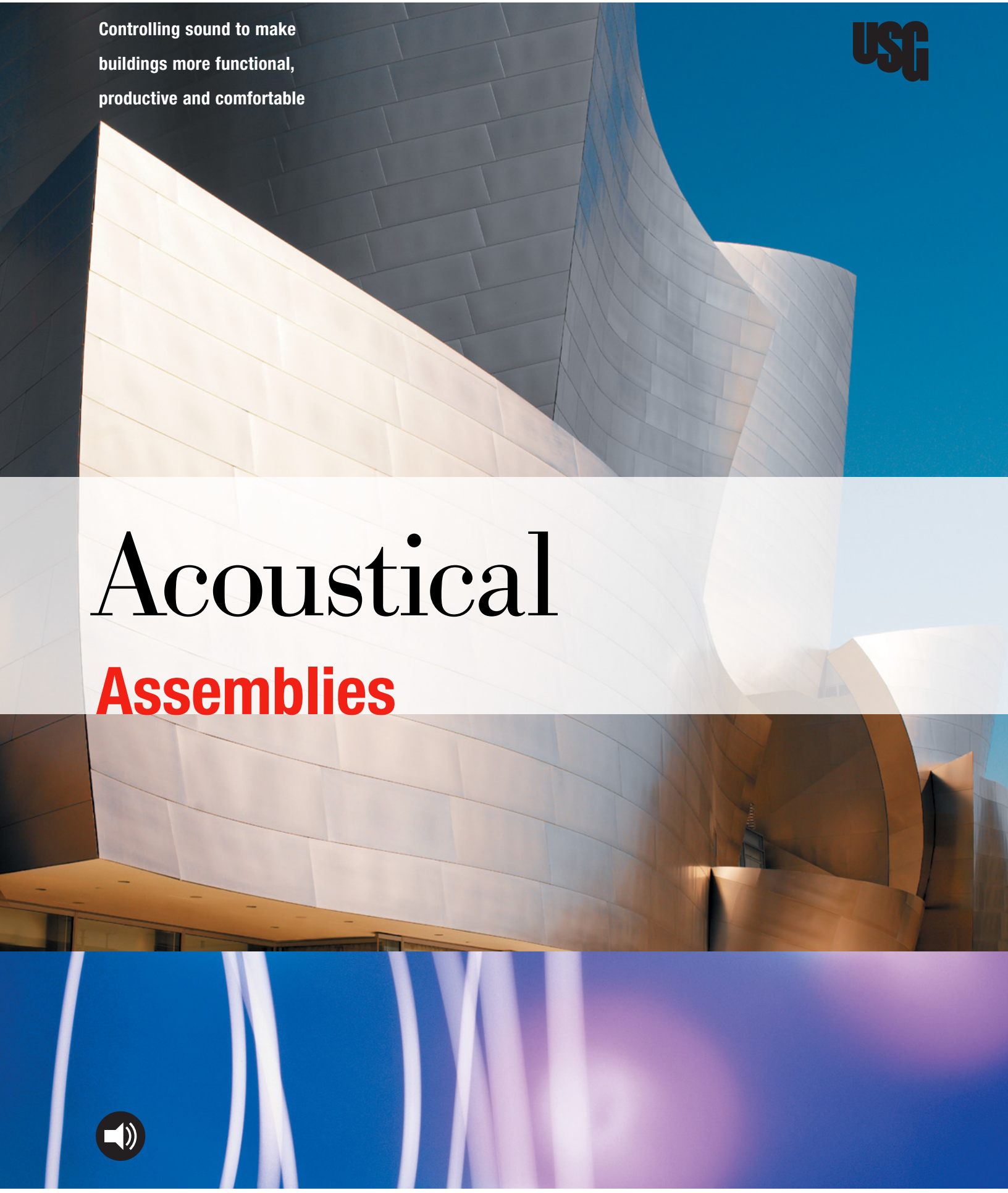
Controlling sound to make buildings more functional, productive and comfortable

USG

Acoustical

Assemblies



Acoustical design can be one of the most complex facets of architecture and construction. Depending on the purpose of a building or room, primary acoustical requirements could include sound control between spaces, sound control within a space, or listening efficiency in meeting rooms and auditoriums. Just as technical challenges can vary widely from space to space, so, too, do the choices of materials and design details that can meet them. Thoroughly exploring these options requires time and effort. However, this investment can yield important benefits – happier tenants, higher property values, reduced turnovers and vacancies, and greater productivity – that clients will value just as highly as they do the allure of your design.

Making Sound Choices

User's Guide

This brochure provides:

- Comprehensive information about strategies for enhancing acoustics and sound control
- Guidelines for selecting USG products and systems to meet acoustical needs in a range of applications
- Technical information and test data for featured products and systems

Overview

Acoustics affect critical aspects of a building's function, from productivity in office settings and performance quality in theaters and auditoriums, to the price an apartment, condominium or single-family house can command. Understanding how to select a combination of building materials, system designs and construction technologies that will provide the most appropriate sound control is key to creating a successful acoustical design.

While the science behind sound is well understood, using that science to create the desired acoustical quality within a building or room is complex. No single acoustical "solution" can be universally applied to all designs. Each environment features unique parameters the architect and designer must consider when developing floor plans, selecting materials and designing assemblies. Virtually every material—from furniture and wall and floor coverings to computer equipment—will affect sound to some degree. However, designing wall partitions, ceiling systems and floor/ceiling assemblies for the distinct qualities of a space will achieve the most effective sound control.

Sound is defined as a vibration in an elastic medium, that is, any material (air, water, physical object) that returns to its normal state after being deflected by an outside force such as a sound vibration. The more elastic a substance, the better it can conduct sound. Lead, for instance, is very inelastic and therefore a poor sound conductor. Steel, on the other hand, is highly elastic, making it an excellent conductor of sound.

Sound travels not only in a straight path from its source but also bounces off partitions, bends around barriers and squeezes through small openings, all of which can allow noise to reach surprisingly far beyond its point of origin. Designers must consider the dynamics of sound when determining how they will control noise within a building.

Definitions

Like most specialized fields, the science of acoustics has a language all its own. Some of the most important terms and concepts to be familiar with include:

Absorption	Percentage of sound waves that a material transforms into heat energy and thereby does not reflect back into the space.
Articulation index (AI)	A measurement of how well speech can be understood in a space. High AI is desirable in spaces such as auditoriums and theaters and can be achieved with a combination of materials and design details that strategically reflect and absorb sound. Reduced AI is desirable for spaces such as open offices, where many people must work independently, and in financial and healthcare facilities, which are subject to federal privacy rules; sound masking can be used to reduce AI (see the next page for more information).
Ceiling Attenuation Class (CAC)	A measurement of the ability of a ceiling panel to block the travel of sound from an enclosed room up into the plenum and down to adjacent spaces. High-CAC ceiling panels can provide this type of sound control, increasing speech privacy in private spaces and reducing distractions to those outside.
Conductivity	The ability of a material to transmit sound waves. In addition to moving through air, sound waves can travel even more easily through many solid objects. For example, sound waves move through air (70 °F) at just 1,128 feet per second but travel about 10 times faster (11,700 feet per second) through wood, and faster still (18,000 feet per second) through steel. Therefore, designers must consider not only airborne sound, such as voices and ringing telephones, but also structure-borne sound created by footfall, doors opening and closing, and building systems such as elevator machinery and HVAC equipment.
Diffraction	The bending of sound waves around objects or through small spaces and openings with little energy loss. Spaces around doors, floor tracks, electrical boxes, and conduit and HVAC ducting are typical channels for sound diffraction. These spaces should be filled with acoustical sealant to prevent unwanted sound from intruding into adjacent spaces.
Flanking Paths	Small gaps and openings around doors, floor tracks, electrical boxes, and conduit and HVAC ducting that allow sound to pass through if not filled with acoustical sealant. Also called “leaking paths.”
Impact Isolation Class (IIC)	Measurement of the ability of a floor/ceiling assembly to isolate sound from footfall and other impact sources, reducing the intrusion of noise into rooms directly below.
Noise Reduction Coefficient (NRC)	Measurement of the ability of a material such as an acoustical ceiling panel to absorb sound energy in the frequency range of 250 Hz to 2,000 Hz (see “pitch” for more information). High-NRC ceiling panels provide this type of sound control, which is important for large spaces such as open-plan offices.

Definitions

Pitch	The oscillation rate of a sound wave, which travels as a small pressure change alternating above and below the static (at rest) state of the conducting material. Each cycle of compression and re-expansion is a wave. The number of waves occurring per second is the frequency, which is measured as hertz (Hz); one Hz equals one cycle per second. A sound's pitch rises as its frequency increases. The human ear can discern sounds ranging from approximately 20 Hz to 20,000 Hz. Human speech ranges between 125 Hz and 4,000 Hz.
Reflection	The bouncing of sound waves off any hard, smooth wall, ceiling or floor surface, making them audible beyond the immediate area of the source. The shape of surfaces also affects where sound may travel. Concave surfaces concentrate or focus sound, while convex surfaces can disperse sound in multiple directions.
Reverberation	Sound that persists in an enclosed space by reflecting off surfaces in the room.
Sound Masking	A carefully engineered sound spectrum similar to that of softly blowing air, which is amplified through speakers to raise the ambient sound level, "masking" conversations and background noise. In enclosed rooms, sound masking increases speech privacy by lowering the articulation index, preventing conversations from being overheard.
Sound Transmission Class (STC)	Measurement of the ability of a wall or floor assembly to isolate airborne sound and prevent it from passing from one side to the other.
Transmission	The passage of sound waves from its source, through a vibrating medium, and to a listener. "Airborne sound" passes through a space by vibrating the air. "Structure-borne sound" travels through wall partitions, ceilings and floor/ceiling assemblies.
Volume	The loudness of a sound—how much the amplitude of a sound wave exceeds the static pressure of the conducting medium—as measured in decibels (dB). The higher the decibel level, the greater the volume. Noise from a jet plane has an amplitude of 140 dB, while a human whisper is approximately 20 dB. Sound in a typical office environment reaches 40 dB to 60 dB. Volume doubles with each 10 dB increase in sound energy.

Components

Acoustically-rated systems have been comprehensively tested for sound control. Substitution of any components is not recommended or supported by USG. Refer to the material safety data sheet for each product for complete health and safety information.

Ceilings

USG Acoustical Ceiling Panels

- Available with high NRC, CAC, and combination NRC/CAC ratings
- Provide stylish and effective sound control in a full range of commercial applications including retail, healthcare, hospitality, educational and office settings
- Combine top-rated acoustical performance with durability, high light reflectance and a range of textures to complement any décor
- Many feature the *ClimaPlus*™ Non-Sag Warranty
- Cast ceiling panels provide unparalleled strength and integral color to mask nicks and scratches for long service life and low lifecycle costs
- Select panels provide antimicrobial treatment for true protection against mold

For more information see the following brochures:

Ceiling Systems Binder
SC2392

Ceiling Systems Desktop Reference
SC2000

LENCORE® SPECTRA® Sound Masking

- Covers ambient noise in large spaces so potential distractions are less intrusive
- Enhances speech privacy in private offices by preventing conversations from being overheard outside
- Adds acoustical balance to exceptionally quiet environments
- Each unit is powered by 16/18 volts AC and includes a self-contained noise generator, audio amplifier, loudspeaker, and power supply unit in an aluminum enclosure
- Supports an optional paging system
- Allows paging and masking volume to be adjusted independently, and additional central control capabilities are available

For more information see the following brochures:

The Acoustics Solution
SC2411

Will You Achieve HIPAA Compliance?
SC2412

Components

Walls and Partitions

SHEETROCK® Brand Gypsum Panels

– Available in thicknesses of 1/4″ to 3/4″ for assembling interior partitions with one or more layers per side for effective sound control in any application

– Steel-framed resilient partition systems with sound attenuation fire blanket (SAFB) in the partition cavity can achieve up to 65 STC with multi-layer designs, up to 63 STC with double-layer designs, and up to 56 STC with single-layer designs

– Wood-framed resilient partition systems with SAFB can achieve up to 59 STC with double-layer designs and up to 50 STC with single-layer designs

– Have achieved up to 4-hr. fire-resistance ratings with 3/4″ ULTRACODE® Core panels in steel-framed partition assemblies

For more information see the following brochures:

Moisture-Resistant Assemblies
SA932

Aesthetic Assemblies
SA933

SHEETROCK Gypsum Panels Submittal Sheet
WB1473

USG Area Separation Walls

– Achieve up to 60 STC

– Offer 2-hr. and 3-hr. fire-resistance ratings; comply with fire-resistance requirements under evaluation reports of UL U336

