



# Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions<sup>1</sup>

This standard is issued under the fixed designation E557; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope

1.1 This guide provides design details that should be considered in the design of buildings that include operable partitions. Operable partitions are those that can be quickly put in place or removed and stored to provide flexibility in the size of spaces typically used for meetings or social functions.

1.1.1 The guide primarily discusses details in the building design required to limit leakage of sound around an operable partition.

1.1.2 The guide also discusses some factors that affect the performance of the partitions themselves.

1.1.3 This guide is neither a specification for operable partitions nor a document intended to be imposed as a requirement on manufacturers of operable partitions.

1.2 Excluded from this guide are those partitions that are classified by the building products industry as *demountable*. Demountable partitions are those that are designed and installed with the intent of later being taken down and re-erected by a crew over a period of time, with the components being reusable.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee E33 on Building and Environmental Acoustics and is the direct responsibility of Subcommittee E33.04 on Application of Acoustical Materials and Systems.

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## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

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

E336 Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings

E413 Classification for Rating Sound Insulation

E1155 Test Method for Determining  $F_F$  Floor Flatness and  $F_L$  Floor Levelness Numbers

E1155M Test Method for Determining  $F_F$  Floor Flatness and  $F_L$  Floor Levelness Numbers (Metric)

## 3. Significance and Use

3.1 Rooms formed by operable partitions often need to be isolated acoustically. Sound-isolating properties of operable partitions are specified by architects in terms of sound transmission class (STC) and so advertised by the manufacturer on the basis of laboratory tests in accordance with Test Method E90 and Classification E413.

3.2 Because normal building design and construction practices are not the same as those used in acoustical laboratories, actual field performance of partitions, including operable partitions, will probably be less than that of test specimens. Sound transmission between areas to be isolated will occur through all of the connecting building components in addition to the operable partition, that is, floor and ceiling slabs, ceiling plenums, common walls, etc. All possible paths between the areas being isolated should have a sound insulation performance at least equal to the operable partition. Unless good acoustical practice is followed in both building design and installation, there may be a significant discrepancy between the sound isolation expected and that achieved.

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

3.3 Because of the complex nature of the sound flanking paths adjacent to operable partitions, it is highly recommended that all related construction details be reviewed by a person qualified in acoustical design and construction.

3.4 This guide does not specify requirements. However, persons desiring to write installation and construction specifications may find the contents useful in developing requirements for the building design site preparation, and installation practices necessary to minimize leakage and flanking sound around the operable partition.

**4. Properties of Operable Partitions**

4.1 There are several types of operable partitions: hinged panel groups, individual panel and continuously hinged partition systems. Some are supported by overhead track with or without a floor guide or track. Some are floor supported with an overhead track to guide them. They may be manual or power-operated. One type consists of movable panels secured in place by vertical expansion to seal against the floor and ceiling.

4.2 Several factors should be considered in specifications:

4.2.1 Seals or gaskets are of many kinds; some consist of resilient material that maintains continuous flexible contact with floor or ceiling, and some include a mechanical, hydraulic or pneumatic mechanism that maintains clearance when in motion and a positive seal when finally closed. The seals at the top of the partitions should make continuous contact with smooth surfaces on both sides of the operable partitions. The sound path through an insufficient seal, up and over the track, and out on the other side through the insufficient seal constitutes a serious sound leak.

4.2.2 When a partition consists of several panels, leaks may occur at the vertical joints when the seals at the joint are not tight.

4.2.3 Pass-through doors in partitions will generally reduce the overall sound isolation of the wall. For this reason, pass-through doors should be equipped with full perimeter gasketing, including seals at head.

4.2.4 Track assemblies installed outside the partition storage pocket area to form cross-through paths (90° to each other ) primarily for the transport of partitions from one location to the other should be avoided unless a satisfactory method is provided to reduce the flanking path created through the track section from one side of the partition to the other.

**5. Properties of the Building**

5.1 *Sound Flanking Paths and Interface Surfaces*— Although the operable partition may be an adequate barrier itself, sound may pass from one side to the other by going over, around, or under the partition. The passage of sound by paths other than directly through the partition itself is called flanking transmission. The building should provide proper flat surfaces to interface with the seals. These flanking paths and surfaces for seals in various areas should be addressed in the design of the building as discussed in the following.

