Designation: E1289 – 08 (Reapproved 2022)

Standard Specification for Reference Specimen for Sound Transmission Loss[1]

This standard is issued under the fixed designation E1289; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification describes the construction and installation of standard reference specimens for quality control of laboratory sound transmission loss measurements using Test Method E90.

1.2 Laboratories may choose to construct and test all of the reference specimens described here or only a subset. Specific specimens may be required by a test method or an accrediting agency.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses are for information only.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C634 Terminology Relating to Building and Environmental Acoustics

E90 Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, see Terminology C634.

4. Construction of Reference Specimen

4.1 *General:*

4.1.1 The reference specimen is composed of framed steel panels. The required materials for fabrication and installation are as follows:

Galvanized steel sheets—width, 1220 mm (4 ft); nominal thickness, 0.63 mm (24 gauge). The weight of the sheets shall be 5.1 ± 0.7 kg/m^2 (1.05 ± 0.15 lb/ft^2).
Steel right angles with 25-mm (1-in.) flanges—metal thickness, 3.2 mm (⅛ in.).
Blind rivets—diameter, 3.2 mm (⅛ in.).
Duct tape, 50 mm (2 in.) wide.
Drywall screws, Type W—length, 32 mm (1.25 in.).
Bolts #10–24 —25 mm (1 in.) long with appropriate nuts and washers.
Fasteners, to hold wood frame to the perimeter of the test opening.
Non-hardening, caulking,
Nominal 2 by 4 in. wood framing, approximately 40 by 90 mm.

NOTE 1—The quantity and length of each component needed depends on the size of the laboratory test opening.

NOTE 1—To simplify cleaning, the wood framing used to support the steel panels may be painted.

4.1.2 The weight of each component of the reference specimen and the assembled specimen shall be measured and kept on record. In addition, the thickness of each of the steel panels shall be measured in six locations. (See Appendix X1.)

4.2 *Assembly:*

4.2.1 *Galvanized Sheets*—The length of each galvanized sheet shall be a few millimetres less than the height of the laboratory test opening. The total width of all the sheets shall be a few millimetres less than the width of the laboratory test opening. This may require that one or more sheets be cut lengthwise. The intent is that, when installed, the panels fill the test opening completely.

4.2.2 *Frame*—Cut steel right angles to size to form a frame for each sheet; the frame shall have the same outside dimensions as the sheets. Notch and weld the steel angles to form the four corners of the frame as shown in Fig. 1. Alternatively, miter the angles and weld similarly. Smooth corners after welding.

4.2.3 *Panels*—Construct a panel by riveting steel sheets to the frames as follows:0

4.2.3.1 Drill holes at 100 mm (4 in.) on-center around the perimeter of the sheets for the installation of the blind rivets. To ensure proper alignment of the sheets with the frame, it is recommended to drill a few holes and then install rivets to hold the sheet in place. Once this is done, the remaining holes may be drilled and the rivets installed. Position these holes to avoid conflict with the clearance holes described in 4.2.3.2.

[1] This specification is under the jurisdiction of ASTM Committee E33 on Building and Environmental Acoustics and is the direct responsibility of Subcommittee E33.03 on Sound Transmission.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

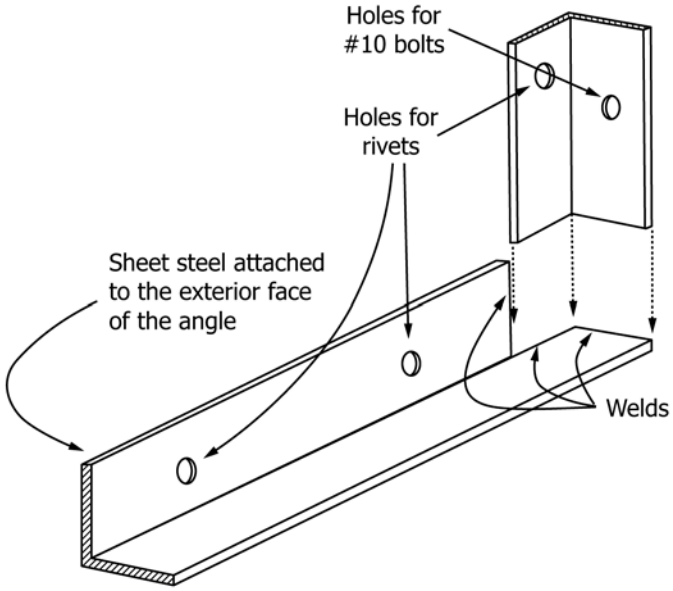


FIG. 1 Notching and Welding Corners of Steel Angles

4.2.3.2 Drill 4 mm (5⁄32 inch) diameter holes through the horizontal members of the frame and sheet as shown in Fig. 2. These are clearance holes for the drywall screws used to attach the panel to the wood plate (see 5.4). Drill similar holes through the vertical members of the panels that will be used to attach the assembled specimen to the vertical wood plates. The spacing between these holes is not important.

