

NRC·CMRC CONSTRUCTION

Acoustic Testing of Skyfold Prisma with Glass Panels

Author: Pascal Beaulieu
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Contract Number: A-0039125
Agreement Date: 02 March 2022



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Client Skyfold Inc
325 Avenue Lee, Montreal, Quebec,
H9X3S3

Specimen **Skyfold Prisma – 1x3 Double Glass Panels**

- Laminated tempered glass panels, each 12.5mm thick

Lifting Mechanism

- Telescoping arms
- Beams
- Trim
- Seals

Specimen ID A1-021085-05W

Specimen Description

The size of the 2.44 m x 3.66 m NRC facility test opening was reduced to accommodate the specimen by constructing a filler element as follows: The test opening was lined with a layer of sill gasket. A header consisting of a steel beam measuring 77 mm x 305 mm x 3667 mm covered on both sides with 2 layers of plywood with dimensions of 19 mm x 305 mm x 3667 mm and 6 layers of CGC SHEETROCK gypsum panels with dimensions of 16 mm x 305 mm x 3667 mm was constructed. The header housed the motor and other operable parts of the lifting mechanism. The header assembly was supported at each end by 39 mm x 89 mm wood studs 2439 mm long and spaced 89 mm apart and fastened to the test frame using Type S screws 51 mm long spaced every 200 mm on centre. The space between the studs, which measured 39 mm x 89 mm, was filled with fiberglass insulation and the supports were then enclosed with 3 layers of 13 mm CGC SHEETROCK gypsum board on the face and sides. The supports had a finished measurement of 76 mm deep x 380 mm wide and 2362 mm high. Two layers of CGC Type X gypsum board each measuring 13 mm x 189 mm x 3581 mm and 16 mm x 189 mm x 3581 mm were placed on the bottom portion of the test frame. Exposed joints between pieces of gypsum board were caulked and covered with metal foil tape.

The Skyfold Prisma operable partition was installed by the client. It consisted of 6 single laminated glass panels; each factory mounted in aluminum frames which were fixed to two lifting mechanisms that were supported from the top. The panels and lifting mechanisms raised and lowered in a telescoping manner for operation. The framed panels measured 721 mm high x 3310 mm wide. The partition was made up of three sections of different thickness, 150mm, 230mm and 308mm (~6", ~9", and ~12") (outer face of frame to outer face of frame). The overall dimensions of the partition were 2172 mm high x 3508 mm wide.

The client reported that each single laminated glass panel was constructed as follows: tempered glass + film + tempered glass. The laminated glass panels, without frames, measured 697mm x 3226 mm x 12.5mm (27.4375" x 127" x ½") and weighed ~62 kg (~136 lbs). The mass of each framed glass panel was 78.6 kg. The total mass of all 6 glass panels was 471.6 kg. The total mass of the lifting mechanisms including floor bar, and side seals was 83.9 kg. The total mass of the specimen was 555.5 kg.

The client reported the highlights of the specimen as follows: Various cover plates, gaskets, foam tapes, and bulb seals act as acoustic seals between panels, lifting mechanisms and the perimeter construction elements.

Proprietary details of the specimen are withheld from this report at the request of the client.



Figure 1: Wall Specimen

Specimen Properties

Element		Actual thickness (mm)	Mass (Kg)	Mass/length, area or volume
Skyfold Prisma 1X3 Double	Each glass panel: laminated tempered glass	12.5	62	27.6 kg/m ²
	Lifting mechanism: Telescoping arms, beams, trim and seals	127	83.9	
Total		127	555.5	62.3 kg/m ²

ASTM E90 Test Results – Airborne Sound Transmission Loss

Client: Skyfold Inc.
Specimen ID: A1-021085-05W

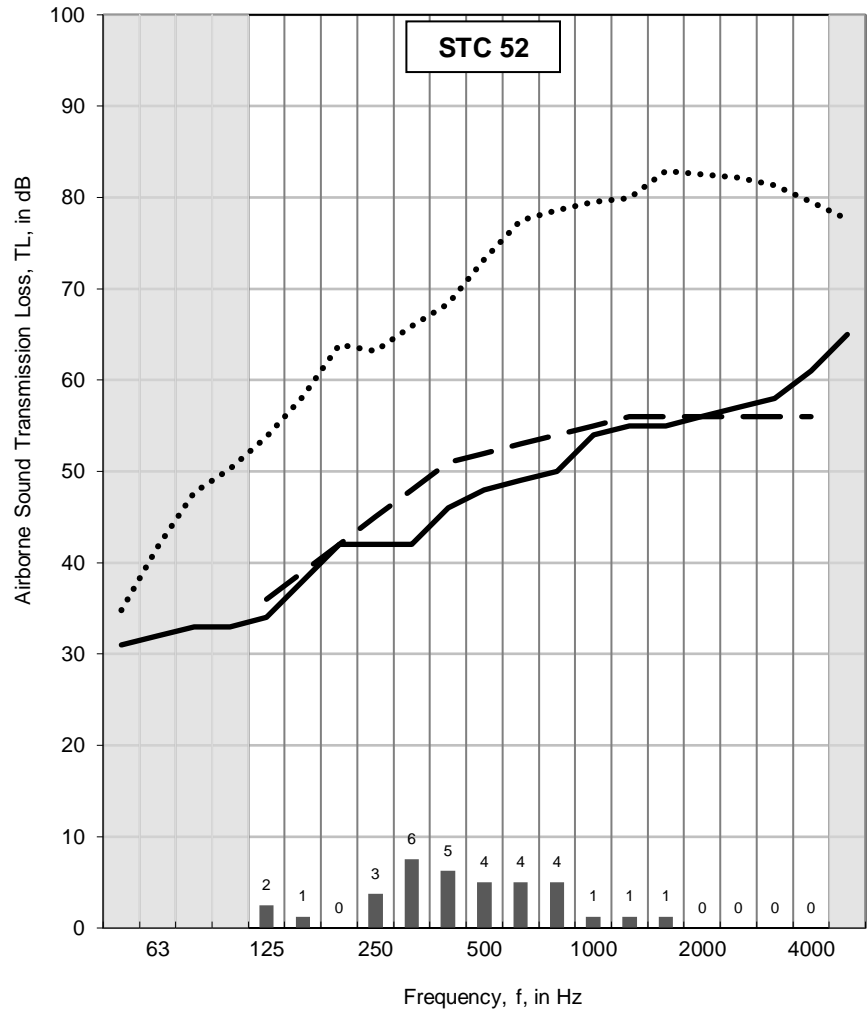
Test ID: TLA-22-206
Date of Test: 2022-08-05