5.2 *Area Above Track:*

5.2.1 If there is a plenum above the partition, sound may pass up through the ceiling on one side and down through the

ceiling on the other. A barrier should be erected directly above the operable partitions. This barrier, in conjunction with the ceiling, should have a sound transmission loss equal to or greater than that of the partition. The barrier is best designed as part of the building and not added as an afterthought (see Fig. 1). Often a seemingly solid ceiling has hollows behind it, such as spaces between the joists, or spaces in corrugated decks, that provide a flanking path around an operable partition below. The hollow spaces should be blocked directly above the operable partition. The sound transmission loss provided by the blocking barrier should be equal to or greater than that provided by the operable partition.

5.2.2 When a plenum is part of the air conditioning system, direct connections between the plenums on each side of the operable partition should be avoided wherever possible. When this is not possible a sound-attenuating duct or silencer should be installed through the barrier wall straddling the operable partition below. The duct or silencer, and the ceiling, should be designed so the noise reduction through that path is approximately 10 dB greater than the expected noise reduction

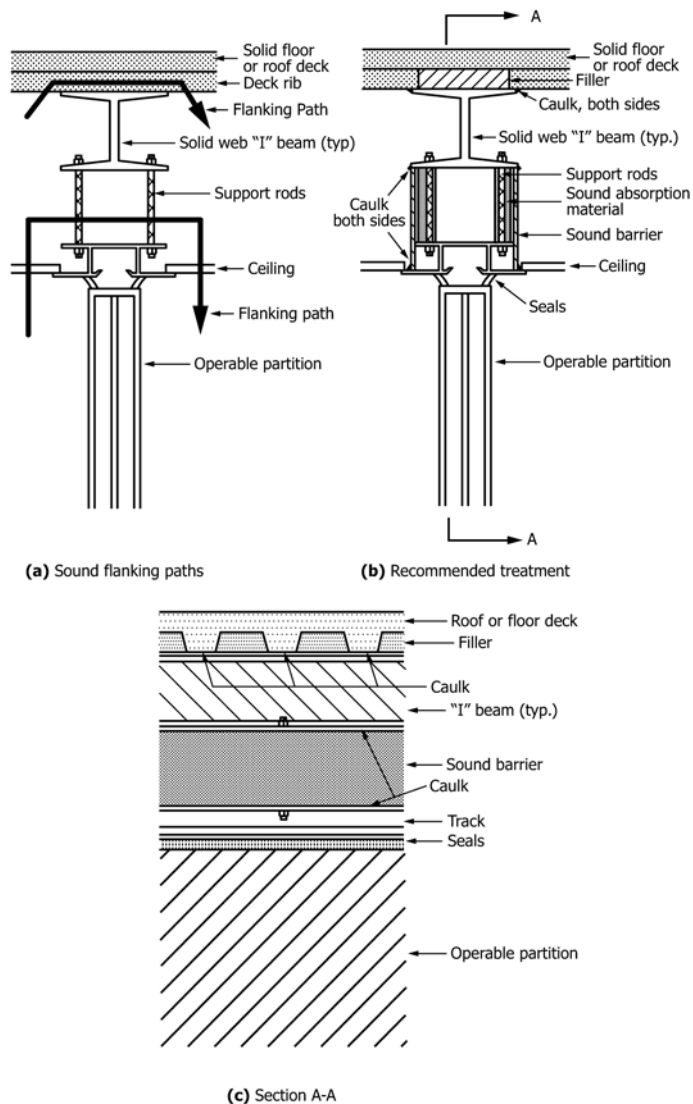


FIG. 1 Recommended Ceiling Barrier Installation

between the spaces (see Fig. 2). Lagging of the silencer or ductwork, or constructing these of heavier gage sheet metal, may be required on both sides of the barrier wall to achieve the necessary composite sound transmission loss requirements. Seals should be provided in the header wall at penetrations such as for the ducts and pipes.

