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Airborne Sound Transmission Loss Measurement of Skyfold Mirage 33 STC

Skyfold Inc.
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SKYFOLD MIRAGE®

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Client:	Skyfold Inc. 325 Lee Avenue Montréal, Québec, CANADA H9X 3S3
Specimen:	Skyfold Mirage
Specimen ID:	A1-011025-1X4 Single-8W
Construction Date:	May 12, 2017

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 Mirage operable partition was installed by the client. It consisted of 4 single laminated glass panels, mounted in a lifting mechanism that was supported from the top. The glass panels measured 460 mm high x 3290 mm wide. The panels were supported by horizontal aluminum "beams" attached to moveable “pantographs” that folded when raised and lowered for operation. A non-moveable aluminum channel measuring 2172 mm high x 127 mm thick x 25 mm wide was attached to each side of the opening, to guide the raising and lowering of the partition. The overall dimensions of the partition, including these channels, were 2172 mm high x 3508 mm wide x 127 mm thick.

The client reported that each single laminated glass panel was constructed as follows: a laminated pane of 5 mm (3/16”) annealed glass, 1 mm (1/16”) film, 5 mm (3/16”) annealed glass. The total thickness of each glass panel was 11 mm (7/16”). The mass of each glass panel was 38.1 kg. The total mass of all 4 glass panels was 152.4 kg. The total mass of the lifting mechanism including the pantographs, beams, trim, and seals was 83.9 kg. The total mass of the specimen was 236.3 kg.

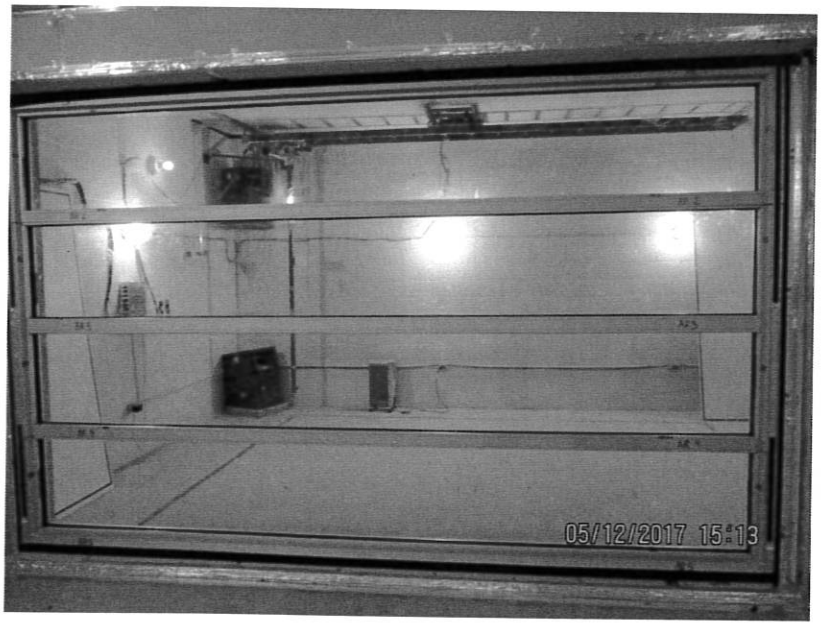
The client reported the highlights of the specimen as follows: Backing rod around glass; foam

gasket between slash cuts; foam in bulb seals at corner; added 1/2 in x 2 in open cell foam strip between large sweep seals; added 2 strips 3/4 in x 1 in open cell foam behind large brush seals.

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

Specimen Properties:

Element		Actual thickness (mm)	Mass (kg)	Mass/area
Skyfold Mirage 1X4 Single	Each glass panel: laminated pane of 5 mm annealed glass/1mm film/5 mm annealed glass	11	38.1	25.2 kg/m²
	Lifting mechanism: Pantographs, beams, trim and seals	127	83.9	
Total		127	236.3	31.0 kg/m²



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ASTM E90 Test Results – Airborne Sound Transmission Loss