Room	Volume (m ³)	Air Temperature (°C)	Humidity (%)
Small	140.9	22.4 to 22.4	68.2 to 68.3
Large	255.5	22.0 to 22.1	64.5 to 64.7

Area of test specimen:	8.92 m ²
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f (Hz)	Airborne TL (dB)
50	31
63	32
80	33
100	33
125	34
160	38
200	42
250	42
315	42
400	46
500	48
630	49
800	50
1000	54
1250	55
1600	55
2000	56
2500	57
3150	58
4000	61
5000	65
Sound Transmission Class (STC)	52

Sum of Deficiencies (dB)
32
Max. Deficiency (dB)
6 dB at 315 Hz



For a description of the test specimen and mounting conditions see text pages before. The results in this report apply only to the specific sample submitted for measurement. No responsibility is assumed for performance of any other specimen. **Airborne sound transmission loss measurements were conducted in accordance with the requirements of ASTM E90-09, "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements".**

In the graph:

The solid line is the measured sound transmission loss for this specimen. The dashed line is the STC contour fitted to the measured values according to ASTM E413-22. The dotted line (may be above the displayed range) is the flanking limit established for this facility. For any frequency band where the measured transmission loss is less than 10 dB lower than the dotted line, the reported value is potentially limited by flanking transmission via laboratory surfaces, and the true value may be higher than that measured. Bars at the bottom of the graph show deficiencies where the measured data are less than the reference contour as described in the fitting procedure for the STC, defined in ASTM E413-22. The shaded cells in the table and areas in the graph are outside the STC contour range.

In the table:

Values marked "c" indicate that the measured background level was between 5 dB and 10 dB below the combined receiving room level and background level. The reported values have been corrected according to the procedure outlined in ASTM E90-09. Values marked "*" indicate that the measured background level was less than 5 dB below the combined receiving room level and background level, in which case, the corrected values provide an estimate of the lower limit of airborne sound transmission loss.

APPENDIX: ASTM E90-09(2016) – Airborne Sound Transmission – Wall Facility

Facility and Equipment: The NRC Construction Wall Sound Transmission Facility comprises two reverberation rooms (referred to in this report as the large and small rooms) with a moveable test frame between the two rooms. The large room has an approximate volume of 256 m³ while the small room has an approximate volume of 141 m³. In each room, there are 8 pre-polarized diffuse-field ½" microphones, Brüel & Kjær Type 4942. Measurements are made in both rooms simultaneously using a NI PXI 4499 DAQ system with LabVIEW measurement software. Each room has four bi-amped loudspeakers driven by separate amplifiers and noise sources. To increase diffusivity of the sound field, there are fixed diffusing panels in each room.

Test Procedure: Airborne sound transmission loss measurements were conducted in accordance with the requirements of ASTM E90-09(2016), "Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements". Airborne sound transmission loss tests were performed in the forward (receiving room is the large room) and reverse (receiving room is the small room) directions. Results presented in this report are the average of the tests in these two directions. In each case, sound transmission loss values were calculated from the average sound pressure levels of both the source and receiving rooms and the average reverberation times of the receiving room. One-third octave band sound pressure levels were measured for 32 seconds at eight microphone positions in each room and then averaged to get the average sound pressure level in each room. Five sound decays were averaged to get the reverberation time at each microphone position in the receiving room; these reverberation times were averaged to get the average reverberation times for each room. Information on the flanking limit of the facility and reference specimen test results are available on request.

Significance of Test Results: ASTM E90-09(2016) requires measurements in one-third octave bands in the frequency range between 100 Hz and 5000 Hz. Within this range, reproducibility has been assessed by inter-laboratory round robin studies. The standard recommends making measurements and reporting results over a larger frequency range, and this report presents such results, which may be useful for expert evaluation of the specimen performance. The precision of results outside the 100 Hz to 5000 Hz range has not been established, and is expected to depend on laboratory-specific factors.

Sound Transmission Class (STC): The Sound Transmission Class (STC) was determined in accordance with ASTM E413-22, "Classification for Rating Sound Insulation." It is a single-figure rating scheme intended to rate the acoustical performance of a partition element separating offices or dwellings. The higher the value of the STC rating, the better the performance of the building element is expected to be. The rating is intended to correlate with subjective impressions of the sound insulation provided against the sounds of speech, radio, television, music, and similar sources of noise characteristic of offices and dwellings. The STC is of limited use in applications involving noise spectra that differ markedly from those referred to above (for example, heavy machinery, power transformers, aircraft noise, motor vehicle noise). Generally, in such applications it is preferable to consider the source levels and insulation requirements for each frequency band.

In-Situ Performance: The ratings obtained by this standard test method tend to represent an upper limit of what might be measured in a field test, due to structure-borne sound transmission ("flanking") and construction deficiencies in actual buildings.