5.2.3 Generally, track systems for operable partitions are installed during the early phases of building interior construction. The panels are often among the last items installed in the building. The barrier above the track may be built between these two events. To level the track after the weight of the panels is applied, manufacturers and installers of operable partitions request access to the area above the track. This can conflict with the need to build a barrier in the same area. It is important to work out a design that provides an adequate acoustical barrier and allows access for adjustment of the track. If built-in access doors or removable gypsum board panels are used for this purpose, they should be sealed at the periphery with solid or closed cell gaskets.

5.2.4 If doors or removable panels used to cover openings in a monolithic ceiling, to gain access for servicing partition drive train components, the openings should be sufficiently large to permit all service operations without modification or damage to the ceiling. The covers should be sealed at the periphery with solid or closed cell gaskets. Fig. 3 shows the recommended locations of access panels. The doors or removable access panels should have a sound transmission loss equal to or greater than the ceiling transmission loss. Seals should be provided in the header wall at penetrations such as for ducts and pipes.

5.3 Floor Below Partition:

5.3.1 Some types of floors are intentionally designed with hollow spaces below (for example, some gymnasium wood floors or computer room access floors). Where there is a hollow space under the operable partition, sound may pass down through the floor on one side and up through the floor on the other, or flank through a light floor structure. A barrier should be erected directly below the operable partition. The barrier, in conjunction with the floor, should have a sound transmission loss equal to or greater than that of the partition (see Fig. 4, (a)

and (b)). Wood or other light floor structures should have a break in them under the partition to limit flanking through the floor surface.

5.3.2 If the floor is carpeted, it will be difficult to obtain a good seal at the bottom of the operable partition. It is preferable to replace the carpet with a strip of smooth material, such as metal, wood, or vinyl, where the bottom seals make contact with the floor (see Fig. 5 (a) and (b)).

5.3.3 The seals at the bottom of the partition should make airtight contact with the floor. The floor immediately under the partition should not vary from a smooth level surface by more than  $\pm 1/8$  in. ( $\pm 3.2$  mm) in 12 ft (3.7 m) non-accumulative. A steel member, such as a standard terrazzo strip, can be placed in a concrete floor to ensure this accuracy (see Fig. 5 (b)). Test Methods E1155 and E1155M are test methods for measuring floor flatness and levelness.

5.3.4 When floors under operable partitions are on upper stories, they are subject to live load deflections. If the deflections exceed the ability of the bottom seals of the operable partition to extend, all seal contact will be lost, opening a large sound leak. Either the floor should be designed to limit the deflections to less than the extension offered by the operable partition, or an operable partition whose bottom seals offer sufficient extension to maintain contact with the floor under these conditions should be specified.

5.3.5 If the operable partition extends directly to a floor truss or to the underside of a floor structure, the use of a slip joint may be considered to accommodate deflection of the floor. All slip joints should be specially designed or tested, or both, to ensure that no sound leakage is introduced.

5.4 End Conditions:

5.4.1 Operable partitions use various techniques to seal against permanent walls and partitions. These may include bulb seals, telescoping closures, fixed jambs mounted to the permanent wall or partition, or jambs recessed into the permanent surface. In any case, provision should be made to permit an airtight closure against the permanent wall, including gaps in baseboards, chair rails, crown moldings, and other surface-mounted trim on the wall surface. Additionally, provision should be made to ensure flanking sound is not conducted through the structure of the permanent walls and partitions. For this reason, it is recommended that the room surface finishes be made discontinuous wherever the operable partition intersects such room surfaces (see Fig. 6). Recognize that if an operable partition is sealed against a window mullion, flanking through the mullion and glass may limit the noise reduction achieved.

5.4.2 Operable partitions generally close against a permanent wall or partition. Each of the paragraphs below addresses a condition where operable partitions intersect other building systems. Each condition includes recommendations for treatments intended to (a) minimize loss of an airtight seal and, (b) control flanking sound transmission.

5.4.2.1 Fixed partitions in the same plane as the operable partition should have a sound transmission loss equal to or greater than that of the operable partition.

