



NRC Construction

Client Report

September 6, 2012

Measurement of Airborne Sound Transmission Loss in Accordance with ISO 140-3 of Classic NR Panel Assemblies

B3504.8

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Measurement of Airborne Sound Transmission Loss in Accordance with ISO 140-3 of Classic NR Panel Assemblies



A Client Report based on the results of the NRC Research Project on:

Acoustic Measurements of Railtech Panel Assemblies

for

Skyfold Custom Powerlift Partitions, Railtech LTD.
Montréal, Québec
H9X 3S3

September 6, 2012



Measurement of Airborne Sound Transmission Loss in Accordance with ISO 140-3 of Classic NR Panel Assemblies

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Construction Portfolio
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Ottawa, Ontario K1A 0R6

Client: Skyfold Custom Powerlift Partitions, Railtech LTD.
325 Lee Avenue, Montréal, Québec H9X 3S3

Specimen: Classic NR Panel Assemblies

Specimen ID: B3504-41W-F3

Manufacturer: Client

Construction Date: March 16, 2012

Test specimen mounted by: Testing Laboratory



Specimen Description:

Panel Assembly F3 – Standard Classic NR Panel - Fabric Finish – Perforated Face - Insulation 38 mm (1.5")
Specimen Thickness – 298 mm (11.75")

Specimen B3504-41W-F3 consisted of two 0.61 m X 2.44 m (2'X 8') panel assemblies indicated with the label F3 (placed by the client) mounted on each side of the opening of a filler wall. The panel assemblies were mounted against 25 mm X 25 mm (1" x 1") wood strips around the inside perimeter, with a layer of sill gasket in between the wood and the panel. On both sides of the specimen, backer rod was installed around the outside perimeter of the panels and then caulked and taped.

The composition of the Specimen from one side to the other was:

- Panel Assembly F3: Panel Thickness 19 mm (0.75") - Insulation Thickness 38 mm (1.5")
- Airspace 184 mm (7.25")
- Panel Assembly F3: Panel Thickness 19 mm (0.75") - Insulation Thickness 38 mm (1.5")

The total specimen thickness was 298 mm (11.75"). The masses of the two panel assemblies, including attached insulation, were measured to be 18.10 kg and 18.10 kg, for a total specimen mass of 36.20 kg.

Filler Wall Description:

Filler wall TLA-12-009: Since the area of the test specimen was smaller than the facility test opening, the procedures in the Standard were followed to build a filler wall that transmitted a negligible amount of sound relative to that through the specimen. The filler wall assembly comprised the following elements, listed from one side of the wall to the other:

- 3 layers of 15.9 mm Type X gypsum board
- 13 mm resilient channels, spaced 610 mm oc
- 65 mm steel studs, spaced 610 mm oc
- 13 mm air space

- 65 mm mineral fibre insulation
- 65 mm steel studs, spaced 610 mm oc
- 38 mm air space
- 95 mm mineral fibre insulation
- 95 mm steel studs, spaced 610 mm oc
- 13 mm resilient channels, spaced 610 mm oc
- 4 layers of 15.9 mm Type X gypsum board

The filler wall was mounted in the wall test opening which measures 3658 mm X 2434 mm. The opening in the filler wall to mount the specimen measured 2452 mm X 623 mm. All gypsum board joints were caulked and sealed with metal tape.

Specimen Properties:

Element		Actual thickness (mm)	Mass (kg)	Mass/length, area or volume
Panel Assembly	Operable partition panel 19 mm	19	17.4	11.7 kg/m ²
Generic	Semi-Rigid fiberglass 38 mm	38	0.7	13.8 kg/m ³
Air	184 mm	184	0.0	0.0
Generic	Semi-Rigid fiberglass 38 mm	38	0.7	13.8 kg/m ³
Panel Assembly	Operable partition panel 19 mm	19	17.4	11.7 kg/m ²
Total		298	36.2	

Test Specimen Installation:

