard such as:

- the number of microphone positions
- the distance between source and microphone position
- the distance between source/microphone position and the room boundaries
- the distance between two sources/microphones positions
- the distance between the microphone position and the tested specimen

The sections below provide a summary of the test procedure detailed within the standard.

Airborne Sound Insulation Testing - Summary of Test Procedure

- Pink noise is generated in the 'source' room that a diffuse sound field is created within the room. Spatially averaged noise levels in each one-third octave band (50 - 5000 Hz) are recorded in the 'source' and the

'receiving' room using the fixed microphone method. The spatially averaged measurements are recorded for 7 microphone positions in the 'receiving' and the 'source' room over a sample period of 15 seconds for each microphone position.

- Reverberation time measurements are undertaken based on interrupted noise method as described in ISO 3382-2:2008 "Acoustics - Measurement of room acoustic parameters - Part 2: Reverberation time in ordinary rooms" within the 'receiving' room using an interrupted pink noise source. Seven measurements of reverberation time are undertaken within the room using the fixed microphone method.

- Spatially averaged measurements of background noise are made within the 'receiving' room using the fixed microphone method. The spatially averaged measurements are recorded for 7 microphone positions in the 'receiving' room over a sample period of 15 seconds for each microphone position.

Airborne Sound Insulation Testing - Analysis of Results

The measured noise levels in the 'receive' room are first corrected for background noise and then subtracted from the measured noise levels in the 'source' room to obtain the sound level difference in each one-third octave band.

The sound level differences are then corrected for reverberation time in the receive room, which is taking into consideration the equivalent sound absorption area of the receive room and the area of the free test opening in which the test specimen is installed.

Following the above, each one-third octave band R-value and STC value is compared against a standard curve, as defined in BS EN ISO 717-1:2020 & ASTM E413-16 "*Classification for Rating Sound Insulation*", and shifted in 1dB increments until a point is found where the value of deviations on the measured curve from the standard curve is as close to 32dB as possible, but does not exceed this value. The value of the shifted standard curve in the 500 Hz one-third octave band center frequency band is then taken to be the single figure of the weighted sound reduction index (R_w) and Sound Transmission Class (STC).

5.0 TEST SPECIMEN

It has been requested by Gulf Walls System to undertake acoustic laboratory testing to acquire the acoustic rating for the proposed ICF Wall.

On the day of testing 17th January 2025, the laboratory conditions were measured and are presented in the table below.

Air Temperature (°C)	25.6
Relative Humidity (%)	51
Static Pressure (hPa)	1032.9

Table 2: Laboratory conditions on the day of the test.

Description of the test element according to the data supplied by the client

Item Reference	Description
ICF Wall	ICF – Isolated Concrete Forms Wall with 60mm EPS on bothside and one side plastered with fibre mesh coat and one side is with gypsum board.

Table 3: Test System Description

The dimensions of the test element are as follow –

Width (mm)	2400
Height (mm)	4000

Table 4: Test specimen dimensions.

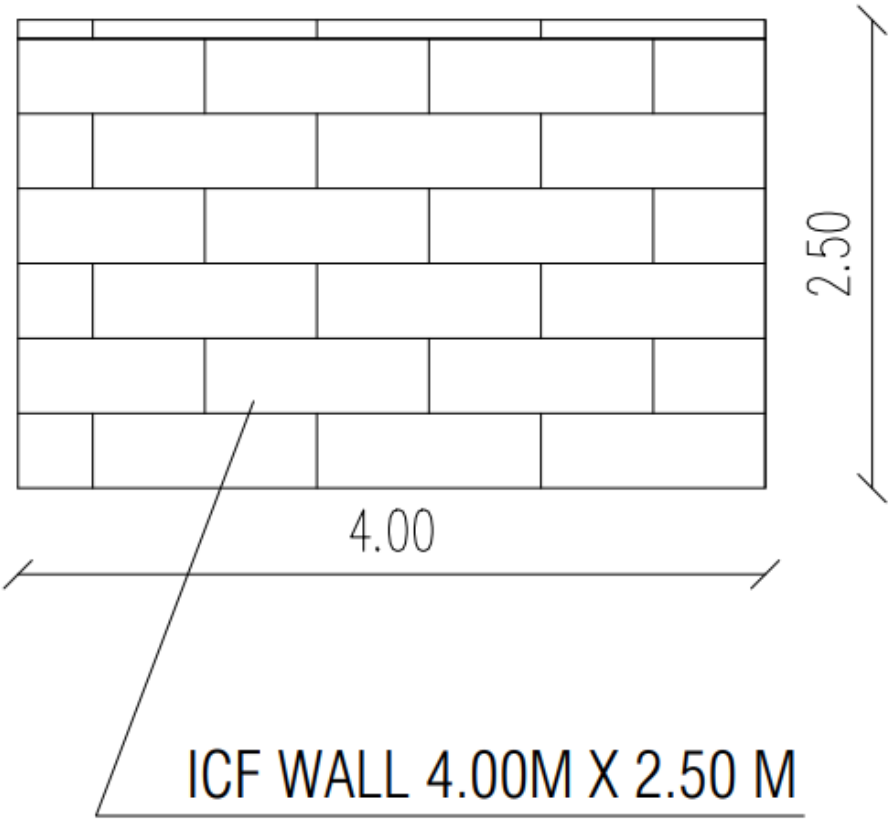
During and after the testing it has been noticed that the test sample has not suffered visible damage. However, it should be noted that the concrete was not fully cured prior to the commencement of testing.