4.2.3.3 Drill 6.4 mm (¼ in.) diameter holes at 406 mm (16 in.) on-center through the vertical flanges of the steel frame. These are clearance holes for the bolts used to connect the panels together (see 5.3 and Fig. 3). The holes in adjacent vertical members should be carefully aligned with each other to ease installation of the panels.

5. Installation A: Single Layer Reference Specimen

5.1 Using approximately 40 mm by 90 mm wood studs (nominal 2 in. by 4 in.), install a wood frame around the perimeter of the laboratory opening. Use a double bead of caulking between the wood frame and the surface of the laboratory opening. Use suitable fasteners no more than 305 mm (12 in.) on-center.

5.2 Place the reference specimen against the wood frame with the flanges of the panel frames as shown in Fig. 4.

NOTE 1—The panels are positioned 75 mm from the mid-plane of the laboratory test opening to minimize changes when laboratories intend to test other reference specimens described in this document that use separate plates.

NOTE 2—The direction of sound transmission for these reference specimens is not important. It can be left-to-right or right-to-left.

5.3 Insert 25-mm (1-in.) long No. 10-24 bolts or equivalent through the holes in adjacent vertical flanges drilled according to 4.2.3.3. Washers may be used if desired. Tighten nut snugly to close the gap between adjacent panels. (See Fig. 3).

5.4 Fasten the test panels to the vertical and horizontal sections of the wood frame with Type W drywall screws 32 mm (1.25 in.) long inserted through the holes drilled according to 4.2.3.2.

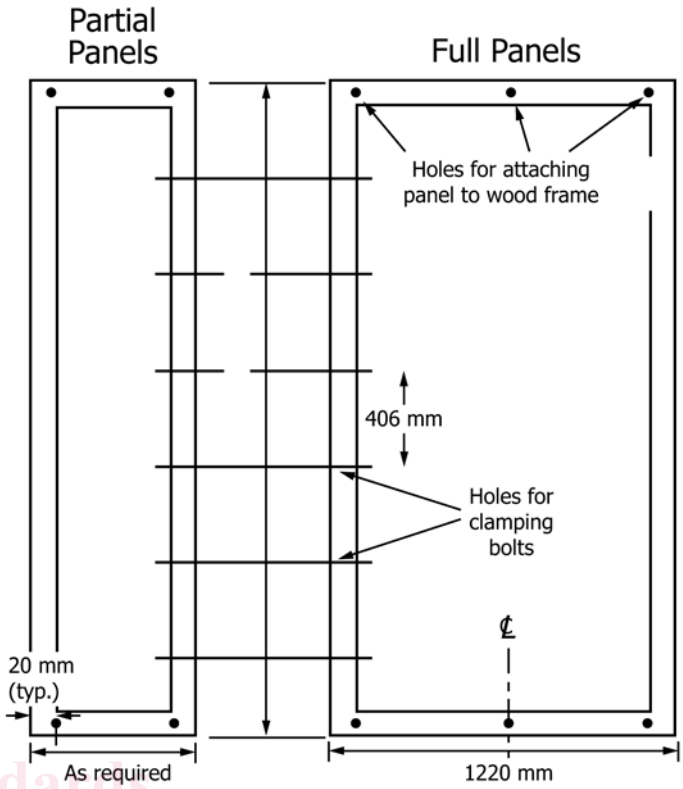


FIG. 2 Construction Details of Steel Panels (not to scale)

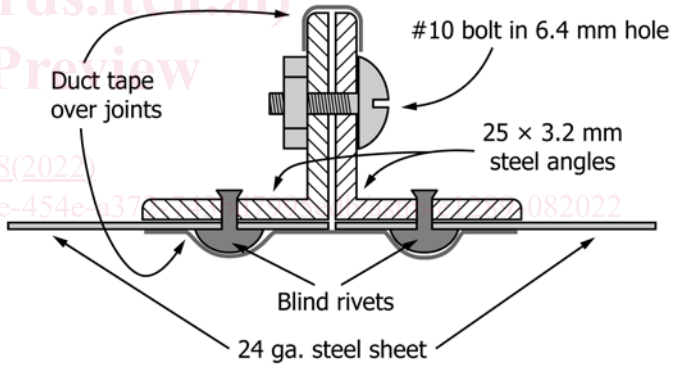


FIG. 3 Construction Details of Steel Panels (not to scale)