– Weigh at least 50% less than masonry walls, allowing faster, easier installation

For more information see the following brochures:

Area Separation Wall Systems
SA925

Area Separation Wall Submittal Sheet
WB2129

SHEETROCK Shaft Wall Systems

– Tested systems achieve up to 58 STC

– Have achieved up to 4-hr. fire-resistance ratings with multi-layer designs (UL U415)

– Oscillation tested to 1 million cycles to ensure structural performance

– Feature panels with water-resistant facings and/or mold-resistant paper and a water-resistant core to help minimize the risk of moisture damage

For more information see the following brochures:

Shaft Wall Systems
SA926

SHEETROCK Gypsum Liner Panels Submittal Sheet
WB2278

Plaster Systems

– Veneer plaster partitions achieve up to 63 STC in steel-framed resilient systems and up to 52 STC in wood-framed resilient systems
– Have achieved 1- to 4-hr. fire-resistance ratings for veneer and conventional systems
– Can minimize or eliminate irregularities such as ridging, boarding and nail pops associated with standard drywall construction, plus lower lifecycle costs and greater sustainability
– Used in theaters and auditoriums to create reflective surfaces near the stage to reinforce sound

For more information see the following brochure:

Plaster Wall Systems
SA920

SHEETROCK Acoustical Sealant

– Helps ensure that partition sound performance matches the promise of sound tests by sealing off spaces at partition perimeters and around cutouts
– Can increase the STC rating of a double-layer, steel-framed partition from 29 to 53 STC
– An integral part of high-performance USG partition designs for attenuation of low-frequency sound from machinery and music
– Suitable for use at the perimeter of fire-rated wall assemblies

For more information see the following brochure:

SHEETROCK Acoustical Sealant Submittal Sheet
J678

MICORE® Mineral Fiber Board

– A quality substrate or core for upholstered sound-absorbing wall panels, office dividers and baffles
– Available in thicknesses of 3/8″ to 3/4″, with 24-28 STC and .25-.35 NRC
– Nearly 50% lighter than particle board for easy handling and lower freight rates
– Inorganic mineral fibers won't absorb moisture, preventing expansion and warping
– Class A flame spread ratings developed per ASTM E84; UL classification
– Provides very low VOC emissions, per ASTM D5116-97
– Meets requirements for classrooms, per Collaborative for High-Performance Schools (CHPS), Section 01350

For more information see the following brochures:

MICORE 300 Board Submittal Sheet
IW803

MICORE 160 Board Submittal Sheet
IW944

Components

Floor/Ceiling Assemblies

LEVELROCK® Floor Underlayment

– Low-profile leveling gypsum concrete system increases IIC ratings by as much as 13 points when used with LEVELROCK™ SRB™ sound reduction board or SRM-25™ sound reduction mat
– Improves sound control in nominal wood-joist, engineered I-joist, open-web truss, and concrete floor systems
– Provides 1- and 2-hr. fire-resistance ratings for wood-framed floor/ceiling assemblies, and 4-hr. ratings for precast concrete assemblies
– Available in an unmatched range of compressive strengths from 2,500 to 8,000 psi

For more information see the following brochures:

Floor Underlayment Systems
SA305

High-Strength Flooring Solutions
IG1503

SRM-25 Sound Reduction Mat

– Low 1/4″ profile allows use of the full range of flooring finish materials including hardwood, ceramic tile, and marble with smooth transitions between surfaces
– Elevated on small nodes so less than 5% of surface area makes direct contact with the subfloor
– Increases STC rating by 4-7 points and IIC rating by 8-13 points

For more information see the following brochure:

LEVELROCK SRM-25 Sound Reduction Mat Submittal Sheet
IG1619

SRB Sound Reduction Board

– Smooth, coated finish resists abrasion and maintains tight tolerance
– Just 3/8″ thick; allows flexibility in choosing flooring materials
– Increases STC rating by 2-3 points and IIC rating by 5-8 points

For more information see the following brochure:

LEVELROCK SRB Sound Reduction Board Submittal Sheet
IG1523

Performance Testing

Testing provides a measurement of maximum performance potential achieved under controlled laboratory conditions. The actual ability of partitions and assemblies to control sound in real-life applications, however, depends on their design and the methods used to install them. Deviations from the detailing shown in this publication, substitution of components, or damage and improper repair or maintenance could severely reduce the acoustical performance of these installations.

Testing Methods

All USG products and systems undergo exhaustive testing to ensure that they meet exacting standards. USG's products are Classified as to fire resistance and fire-hazard properties. As part of this protocol, Underwriters Laboratories (UL) periodically audits production of these materials to ensure compliance with necessary properties. UL is an independent, not-for-profit organization that has tested products for public safety for over a century.

Products are manufactured and tested in accordance with recognized standards. ASTM International is one of the largest voluntary standards development organizations in the world, and is a trusted source for technical standards for materials, products, systems, and services.

Testing Results

ASTM C423

Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method measures Noise Reduction Coefficient (NRC). This rating represents the average of a given material's sound absorption coefficients at four frequencies from 250 Hz to 2000 Hz.

ASTM E1414

Determination of Sound Transmission Class by the Two-Room Method measures Ceiling Attenuation Class (CAC), the sound reduction in decibels provided between rooms with a shared ceiling and common plenum. This rating represents the average of the sound attenuation at four frequencies from 250 Hz to 2000 Hz.

Acoustical Ceilings

Panels	NRC	CAC	CAC with Lencore Sound Masking[a]
Eclipse™ *ClimaPlus*	.70	35	45
Frost™ *ClimaPlus*	.70	40	50
Halcyon™ *ClimaPlus*	.90	30	40
Mars® *ClimaPlus*	.70	35	45

Performance Testing

ASTM E90

Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements measures Sound Transmission Class (STC), the acoustical isolation provided by a barrier material or partition assembly. This rating represents the average of the sound attenuation between two spaces at four frequencies from 250 Hz to 2000 Hz.

Walls and Partitions

SHEETROCK Brand Gypsum Panels

Partition Type	UL Designs	Framing[b]	Max. STC
Multi-Layer	U419, U455	Steel/Resilient Channel	65
Double-Layer	U419, U454		63
Single-Layer	U419, U451		56
Double-Layer	U334	Wood/Resilient Channel	59
Single-Layer	U311		50

USG Area Separation Walls

Wall Type	UL Designs	STC (Tested Assemblies)
Solid	U336	46 to 60

SHEETROCK Shaft Wall Systems

Nail Type	UL Designs	STC (Tested Range)
Cavity	U415	39-58

Veneer Plaster Systems

Framing	UL Designs	STC (Tested Assemblies)
Non-loadbearing Steel	U411, U412, U419, U435, U448, U455	40-59
Non-loadbearing Steel/Resilient	U419, U423, U440, U451, U452, U453, U454	50-63
Wood	U305, U314	34-46
Wood/Resilient	U311	49-52

Mineral Fiber Board

	MICORE 300 Board		MICORE 160 Board	
Thickness	STC	NRC	STC	NRC
3/8″	24	.25	22	—
7/16″	24	.25-.30	—	—
1/2″	25	.30-.35	24	.30-.40
5/8″	26	.30-.35	26	.30-.40
3/4″	28	.30-.35	26	.55-.60

Notes

(a) LENCORE sound masking adds the equivalent of 10 points of CAC by increasing ambient background sound by 10 dB.
(b) Includes SAFB in the partition cavity.
(c) Performance shown for perforated products.

ASTM E492

Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine determines Impact Isolation Class (IIC), the ability of a floor/ceiling assembly to isolate noise from footsteps and other impact sources. This performance is tested using a tapping machine that impacts the floor of a "source" room and measuring the amount of sound that comes through the ceiling of a "receiving" room located directly below.

Floor/Ceiling Assemblies

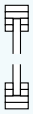
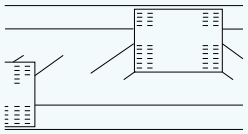
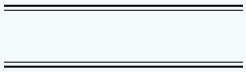
LEVELROCK Floor Underlayment Sound Isolation System

Framing	Sound Barrier	Floor Finish	IIC	STC
I-Joist	SRM-25 Sound Reduction Mat	Carpet	77	65
		Sheet Vinyl	55-58	60-64
		Ceramic Tile	54-56	60-66
		Wood Laminate	52-54	60-64
I-Joist	SRB Sound Reduction Board	Wood Laminate	61	65
		Ceramic Tile	51	65
		Sheet Vinyl	54	65
Truss	SRM-25 Sound Reduction Mat	Carpet	73	61
		Ceramic Tile	56	61
		Sheet Vinyl	55	61
Truss		Carpet	76	58
		Sheet Vinyl	48	58

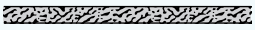
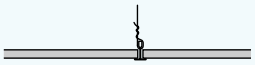
Legend

This legend contains the symbols used throughout the Architectural Reference Library to represent various architectural elements. Profile and cross-section views are shown where appropriate, along with architectural material symbols.

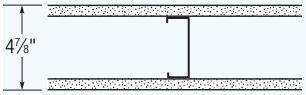
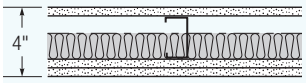
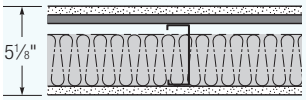
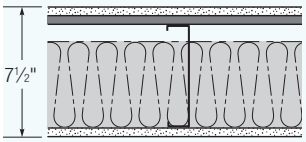
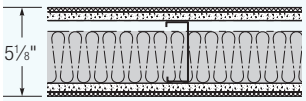
Architectural Elements

Component	Cross Section	Profile
C-H studs		
Z-furring		
Engineered joist		
Decking		
Decking		
Lath		
Wood truss		
Wood joist or stud		
Steel joist or stud		
Steel truss		
RC-1 channel		
Furring channel		

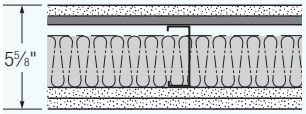
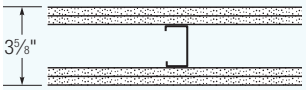
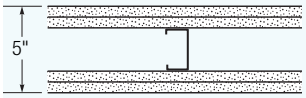
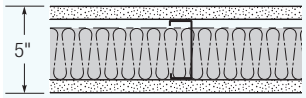
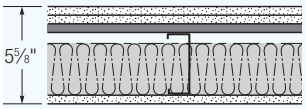
Architectural Elements

Component	Cross Section	Architectural Material Symbols
Polystyrene insulation		
Blanket insulation		
Solid wall		
Plywood		
Cement board		
Poured gypsum		
Gypsum board or plaster		
Veneer finish		
Tile		
Concrete or precast concrete		
Ceiling panel		

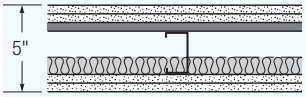
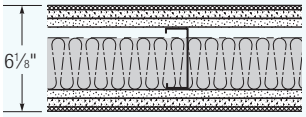
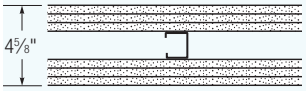
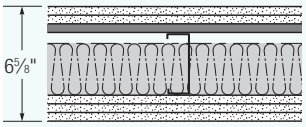
Steel Framed