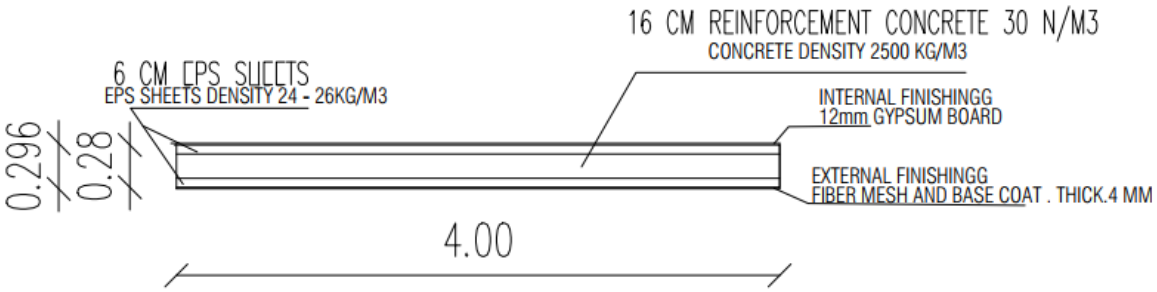
Pictures of test specimen – on the day of the test

Figure 1: Tested sample- Source Side

Figure 2: Tested sample- Receiver Side

Drawings – provided by the client





6.0 MEASUREMENT DATA

Spatially-averaged measurement data is presented below –

Source SPL (dB)	Microphone position							
Frequency (Hz)	1	2	3	4	5	6	7	Average
50	109.9	109.7	108.1	110.0	109.8	108.5	103.4	108.9
63	111.8	111.4	110.3	115.4	111.3	109.4	109.0	111.7
80	109.2	107.8	108.9	115.0	108.6	109.2	115.7	111.8
100	113.0	109.9	106.9	113.2	112.7	111.4	114.8	112.3
125	118.3	115.0	112.6	118.3	113.2	112.7	114.5	115.6
160	113.1	110.1	109.0	113.7	113.7	113.8	114.2	112.9
200	110.8	107.8	106.5	110.0	107.6	107.0	111.2	109.1
250	112.0	111.9	112.4	111.6	111.1	110.7	111.6	111.6
315	109.7	110.9	110.9	111.9	110.5	110.8	110.7	110.8
400	109.4	110.4	109.1	110.2	109.9	109.5	110.2	109.8
500	108.0	108.5	108.5	108.8	108.5	108.0	109.0	108.5
630	105.9	106.7	106.0	107.1	107.2	106.3	106.7	106.6
800	104.6	104.9	104.0	103.7	104.6	104.4	104.1	104.3
1000	103.1	102.9	103.1	103.0	102.7	102.8	102.6	102.9
1250	100.0	101.2	100.4	99.9	100.0	100.6	100.3	100.4
1600	100.5	100.7	100.4	100.6	100.3	100.6	99.9	100.4
2000	102.5	102.3	102.3	102.8	101.9	102.6	101.8	102.3
2500	101.9	102.3	101.9	102.3	102.2	102.1	102.3	102.1
3150	101.6	102.0	102.0	101.7	101.6	102.1	101.8	101.8
4000	99.3	99.8	99.8	99.8	99.7	99.3	99.3	99.6
5000	99.6	100.5	100.1	99.5	99.8	99.8	99.5	99.8

Table 5: Measurement data - source room.