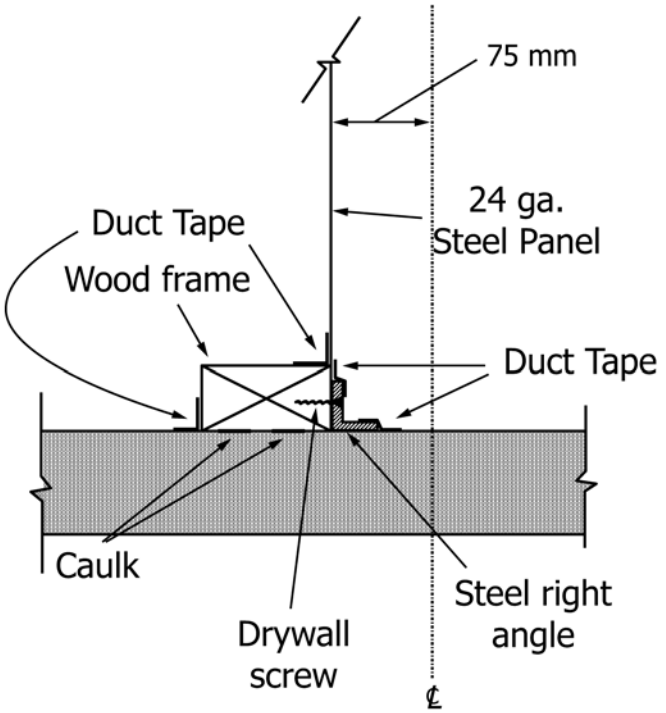
5.5 Seal the test panel joints on both sides with a single layer of 50-mm (2-in.) wide duct tape (centered on the joints).

5.6 Seal the perimeter joint on both sides with a single layer of 50-mm (2-in.) wide duct tape (centered on the joints) as shown in Fig. 4.

6. Installation B: Double Layer Reference Specimen With a Common Plate

6.1 The first layer of this double layer specimen is installed as for the single layer specimen, installation A.

6.2 Once the frame and the panels on one side are in place, install the second set of panels on the opposite side of the wood frame as shown in Fig. 5. Use a similar screw pattern for attaching the panels to the wood frame as on the first side.



NOTE 1—Wood frame caulked, specimen joints and perimeter taped on both sides.

FIG. 4 Installation of Reference Specimen Showing Caulking of Wood Frame and the Taping of the Specimen Joints and Perimeter on Both Sides

7. Installation C: Double Layer Reference Specimen with Separate Plates-Empty Cavity

7.1 The first layer of this double layer specimen is installed as for the single layer specimen, installation A.

7.2 Once the frame and the panels on one side are in place, install the second wood frame and the second set of panels as shown on the right side of Fig. 6. Use a similar screw pattern for attaching the panels to the second wood frame as on the first side.

7.3 The distance between the steel sheets, measured at the wood frames, shall be 150 ± 3 mm.

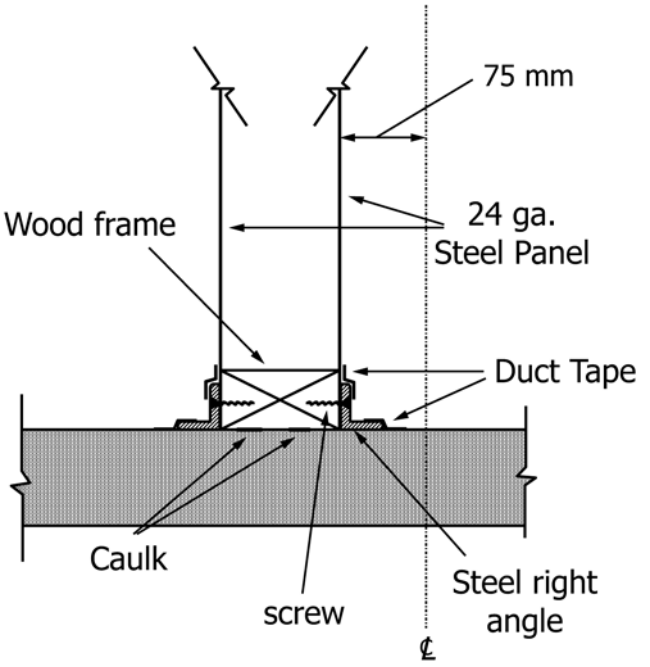


FIG. 5 Installation of Steel panels as double layer specimen on a single wood frame. The centerline symbol, ¢, represents the mid-plane of the test opening between two rooms.

