Noise Control

A Quality of Life Issue for Today's Families

NAIMA
North American Insulation Manufacturers Association

Improving a home's acoustic comfort can reduce stress and improve overall health and wellness.

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Contemporary Living is Noisy

Today's lifestyle is a loud one. Modern appliances and amenities coupled with today's high ceilings and hardwood floors help create beautiful indoor environments, but also contribute to noise that impacts a family's quality of life. An often overlooked amenity in a home is noise control. "Before the walls are painted or the accent rug is placed, new homeowners need to consider the elements behind and below these items that will allow them to fully enjoy the finished product."[1]

Noise Control Solutions Provide a Green, Comfortable Home

Today's home buyers are looking for ways to make their homes more energy and environmentally efficient while gaining quality and comfort. A comfortable, energy efficient home goes beyond warmth – it includes acoustic comfort as well. For years, noise control has been overlooked in home design. Today's focus on healthier and greener living has new home buyers asking for solutions to better manage sound to maximize the enjoyment of their living environment.

There are many ways to build a greener home and improve acoustical comfort – from house placement, to house design, to landscaping. You can start with using one of the best 'quieting' technologies available – insulation. In fact, one of the most economical ways to improve the acoustic comfort of your home is to install fiber glass acoustic insulation at the time of construction. A good noise control insulation package not only increases the comfort of your home but also adds to its value.

What is Noise?

Noise in the home is unwanted sound that is disturbing, interfering or annoying. Sound does not have to be loud to be unwanted. It is transmitted by vibration through air, walls, floors and ceilings. Unfortunately, most walls and ceilings in today's homes are only marginally effective at blocking noise.

For a house to be comfortable it must be designed so that its layout and structure keep noise to an acceptable level.

Noise Can Adversely Affect Quality of Life

Many people don't think of their homes as noisy, but if there's a lot of activity in or around the outside of the home, the overall noise level can have a negative effect on the health and wellness of the occupants. According to the Environmental Protection Agency (EPA), unwanted noise is America's most widespread nuisance. But noise is more than just a nuisance. It constitutes a real and present danger to people's health.[2] Of the many health hazards related to noise, hearing loss is the most clearly observable and measurable by health professionals.[3] Throughout dozens of studies, noise has been clearly identified as an important cause of physical and psychological stress, and stress has been directly linked with many of our most common health problems. Thus, noise can be associated with many of these disabilities and diseases, which include heart disease, high blood pressure, headaches, fatigue and irritability. [4]

Internal and External Sources of Noise in a Typical Home

- Metal air ducts
- Home theaters
- Telephones
- Air conditioners
- Hair dryers
- Dishwashers
- Road noise
- Dryers
- Blenders
- Vacuum cleaners
- Radios
- CD players
- Stereos
- Power tools
- Garbage disposals
- Washers
- Leaf blowers
- TVs
- Lawnmowers
- Aircrafts

How Sound is Measured

Sound is measured in decibels. The decibel (dB) is a measure of sound intensity – that is, the magnitude of the fluctuations in air pressure caused by sound waves. The decibel scale is logarithmic, not arithmetic. This means that a doubling of sound intensity is not represented as a doubling of the decibel level. In fact, an increase of just 3 dB means twice as much sound intensity, and an increase of 10 dB means ten times as much sound intensity.[5]

Damaging Noise Exposure[6]

85 dB	Prolonged exposure to any noise at or above 85 decibels can cause gradual hearing loss.
100 dB	No more than 15 minutes of unprotected exposure recommended.
110 dB	Regular exposure of more than 1 minute risks permanent hearing loss.

How Loud?[7]

Whispered voice	30 dB
Refrigerator humming	40 dB
Normal conversation	60 dB
Heavy city traffic	85 dB
Power mower	90 dB
Motorcycle	95 dB
Snowmobile	100 dB
Personal stereo at maximum level	105 dB
Chain saw/rock concert	110 dB
Ambulance siren	120 dB
Firecracker	150 dB

Sound Transmission

Airborne Sound

The Sound Transmission Class (STC) is a single number rating used to indicate the effectiveness of an entire construction assembly (partition, wall, floor/ceiling) in resisting the passage of airborne sound. The higher the STC rating, the better the sound insulation performance of the construction.

