
**ACOUSTIC ABSORPTION REPORT:
ACOUSTIC WOOD SLAT WALL
PANELS**

**DOCUMENT PRESENTED TO:
RICHELIEU HARDWARE LTD.**

WRITTEN BY:



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SOLUTIONS
NOVIKA 

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SUMMARY

This report presents the methodology and results of acoustic absorption testing performed on Acoustic Wood Slat Wall Panels. This testing was performed on April 13th, 2023, following the methods described in ASTM standard C 423.

The panels consist of a 9 mm felt backing upon which 12 mm decorative wood slats are glued.

The panels were tested in three mountings:

1. Type A – Installed directly on the floor.
2. Type C-20 – Installed on an additional felt with 1” x 3” furring between the felt and panel.
3. Type A – Installed on a wood frame with 3.5” mineral wool in the frame’s cavities. In this case, the combination of wool and panel are considered the material under test.

The testing results were as follows:

Sample and mounting	NRC	SAA
Panel - Type A	0.54	0.56
Panel - Type C-20 on felt	0.82	0.83
Panel and wool - Type A	0.90	0.91

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ACOUSTIC ABSORPTION REPORT: ACOUSTIC WOOD SLAT WALL PANELS

1 General Information

Tests performed by:	Adrien Amyotte, P. Eng. Émile Raymond, Intern
Test Location:	Cégep de La Pocatière (Reverberation chamber)
Test date:	April 13 th , 2023
Client:	Richelieu Hardware Ltd.
Test Description:	Felt and wood acoustic panels. Panels in following mountings: <ul style="list-style-type: none">• Type A• Type C-20 with additional felt• Type A with 3.5" mineral wool

2 Introduction

Novika Solutions was mandated to characterize the acoustical absorption of a new line of acoustic panels.

Testing techniques inspired by the following standards:

- *ASTM C 423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method;*
- *ASTM E 795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests.*

The following points deviate from the standards:

- The reverberation chamber has a volume of 120.1 m₃ rather than the 125 m₃ minimally prescribed by ASTM C 423.

- The variation of decay rate with microphone position exceeds the limits prescribed in Annexe A3 of ASTM C 423 at the following third octave bands: 100 Hz to 250 Hz (See appendix for a summary of the room qualification).

These deviations affect the repeatability and reproducibility of the results in very low frequencies. The volume of the room affects very low frequencies, in particular the 100 Hz octave band. The derogation regarding the variation of decay rate affects the third octave bands listed above, that is to say the 100 Hz to 250 Hz bands.

To finish, the only octave band contributing to the NRC calculation affected by these deviations is the 250 Hz band.

3 Sample and mounting descriptions

3.1 Samples

Samples tested were Acoustic Wood Slat Wall Panels.

The panels consist of a 9 mm felt on which 12 mm decorative wood slats are glued. The slats are 1" wide and spaced 11/16". One panel is 11.75" wide and 96" long. The panel composition is shown in Figure 1.

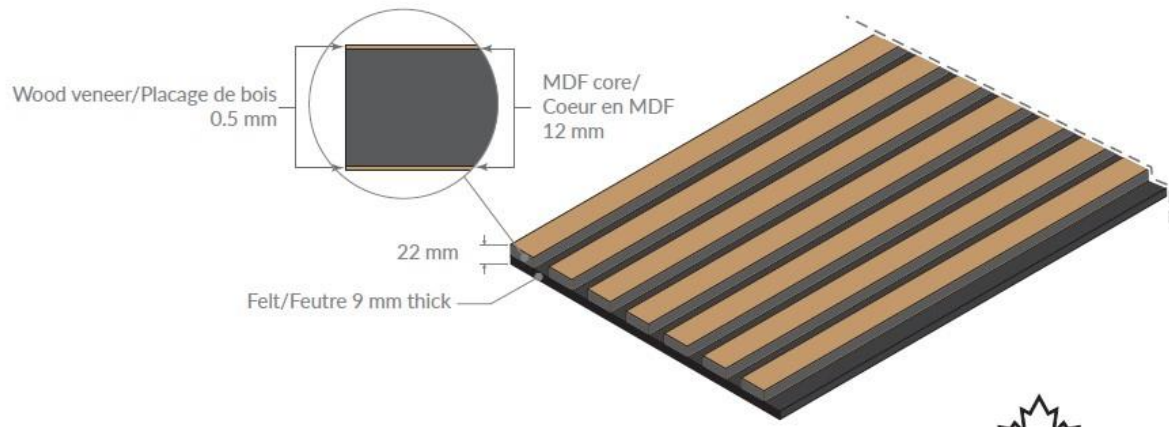


Figure 1 – Panel composition

3.2 Mounting

3 panel mounting. All tested mountings are representative of final product installation. To note, the C-20 mounting on additional felt was performed with a smaller felt area than final installation. This test is, therefore, conservative compared to final installation.

