



Test Number: NOAL 19-1045

Test Method: ASTM E90-09 (2016): Laboratory Measurement of Airborne Sound Transmission of Building Partitions and Elements

Result Summary: STC 62

Test Date: October 31, 2019

Specimen: Wall Assembly

Test Site: North Orbit Acoustic Laboratory Facility
512 5th Street NW
Dyersville, IA 52040

Report Date: December 19, 2019

Prepared For: CEMCO
13191 Cross Road Parkway, Suite 325 City of Industry, CA 91746

Technician: D. Berg

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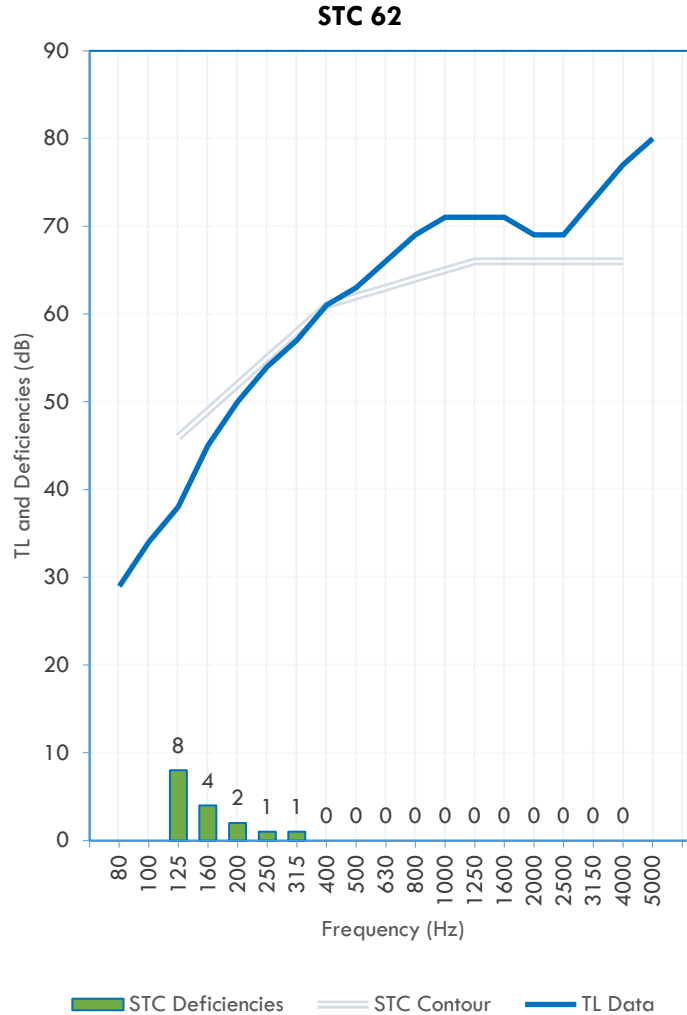
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| Frequency (Hz) | TL (dB) | Deficiencies (dB) |
|---------------------------|---------|-------------------|
| 80 | 29 | |
| 100 | 34 | |
| 125 | 38 | 8 |
| 160 | 45 | 4 |
| 200 | 50 | 2 |
| 250 | 54 | 1 |
| 315 | 57 | 1 |
| 400 | 61 | 0 |
| 500 | 63 | 0 |
| 630 | 66 | 0 |
| 800 | 69 | 0 |
| 1000 | 71 | 0 |
| 1250 | 71 | 0 |
| 1600 | 71 | 0 |
| 2000 | 69 | 0 |
| 2500 | 69 | 0 |
| 3150 | 73 | 0 |
| 4000 | 77 | 0 |
| 5000 | 80 | 0 |
| Total Deficiencies | | 16 |



ASSEMBLY ELEMENTS:

(From Source Room Side to Receive Room Side)

- Sheathing 5/8" Type X gypsum wallboard (vs); 1.625" #6 type S screws spaced 12" OC at perimeter except top and 16" OC in field
- Sheathing 5/8" Type X gypsum wallboard (v); 1" #6 type S screws spaced 8" OC at perimeter except top and 12" OC in field
- Framing Double row 2-1/2" CEMCO Viper-X (VXS) 18 mil (20 EQ) studs (1" AS) spaced 24" OC
- Insulation Double layer 3-1/2" fiberglass insulation batts (R13)
- Sheathing 5/8" Type X gypsum wallboard (vs); 1" #6 type S screws spaced 8" OC at perimeter except top and 12" OC in field

CEMCO Sound Gasket installed at sample perimeter on both source and receiver side.
No other seals/sealant used at sample perimeter.