Non-loadbearing		Acoustical Performance		Fire Performance		Reference	
Construction Detail	**Description**	**STC**	**Test Number**	**Rating**	**Test Number**	**ARL**	**Index**
wt. 6  	• 5/8″ Sheetrock® Brand Firecode® Core Gypsum Panels or Imperial® Brand Firecode Core Abuse-Resistant Gypsum Base, Fiberock® Brand Panels – 3-5/8″ 25 gauge steel studs 24″ o.c. – joints finished • optional veneer plaster	40 49 51	**USG-860808** **SA-870717** Based on 3″ SAFB in cavity **RAL-TL-90-166** Based on 5/8″ Firecode C Core panels and 3″ SAFB, and veneer finish surface SAFB 25″ wide, creased to fit cavity	1 hour	**UL Des U419** or **U465**	SA700 SA920	**A-1**
wt. 7  	• 1/2″ Sheetrock Brand Firecode C Core Gypsum Panels – 2-1/2″ 25 gauge steel studs 24″ o.c. – 1-1/2″ Thermafiber SAFB – joints finished	41 50	**RAL-TL-69-148** Based on same construction without Thermafiber SAFB **SA-800504**	1 hour	**UL Des U419** or **U448**	SA920	**A-2**
wt. 7  	• Face layer 1/2″ Sheetrock Brand Firecode C Core Gypsum Panels – 1-5/8″ 25 gauge steel studs 24″ o.c. • base layer 1/4″ Sheetrock Brand Gypsum Panels – joints finished	53	**CK-684-13** Based on 1-1/2″ mineral wool batt and 2-1/2″ studs	1 hour	**GA-WP-1090**		**A-3**
wt. 7  	Alternate based on 2-1/2″ 25 gauge steel studs and 1/2″ face layer laminated	53	**NGC-2318** Based on 2″ glass fiber	1 hour	**GA-WP-1051**		**A-4**
wt. 5  	• 1/2″ Sheetrock Brand Firecode C Core Gypsum Panels – 3-5/8″ 25 gauge steel studs 24″ o.c. – 3″ Thermafiber SAFB – RC-1 channel or equivalent one side spaced 24″ o.c. • optional veneer plaster	50 54	**RAL-TL-87-156** **RAL-TL-83-216** Based on 5/8″ thick panels	1 hour	**UL Des U419** or **U451**	SA920	**A-5**
clg. wt. 5  	• 1/2″ Sheetrock Brand Firecode C Core Gypsum Panels – 6″ 20 gauge steel studs 24″ o.c. – 5″ Thermafiber SAFB – RC-1 channel or equivalent one side spaced 24″ o.c.	56 56	**RAL-TL-87-139** **RAL-TL-84-141** Based on 5/8″ thick Sheetrock Brand Firecode C Core Gypsum Panels	1 hour	**UL Des U419** or **U451**	SA920	**A-6**
wt. 14  	• 1/2″ Durock Brand Cement Board and 1/4″ ceramic tile – 3-5/8″ 20 gauge steel studs 16″ o.c. – 3″ Thermafiber SAFB – alternate design 5/8″ Sheetrock Brand Firecode Core Gypsum Panels, one side	48 50	**SA-840321** **SA-840313** Based on alt design	1 hour	**UL Des U442**	SA934	**A-7**

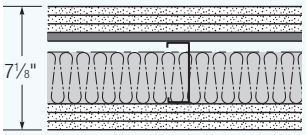
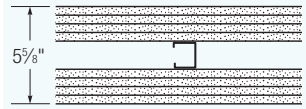
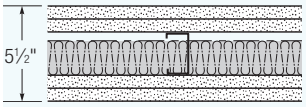
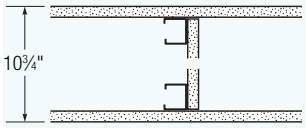
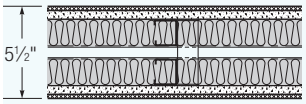
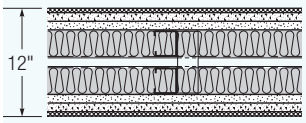
Steel Framed

Non-loadbearing		Acoustical Performance		Fire Performance		Reference	
Construction Detail	**Description**	**STC**	**Test Number**	**Rating**	**Test Number**	**ARL**	**Index**
wt. 7  	• 1/2″ Sheetrock Brand Firecode C Core Gypsum Panels – 3-5/8″ 20 gauge studs 24″ o.c. – 3″ Thermafiber SAFB – RC-1 channel or equivalent one side spaced 24″ o.c. – 2 layers gypsum panels – face layer joints finished • optional veneer plaster	58	**RAL-TL-83-215**	1-1/2 hour	**UL Des U452**	SA920	**A-8**
		59	**RAL-TL-84-140** 6″ 20 ga struc studs and 5″ Thermafiber SAFB				
wt. 9  	• 1/2″ Sheetrock Brand Firecode C Core Gypsum Panels each side – 1-5/8″ 25 gauge steel studs 24″ o.c. – face layer joints finished • optional veneer plaster	50	**USG-840817** Based on 3-5/8″ stud assembly without mineral wool batt	2 hour	**UL Des U419** or **U412**	SA920	**A-9**
		52	**SA-860932** Based on lamin. face layer, 1-1/2″ mineral wool batt and 2-1/2″ studs				
		54	**CK-654-40** Based on 2-1/2″ studs, screw-attached face layer and 1-1/2″ mineral wool batt				
		55	**SA-800421** Based on 3-5/8″ studs and 1-1/2″ mineral wool batt				
wt. 11  	• 5/8″ Sheetrock Brand Firecode Core Gypsum Panels, or Fiberock Brand Panels – 1-5/8″ 25 gauge steel studs 24″ o.c. – face layer joints finished • optional veneer plaster	48	**BBN-770408** Based on 3-5/8″ studs and 5/8″ Sheetrock Brand Firecode C Core Gypsum Panels	2 hour	**UL Des U419** or **U411**	SA920	**A-10**
		56	**USG-840818** Based on 3-5/8″ studs and 3″ mineral wool batt				
wt. 7  	• 3/4″ Sheetrock Brand Ultracode Core Gypsum Panels – 3-1/2″ 25 gauge steel studs 24″ o.c. – 3″ Thermafiber SAFB – joints finished	50	**USG–910617**	2 hour	**UL Des U419** or **U491**		**A-11**
wt. 7  	• 1/2″ Sheetrock Brand Firecode C Core Gypsum Panels – 3-5/8″ 20 gauge studs 24″ o.c. – 3″ Thermafiber SAFB – RC-1 channel or equivalent one side spaced 24″ o.c. – single-layer gypsum panels screw-attached to studs – double layer screw-attached to channel – face layer joints finished • optional veneer plaster	59	**RAL-TL-84-136** Based on 5/8″ thick panels, 6″ 20 gauge structural studs, 5″ mineral wool batt	2 hour	**UL Des U419** or **U453**	SA920	**A-12**
		60	**RAL-TL-87-140** Based on 1/2″ thick panels, 6″ 20 gauge structural studs, 5″ mineral wool batt				

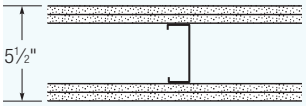
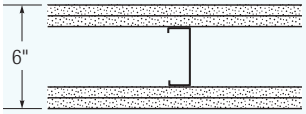
Steel Framed

Non-loadbearing		Acoustical Performance		Fire Performance		Reference	
Construction Detail	**Description**	**STC**	**Test Number**	**Rating**	**Test Number**	**ARL**	**Index**
wt. 9  	• 1/2″ SHEETROCK Brand FIRECODE C Core Gypsum Panels – 2-1/2″ 25 gauge steel studs 24″ o.c. – 1″ THERMAFIBER SAFB – RC-1 channel or equivalent one side, spaced 24″ o.c. – double layer gypsum panels screw-attached to channel, 2 layers screw-attached to steel studs – face layer joints finished • optional veneer plaster	57	**USG-871207** Based on 5/8″ thick panels	2 hour	**UL Des U454**	SA920	**A-13**
		60	**RAL-TL-87-154**				
		61	**RAL-TL-83-214** Based on 5/8″ thick panels				
		63	**RAL-TL-87-141** Based on 6″ 20 gauge structural studs and 5″ mineral wool batt				
		62	**RAL-TL-84-139** Based on 5/8″ thick panels, 6″ 20 gauge structural studs and 5″ mineral wool batt				
wt. 18  	• 1/2″ DUROCK Brand Cement Board and 1/4″ ceramic tile • base layer 1/2″ SHEETROCK Brand FIRECODE C Core Gypsum Panels – 3-5/8″ 20 gauge steel studs 16″ o.c. – 3″ THERMAFIBER SAFB – face layer joints taped • alternate design 2 layers 1/2″ SHEETROCK Brand FIRECODE C Core Gypsum Panels, one side	56	**SA-851016** Based on alternate design	2 hour	**UL Des U443**	SA934	**A-14**
		58	**SA-851028**				
wt. 13  	• 1/2″ SHEETROCK Brand FIRECODE C Core Gypsum Panels – 1-5/8″ 25 gauge steel studs 24″ o.c. • optional veneer plaster	59	**SA-830112** Based on assembly with 1-1/2″ mineral wool batt in cavity	3 hour	**UL Des U419** or **U435**	SA920	**A-15**
wt. 11  	• 1/2″ SHEETROCK Brand FIRECODE C Core Gypsum Panels – 3-5/8″ 20 gauge studs 24″ o.c. – 3″ THERMAFIBER SAFB – RC-1 channel or equivalent one side, spaced 24″ o.c. – face layer joints finished	61	**RAL-TL-87-153** Based on 5/8″ thick panels	3 hour	**UL Des U419** or **U455**	SA920	**A-16**
		62	**RAL-TL-83-213** Based on 5/8″ thick panels				
		63	**RAL-TL-84-138** Based on 5/8″ thick panels, 6″ 20 gauge structural studs and 5″ THERMAFIBER SAFB				
		64	**RAL-TL-87-142** Based on 6″ 20 gauge structural studs and 5″ THERMAFIBER SAFB				
		65	**RAL-TL-84-150** Based on 5/8″ thick panels, 6″ 20 gauge structural studs, 5″ THERMAFIBER SAFB, acoustical sealant bead between panels and studs, dabs 8″ o.c. between panel layers on stud side				

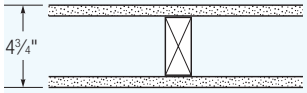
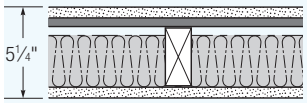
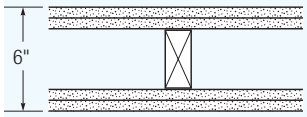
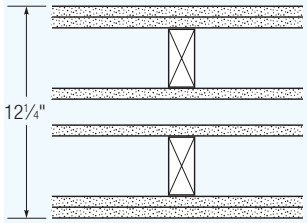
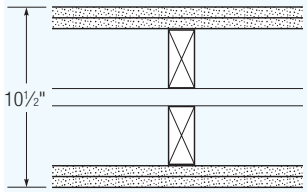
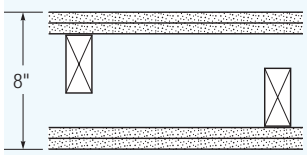
Steel Framed

Non-loadbearing		Acoustical Performance		Fire Performance		Reference	
Construction Detail	**Description**	**STC**	**Test Number**	**Rating**	**Test Number**	**ARL**	**Index**
wt. 13  	• 1/2″ Sheetrock Brand Firecode C Core Gypsum Panels – 3-5/8″ 20 gauge studs 24″ o.c. – 3″ Thermafiber SAFB – RC-1 channel or equivalent one side, spaced 24″ o.c. – face layer joints finished	63 65	**RAL-TL-87-152** **RAL-TL-87-143** 6″ 20 gauge structural studs, 5″ Thermafiber SAFB	3 hour	**UL Des U419** or **U455**		**A-17**
wt. 17  	• 4 layers 1/2″ Sheetrock Brand Firecode C Core Gypsum Panels, each side – 1-5/8″ 25 gauge steel studs 24″ o.c. • optional veneer plaster	62	**SA-830113** Based on assembly with 1-1/2″ mineral wool batt in cavity	4 hour	**UL Des U419** or **U435**	SA920	**A-18**
wt. 13  	• 2 layers 3/4″ Sheetrock Brand Ultracode Core Gypsum Panels, each side – 2-1/2″ 25 gauge steel studs 24″ o.c – 2″ Thermafiber SAFB – face layer joints finished	56	**SA-910907**	4 hour	**UL Des U419** or **U490**		**A-19**
Chase Walls							
wt. 6  	• 5/8″ Sheetrock Brand Firecode Core Gypsum Panels, each side or Fiberock Brand Panels – 1-5/8″ 25 gauge steel studs 24″ o.c. in 2 rows – 5/8″ gypsum panel gussets or steel runner braces spanning chase screw-attached to studs • optional veneer plaster	52	**RAL-TL-76-155** Based on 3-1/2″ insulation, one side	1 hour	**UL Des U420**	SA920	**A-20**
wt. 17  	• 1/2″ Durock Brand Cement Board and 1/4″ ceramic tile – 1-5/8″ 20 gauge steel studs 16″ o.c. in two rows with horizontal braces – 1-1/2″ Thermafiber SAFB • alternate design 5/8″ Sheetrock Brand Firecode Core Gypsum Panels, one side	60 61	**SA-840515** Based on 3″ Thermafiber SAFB and alternate design **SA-840524** Based on 3″ Thermafiber SAFB and 3-5/8″ studs	1 hour	**UL Des U404**	SA934	**A-21**
wt. 18  	• 1/2″ Durock Brand Cement Board and 1/4″ ceramic tile • base layer 1/2″ Sheetrock Brand Firecode C Core Gypsum Panels – 1-5/8″ 25 gauge steel studs 16″ o.c. in two rows with horizontal braces – 1-1/2″ Thermafiber SAFB • alternate design 2 layers 1/2″ Sheetrock Brand Firecode C Core Gypsum Panels, one side	65 62	**SA-841112** **SA-841102** Based on 3″ Thermafiber SAFB and alternate design	2 hour	**UL Des U444**	SA934	**A-22**