3.2.1 Panels

The panels were tested in 3 mountings:

- Type A, installed directly on the floor
- Type C-20, installed on a 9 mm felt, separated by 1" x 3" wood furring
- Type A, installed on a wood frame with 3.5" mineral wool in the frame's cavities

The first mounting, type A, is very simple. The panels are laid directly on the floor and measurements are taken.

For the C-20 mounting, a 9 mm felt is installed on the floor. The panels are then installed on the felt, separated with 1" x 3" wood furring. Note that the felt surface used for this test was smaller than the panel surface (58 sqft of felt vs 72 sqft of panels). As final installation will use equal felt and panel surfaces, this test is conservative. Mounting, along with felt distribution during testing, are shown in Figure 3.



Figure 3 – Felt distribution and furring (left) and assembled C-20 mounting (right)

The final mounting used panels installed on a wood frame with 3.5” mineral wool in its cavities. In this case, the “panel” consists of the felt and wood panel and the mineral wool installed in A mounting, directly on the floor. This mounting is shown in Figure 4.



Figure 4 – Panel installed on mineral wool

4 Theory and Calculation

This section contains a brief presentation of definitions and concepts relating to acoustical absorption testing.

4.1 Definitions

- Diffuse Field: A field is said to be diffuse when the acoustic intensity is provided entirely by acoustic reflections and is, in theory, perfectly uniform. In practice, no field is perfectly diffuse, but reverberation chambers provide a good approximation of a diffuse field.
- Reverberation Time: Reverberation time is a characteristic of a room and the materials it contains. It consists of the time required for sound to be reduced by 60 dB, or to inaudibility, after the source stopped producing the sound. This characteristic is notably used to calculate absorption coefficients. Reverberation time increases with room volume and is reduced by the introduction of acoustically absorbent materials.

- Reverberation Chamber: A reverberation chamber is an experimental room designed to provide an approximately diffuse sound field. It is typically large, with walls made up of highly reflective materials, such as concrete.
- Absorption Coefficient (α): The absorption coefficient is the ratio between the acoustic energy absorbed by a material and the total incident energy and depends on frequency.

4.2 Acoustical absorption

Acoustical absorption is the phenomenon by which acoustical energy is absorbed and transformed to heat through friction. This principle is illustrated in figure 2. The absorption coefficient is the ratio between the absorbed acoustical intensity (I_a) and the total incident acoustical intensity (I). The remainder of the acoustical intensity is reflected (I_r). The absorption coefficient varies with the frequency of the acoustical wave and is typically presented as a function of frequency in either octave or third-octave bands. The value of absorption coefficients can vary between 0 and 1. In practice it can exceed 1 in the case of very absorbent materials due to the effects of the edge of the material, which are not accounted for in the theoretical model.

It is important not to confuse acoustical absorption with acoustical isolation. Sound isolation refers to a materials capacity of blocking sound from passing from one space to another, while acoustical absorption refers to a materials capacity at absorbing sound energy within a space. A material can be an excellent sound absorber, but a poor sound insulator and vice-versa. For example, fiber glass panels are excellent at absorbing sound but poor at isolating sound. On the other hand, concrete is a very poor sound absorber, but provides excellent sound isolation.

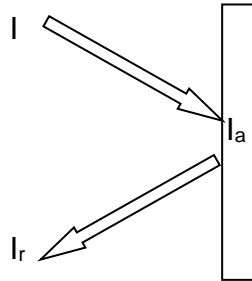


Figure 7 - Illustration of the principle of acoustical absorption

4.2.1 Sound Absorption Average (SAA)

The Sound Absorption Average (SAA) is a single number rating of a materials sound absorption capacity. It is obtained by calculating the average of the twelve third octave bands between 200 Hz and 2500 Hz inclusively.

