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Client Report

October 6, 2010

Measurement of Airborne Sound Insulation in Accordance with ISO 140-3, Performed on a Skyfold Classic Operable Partition in Testing Configuration "4E"

B3484.4

SKYFOLD
ALL NRC MODELS

National Research Council Canada
Conseil national de recherches Canada

Canada

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Measurement of Airborne Sound Insulation in Accordance with ISO 140-3, Performed on a Skyfold Classic Operable Partition

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

Measurement of Airborne Sound Insulation in Accordance with ISO 140-3, Performed on a Skyfold Classic Operable Partition (in Testing Configuration "4E")

SKYFOLD ALL NRC MODELS

for

Railtech Ltd.,
Skyfold Division of Railtech
325, Lee Avenue
Baie d'Urfé
Montréal, QC
H9X 3S3

6 October 2010

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SKYFOLD
ALL NRC MODELS

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Testing Laboratory:	National Research Council Canada Institute for Research in Construction 1200 Montreal Road Ottawa, Ontario K1A 0R6
Client:	Skyfold Custom Powerlift Partitions, Railtech Ltd. 325 Lee Ave, Baie D'urfe Montreal, Quebec H9X 3S3
Specimen:	Skyfold Classic "4E"
Specimen ID:	B3484-32W
Manufacturer:	Client
Construction Dates:	August 19, 2010 to August 20, 2010
Test specimen mounted by:	Client

Specimen Description:

The specimen B3484-32W was identified by the client as a Skyfold Classic operable partition, with panels, seals, and clearances in configuration "4E".

The Skyfold Classic operable partition was installed by the client and consisted of 8 panels, mounted to a lifting mechanism that was supported from the top. Four panels were installed on each side of the mechanism. The overall dimensions of the partition, including seals, were 3508 mm wide by 2172 mm high. The overall thickness of the partition was 299 mm.

The client reported that each panel consisted of an honeycomb cellulose core between a fabric covered perforated steel plate on the outer face, and a backer plate of sheet steel on the inner face. The steel-core-steel part of each panel was 19 mm thick, 3457 mm wide and 510 mm high. The inside surface of each panel had a layer of 38 mm fiberglass duct liner.

Each panel had lined rubber "end" seals on the vertical edges that retracted and extended for operation. The width of these vertical end seals when fully extended was nominally 25 mm. All panels sealed to each other with horizontal "lip" seals that compressed a strip of foam when the partition was closed. The top panel sealed to the header with a lined extruded rubber "bulb" seal 57 mm high. The bottom panel sealed to the floor with a lined extruded rubber "bulb" seal 57 mm high.

The total mass of all 8 panels including seals was 229.9 kg. The total mass of the specimen was 342.7 kg.

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

The size of the 2.44 m by 3.66 m facility test opening was reduced to accommodate the specimen by constructing a filler element as follows: A header consisting of a steel beam (C12 x 20.7) 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 2 layers of 16 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. 2 strips of a single layer of CGC Type X gypsum board each measuring 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.

Specimen Properties:

Element		Actual thickness (mm)	Mass (kg)	Mass/length, area or volume
Operable Partition	Classic 299 mm	299	342.7	44.7 kg/m²
Total		299	342.7	

Test Specimen Installation:

The test specimen was installed in the NRC-IRC Wall Sound Transmission Facility. The facility test opening measures 2.44 m by 3. 66 m. The area was reduced by constructing filler elements, as described above. The perimeter of the filler elements was sealed on both sides to the facility test opening with latex caulk and covered with metal foil tape. The opening in the filler elements for the test specimen measured 3508 mm wide by 2172 mm high. The area used for calculation of airborne sound transmission loss was 7.66 m².

The specimen was opened and closed five times after installation was completed and was tested without further adjustments.