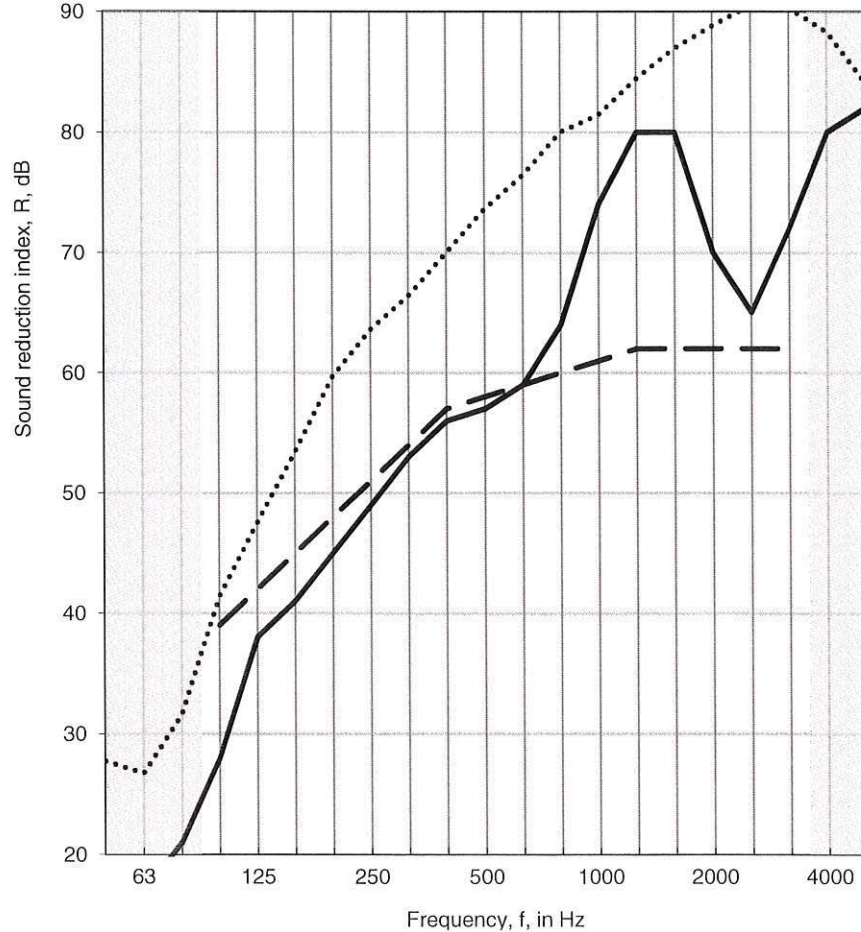
During the measurements, a filler wall with high sound transmission loss was mounted in the NRC acoustical wall test opening which measures approximately 3.66 m x 2.44 m, and the specimen was mounted in a smaller opening in this filler wall. The perimeter of the filler wall and the specimen were sealed on both sides with caulking and then covered with a metal tape. The sound transmission loss of the test specimen was calculated according to ISO 140-3. The area used for the calculations of airborne sound transmission loss was 1.49 m².

Airborne sound transmission loss measurements were conducted in accordance with the requirements of ISO 140-3:1995, "Acoustics – Measurement of sound insulation in buildings and of building elements – Part 3: Laboratory measurements of airborne sound insulation of building elements"

Client: Skyfold Custom Powerlift Partitions, Railtech LTD. Test ID: TLA-12-070
Specimen ID: B3504-41W-F3 **SKYFOLD**® classic NRC™ Date of Test: March 16, 2012
Large Room Volume: 255.0 m³ **SKYFOLD** Area S of test specimen: 1.49 m²
Small Room Volume: 139.6 m³ **zenith NRC** Mass per unit area: 24.3 kg/m²

Room	Air temperature, °C	Humidity, %	For a further 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.
Small	19.6 to 19.7	45.8 to 46.4	
Large	21.0 to 21.1	52.7 to 56.2	

Frequency f Hz	R 1/3-octave (dB)
50	≥ 18.2
63	17.0
80	21.3
100	28.2
125	37.8
160	40.9
200	45.2
250	49.3
315	53.0
400	56.4
500	57.4
630	58.8
800	63.9
1000	≥ 74.0
1250	*min 80.3
1600	* 79.8
2000	69.8
2500	64.9
3150	≥ 72.1
4000	* 79.7
5000	*min 82.5



In the graph: Solid line is the sound reduction index, R_s , for this specimen corrected for sound transmission through the filler wall if necessary. Dotted line is 6 dB below the measured value R'_T of filler wall with test opening covered. For any frequency where R_s is above the dotted line, the reported value is potentially limited and the true value may be higher than that measured. Dashed line is the curve of reference values fitted to the measured values according to ISO 717-1. Shaded values are not accounted for the single number rating, R_w , according to ISO 717-1.