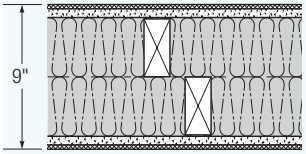
Steel Framed

Loadbearing		Acoustical Performance		Fire Performance		Reference	
Construction Detail	**Description**	**STC**	**Test Number**	**Rating**	**Test Number**	**ARL**	**Index**
wt. 9  	• 1/2″ SHEETROCK Brand FIRECODE C Core Gypsum Panels – 3-1/2″ 20 gauge steel structural studs 24″ o.c. – face layer joints finished	49	**USG-811009** Based on 2″ mineral wool batt	1-1/2 hour	**UL Des U425**		**A-23**
		49	**USG-810940** Based on 2″ mineral wool batt and 6″ 20 ga struc studs				
wt. 11  	• 5/8″ SHEETROCK Brand FIRECODE Core Gypsum Panels or FIBEROCK Brand Panels – 3-1/2″ 20 gauge steel structural studs 24″ o.c. – face layer joints finished – *loadbearing up to 100% allowable stud axial load when min 2″ THERMAFIBER mineral wool batt is used in stud cavities; otherwise load-bearing up to 80% allowable steel axial load* (UL Des U423 or U425) – *loadbearing up to 100% allowable stud axial load* (UL Des U423) • Alternate based on three layers 1/2″ SHEETROCK Brand FIRECODE C Core Gypsum Panels, each side	48	**USG-811006** Based on 2″ SAFB in cavity	2 hour	**UL Des U423** or **U425**		**A-24**
		49	**USG-810937** Based on 2″ SAFB and 6″ 20 gauge structural studs				

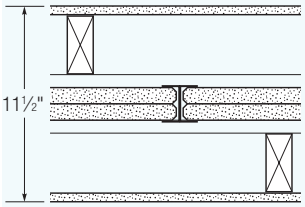
Wood Framed

Loadbearing		Acoustical Performance		Fire Performance		Reference	
Construction Detail	**Description**	**STC**	**Test Number**	**Rating**	**Test Number**	**ARL**	**Index**
wt. 7  	• 5/8″ Sheetrock Brand Firecode Core Gypsum Panels or Fiberock Brand Panels – 2x4 wood stud 16″ or 24″ o.c. – joints finished • optional veneer plaster	34	**USG-30-FT-G&H** Based on 16″ stud spacing and screws 6″ o.c.	1 hour	**UL Des U305, U314**	SA920	**A-25**
		37	**USG-860807** Based on 24″ stud spacing				
		46	**BBN-700725** Based on 24″ stud spacing and 3″ mineral wool batt				
wt. 7  	• 5/8″ Sheetrock Brand Firecode C Core Gypsum Panels – 2x4 wood stud 16″ or 24″ o.c. – 3″ Thermafiber SAFB – RC-1 channel or equivalent one side – joints finished	50	**BBN-760903**	1 hour	**UL Des U327**		**A-26**
wt. 12  	• 5/8″ Sheetrock Brand Firecode Core Gypsum Panels or Sheetrock Brand Water-Resistant Firecode Core Gypsum Panels or Fiberock Brand Panels – 2x4 wood studs 16″ o.c. – joints finished • optional veneer plaster	52	**USG-810218** Based on same assembly (non-fire rated) with RC-1 channel and without mineral wool batt	2 hour	**UL Des U301**	SA920	**A-27**
		58	**USG-810219** Based on same assembly with RC-1 channel and 2″ mineral wool batt				
Chase Walls							
 	• 1/2″ Sheetrock Brand Firecode C Core Gypsum Panels, both outside both walls double layer and inside single layer	57	**RAL-TL-73-224** 3-1/2″ glass fiber	1 hour	**GA-WP-3810**		**A-28**
 	• 5/8″ Sheetrock Brand Firecode Core Gypsum Panels, or Fiberock Brand Panels – 2 rows 2x4 wood studs 16″ o.c. on separate plates 1″ apart – joints finished	51	**RAL-TL-69-214**	2 hour	**GA-WP-3820**		**A-29**
		56	**USG-710120** Based on 3-1/2″ thick insulation in one cavity				
		58	**GA-NGC-3056**				
 	• 5/8″ Sheetrock Brand Firecode C Core Gypsum Panels or Fiberock Brand Panels – 2x4 wood studs 16″ o.c. on 2x6 common plate – joints finished	47	**RAL-TL-69-211**	2 hour	**GA-WP-3910**		**A-30**
		51	**GA-NGC-2377**				

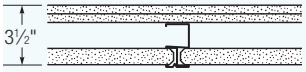
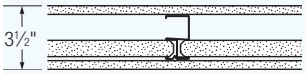
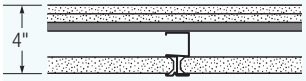
Wood Framed

Chase Walls		Acoustical Performance		Fire Performance		Reference	
Construction Detail	**Description**	**STC**	**Test Number**	**Rating**	**Test Number**	**ARL**	**Index**
	• 1/2″ DUROCK Brand Cement Board and 1/4″ ceramic tile – 2 rows 2x4 16″ o.c. on 2x8 common plate – 3-1/2″ THERMAFIBER SAFB both cavities – joints taped – *load-bearing up to 50% allowable design load*	50	**SA-840523**	2 hour	**WHI-495-0505** and **0508**	SA934	**A-31**

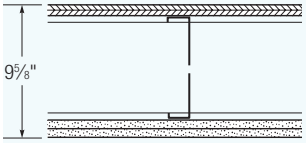
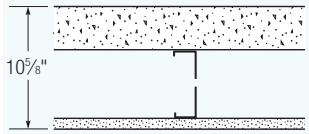
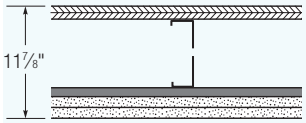
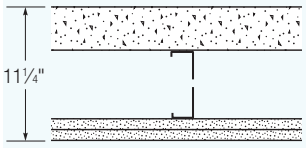
Area Separation Wall Systems

Non-loadbearing		Acoustical Performance		Fire Performance		Reference	
Construction Detail	**Description**	**STC**	**Test Number**	**Rating**	**Test Number**	**ARL**	**Index**
	Separation wall (non-loadbearing) • 1″ SHEETROCK Brand Gypsum Liner Panels • 2″ USG H-Studs 24″ o.c. Protected wall (bearing or non-loadbearing) of wood or steel studs each side min 3/4″ from liner panels • 1/2″ SHEETROCK Brand Gypsum Panels	46	**RAL-TL-88-353**	2 hour	**UL Des U336**	SA925	**A-32**
		54	**RAL-TL-88-348** Based on 2″ mineral wool batt on one side				
		57	**RAL-TL-88-351** Based on 2x4s and 3″ mineral wool batt one side				
		58	**RAL-TL-88-347** Based on 2x4s and 2″ mineral wool batt on both sides				
		60	**RAL-TL-88-350** Based on 2x4s and 3″ mineral wool batt on both sides				

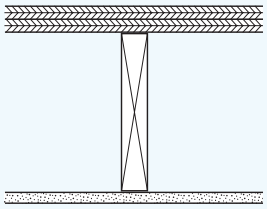
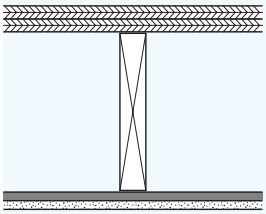
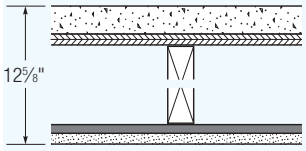
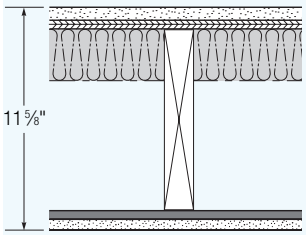
Shaft Wall Systems

Non-loadbearing		Acoustical Performance		Fire Performance		Reference	
Construction Detail	**Description**	**STC**	**Test Number**	**Rating**	**Test Number**	**ARL**	**Index**
wt. 9  	• 1/2″ SHEETROCK Brand FIRECODE C Core Gypsum Panels, face layer joints finished • 2-1/2″ USG C-H Studs 25 gauge 24″ o.c. • 1″ SHEETROCK Brand Gypsum Liner Panels	38	**USG-040917**	2 hour	**UL Des U415, System B** or **U438**	SA926	**A-33**
		43	**USG-040912** Based on 4″ C-H studs 25 gauge				
		48	**RAL-OT-04-022** Based on 1″ sound batts in cavity				
		50	**RAL-OT-04-019** Based on 4″ C-H studs 25 gauge with 3″ mineral fiber insulation				
wt. 9  	• 1/2″ SHEETROCK Brand FIRECODE C Core Gypsum Panels • 2-1/2″ USG C-H Studs 25 gauge 24″ o.c. • 1″ SHEETROCK Brand Gypsum Liner Panels – joints finished both sides	44	**USG-040911** Based on 4″ C-H studs 25 gauge	2 hour	**UL Des U415, System E** or **U467**	SA926	**A-34**
wt. 10  	• 1/2″ SHEETROCK Brand FIRECODE C Core Gypsum Panels applied vertically, face layer joints finished – RC-1 resilient channel or equivalent 24″ o.c. • 2-1/2″ USG C-H Studs 25 gauge 24″ o.c. • 1″ SHEETROCK Brand Gypsum Liner Panels	53	**USG-040909** Based on 4″ C-H studs 25 gauge with 3″ mineral fiber insulation	2 hour	**UL Des U415, System F**	SA926	**A-35**
		58	**USG-040910** Based on 4″ C-H studs 25 gauge with additional layer on liner panel side and 3″ mineral fiber insulation				

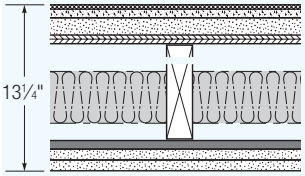
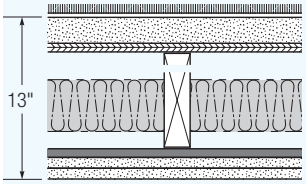
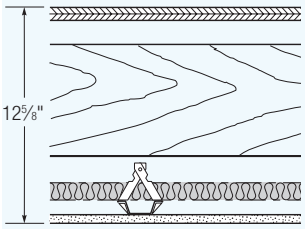
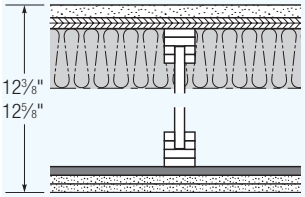
Steel Framed

Steel C-joist Framing		Acoustical Performance			Fire Performance		Reference	
Construction Detail	**Description**	**STC**	**IIC**	**Test Number**	**Rating**	**Test Number**	**ARL**	**Index**
clg. wt. 4  	• 2 layers 1/2″ Sheetrock Brand Firecode C Core Gypsum Panels – 7″ 18 gauge steel joists 24″ o.c. • USG DGL Drywall Suspension System (not shown)	39		**USG-760105** Based on 9-1/2″ 16 gauge steel joists	1 hour	**UL Des L524**		**B-1**
		43		**USG-760310** Based on 9-1/2″ 16 gauge steel joists and 3″ mineral wool batt				
		56		**USG-760106** Based on 9-1/2″ 16 gauge steel joists and carpet pad				
		60		**USG-760405** Based on 9-1/2″ 16 gauge steel joists and carpet pad with 3″ mineral wool batt				
clg. wt. 3  	• 5/8″ Sheetrock Brand Firecode C Core Gypsum Panels – 7-1/2″ 18 gauge steel joists 24″ o.c. – 2-1/2″ concrete floor on corrugated steel deck – joints finished	45		**KAL-443536** Based on RC-1 channel or equivalent 24″ o.c.	1 hour	Estimated fire rating based on witnessed laboratory test		**B-2**
			70	**KAL-443535** Based on carpet and pad				
clg. wt. 5  	• 2 layers 5/8″ Sheetrock Brand Firecode C Core Gypsum Panels – 3/4″ T&G plywood floor – 9-3/8″ 16 gauge steel joists 24″ o.c. – RC-1 channel or equivalent – joints finished	48		**USG-771101**	1-1/2 hour	**UL Des L527**		**B-3**
		51		**SA-781110** Based on carpet and pad				
clg. wt. 5  	• 5/8″ Sheetrock Brand Firecode C Core Gypsum Panels – 7-1/2″ 18 gauge steel joists 24″ o.c. – 2-1/2″ concrete floor over corrugated steel deck – joints finished	44		**KAL-443533**	2 hour	Estimated fire rating based on witnessed laboratory test		**B-4**
			73	**KAL-443680** Based on carpet and pad				
		47		**KAL-443534** Based on RC-1 resilient channel or equivalent 24″ o.c.				