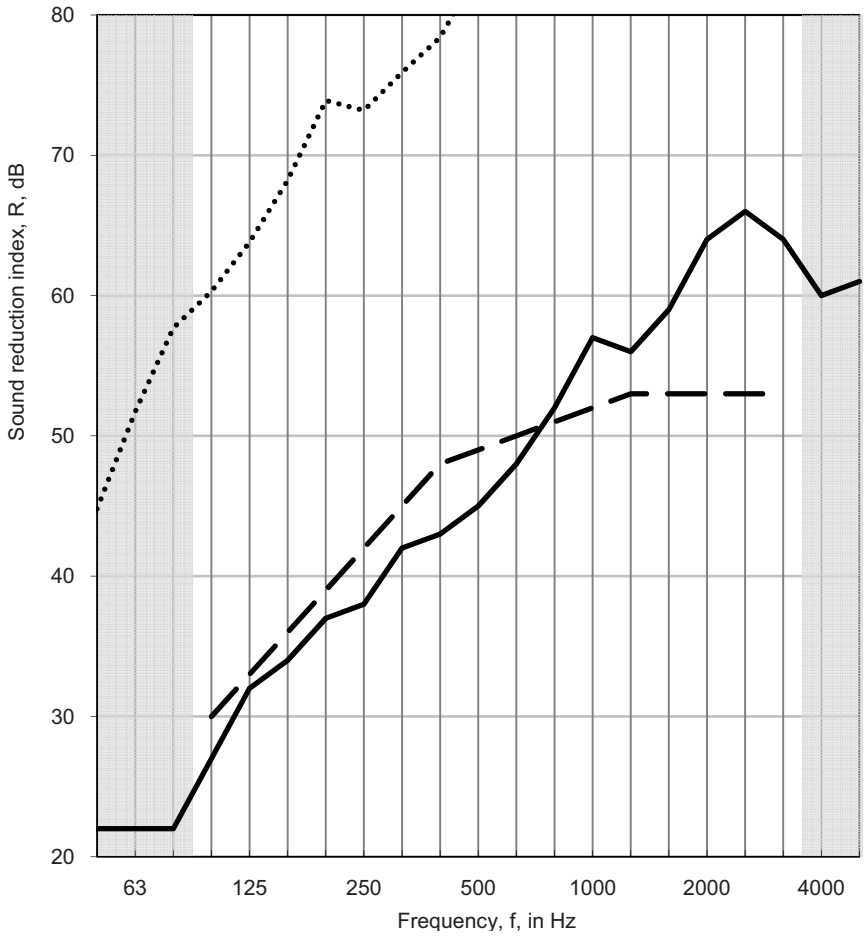
Airborne sound transmission loss measurements were conducted in accordance with the requirements of ISO 140-3:1995, "Acoustics – Measurement of sound insulation in buildings and of building elements – Part 3: Laboratory measurements of airborne sound insulation of building elements"

Client:	Skyfold Custom Powerlift Partitions, Railtech Ltd.	**Test ID:**	TLA-10-059
Specimen ID:	B3484-32W	**Date of Test:**	August 20, 2010
Small Room Volume:	254.9 m³	**Area S of test specimen:**	7.66 m²
Large Room Volume:	139.9 m³	**Mass per unit area:**	44.7 kg/m²

Room	Air temperature, °C	Humidity, %
Small	22.2 to 22.3	47.7 to 48.3
Large	22.1 to 22.3	45.8 to 46.1

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.

Frequency f Hz	R 1/3-octave (dB)
50	22
63	22
80	22
100	27
125	32
160	34
200	37
250	38
315	42
400	43
500	45
630	48
800	52
1000	57
1250	56
1600	59
2000	64
2500	66
3150	64
4000	60
5000	61



In the graph:
Solid line is the measured sound reduction index, R, for this specimen. 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 717-1. Dotted line is 15 dB below the flanking limit R'_{max} established for this facility (may be above graph boundary). For any frequency where measured R is above the dotted line, the reported value is potentially limited by vibration transmission via the laboratory surfaces, and the true value may be higher than that measured.

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 "**" indicate that the measured value of R' was less than or equal to 15 dB below the flanking limit R'_{max} for the facility.

Rating according to ISO 717-1:

R_w (C;C_{tr}) = 49 (-1;-6) dB $C_{50\text{-}5000}$ = -2 dB; $C_{tr,50\text{-}5000}$ = -11 dB

Evaluation based on laboratory measurement results obtained by an engineering method

APPENDIX:

Airborne Sound Transmission Wall Facility

National Research Council Canada
Institute for Research in Construction
Acoustics Laboratory
1200 Montreal Road, Ottawa, Ontario K1A 0R6
Tel: 613-993-2305 Fax: 613-954-1495

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 km/h), jet aircraft at short distance, or factories emitting mainly medium and high frequency noise. Spectrum Adaptation Term C_{tr} is intend 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 asses 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.