5.4.2.2 Gypsum-board-on-stud fixed partitions perpendicular to the operable partition should have solid backing directly behind the fixed jamb or bulb seal contact point to resist

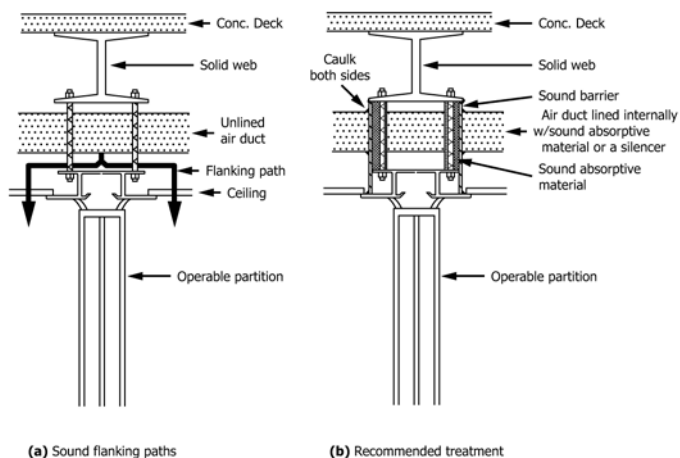


FIG. 2 Recommended Sound Attenuating Duct Installation

Minimum of (3) access panels required

1. Opposite drive Unit
2. 60 in (1.524 m) beyond stack recess or pocket
3. At lead end

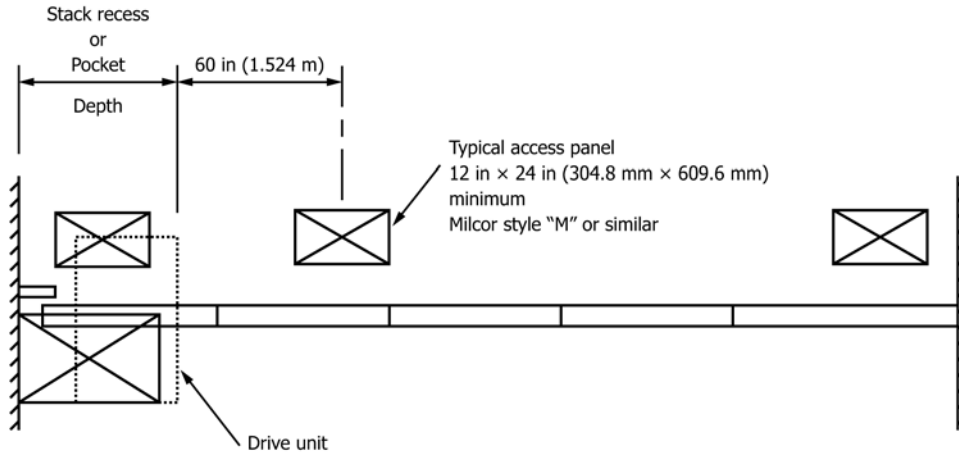


FIG. 3 Ceiling Access Panels for Partitions With or Without a Pocket

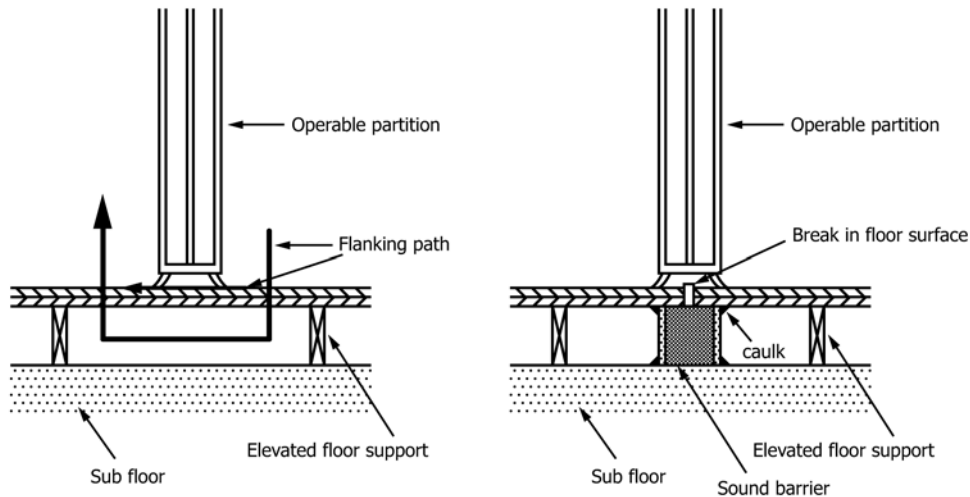


FIG. 4 Recommended Floor Barrier Installation

bowing when the operable partition applies pressure. The blocking should be designed similar or equivalent to that shown in Fig. 6 (a) and (b). Often it is best to fill the fixed partition with mineral or glass wool to increase its sound transmission loss.

5.4.2.3 Concrete block or brick walls without facing usually have concave grout lines which can be severe flanking paths. Either a fixed jamb or a smooth closure surface should be mounted to the wall and caulked or sealed in place.

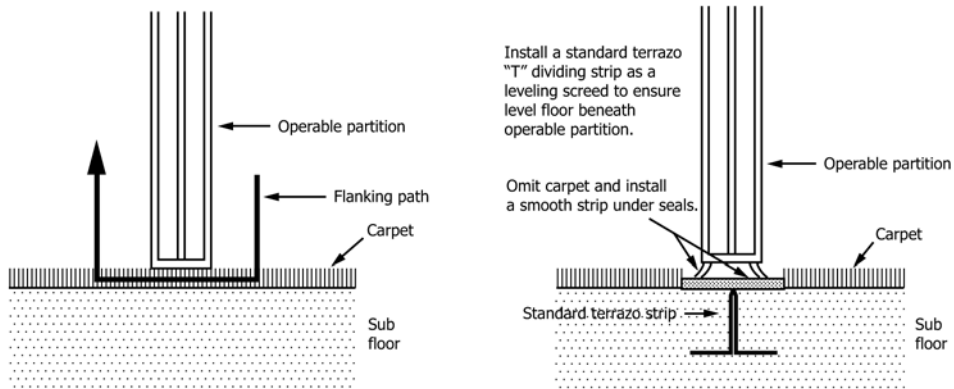
5.4.2.4 Gypsum board furred from masonry walls or surrounding columns should be blocked and filled at the jamb. Fig. 7 (a) and (b) show typical details.

5.4.3 It is necessary to obtain good contact between the operable partition and the fixed jamb (if used) or the bulb seal and the permanent wall. If a fixed jamb is used, it should be plumb and the partition adjusted to exert adequate pressure. The surface to receive the jamb or bulb seals should be plumb to within  $\pm 1/8$  in. (3.2 mm) for every 10 ft (3.048 m) of height.

The fixed portion of the jamb should be caulked or sealed to the wall to prevent leaks between it and the building construction (see Fig. 6 (b)).

5.5 *Structural Support for Operable Partitions*—The weight of the operable partition, in addition to all dead loads, should be taken into consideration when designing the supporting member. Deflection under maximum anticipated load should be no more than  $1/8$  in. (3.2 mm) per 12 ft (3.658 m) of opening width. If greater deflection is anticipated, either a structural member independent of the roof structure should be installed to support the operable partition, or an operable partition with bottom seals designed to accommodate the larger deflection should be specified.

5.6 *Flanking Transmission of Sound through Doors and Corridors*—Spaces separated by operable partitions are often accessed through doors from a common corridor. Consideration should be given to seals on such doors and the sound



(a) Sound flanking path

(b) Recommended treatment

FIG. 5 Recommended Floor Leveling Installation

absorption in the corridors in order to limit unwanted sound transmission by this flanking path.

## 6. Room Acoustics Considerations

6.1 *Focusing of Sound*—Partitions with curved surfaces that can bring sound to a focus should be avoided. They can cause acoustical problems within the enclosed space entirely apart from any noise that may intrude from the outside.