Wood Framed

Dimensional Lumber		Acoustical Performance			Fire Performance		Reference	
Construction Detail	**Description**	**STC**	**IIC**	**Test Number**	**Rating**	**Test Number**	**ARL**	**Index**
clg. wt. 3 	• 5/8″ SHEETROCK Brand FIRECODE Core Gypsum Panels, ceiling – 1″ nominal wood sub and finished floor – 2x10 wood joist 16″ o.c. – joints finished • optional LEVELROCK Brand Floor Underlayment • optional SRM-25 or SRB sound mat • optional veneer plaster	38	32	**CK-6412-7** Based on 1-1/4″ nominal wood floor	1 hour	**UL Des L501**	SA305 SA920	**B-5**
		39	56	**CK-6412-8** Based on 1-1/4″ nominal wood floor, 44 oz carpet and 40 oz pad atop flooring				
clg. wt. 3 	• 1/2″ or 5/8″ SHEETROCK Brand FIRECODE C Core Gypsum Panels – 1-1/4″ nominal wood sub and finished floor – 44 oz carpet and 40 oz pad atop floor – 2x10 wood joist 16″ o.c. – RC-1 channel or equivalent – joints finished	47	67	**CK-6512-7** Based on 1/2″ SHEETROCK Brand FIRECODE C Core Gypsum Panels	1 hour	**UL Des L514**		**B-6**
		48	66	**CK-6412-9** Based on 5/8″ SHEETROCK Brand FIRECODE Core Gypsum Panels				
clg. wt. 3  12⅝"	• 5/8″ SHEETROCK Brand FIRECODE C Core Gypsum Panels – 1-5/8″ perlite-sand concrete – plywood subfloor – 2x10 wood joists 16″ o.c. – RC-1 channel or equivalent – joints finished • optional veneer plaster	59		**USG 740704** Based 3″ mineral wool batt, 3/4″ gypsum concrete and 1/2″ SHEETROCK Brand FIRECODE C Core Gypsum Panels	1 hour	**UL Des L516**	SA920	**B-7**
			47	**USG 740703** Based on 3″ mineral wool bat, vinyl tile atop flooring				
			65	**USG 740705** Based on 3″ mineral wool batt, 44 oz. carpet and 40 oz. pad atop flooring				
clg. wt. 3  11⅝"	• 5/8″ SHEETROCK Brand FIRECODE C Core Gypsum Panels – 2x10″ wood joist 16″ o.c. – RC-1 channel or equivalent 16″ o.c. – Insulation held up under subfloor by lightning clips – 19/32″ T&G wood subfloor • 3/4″ LEVELROCK Brand Floor Underlayment	59	54	**RAL-IN04-006/TL04-033** Cushioned vinyl floor, SRM-25, 1″ LEVELROCK	1 hour		SA305	**B-8**
		58	55	**RAL-IN04-007/TL04-034** Engineered wood-laminate floor SRM-25, 1″ LEVELROCK				
		59	77	**RAL-IN04-005/TL04-032** Carpet with SRM-25, 1″ LEVELROCK				
		59	52	**RAL-IN04-009/TL04-067** Ceramic tile with crack-isolation membrane, SRM-25, 1″ LEVELROCK				
		58	50	**RAL-IN04-013/TL04-100** Cushioned vinyl floor, SRB board				
		58	51	**RAL-IN04-012/TL04-099** Engineered wood-laminate floor, SRB board				
		58	73	**RAL-IN04-010/TL04-097** Carpet with SRB board				

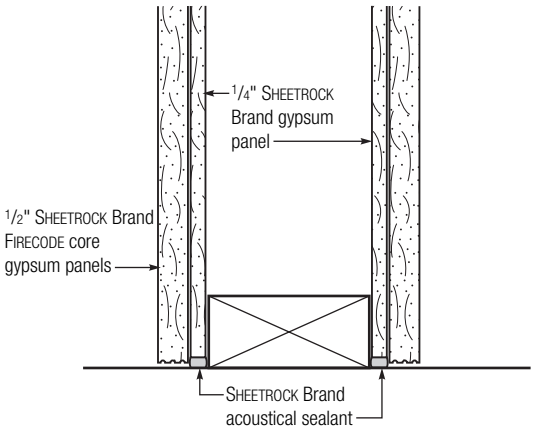
Wood Framed

Dimensional Lumber		Acoustical Performance			Fire Performance		Reference	
Construction Detail	**Description**	**STC**	**IIC**	**Test Number**	**Rating**	**Test Number**	**ARL**	**Index**
	• 2 layers 5/8″ Sheetrock Brand Firecode C Core Gypsum Panels – 8″ x 8″ ceramic tile • 1/2″ Durock Brand Exterior Cement Board • 1″ Sheetrock Brand Gypsum Liner Panels – 1/2″ plywood – 2x10 wood joist 16″ o.c. – 3″ mineral wool batt – RC-1 channel or equivalent		52	**RAL-IN-89-5**	2 hour	**UL Des L541**	SA934	**B-9**
		58		**RAL-TL-89-145** Based on vinyl tile over oriented strand board in place of ceramic tile and cement board				
			51	**RAL-IN-89-7**				
		59		**RAL-TL-89-146** Based on carpet/pad over oriented strand board in place of ceramic tile and cement board				
		60		**RAL-TL-89-141**				
		62		**RAL-IN-89-8**				
	• 2 layers 5/8″ Sheetrock Brand Firecode C Core Gypsum Panels – 2x10 wood joists 16″ o.c. – 3″ mineral wool batt – RC-1 channel or equivalent	59		**RAL-TL-90-40**	2 hour	**UL Des L541**		**B-10**
			69	**RAL-IN-90-5**				
		59		**RAL-TL-90-40** Based on vinyl tile in place of carpet/pad				
			37	**RAL-IN-90-6**				
Engineered Joist								
clg. wt. 3 	• 5/8″ Sheetrock Brand Firecode C Core Gypsum Panels, ceiling – 3/4″ T&G plywood – I-shaped wood joist 24″ o.c. – metal furring channel 24″ o.c. – 1-1/4″ 8 pcf Thermafiber insulation (UL Des 531) – joints finished • optional 3/4″ Levelrock Brand Floor Underlayment • optional SRM-25 or SRB sound mat	47	40	**RAL-TL-81-87** **RAL-IN-81-16**	1 hour	**UL Des L530** based on 9-1/2″ deep TJI® joists	SA305	**B-11**
			54	**RAL-IN-81-17** Based on carpet and pad atop flooring				
			43	**RAL-IN-81-19** Based on cushioned vinyl atop flooring				
	• 2 layers 1/2″ Sheetrock Brand Firecode C Core Gypsum Panels • optional SRM-25 or SRB sound mat – 19/32″ wood subfloor – 9-1/2″deep “I” shaped wood joist 24″ o.c. – 14″ parallel chord wood truss 32″ o.c. – RC-1 or equivalent • 3/4″ Levelrock Brand Floor Underlayment	64	58	**RAL-OT03-05/06** 1″ Levelrock, vinyl, SRM-25, 3-1/2″ insulation	1 hour	**UL Des L570**	SA305	**B-12**
		64	62	**RAL-OT03-07/08** 1″ Levelrock, engineered wood-laminate floor, SRM-25, 3-1/2″ insulation				
		66	54	**RAL-OT03-09/10** 1″ Levelrock, ceramic tile, SRM-25, 3-1/2″ insulation				
		65	54	**RAL-OT03-01/02** 3/4″ Levelrock, vinyl, SRB, 3-1/2″ insulation				
		66	51	**RAL-OT03-03/04** 3/4″ Levelrock, ceramic tile, SRB, 3-1/2″ insulation, crack isolation membrane				

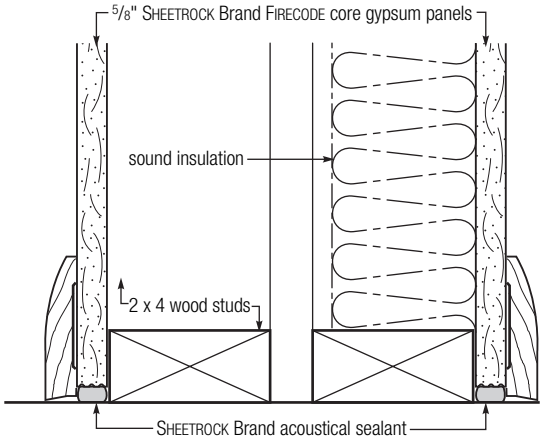
Design Details

Wood Framed

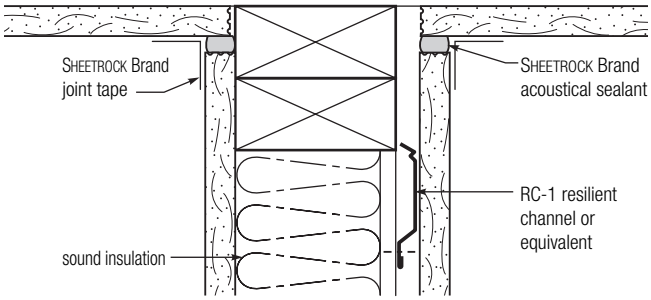
Sound isolating partition



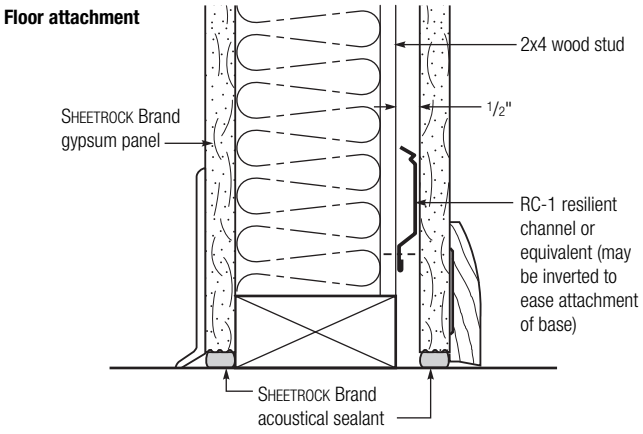
Sound isolating partition — chase wall



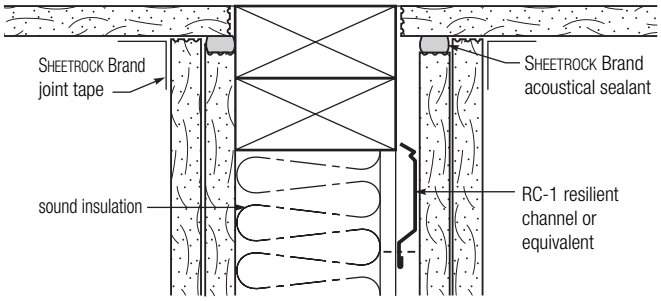
Ceiling/floor attachment — SHEETROCK Brand gypsum panel