An indication of the approximate effectiveness of constructions with various STC ratings in blocking the passage of loud speech is shown in the following chart:

STC	AUDIBILITY OF LOUD SPEECH FROM OPPOSITE SIDE OF WALL[8]
25	Easily understood
30	Fairly understood
35	Audible but not intelligible
45	Must strain to hear
48	Barely audible
50	Inaudible

Recommended STCs

For residential partition walls, the recommended STC depends on the particular type of room: for example, in bedrooms, an STC of 52 is good. Living rooms, bathrooms and kitchens should be a minimum of 55.[9]

Impact Sound

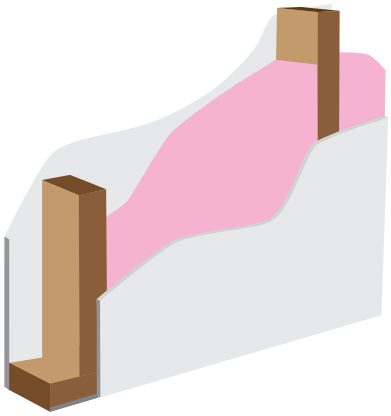
In addition to the STC rating which concerns airborne sound, floor/ceiling assemblies are also rated for impact sound resistance. Impact sound is structure-borne sound transmitted when one body strikes another, such as in the case of footsteps and falling objects. A single number, the impact insulation class (IIC), is used to describe impact sound performance. As with STCs, a higher number indicates better performance. The current International Building Code requires a minimum IIC rating of 50.[10]

Strategies for Acoustical Control With Insulation

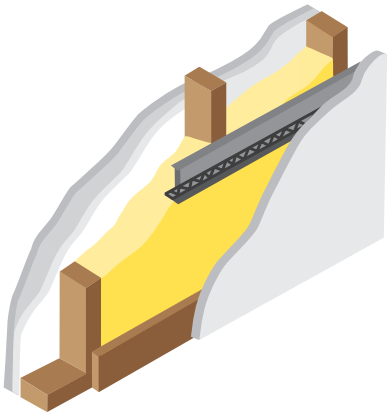
You can improve indoor acoustic comfort and reduce stressors by limiting structure-borne and airborne sound transmission from exterior sources and interior sources by integrating sound reduction measures into the basic planning and layout of your home.

Walls

Most conventionally built partitions constructed with ½ inch drywall applied to each side of 2x4 wood studs, 16 inches on center, will have an STC rating of about 30.[11] Loud speech can be understood fairly well through an STC 30 wall.[12] There are a number of construction designs that can improve the effectiveness of sound transmission loss in wall constructions. These include cavity absorption insulation, breaking the vibration path and increasing mass.



Typical Interior Wall Construction
One layer on each side of ½ inch drywall, 2x4 wood studs, 16 inches on center, 3½ inches of fiber glass cavity insulation, acoustical sealant at bottom plate and wall penetrations will result in an STC of 32 to 34.[13]



Typical Wood Stud Channel Partition
Two layers of ½ inch gypsum on one side, 2x4 wood studs, 16 inches on center, 3½ inches of fiber glass insulation, resilient channel one side results in an STC of 52.[13]

Cavity Absorption

An easy and economical method for increasing the sound transmission loss of a wall is to install sound absorbing insulation in the wall cavity. Installing fiber glass insulation batts between rooms such as bedrooms and adjoining bathrooms, or between a recreation room and a den or study will keep the noise level between rooms. Installing insulation within a wall or floor/ceiling cavity will improve the STC by about 4-6 dB, which is clearly noticeable.[14] 2x4 wood stud walls with ½ inch gypsum board and 3½ inches of acoustic fiber glass batt insulation absorb and dampen sound waves and result in an STC of 32 to 34.[15]

Breaking the Vibration Path

An even more effective way to increase the STC rating is to use resilient channels between drywall and studs or joists. Properly installed resilient channels will break the vibration path, which will help reduce sound transmission. Typically, the drywall is screwed to a flange on these channels – not to the studs. By combining insulation, gypsum board mounted on resilient channel, and two layers of ½ inch gypsum board on one side, a very good STC rating of 52 can be achieved.[16]

Increasing Mass

Heavier materials block sound better than lighter materials. Adding one or two layers of gypsum board to a wall construction can reduce sound transmission through that wall. However, heavier walls may not be structurally practical or cost-effective.