See Appendix C on pages 6 and 7 for a full description of Assembly Elements



SPECIMEN DESCRIPTION

The specimen is a wall assembly and its elements are described below with results on page 2. Detailed information regarding the specimen is found in Appendix C on pages 6 and 7.

INSTALLATION AND DISPOSITION

The wall assembly was originally constructed on October 31, 2019 at the Dyersville acoustic laboratory location.

Qualified representatives from North Orbit Acoustic Laboratories observed the installation process and inspected all major building elements when completed and prior to testing.

FILLER WALL

A high transmission loss double stud filler wall was constructed in the entire 20' x 12' test opening. The filler wall consisted of two 1.5" x 7.5" x 12' wood bottom and top plates separated by approximately 3" of air space. 1.5" x 3.5" wood studs were placed at 24" OC in each frame. The resulting cavity was filled entirely with fiberglass batt insulation. Four layers of Type C gypsum wall board (GWB) were attached to the outside of the frames on both sides. The GWB on the north side of the filler is mounted on resilient clips and 7/8" hat channel at 16" OC. The GWB on the south side is directly attached to the frame. The filler wall assembly was tested and the results retained for use in composite wall corrections. The filler wall was then modified to provide a 12' x 8' decoupled opening to accommodate tests in this series.

TEST METHODS

Methods follow the published standards listed below. All values derived from single-direction transmission loss measurements.

ASTM E90-09 (2016): Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

ASTM E413-16: Classification for Rating Sound Insulation

All results reported herein were derived from tests performed in full accordance with test method ASTM E90-09 (2016). The laboratory and measurement systems fully meet all requirements of the test standard and the requirements of ASTM E90-09 (2016) Annex A2: Qualification of room sound fields and microphone systems used for sampling.

North Orbit Acoustic Laboratory (NOAL) is accredited through A2LA certificate number 4240.01 for this test procedure. This test report relates only to the item(s) tested. This report shall not be used to claim product certification, approval, or endorsement by North Orbit Acoustic Laboratories or A2LA.

CONFIDENTIALITY

The client has full control over this information and any release of information will be only to the client. The specific testing results are deemed to be confidential exclusively for the client's use. Reproduction of this report, except in full, is prohibited.

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APPENDIX A: MEASUREMENT SETUP

ENVIRONMENT

Temperature: 67.0 °F [19.4 °C]
Relative Humidity: 56.0%

SPECIMEN AREA

Specimen Area: 96.0 ft² [8.9 m²]

CHAMBER VOLUME - AIRBORNE TRANSMISSION

Source Room 7,134.0 ft³ [202.0 m³]
Receiver Room 7,754.8 ft³ [219.6 m³]

INSTRUMENTATION

| Description | Brand | Model | Serial |
|------------------|--------------|----------|------------|
| Analyzer | Sinus | Apollo | 7510 |
| Software | Sinus | Samurai | ver. 2.8.3 |
| Microphone | Brüel & Kjær | 4166 | 1620281 |
| Microphone | Brüel & Kjær | 4166 | 1620312 |
| Preamplifier | Brüel & Kjær | 2669 | 2025373 |
| Preamplifier | Brüel & Kjær | 2669 | 2083679 |
| Rotating Boom | Brüel & Kjær | 3923 | 2736620 |
| Rotating Boom | Brüel & Kjær | 3923 | 2705113 |
| Calibrator | Brüel & Kjær | 4231 | 2416109 |
| Loudspeaker | Mackie | SA1501 | PP14915 |
| Loudspeaker | Mackie | SA1501 | PP14940 |
| Thermohygrometer | Digi-Sense | 20250-21 | 181013163 |