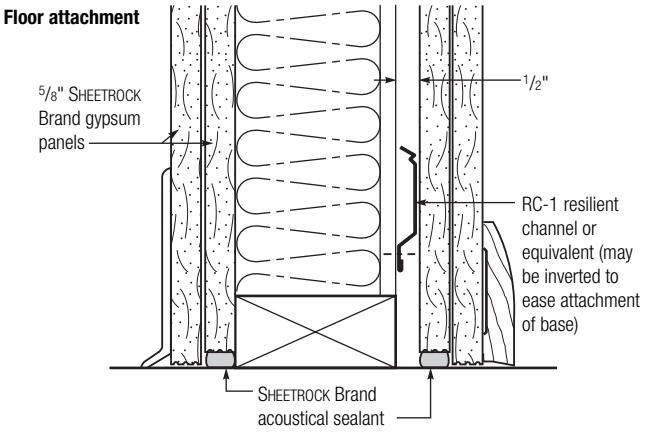
Floor attachment



Ceiling/floor attachment/SHEETROCK Brand gypsum panel, FIRECODE C Core panel



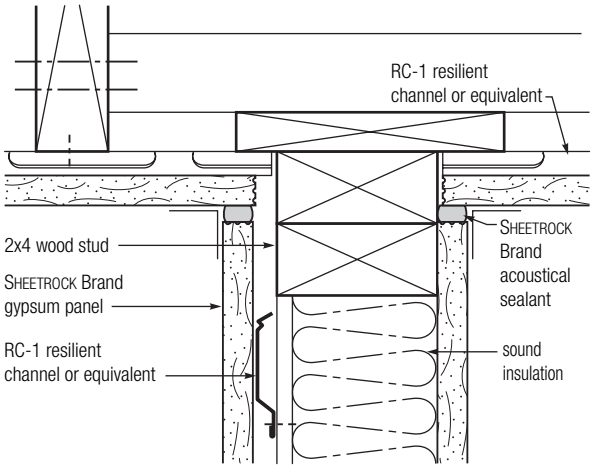
Floor attachment



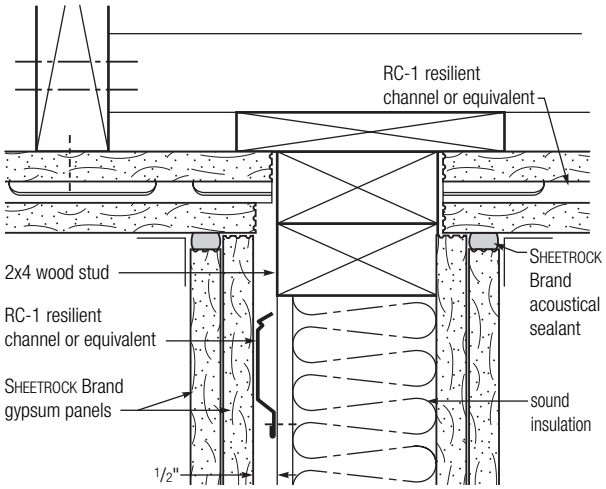
Design Details

Wood Framed

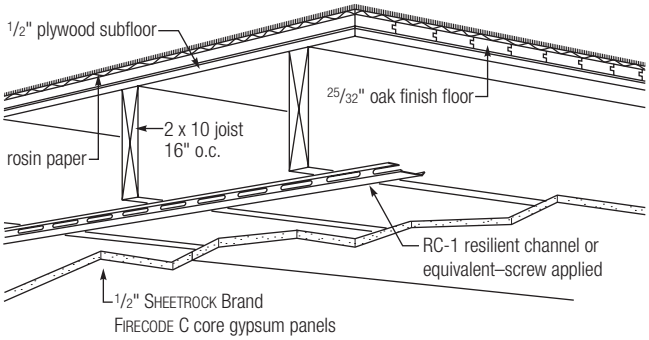
Single-layer panels with RC-1 Channel

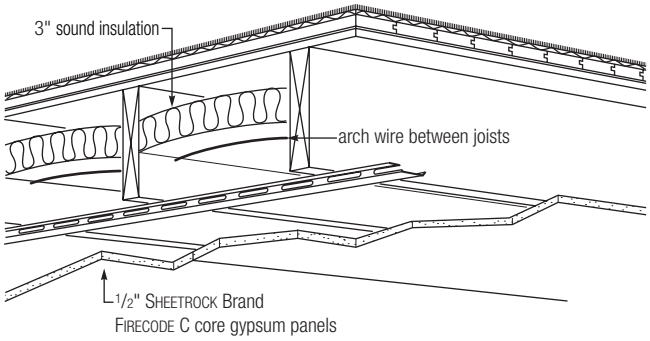


Double-layer panels with RC-1 Channel



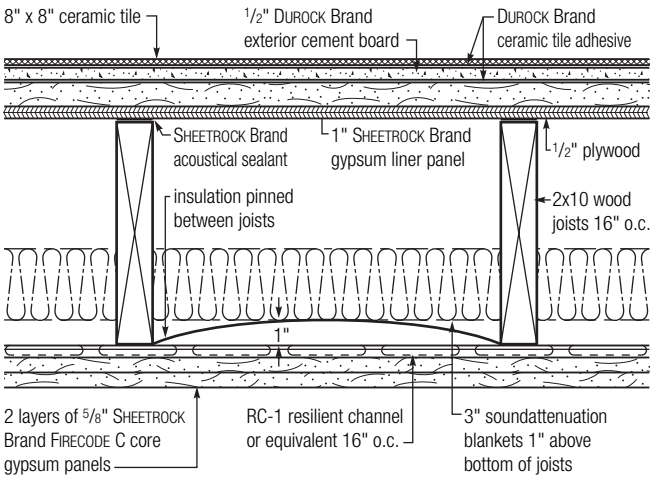
Ceiling and floor assemblies



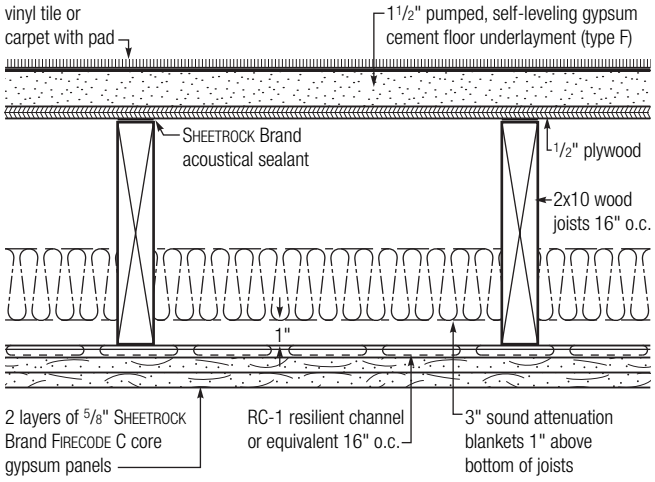


Ceramic tile

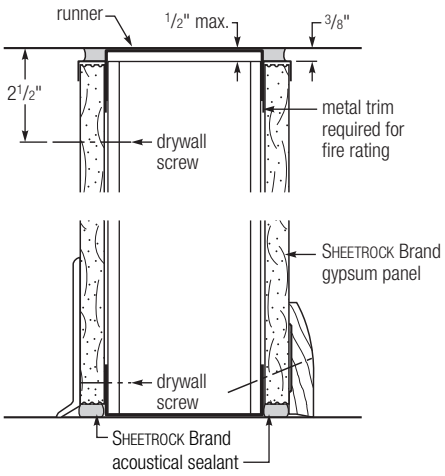
UL Design L541



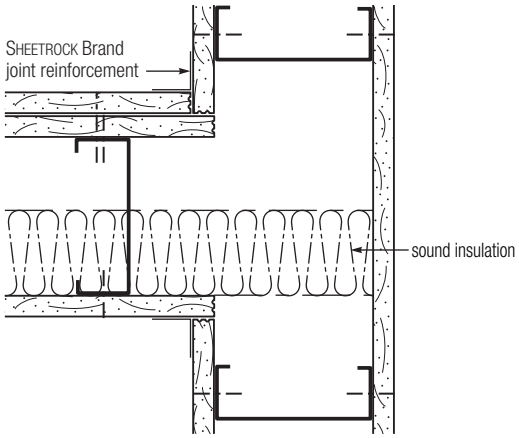
Vinyl tile or carpet/pad



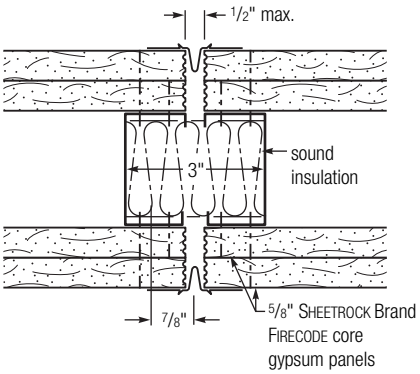
Partitions

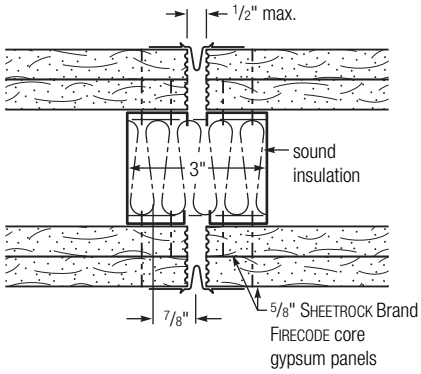


Sound isolating partition intersection

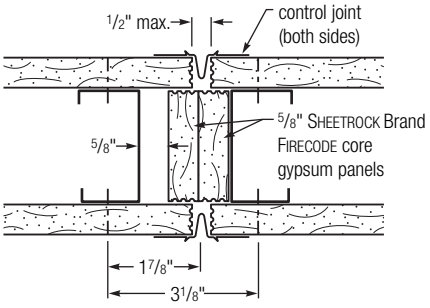


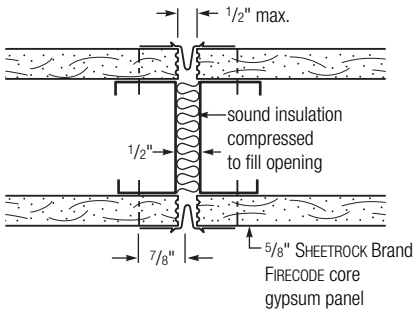
Two-hour rated steel stud partitions





One-hour rated steel stud partitions