Receiver SPL (dB)	Microphone position							
Frequency (Hz)	1	2	3	4	5	6	7	Average
50	81.2	77.6	75.7	71.0	77.3	75.7	75.9	77.2
63	79.0	75.6	73.8	68.6	75.8	74.0	76.2	75.6
80	60.0	66.7	65.1	69.7	66.4	63.2	70.1	67.0
100	64.4	62.5	62.5	66.0	65.0	64.9	65.7	64.6
125	73.1	76.9	71.9	76.2	75.6	73.0	70.9	74.5
160	66.0	70.0	66.6	68.2	68.3	68.6	71.5	68.8
200	67.7	66.4	64.3	66.4	64.2	65.9	68.6	66.5
250	65.0	65.0	65.2	63.5	65.7	66.1	65.5	65.2
315	64.4	66.4	66.8	63.7	66.1	66.0	65.6	65.7
400	65.3	64.3	65.3	63.2	64.0	67.0	66.4	65.2
500	62.7	61.4	62.7	61.8	62.7	63.2	62.8	62.5
630	62.6	62.3	63.0	63.8	63.0	63.1	65.1	63.4
800	58.8	59.7	60.3	60.0	60.2	59.7	63.2	60.5
1000	50.3	51.4	50.8	50.9	51.9	50.9	52.8	51.4
1250	35.6	35.9	35.3	35.9	35.4	37.4	37.2	36.2
1600	23.8	24.1	24.1	25.4	24.3	24.9	25.4	24.6
2000	21.7	21.9	22.3	22.6	22.5	22.8	23.2	22.5
2500	21.4	21.3	21.5	22.2	21.7	22.5	23.3	22.0
3150	23.0	23.7	23.6	23.9	24.0	24.7	25.8	24.2
4000	20.3	21.1	20.6	21.4	21.5	21.6	22.6	21.4
5000	19.5	20.3	20.1	20.7	21.1	21.0	21.1	20.6

Table 6: Measurement data - receiver room.

Background SPL (dB)	Microphone position							
Frequency (Hz)	1	2	3	4	5	6	7	Average
35.0	40.8	46.0	44.7	43.8	42.9	43.0	43.0	43.7
43.9	43.8	44.3	44.6	41.2	38.6	39.4	43.7	42.8
33.4	37.2	37.9	38.1	37.0	35.2	38.9	38.2	37.6
26.2	34.9	31.4	31.2	32.2	31.7	32.7	30.2	32.3
23.3	27.8	30.7	29.3	30.3	26.2	28.0	31.4	29.4
16.7	26.8	26.7	23.4	24.4	23.7	23.1	22.2	24.7
11.4	17.0	18.8	14.7	14.9	15.5	15.6	16.9	16.4
9.2	13.4	17.4	12.7	12.8	14.2	14.3	17.2	15.0
8.4	9.5	11.7	10.1	8.9	9.3	10.1	9.9	10.0
8.4	8.3	11.6	10.6	7.5	7.9	8.9	8.2	9.2
7.4	6.9	8.8	8.5	7.0	7.0	9.9	7.4	8.1
7.5	6.8	7.3	7.2	7.1	7.1	10.2	7.4	7.7
8.0	7.0	7.3	7.4	7.2	7.0	9.6	7.4	7.7
8.6	7.4	7.3	7.4	7.4	7.4	9.1	7.5	7.7
9.1	7.8	7.9	8.2	7.9	7.8	9.9	8.5	8.3
9.3	8.4	8.5	8.7	8.5	8.4	9.6	9.1	8.8
9.5	8.8	8.9	9.0	8.9	8.8	10.1	9.2	9.1
9.8	9.3	9.4	9.6	9.5	9.4	10.2	9.7	9.6
10.2	9.9	9.9	10.0	10.0	9.9	10.7	10.1	10.1
10.7	10.4	10.3	10.4	10.4	10.4	10.7	10.5	10.4
11.1	10.8	10.7	10.8	10.8	10.8	10.9	10.8	10.8

Table 7: Measurement data - background noise in the receiver room.

Frequency (Hz)	Meas. RT60 (s)
50	1.19
63	1.45
80	1.45
100	1.53
125	1.52
160	1.60
200	1.45
250	1.38
315	1.31
400	1.25
500	1.17
630	1.08
800	1.06
1000	1.11
1250	1.15
1600	1.19
2000	1.19
2500	1.21
3150	1.25
4000	1.24
5000	1.16

Table 8: Reverberation time.