4.2.2 Noise Reduction Coefficient (NRC)

The Noise Reduction Coefficient (NRC), similarly to the SAA, is a single number rating of a materials sound absorption capacity. It is obtained by calculating the average of the sound absorption coefficients at 250 Hz, 500 Hz, 1000 Hz and 2000 Hz.

5 **Methodology and Results**

5.1 Acoustic Equipment

Table 1 – List of measurement equipment

Instrument	Manufacturer	Model	Novika Number	Calibration Date
Calibrator 1000 Hz	Larson Davis	CAL200	A0059	2022-07-20
Professional Sound Level Meter	Brüel et Kjaer	2270	A0048	2022-12-19
Microphone et Preamplifier	Brüel et Kjaer	4189	A0048B	N.A.
Temperature and Humidity Sensor	Omega	RH700	E0682	2022-11-18

5.2 Temperature and Humidity

Acoustical measurements were performed in the reverberation chamber at the Cegep de La Pocatière. Temperature and humidity measurements were taken before each measurement. The room was initially below the minimum required humidity. To correct this, a humidifier was used prior and during testing to maintain constant humidity levels above the 40% minimum requirement. Temperature and humidity levels measured during testing are presented in Table 2. The humidity range for a given sample should be within 3% and the temperature range within 3 °C. If these limits are exceeded, a correction must be applied.

Table 2 – Temperature and Humidity Measurements

	Temperature (°C)	Humidity (%)
Panel A Mount – Position 1	25.3	48.4
Panel A Mount – Position 2	24.9	48.1
Panel A Mount – Position 3	25.1	46.9
Range	0.4	1.5
Panel C-20 Mount – Position 1	47.6	25.3
Panel C-20 Mount – Position 2	48.7	24.7

Panel C-20 Mount – Position 3	50.7	24.5
Range	3.1	0.8
Panel and Wool a Mount – Position 1	56.7	24.5
Panel and Wool a Mount – Position 2	56.7	24.3
Panel and Wool a Mount – Position 3	56.5	24.5
Range	0.2	0.2

The humidity and temperature ranges are within prescribed limits, with two exceptions: panels in C-20 mount with felt and ceiling tiles in E-455 mount. Corrections prescribed by ASTM C 423 have been applied to the measurements.

5.3 Measurement Methodology

Measurements were taken at three sample positions for each configuration. The sample positions were chosen to avoid having more than 25% shared surface area between each pair of positions and to maintain a minimum 75 cm distance from the chamber walls.

For each sample positions, 5 microphone positions, spaced at a minimum 1.5 m from each other and at least 75 cm from the chamber walls, were chosen. 10 decay measurements were taken at each microphone position for each sample position.

Figure 8 illustrates the testing layout including sample, microphone, and source positions, while figure 6 shows pictures of the test samples during testing.