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APPENDIX B: CALCULATION RESULTS

| Freq. Band (Hz) | Spec TL (dB) | Data Flags (see below) | 95% C.I. (dB) | Flanking Limit (dB) | STC Deficiencies (dB) |
|---|-----------------|---------------------------|------------------|------------------------|-----------------------------|
| 25 | | | | | |
| 32 | | | | | |
| 40 | | | | | |
| 50 | 15.3 | | ±4.87 | 40 | |
| 63 | 18.4 | | ±4.55 | 45 | |
| 80 | 29.3 | ‡ | ±3.62 | 46 | |
| 100 | 34.0 | ‡ | ±2.98 | 49 | |
| 125 | 38.3 | ‡ | ±2.82 | 55 | 8 |
| 160 | 44.8 | ‡ | ±2.62 | 58 | 4 |
| 200 | 49.8 | ‡ | ±1.31 | 62 | 2 |
| 250 | 54.0 | ‡ | ±1.33 | 65 | 1 |
| 315 | 57.1 | ‡ | ±0.98 | 68 | 1 |
| 400 | 60.7 | ‡ | ±0.52 | 71 | 0 |
| 500 | 63.5 | ‡ | ±0.98 | 74 | 0 |
| 630 | 66.0 | ‡ | ±0.78 | 76 | 0 |
| 800 | 69.2 | §‡ | ±0.57 | 79 | 0 |
| 1000 | 71.3 | §‡ | ±0.56 | 81 | 0 |
| 1250 | 70.7 | ‡ | ±0.64 | 84 | 0 |
| 1600 | 71.0 | ‡ | ±0.59 | 83 | 0 |
| 2000 | 68.8 | ‡ | ±0.62 | 82 | 0 |
| 2500 | 69.4 | ‡ | ±0.57 | 86 | 0 |
| 3150 | 73.2 | ‡ | ±0.55 | 90 | 0 |
| 4000 | 77.2 | ‡ | ±0.79 | 89 | 0 |
| 5000 | 80.2 | *§‡ | ±1.22 | 86 | |
| 6300 | | | | | |
| 8000 | | | | | |
| 10000 | | | | | |
| Total deficiencies below STC contour (dB) | | | | | 16 |
| STC contour [ASTM E413] | | | | | 62 |

* Actual transmission loss of specimen may be higher than measured at this frequency band. Signal-to-noise in the receiving room less than 5 dB, therefore the result is "an estimate of the lower limit".

§ Actual transmission loss of specimen may be higher than measured at this frequency band. Result within 10 dB of flanking limit found in separate study, therefore the result may be "potentially limited by the laboratory" due to flanking around the specimen.

‡ Correction included in calculation due to a portion of the sound transmitted by way of the filler wall. Sound transmission through the filler wall is within correction limits established in ASTM E90.

† Actual transmission loss of specimen may be higher than measured at this frequency band. Sound transmission through the filler wall exceeds correction limits established in ASTM E90; therefore the result is "an estimate of the lower limit".

Note: 95% confidence intervals for TL measurements from room qualification data. ASTM E1289 reference sample and repeatability data available upon request. The standard deviation of reproducibility is stated in ASTM E90 as <2 dB for frequencies from 125 Hz to 4 kHz. Flanking Limit derived from chamber flanking study. Extended frequency results below 80Hz and above 5000Hz are for reference only.

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APPENDIX C: SPECIMEN ASSEMBLY DESCRIPTION

Overall Mass 753.2 lb [341.6 kg]

Surface Weight 7.8 PSF [38.3 kg/m²]

| Building Element | Mass lb [kg] | Surface Weight PSF [kg/m ²] |
|--|------------------------|---|
| 5/8" Type X gypsum wallboard (vs); 1.625" #6 type S screws spaced 12" OC at perimeter except top and 16" OC in field | 214.0 [97.1] | 2.23 [10.88] |
| 5/8" Type X gypsum wallboard (v); 1" #6 type S screws spaced 8" OC at perimeter except top and 12" OC in field | 213.8 [97.0] | 2.23 [10.87] |
| Double row 2-1/2" CEMCO Viper-X (VXS) 18 mil (20 EQ) studs (1" AS) spaced 24" OC | 68.2 [30.9] | 0.71 [3.47] |
| Double layer 3-1/2" fiberglass insulation batts (R13) | 45.2 [20.5] | 0.47 [2.30] |
| 5/8" Type X gypsum wallboard (vs); 1" #6 type S screws spaced 8" OC at perimeter except top and 12" OC in field | 212.0 [96.2] | 2.21 [10.78] |