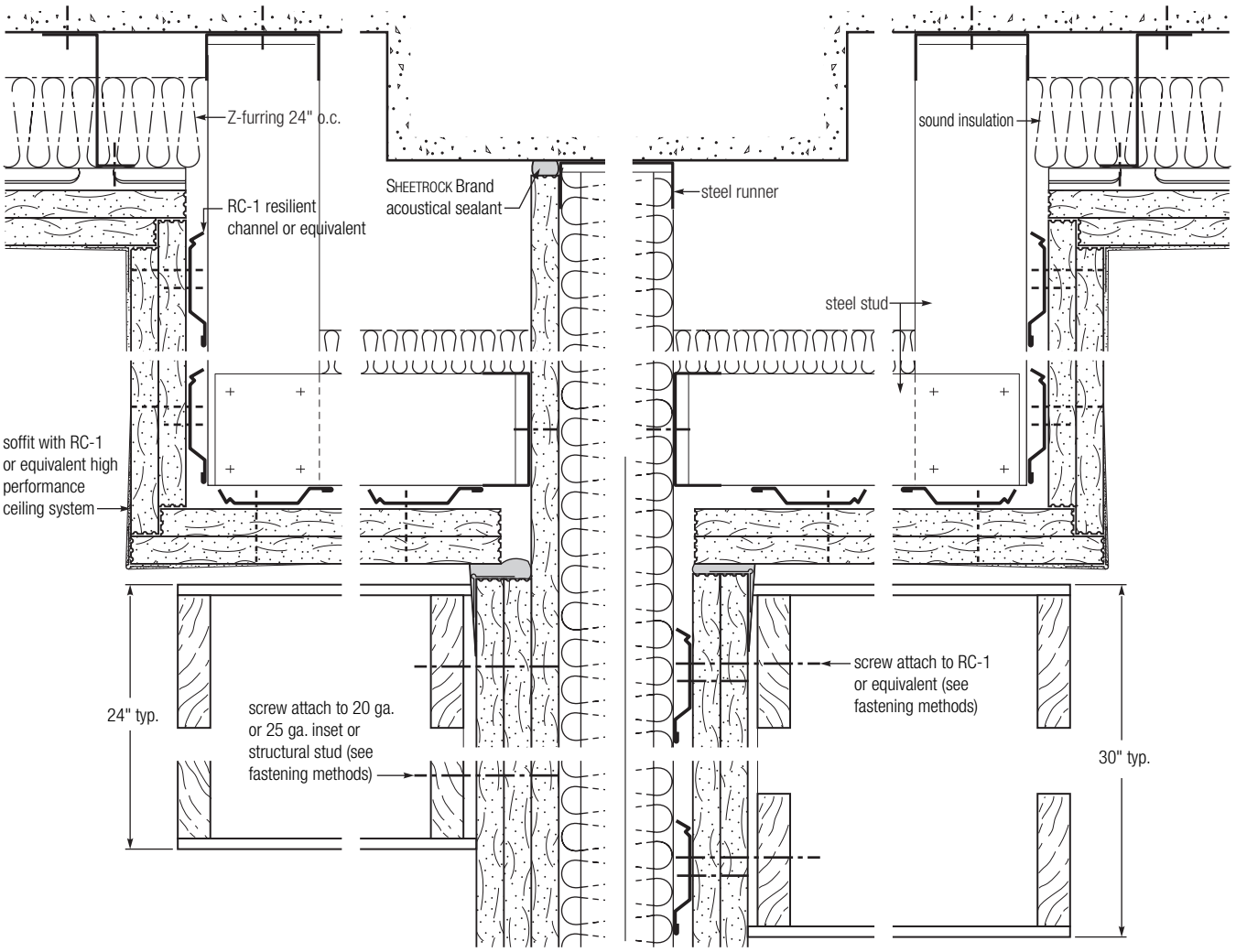




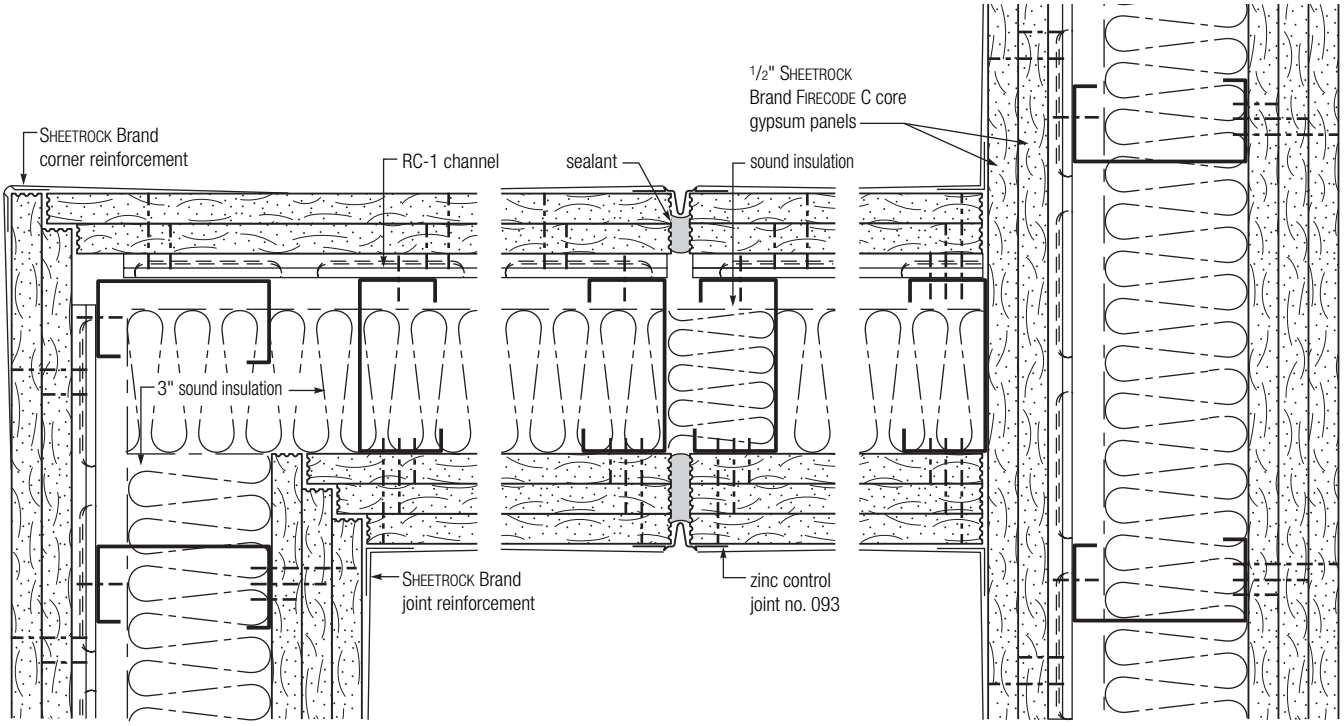
Design Details

Steel Framed

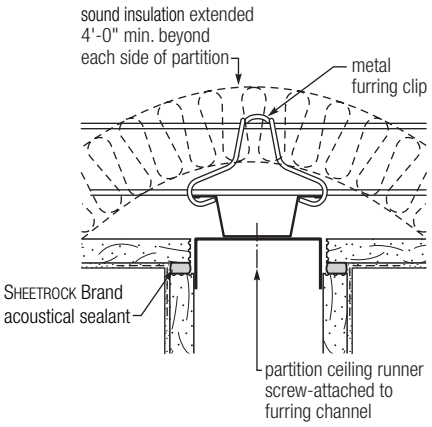
Typical cabinet attachment



Corner wall partition



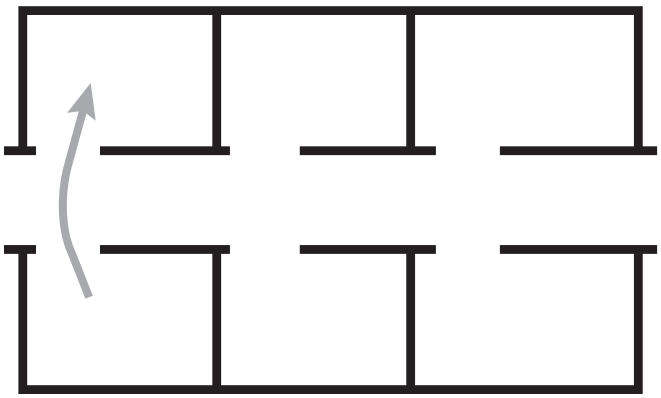
Sound isolating interrupted ceiling



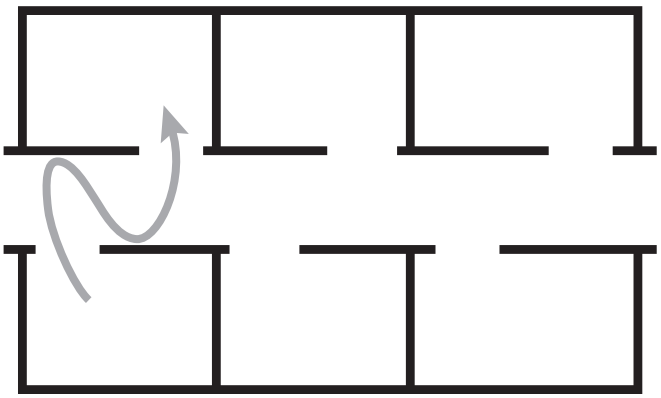
Flanking Path Details

Typical Flanking Paths

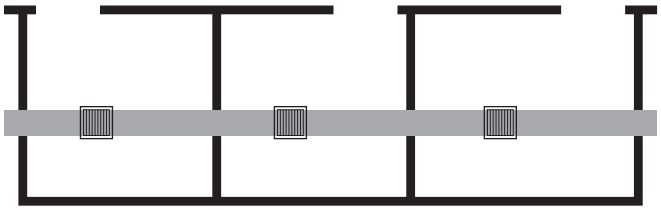
Doorway Placement – Avoid



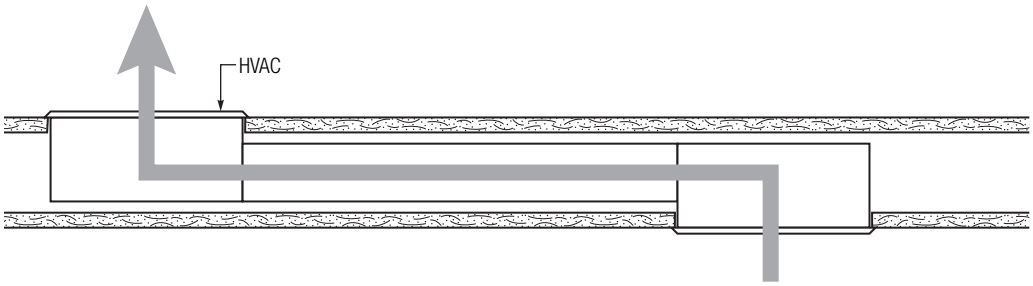
Doorway Placement – Better



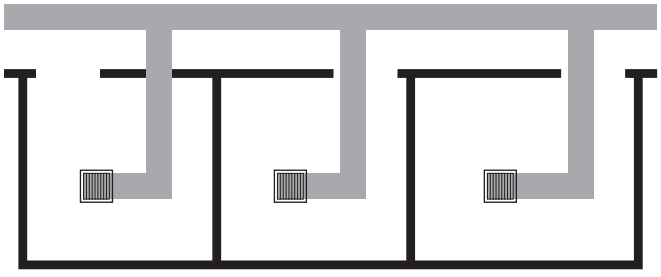
HVAC Design – Avoid



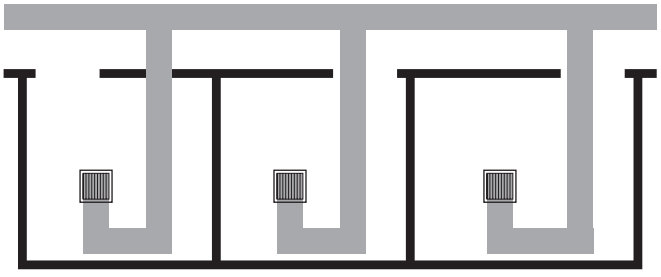
HVAC Design – Avoid



HVAC Design – Better

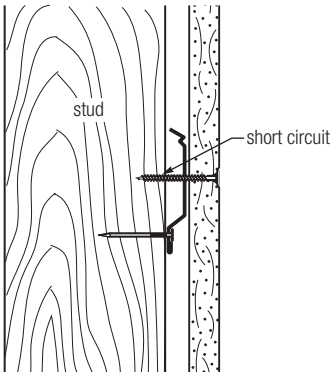


HVAC Design – Recommended

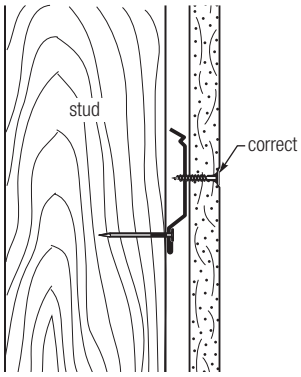


Interrupting Flanking Paths

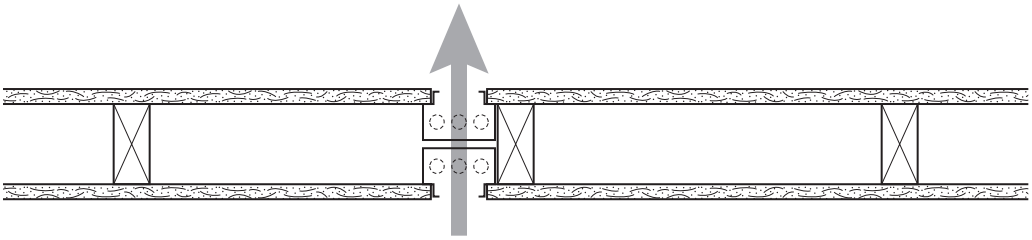
Resilient Channel Wall Framing – Avoid



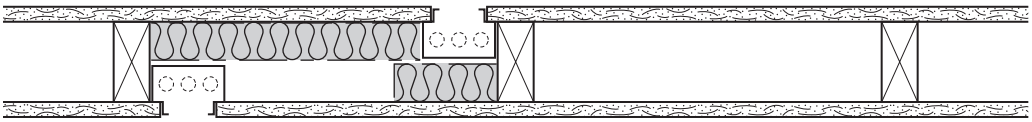
Resilient Channel Wall Framing – Recommended