In the table: Values marked "≥" are to be taken as limits of measurement and the reported values provide an estimate of the lower limit of R . Values marked "*" indicate that the measured background level was 6 dB or less below the combined receiving room level and background level. Values marked "min" indicate that the measured value R'_s of the filler wall with the specimen installed in the test opening was less than or equal to 6 dB below the measured value R'_T of the filler wall with the test opening covered.

Rating according to ISO 717-1:

$R_w (C; C_{tr}) = 58 (-4; -11)$ dB $C_{50-5000} = -8$ dB; $C_{tr, 50-5000} = -22$ dB

Evaluation based on laboratory measurement results obtained by an engineering method

APPENDIX: Airborne Sound Transmission Wall Facility

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Construction Portfolio
Acoustics Laboratory
1200 Montreal Road, Ottawa, Ontario K1A 0R6
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Facility and Equipment: The acoustic wall test facility comprises two reverberation rooms (referred to in this report as the small and large room) with a moveable test frame between the rooms. The small room has approx. volume of 140 m^3 and the large of 255 m^3 . The rooms of the acoustic wall test facility fulfill the requirements of ISO 140-1:1997. The movable frame is made from hollow steel beams filled with concrete, which conforms to the intent but not the specific wording of ISO 140-1:1997/Amd 1:2004. In each room, a calibrated Bruel & Kjaer condenser microphone (type 4166) with preamp is moved under computer control to nine positions, and measurements are made in both rooms using an 8-channel National Instrument NI4472 system installed in a desktop PC-type computer. Each room has four loudspeakers driven by separate amplifiers and noise sources controlled by the computer. To increase randomness of the sound field, there are also fixed diffusing panels in each room.

Test Procedure: Airborne sound transmission measurements were conducted in accordance with the requirements of ISO 140-3:1995, "Acoustics – Measurement of sound insulation in buildings and of building elements – Part 3: Laboratory measurements of airborne sound insulation of building elements". Airborne sound reduction index was measured in the forward (receiving room is the small room) and reverse (receiving room is the large room) direction. Results presented in this report are the average of the tests in these two directions. In each case, sound reduction index 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. The reverberation time is evaluated from sound decay curves following ISO 354. 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: ISO 140-3:1995 requires measurements in 1/3-octave bands in the frequency range 100 Hz to 5000 Hz. Within those ranges, reproducibility has been assessed by inter-laboratory round robin studies. The standards recommend 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 to 5000 Hz range has not been established, but is expected to depend on laboratory-specific factors.

Weighted Sound Reduction Index (R_w) and Spectrum Adaptation Terms (C , C_{tr}): were determined in accordance with ISO 717-1:1996, "Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation". The Weighted Sound Reduction Index (R_w) 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 rating, the better the performance. The Spectrum Adaptation Terms (C , C_{tr}) are values to be added to the single-number rating and intended to correlate with subjective impressions of the sound insulation provided against sounds with different spectra. Two sound spectra are defined in ISO 717-1:1996. Spectrum Adaptation Term C is intended for sources like pink noise, such as living activities (talking, music, radio, TV, children playing), railway traffic at medium and high speed, highway road traffic ($> 80 \text{ km/h}$), jet aircraft at short distance, or factories emitting mainly medium and high frequency noise. Spectrum Adaptation Term C_{tr} is intended for urban road traffic noise, but it is also suitable for other noise sources, such as railway traffic at low speed, propeller driven aircraft, jet aircraft at large distance, disco music, or factories emitting mainly low and medium frequency noise. The ratings above are of limited use in applications involving noise spectra that differ markedly from those referred to above (for example, heavy machinery, power transformers,...). Generally, in such applications it is preferable to consider the source levels and insulation requirements for each frequency band.

Precision: Acoustical measurement in rooms is a sampling process and as such has associated with it a degree of uncertainty. Further uncertainty is associated with the variation expected when a nominally identical specimen is built, installed and tested in same laboratory or when nominally identical specimens are tested in different laboratories. Guidance on methods to assess differences expected for these cases are given in ISO 140-2:1991 "Acoustics -- Measurement of sound insulation in buildings and of building elements -- Part 2: Determination, verification and application of precision data".

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