One-third octave band frequency (Hz)	R One-third octave band (dB)	R Octave band (dB)	Octave band frequency (Hz)
50	26.5	30.0	63
63	31.8		
80	40.4		
100	43.5	39.4	125
125	36.9		
160	40.1		
200	38.2	39.8	250
250	41.8		
315	40.3		
400	39.6	39.1	500
500	40.7		
630	37.6		
800	38.1	42.2	1000
1000	46		
1250	58.8		
1600	70.7	73.1	2000
2000	74.8		
2500	75.2		
3150	72.8	73.5	4000
4000	73.5		
5000	74.4		

Table 9: R-values in one-third and octave band 1.

Receive Room Volume (m²)	249
Test Sample surface area (m²)	10

Table 10: Receive room and test specimen specification.

End of Report

Author

Jishnu Puran
Acoustic Testing Engineer
For DARL

Verified

Paul Schwarz
Laboratory Director
For DARL

APPENDIX A – LABORATORY CERTIFICATE

Sound Reduction Index, *R*, in accordance with ISO 10140-2

Product Name: ICF Wall
Product identification:

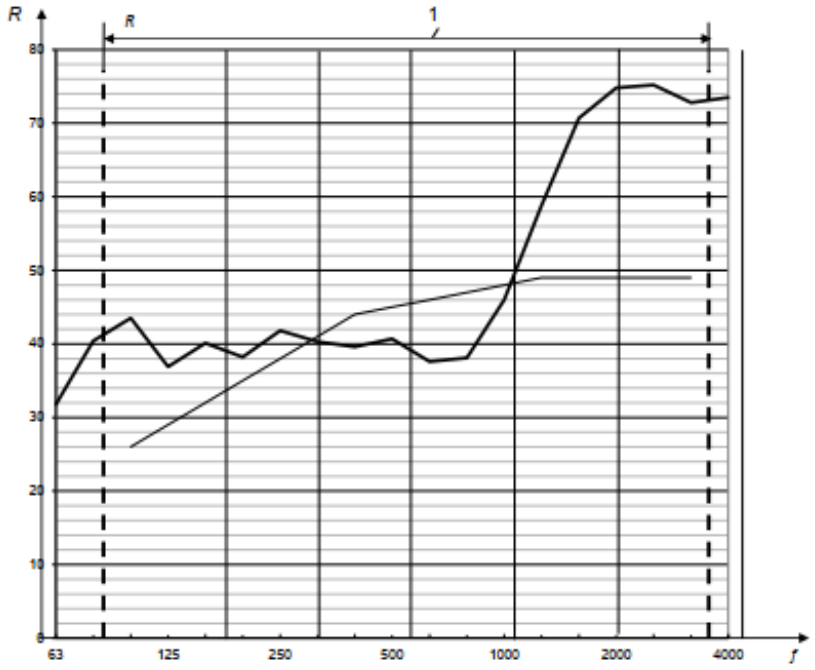
Client: Gwalls

Date of test: 17-01-2025
Test room identification: DARL

Area, S, of test element: 10.08 m^2

Air temp. In the test rooms 25.6 °C
Relative humidity in the test rooms: 51 %
Static pressure: 1032.9 *hPa*
Receiving room volume: 249 m^3

Frequency f Hz	*R one-third octave* dB
50	26.5
63	31.8
80	40.4
100	43.5
125	36.9
160	40.1
200	38.2
250	41.8
315	40.3
400	39.6
500	40.7
630	37.6
800	38.1
1000	46.0
1250	58.8
1600	70.7
2000	74.8
2500	75.2
3150	72.8
4000	73.5
5000	74.4



Key
R sound reduction index, in dB
f frequency, in Hz
1 frequency range for rating in accordance with the curve of reference values (ISO 717-1)

Rating in accordance with ISO 717-1:
$R_w (C;C_{tr})$ = **45 (-1;-3) dB** $C_{50\text{-}3150}$ = (0) dB; $C_{50\text{-}5000}$ = (0) dB; $C_{100\text{-}5000}$ = (0) dB

Evaluation based on laboratory measurements results obtained by an engineering method:
$C_{tr,50\text{-}3150}$ = (-4) dB; $C_{tr,50\text{-}5000}$ (-4) dB; $C_{tr,100\text{-}5000}$ = (-3) dB;

No. of test report : 177T01 *Name of test institute : ISO Acoustic P&MTL*
Date: 17-01-2025 *Signature :*