8. Installation D: Double layer reference specimen with Separate Plates— Sound Absorbing Material in the Cavity

8.1 This double layer specimen is the same as installation C with an added layer of sound-absorbing material in the cavity.

8.2 The first layer of this double layer specimen is installed as for the single layer specimen, installation A.

8.3 Once the frame and the panels on one side are in place, install the second wood frame as shown on the right side of Fig. 6.

8.4 Install a layer of glass fibre batts in the cavity of the specimen. The batts shall be 150 ± 5 mm thick with a density of 10 ± 1 kg/m^3. This density corresponds to common building insulation. Contact between the batts and the metal panels should be minimized in some convenient way.

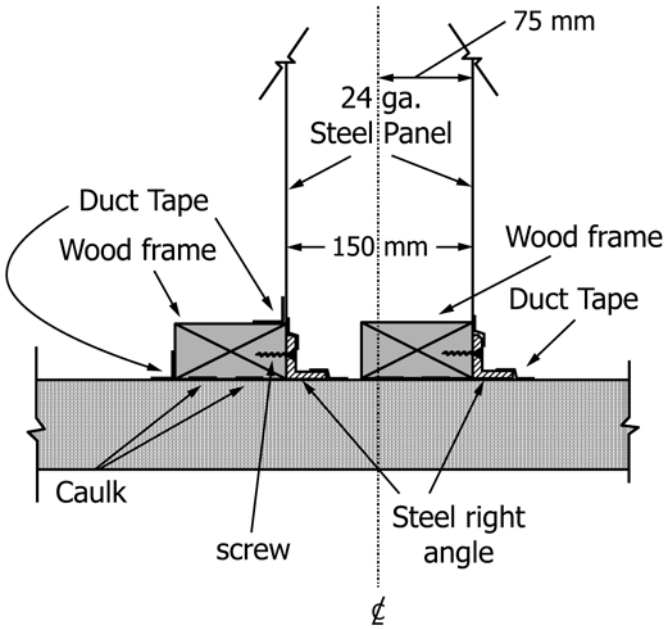


FIG. 6 Installation of Steel panels as double layer specimen on a single wood frame. The centerline symbol, ℄, represents the mid-plane of the test opening between two rooms.

TABLE 1 Mean and Standard Deviations of Transmission Loss Data on a Single Layer Specimen, Installation A.

One Third Octave Band Center Frequency (Hz)	Average Laboratory Value of Sound Transmission Loss (dB)	Standard Deviation (dB)
50	12.2	1.9
63	12.3	1.2
80	10.8	2.0
100	11.2	1.8
125	12.1	1.2
160	12.9	1.3
200	14.6	1.3
250	15.8	1.3
315	17.6	1.1
400	19.1	1.2
500	20.8	1.1
630	22.6	1.1
800	24.3	1.0
1000	26.0	0.9
1250	28.1	0.8
1600	29.9	0.8
2000	31.7	0.9
2500	33.6	0.8
3150	35.4	1.1
4000	37.1	1.2
5000	38.6	1.4
STC	25.3	0.9
OITC	19.0	0.7

8.5 Attach the second set of panels to the second wood frame using a similar screw pattern as on the first side.

9. Measurements

9.1 Conduct a sound transmission loss test in accordance with Test Method E90.

9.2 The specimen area used in the calculation of transmission loss shall be the area of the test opening filled by the panels.

9.3 The Test Method E90 test results for a single panel specimen, installation A, may be compared to the values given in Table 1, which were determined in an inter-laboratory study.[3]

9.4 Although Test Method E90 does not give results that agree with mass law at all frequencies, test results for a single panel specimen may also be compared to theoretical values of transmission loss calculated using the equation for mass law: [4]

$$TL = 20 \cdot \log fm - 47.7 \quad (1)$$

where:

TL = transmission loss, dB,
f = frequency, Hz, and
m = panel mass, kg/m^2.

9.5 The Test Method E90 test results for a double panel specimen, installation B, may be compared to the values given in Table 2 which were determined in an inter-laboratory study.

9.6 No interlaboratory study has yet been conducted on installations C and D.

10. Keywords

10.1 reference specimen; sound transmission loss

[3] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:E33-1007.

[4] Jones, Robert E., "Intercomparisons of Laboratory Determinations of Airborne Sound Transmission Loss," *Journal of the Acoustical Society of America*, Vol 66, No. 1, July 1979, pp. 148–164.