CEMCO Sound Gasket installed at sample perimeter on both source and receiver side
No other seals/sealant used at sample perimeter.

All materials were weighed prior to installation. Weights of fasteners, tape and sealant are not represented in the above totals.

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APPENDIX C: SPECIMEN ASSEMBLY DESCRIPTION (CONTINUED)

CEMCO steel tracks, CEMCO steel studs, CEMCO Sound Gasket and gypsum wallboard panels were supplied by the Client. All other materials were purchased through regional retail or wholesale channels.

FRAMING

Framing was constructed on 10-30-19 and was retained from previous tests in the series.

A double stud frame was constructed within the perimeter of the laboratory test specimen opening. The frame consisted of two rows of CEMCO Viper-X (VXS) 18 mil designated thickness (20 EQ) 2-1/2" bottom track with 1-1/4" flange, two rows of CEMCO (CST), 33 mil designated thickness (20 ga.) 2-1/2" x 2-1/2" top tracks and two rows of seven 2-1/2" x 1-7/16" CEMCO Viper-X (VXS) 18 mil designated thickness (20 EQ) studs installed 24" on center (OC). The two rows of studs were separated by a 1" air space. The bottom tracks and studs were fastened together with two 7/16" #7 type S screws at bottom, outer corner intersections. The perimeter of the frame sides and bottom was sealed at the specimen opening with non-hardening acoustic sealant.

| | |
|----------------------|----------------------------|
| CEMCO bottom tracks: | 250VT125-18 NS G40 33 ksi |
| CEMCO top tracks | 250CST250-33 G40 33 ksi |
| CEMCO Viper-X Studs: | 250VXS144-18 NS G40 57 ksi |

INSULATION

Two layers of fiberglass insulation batts were friction fit into the stud cavities. The batts were 24" wide and 3 1/2" thick with an R-Value of R-13.

SHEATHING

Source Side:

Two layers of gypsum panels were applied to the source room side of the framing.

Base layer: 5/8" Type X gypsum wallboard panels were applied parallel to the studs. A 1/2" (max) gap was left at the perimeter of the sample. The panels were attached to the frame with 1", #6 type S drywall screws at 8" OC at the perimeter (except top) and 12" OC in the field.

Face Layer: 5/8" Type X gypsum wallboard panels were applied parallel to the studs. A 1/2" (max) gap was left at the perimeter of the sample. The panels were attached to the frame with 1 5/8", #6 type S drywall screws at 12" OC at the perimeter (except top) and 16" OC in the field. Joints were staggered one cavity as to offset on each layer.

Prior to installing the gypsum panels, CEMCO Sound Gasket was applied to the perimeter of the frame to provide the seal between the frame and specimen opening. The Sound Gasket was attached to the tracks and outer studs with a self-adhesive strip. No other caulking or sealing was used at the sample perimeter.

Receiver Side:

5/8" Type X gypsum wallboard panels were applied parallel to the studs. A 1/2" (max) gap was left at the perimeter of the sample. The panels were attached to the frame with 1", #6 type S drywall screws at 8" OC at the perimeter (except top) and 12" OC in the field. Joints were staggered one cavity as to offset on opposite sides.

Prior to installing the gypsum panels, CEMCO Sound Gasket was applied to the perimeter of the frame to provide the seal between the frame and specimen opening. The Sound Gasket was attached to the tracks and outer studs with a self-adhesive strip. No other caulking or sealing was used at the sample perimeter.