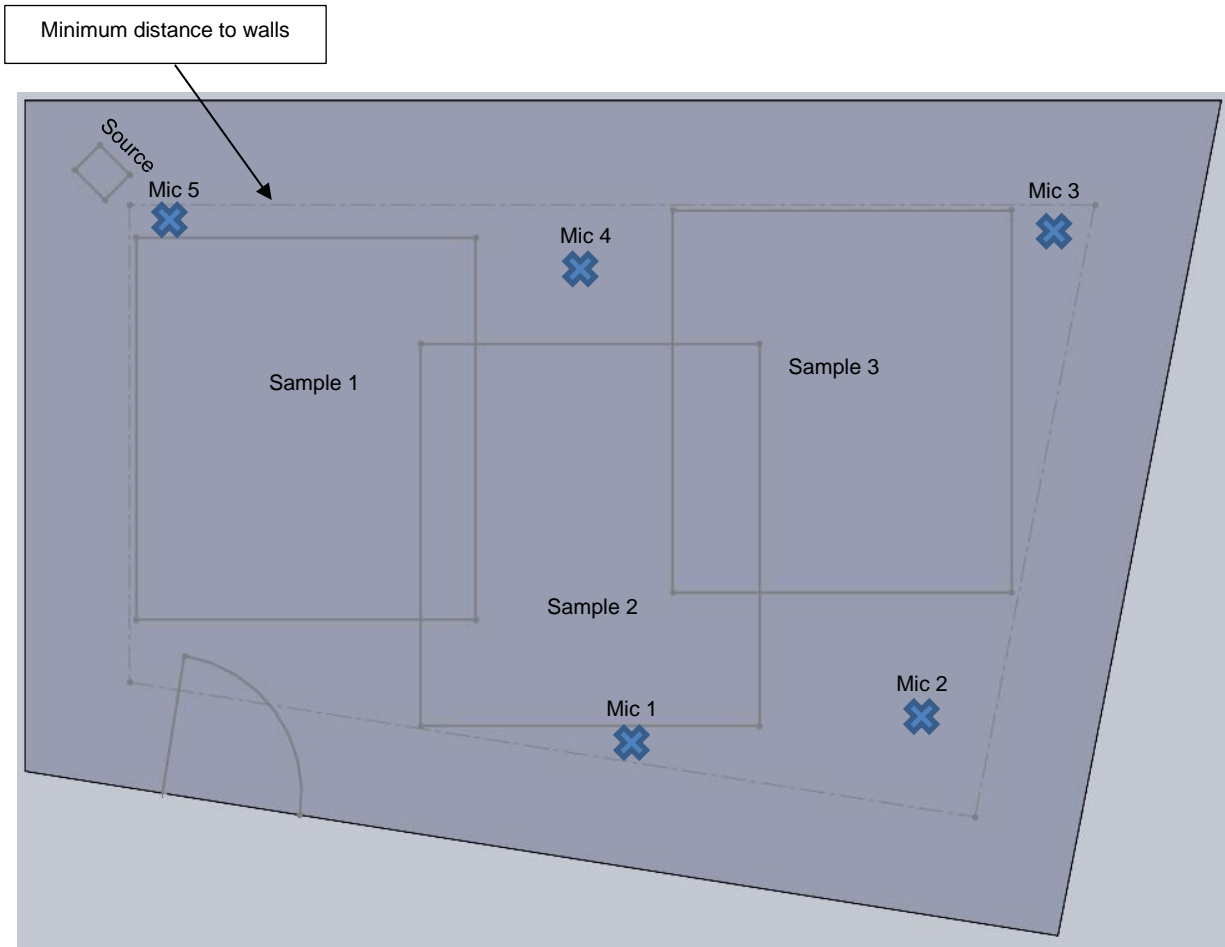


Figure 8 – Testing layout diagram

5.4 **Results**

Table 3 presents the measured absorption coefficients, as well as SAA and NRC values for each material and mounting type. Figure 9 presents the results graphically.

Panneaux			
Frequency (Hz)	A Mount	C-20 Mount – With Felt	A Mount – With Wool
100	0.195	0.247	0.668
125	0.043	0.146	0.585
160	0.118	0.201	0.551
200	0.184	0.306	0.553
250	0.153	0.345	0.744
315	0.272	0.550	0.940
400	0.305	0.702	1.005
500	0.355	0.874	1.019
630	0.462	0.995	0.983
800	0.584	1.061	0.986
1000	0.710	1.072	0.929
1250	0.863	1.061	0.935
1600	0.954	1.056	0.942
2000	0.933	1.003	0.914
2500	0.931	0.986	0.939
3150	0.858	0.957	0.910
4000	0.858	0.954	0.850