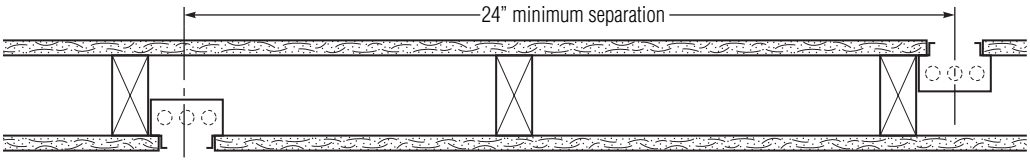
Electrical Boxes – Avoid



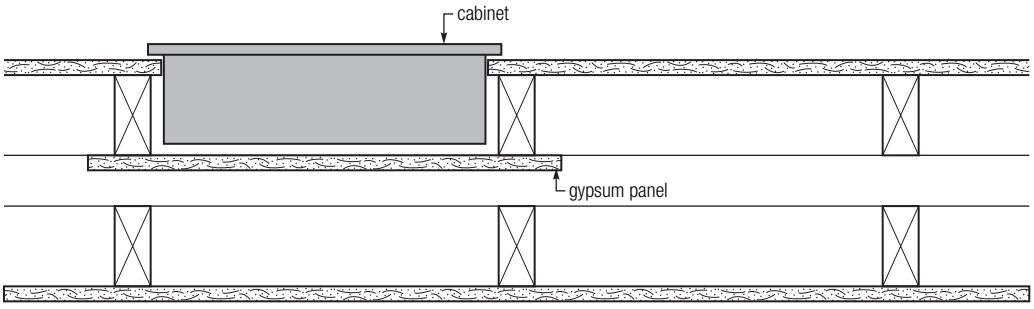
Electrical Boxes – Better



Electrical Boxes – Recommended



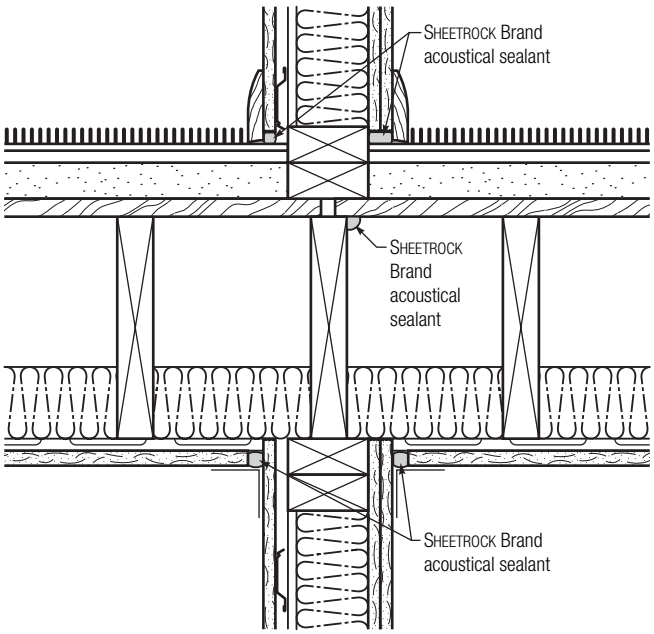
Cabinet Cutout



Flanking Path Details

Interrupting Flanking Paths–Multifamily Construction

Joists



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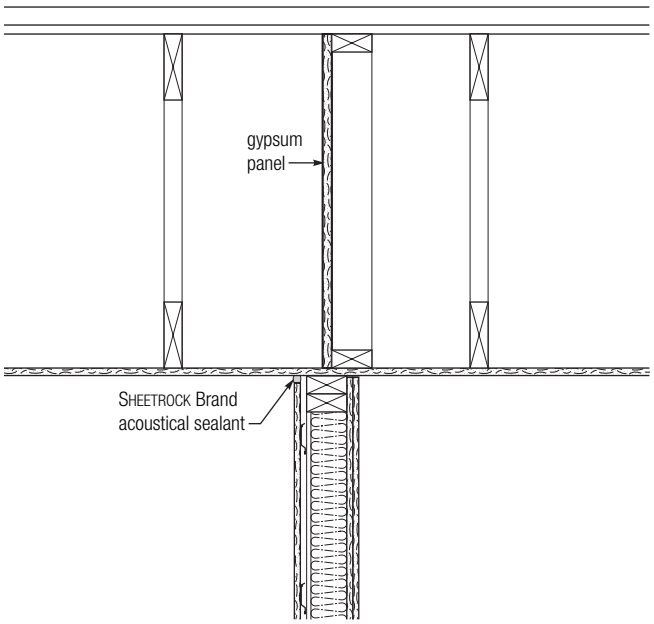
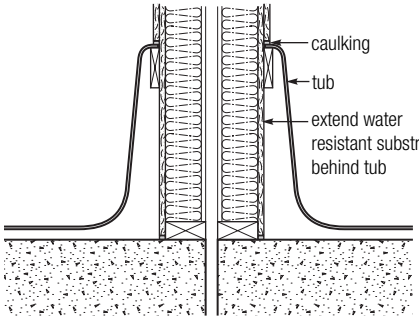
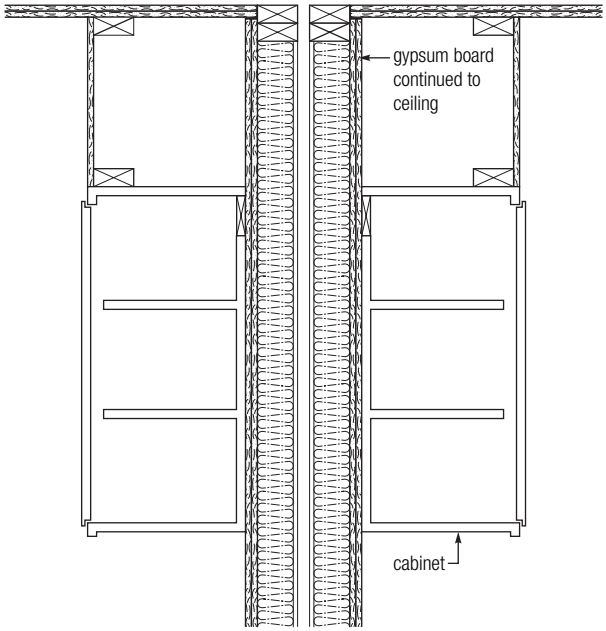


Adjacent Bathrooms



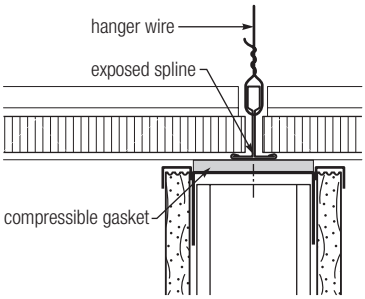
Adjacent Kitchens



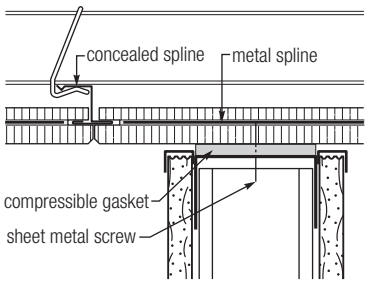
Note
See pg. 29 for high-performance partition.

Interrupting Flanking Paths–Acoustical Ceilings

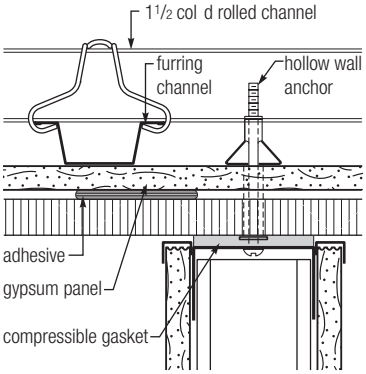
Acoustical Panel – Exposed Grid



Acoustical Panel – Concealed Grid



Acoustical Tile – Adhesive Attachment



Good Design Practices

In most building design, the No. 1 acoustical goal is to specify wall partitions, ceiling systems and floor/ceiling assemblies that will minimize transmission of airborne and impact sound beyond their areas of origin. This performance can be achieved with a combination of materials, assembly designs and construction methods tested for acoustical performance on a variety of parameters. Here is an overview of design strategies for key components that can make spaces more pleasant, comfortable and productive.

Ceilings

Absorb Sound in Open Spaces

Select high-NRC ceiling panels for open areas to absorb a significant amount of the sound generated within these spaces. Acoustics are further improved with partitions having high STC values to help block sound and prevent transmission across large spaces.

Block Sound in Enclosed Spaces

Choose high-CAC ceiling panels for private offices, meeting rooms and other enclosed areas to block sound from traveling up into the plenum and out to adjacent spaces. This approach will reduce distractions for those outside and improve speech privacy for those within.

Cover Sound in All Areas

Sound masking covers noise that is not absorbed or blocked by introducing uniform, ambient, background sound into the space. Sound masking produces an electronic sound spectrum similar to that of softly blowing air; it is amplified through speakers above the suspended ceiling to unobtrusively raise the background sound level. Sound masking makes noise in open spaces less distracting, increases speech privacy in enclosed spaces and provides greater acoustical balance throughout.

Walls

Increase mass

As partition mass increases, sound waves lose more energy passing through the medium, reducing their ability to vibrate air on the other side. Relying on mass alone, however, poses limitations. Doubling the mass of a partition can reduce sound transmission by up to 5 dB. Thus, achieving a 60 dB reduction would require total mass of 320 pounds per square foot, the equivalent of approximately 3′ of solid concrete, not a feasible solution for most building designs.

Enlarge air spaces

Isolating air space within a partition can increase STC performance. But like increasing mass, performance increases are limited. Doubling partition air space can reduce sound transmission by up to 5 dB, so achieving a 60 dB reduction would require an isolated air space 4′ wide, hardly practical for most applications.

Add sound insulation

Adding a layer of fibrous sound-absorbing insulation material such as mineral wool into the partition cavity will dissipate sound by creating friction, which transforms a portion of sound wave energy into heat. However, sound attenuation blankets cannot completely counter the conductivity of the wood or steel studs in the framing assembly, which provide a path of least resistance for sound energy.

Decouple wall panels

Attaching the wall surface diaphragm (e.g. drywall panels) directly to framing members provides an uninterrupted path for sound travel. This route can be interrupted by mounting the surface diaphragm to resilient channels attached to the wall studs and placing sound insulation inside the partition cavity.

Seal flanking paths

Closing off gaps or penetrations in the wall assembly is critical to controlling noise. One of the most effective methods is to apply acoustical sealant at the intersection of the gypsum panel, floor system (wood or concrete), and the leg of the steel runner or wood sole plate; sealant should be applied at this location on both sides of the partition. A properly sealed wall assembly with one 5/8″ gypsum panel on each side and a 1-1/2″ thick sound attenuation blanket installed in the air cavity achieves an STC of 53. Without acoustical sealant, this assembly would produce an STC of only 29—a dramatic 45 percent reduction.

Increase isolation with steel studs

A single-layer partition with 5/8″ gypsum panels and 3-5/8″ stud achieves 40 STC with 25-ga. steel and 38 STC with 20-ga. steel. STC falls to 35 with a traditional 2′ x 4′ stud due to the greater stiffness of wood.

Floor/Ceiling Assemblies

Isolate sound

Whether constructed with joists, trusses or concrete slabs, floor systems can develop gaps or cracks, providing a flanking path for sound to travel between levels of a building. Even properly sealed assemblies can transmit noise from footsteps, falling objects, closing doors and other impacts. These acoustical problems can be significantly reduced with a flooring system that includes a layer of sound absorbing material topped with a poured cementitious underlayment. The poured underlayment finds and seals cracks and other sound channels, then hardens to form a solid barrier isolated from the structure below by the sound mat or board. This system can provide STC ratings as high as 66 and increase IIC by as much as 13 points, a significant improvement.

STC Guidelines

Building Type	Room	Adjacent Room Room	STC Minimum[d]	Medium	High
Residential, including motels, hospitals, and dormitories	**Bedroom**	Bedroom	45	50	55
		Living room	50	55	60
		Kitchen	50	55	60
		Bathroom	50	55	60
		Corridor	45	50	55
		Lobby	50	55	60
		Mech. room	55	60	60+
	Living Room	Living room	40	45	55
		Kitchen	45	50	60
		Bathroom	45	50	60
		Corridor	45	45	55
		Lobby	50	55	60
		Mech. room	50	60	60+
	Kitchen or Bathroom	Kitchen	40	45	50
		Bathroom	40	45	50
		Corridor	40	40	50
		Lobby	45	50	60
		Mech. room	45	55	60+
Business	**Office**	Office	45	50	55
		General area	40	45	50
		Corridor	40	45	50
		Washroom	45	50	55
		Kitchen	45	50	55
		Conference room	45	50	55
	Conference Room	General area	40	45	50
		Corridor	40	40	45
		Washroom	40	45	50
		Kitchen	45	50	55
		Conference room	40	45	50
	General Area	Corridor	40	40	45
		Washroom	40	45	50
		Kitchen	45	50	55
School	**Classroom**	Classroom	45	50	55
		Laboratory	45	50	55
		Corridor	40	40	45
		Kitchen	50	55	55
		Shop	55	60	60
		Recreation area	45	50	55
		Music room	60	60	60
		Mech. room	50	55	60
		Washroom	45	50	55
	Music Room	Laboratory	45	50	55
		Corridor	45	50	55
		Shop	50	55	60
		Recreation area	50	55	60
		Music room	55	60	60
		Mech. room	50	55	60

Note

(d) Current model building codes require a minimum STC (and IIC) separation of dwelling units. The 2003 International Building Code requires a minimum separation of 50 STC and 50 IIC for apartments, condominiums and townhouses. Local jurisdictions using the 2003 International Residential Code may require a minimum separation of 45 STC for townhouses.

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