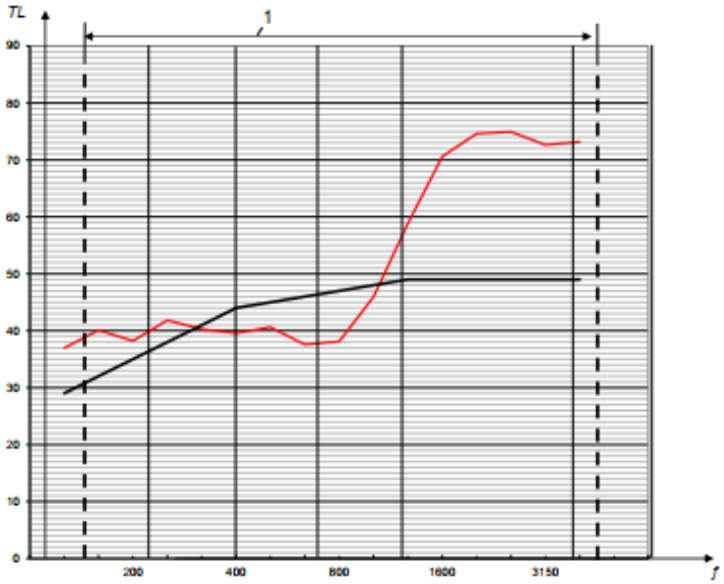
Sound Transmission Class, *STC*, rated in accordance with ASTM E 413

Manufacturer:	Gwalls	Product Identification:	ICF Wall
Client :	Gwalls	Date of test:	17-01-2025
Test element mounted by:	Gwalls	Test room Identification:	DARL

Area, *S*, of test element: 10.00 m²

Air temp. in the test rooms	25.6	°C
Relative humidity in the test rooms:	51	%
Static pressure:	1032.9	hPa
Receiving room volume:	249	m³

Frequency f Hz	TL one-third octave dB
50	26.5
63	31.8
80	40.5
100	43.5
125	36.9
160	40.1
200	38.2
250	41.8
315	40.3
400	39.6
500	40.7
630	37.6
800	38.1
1000	46.0
1250	58.8
1600	70.6
2000	74.6
2500	74.9
3150	72.6
4000	73.2
5000	74.4



Key
TL Transmission Loss, in dB
f frequency, in Hz
1 frequency range for rating in accordance with the curve of reference values (ASTM E 413)

Rating in accordance with ASTM E 413:

STC = 45 dB

Noise Reduction:	36.9	40.1	38.2	41.8	40.3	39.6	40.7	37.6	38.1	46.0	58.8	70.6	74.6	74.9	72.6	73.2
Deficiencies:	0.0	0.0	0.0	0.0	0.7	4.4	4.3	8.4	8.9	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Sum of Deficiencies:	28.8															

No. of test report :	177T01	Name of test Institute :	ISO Acoustic P&MTL
Date:	17-01-2025	Signature :	

APPENDIX B – LABORATORY CONDITIONS

The source room and receive room comprise a fully-enclosed space. The reverberant rooms are having the following details:

Room	Size (m)	Shape	Volume (m^3)	Total surface area (m^2)
Source	8.44 x 6.22	Rectangular	233	234
Receive	8.45 x 6.45	Rhombus	249	246

Table 11: Laboratory chamber dimensions and details

The source room is entirely separated from the receive room as such vibration cannot be transferred and interfere with the receive measurements.

The Laboratory frame (surrounding construction) comprises of 2040 mm reinforced concrete structure with vibration isolation pads in between the source and receive room frames. Source and receive room structures comprise of 325 mm thick isolated floating concrete floor with 450 mm thick sound insulated walls and double-leaf doors. The aperture to place the test specimen has an area size of $10m^2$.

In the receive room 14 diffusive panels of a total surface area of $28m^2$ are installed on the ceiling. Each panel (size: 1.00m x 2.00m) is made of 6mm thick MDF board.

It is considered that any potential flanking noise paths were sufficiently reduced to comply with the requirements of the ISO testing methodologies.

The maximum measurable sound reduction index ($R`_{max}$) has been measured according to the guidance provided in the ISO 10140-5, Appendix A.2.2.1.1 utilizing Type A Lightweight wall.

Frequency (Hz)	R'max (dB)
50	33.8
63	40.9
80	48.3
100	50.7
125	59.9
160	61.3
200	66.9
250	71.6
315	71.5
400	75.1
500	76.6
630	80.7
800	81.6
1000	82.6
1250	83.8
1600	83.4
2000	84.8
2500	82.3
3150	84.2
4000	83.8
5000	84.0

Table 12: Maximum measurable sound reduction index in one-third octave band.

The weighted sound reduction index is:
$R`_{w,\,max}$ = 79 dB.