5000	0.732	0.927	0.780
NRC	0.54	0.82	0.90
SAA	0.56	0.83	0.91

Table 3 – Absorption Coefficients of Tested Materials

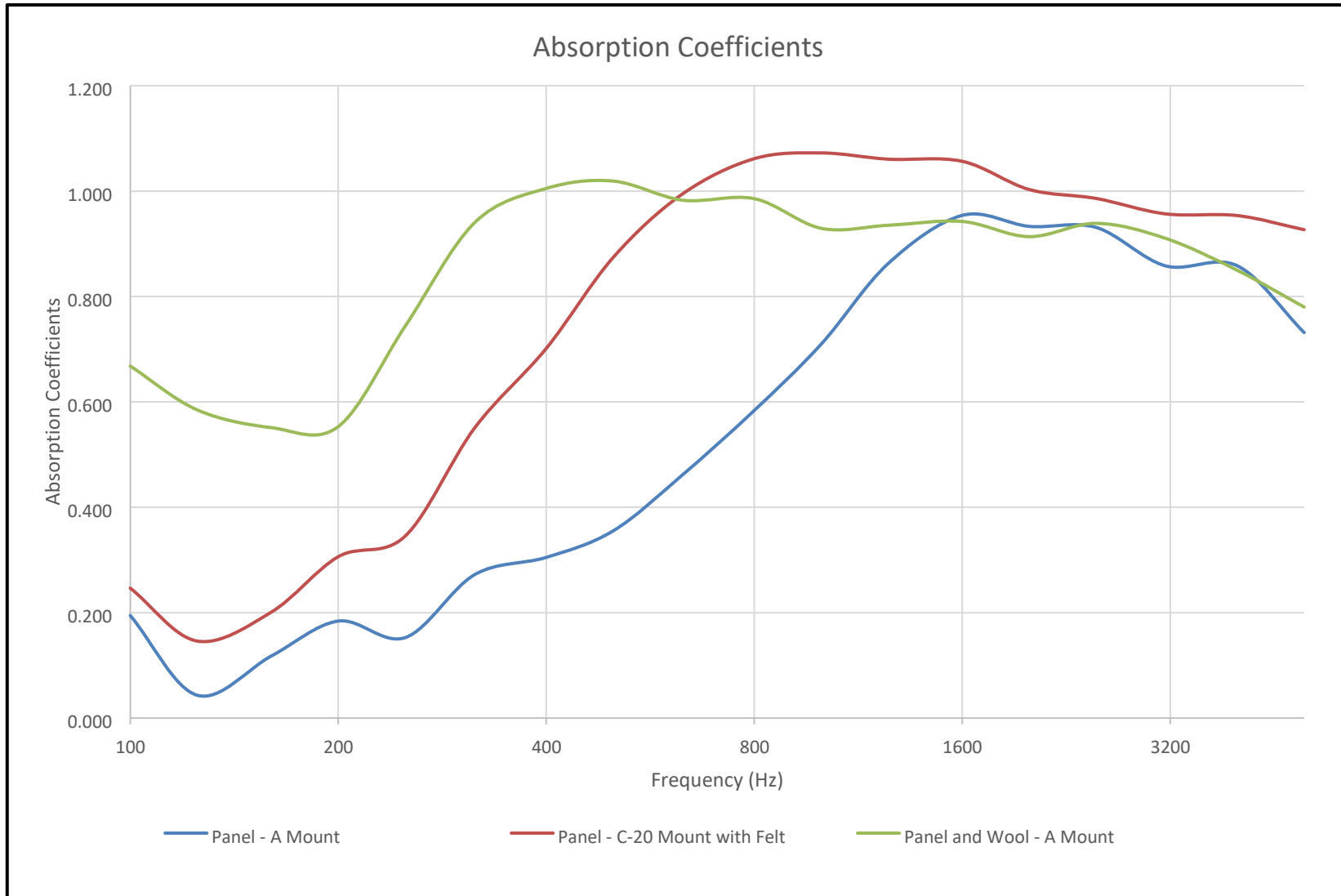


Figure 9 – Absorption Spectrum of Tested Samples

APPENDIX

Reveberation Chamber Characterization

REVERBERATION CHAMBER CHARACTERIZATION

In order to estimate the variation of decay rate with microphone position, twenty decay measurements were taken at the microphone positions identified in the report. The variation of decay rate corresponds to the ratio of the standard deviation between each microphone position (S_M) and the average decay rate ($\langle DM \rangle$). Table A1 presents the result of this characterization, with results exceeding the limit prescribed by Annexe A3 of ASTM C423 noted in red font.

Tableau A 1- Sound absorption and variation of decay rate with microphone position for empty reverberation chamber

Frequency (Hz)	A (m ²) empty chamber	$S_M/\langle D_M \rangle$	Maximum Value
100	1.822	0.31	0.11
125	2.048	0.12	0.07
160	1.668	0.11	0.04
200	1.437	0.08	0.03
250	1.589	0.04	0.03
315	1.616	0.02	0.03
400	1.661	0.01	0.03
500	1.873	0.02	0.02
630	1.908	0.00	0.02
800	2.011	0.01	0.02
1000	2.211	0.01	0.02
1250	2.417	0.01	0.02
1600	2.683	0.01	0.02
2000	3.058	0.01	0.02
2500	3.423	0.00	0.02
3150	4.128	0.01	0.02
4000	5.167	0.01	0.02
5000	6.421	0.00	0.02
* Values exceeding maximum value identified in red font.			