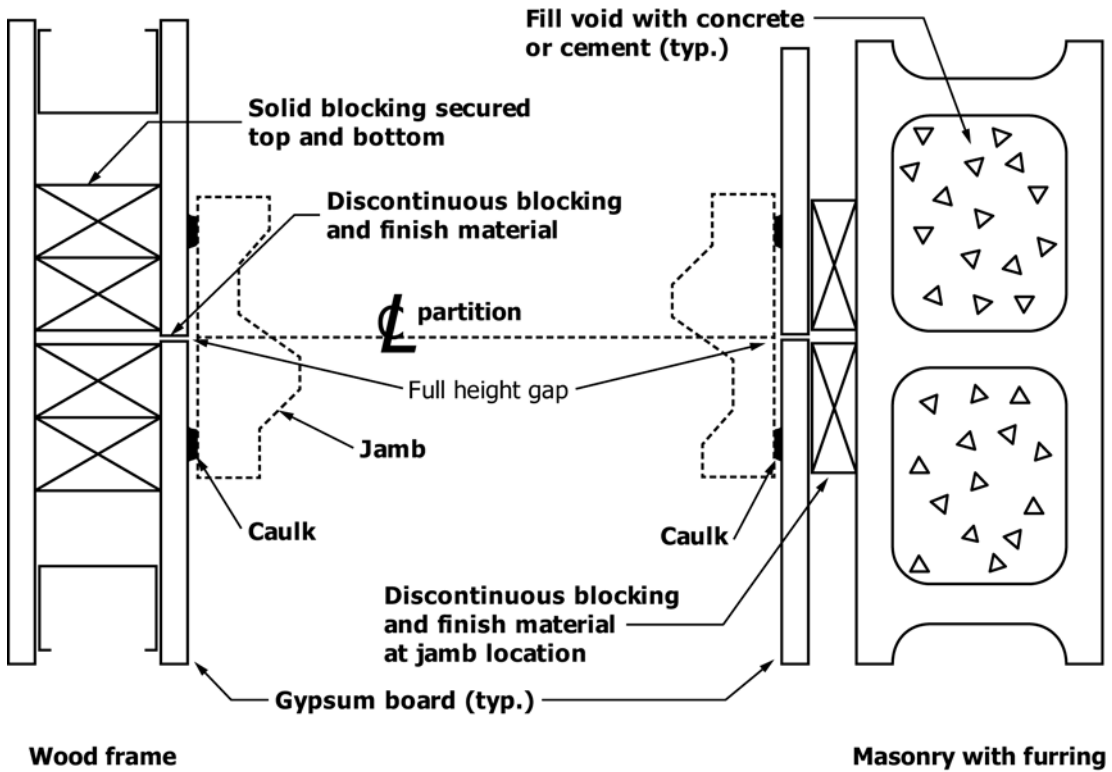
6.2 *Sound Reflection*—Most operable partitions have sound reflective surfaces which may create problems especially in larger rooms if sound from the loudspeakers is directed towards the surface or if there is inadequate sound absorption in the room. This should be considered in the design of the space.