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APPENDIX D: SINGLE-NUMBER CALCULATION TO ISO 717-1

| Freq. Band (Hz) | R _i (R _i ≡ TL) (dB) | Adj. Ref. Curve (dB) | Unfav. Deviat. (dB) | L _{i1} Spectrum (dB) | L _{i1} - R _i Level (dB) | L _{i2} Spectrum (dB) | L _{i2} - R _i Level (dB) | | |
|------------------|---|----------------------|---------------------|-------------------------------|---|-------------------------------|---|--|------|
| 50 | 15.3 | | | | | | | | |
| 63 | 18.4 | | | | | | | | |
| 80 | 29.3 | | | | | | | | |
| 100 | 34.0 | 43 | 9.0 | -29.0 | -64.0 | -20.0 | -54.0 | | |
| 125 | 38.3 | 46 | 7.7 | -26.0 | -65.3 | -20.0 | -58.3 | | |
| 160 | 44.8 | 49 | 4.2 | -23.0 | -68.8 | -18.0 | -62.8 | | |
| 200 | 49.8 | 52 | 2.2 | -21.0 | -71.8 | -18.0 | -67.8 | | |
| 250 | 54.0 | 55 | 1.0 | -19.0 | -74.0 | -15.0 | -69.0 | | |
| 315 | 57.1 | 58 | 0.9 | -17.0 | -75.1 | -14.0 | -71.1 | | |
| 400 | 60.7 | 61 | 0.3 | -15.0 | -76.7 | -13.0 | -73.7 | | |
| 500 | 63.5 | 62 | 0.0 | -13.0 | -77.5 | -12.0 | -75.5 | | |
| 630 | 66.0 | 63 | 0.0 | -12.0 | -79.0 | -11.0 | -77.0 | | |
| 800 | 69.2 | 64 | 0.0 | -11.0 | -81.2 | -9.0 | -78.2 | | |
| 1000 | 71.3 | 65 | 0.0 | -10.0 | -82.3 | -8.0 | -79.3 | | |
| 1250 | 70.7 | 66 | 0.0 | -9.0 | -80.7 | -9.0 | -79.7 | | |
| 1600 | 71.0 | 66 | 0.0 | -9.0 | -81.0 | -10.0 | -81.0 | | |
| 2000 | 68.8 | 66 | 0.0 | -9.0 | -78.8 | -11.0 | -79.8 | | |
| 2500 | 69.4 | 66 | 0.0 | -9.0 | -79.4 | -13.0 | -82.4 | | |
| 3150 | 73.2 | 66 | 0.0 | -9.0 | -83.2 | -15.0 | -88.2 | | |
| 4000 | 77.2 | | | | | | | | |
| 5000 | 80.2 | | | | | | | | |
| Sum = | | | 25.3 | R _{A,1} = | | 58.7 | R _{A,2} = | | 51.9 |
| R _w = | | | 62 | C = | | -3 | C _{tr} = | | -10 |

$$R_w(C; C_{tr}) = 62 (-3; -10)$$

$$R_w(C; C_{tr}, C_{50-3150}; C_{tr,50-3150}) = 62 (-3; -10; -11; -25)$$

$$R_w(C; C_{tr}; C_{100-5000}; C_{tr,100-5000}) = 62 (-3; -10; -2; -10)$$

$$R_w(C; C_{tr}; C_{50-5000}; C_{tr,50-5000}) = 62 (-3; -10; -10; -25)$$

Calculations according to the standard ISO 717-1 are based on an assumed equivalency of the ASTM and the corresponding ISO test methods. NOAL's scope of accreditation includes ASTM E90 and the test herein is performed according to this standard as described, but NOAL does not hold accreditation for the corresponding ISO standards.

The spectrum adaptation terms C and C_{tr} characterize performance against two specific sound sources, A-weighted pink noise and A-weighted traffic noise respectively. The standard ISO 717-1 includes a discussion of "Use of Spectrum Adaptation Terms" in Annex A (informative).

Each spectrum adaptation term may additionally be reported with extended frequency bands included. The calculation above represents the primary frequency range. The results below the table show the calculated primary ratings as well all available extended-frequency ratings, so that this specimen may be compared against corresponding ratings of other specimens.