Acoustical fiber glass batts and duct insulation are known for their excellent sound control properties.

Fiber Glass Acoustic Insulation
Fiber glass acoustic batt insulation is economical, lightweight and easy to install. Acoustic batts are essentially the same as their corresponding thermal batts, except that they may differ slightly in size and density. A partition with either fiber glass acoustic or thermal batts having similar properties achieves the same STC rating.

Guidelines for Installing Insulation

Exterior Walls
All exterior walls should be designed and built to meet or exceed the energy code and have an STC rating of not less than 36.[17] Exterior walls should be constructed with resilient channels and fiber glass insulation filling the stud cavity.

If a residence is impacted by overhead aircraft, then resilient channels should be used in roof/ceiling assemblies as well as using at least 9 inches of blown-in fiber glass insulation in the attic. The insulation should overlap the top of the joists by at least 1 inch. If a vapor retarder is installed, make sure it is toward the heated side of the home. Humid climates may require the vapor retarder to be installed facing the exterior of the wall. Check local building codes for the location of vapor retarder.

Fiber glass acoustic insulation being installed in an exterior wall.

In addition, all exterior penetrations and joints between building components should be sealed as required for thermal performance. This will also improve the acoustical performance.

Acoustical insulation being installed in interior wall cavities.

Interior Walls

All interior walls between living spaces should have an STC rating of at least 36.[18] The basic guideline for installing insulation in wall cavities is to fit the ends of batts snugly against the top, sides and bottom framing.

Ducts — Another Key to Silence

Duct design should be given special consideration when planning a home's layout since ducts can easily transmit sound. Installation of sheet metal ducts, lined with sound-attenuating duct liner insulation, or using fiber glass duct board systems will reduce transmission of unwanted sound, including fan noise through the duct. Sealing the joints in the duct system will also improve the acoustic performance and energy savings.

"Acoustics is paramount to the profitability and overall integrity of numerous industries and to the collective health and safety of those who live, work and play within the spaces created by building and design professionals."[19]

Sound Control Practices

- Insulate heating and air conditioning ducts by using fiber glass flex ducts, fiber glass duct board or by wrapping or lining the ducts with fiber glass insulation.
- Install thick carpeting and padding throughout your home to help reduce impact sound.
- Caulk around windows and use weather-stripping at the bottom of your exterior doors.
- Use solid wood or mineral core doors where privacy is required.
- Install acoustic ceiling panels.
- Double or triple pane glass and storm windows can help reduce sound transmission through windows.
- Select quiet, high quality appliances.
- Install telephones, doorbells, intercoms or audio built-ins on interior walls only – never on common walls or corridor walls.
- Caulk holes made by wiring that penetrates connecting structures with elastic non-hardening caulk or dry packing.
- Seal openings around ceiling fixtures so that they are airtight.
- Make use of plants, draperies and wall hangings throughout your home. The more "soft" objects in a room, the more sound will be absorbed.
- Minimize window sizes facing noisy areas.
- Ask your builder to develop a well-planned layout to minimize the noise of flowing water. Insulate walls containing drainpipes.
- Ask your builder to seal under all bottom plates as the walls are being built.
- Ask your builder to avoid undercutting doors, if possible. Frequently, doors must be undercut to get proper air circulation for the HVAC. A simpler solution to ensure proper circulation is to keep doors open when rooms are not in use or provide transfer registers.

About NAIMA

NAIMA is the association for North American manufacturers of fiber glass, rock wool, and slag wool insulation products. Its role is to promote energy efficiency and environmental preservation through the use of fiber glass, rock wool, and slag wool insulation, and to encourage the safe production and use of these materials.

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