## 7. Verification of Field Performance

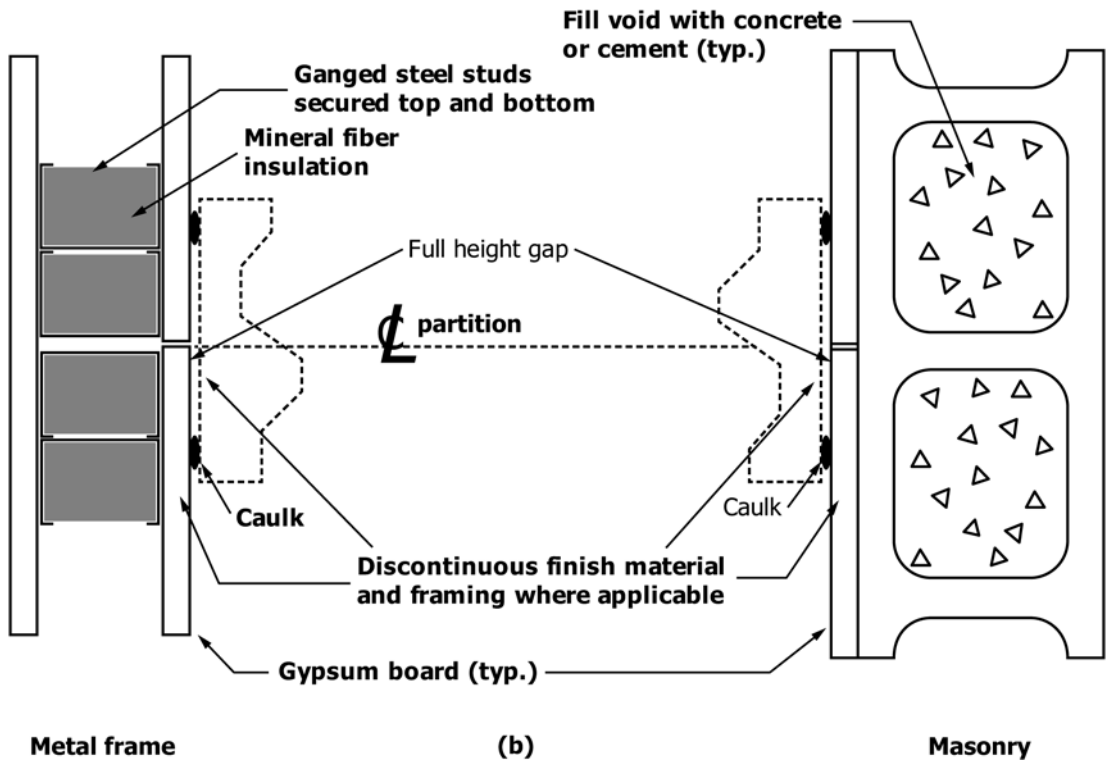
7.1 To reduce leakage due to seals not properly adjusted and to identify other issues that might be corrected for better performance, a field sound test should be conducted in accordance with Test Method E336, and the Noise Isolation Class (NIC) should be calculated in accordance with Classification E413.

## 8. Keywords

8.1 acoustical; design; installation; movable; operable; partition; sound

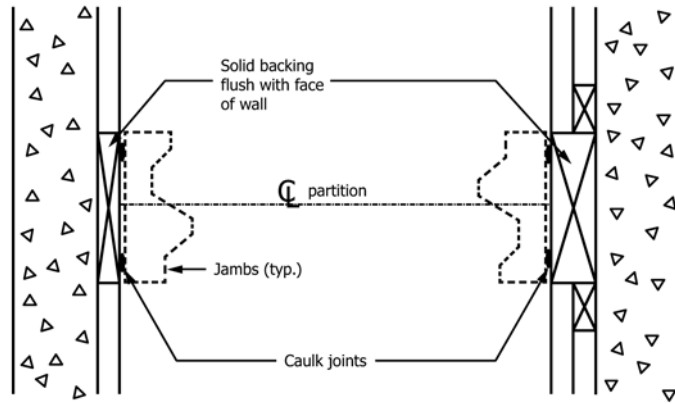


(a)

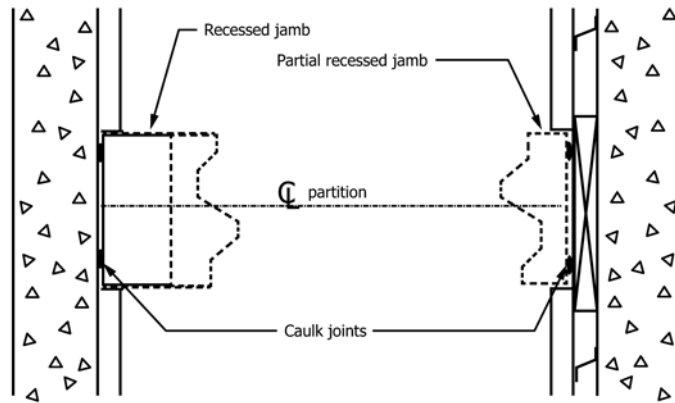


(b)

FIG. 6 Typical Wall/Jamb Details



(a)



(b)

**FIG. 7 Recommended Treatment for Filled Masonry or Concrete Walls with Gypsum or Facing Board**

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