Client: Skyfold Inc. **Test ID:** TLA-17-106

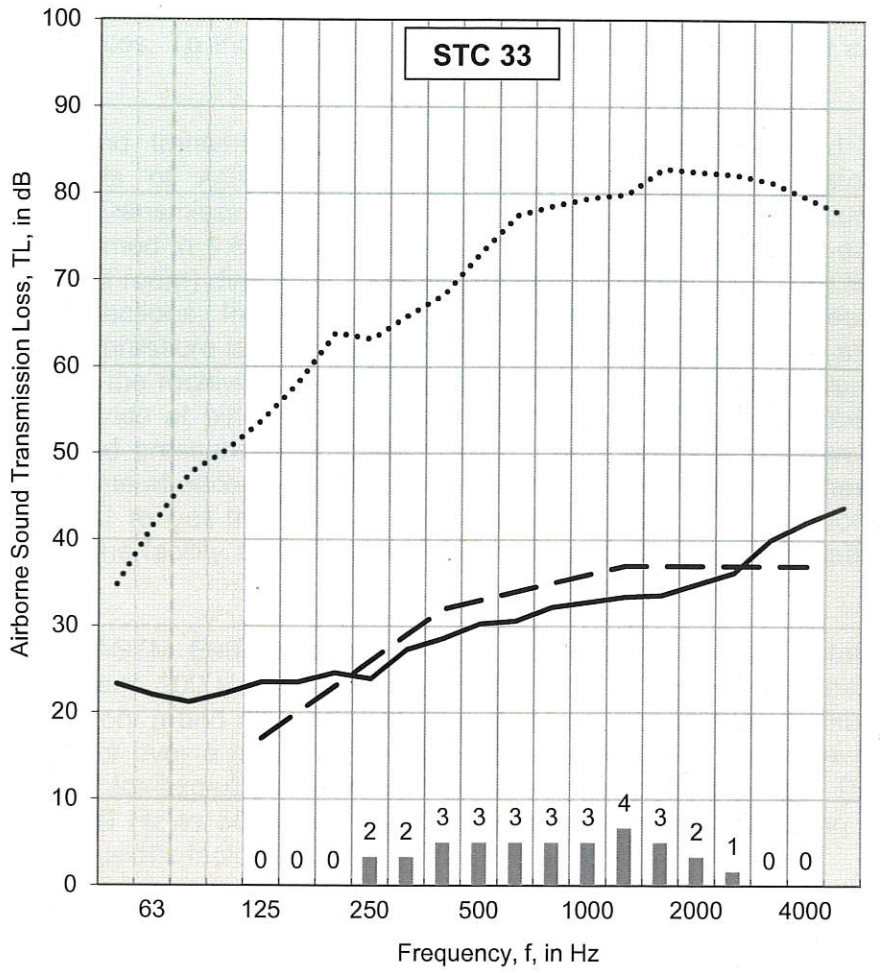
Specimen ID: A1-011025-1X4 Single-8W **Date of Test:** May 12, 2017

Room	Volume (m³)	Air Temperature (°C)	Humidity (%)
Large	255.6	21.7 to 21.9	40.6 to 41.1
Small	140.5	21.5 to 21.5	41.5 to 41.7

Area of test specimen:	7.62 m^2
Mass of test specimen:	236.3 kg

f (Hz)	TL (dB)
50	23
63	22
80	21
100	22
125	24
160	24
200	25
250	24
315	27
400	29
500	30
630	31
800	32
1000	33
1250	33
1600	34
2000	35
2500	36
3150	40
4000	42
5000	44
Sound Transmission Class (STC)	**33**

Sum of Deficiencies (dB)
29
Max. Deficiency (dB)
4 dB at 1250 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 E413-16. The dotted line (may be above the displayed range) is 10 dB below the flanking limit established for this facility. For any frequency band where the measured transmission loss is above 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 E413-16. 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 A - ASTM E90-09 Airborne Sound Transmission Loss Measurement Procedure

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 255 m^3 while the small room has an approximate volume of 140 m^3. In each room, a calibrated Brüel&Kjaer condenser microphone (type 4166 or 4165) with preamplifier is moved under computer control to nine positions, and measurements are made in both rooms using a National Instrument NI-4472 system installed in a computer. Each room has four loudspeakers driven by separate amplifiers and noise sources. To increase randomness 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, "Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions". 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 nine 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 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 E413-16, "Classification for Rating Sound Insulation." It is a single number 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.