ROXUL® Changes the Conversation on Sound

Safe'n'Sound™
Fire & Soundproofing Insulation

ROXUL® talks about sound, noise pollution and SAFE'N'SOUND™ insulation

We live in a louder world today

Modern life is noisier, due in part, to increased traffic congestion and the intrusion of unwanted sounds seeping into our home environment. Think high-tech entertainment rooms, pinging computers, blaring stereos, ringing phones, washer/dryer rumblings. And let's not forget about your son's band practice in the garage.

This cacophony of noise contributes to a form of sonic pollution, a growing problem that can rattle nerves and affect our sleeping habits and quality of life. Most of us cherish a quiet environment to think, work and rest, an environment ROXUL® knows very well, thanks to ceilings and walls that acoustically perform better when fitted with SAFE'N'SOUND™ insulation.

All sounds come from energy made by vibrations travelling through air, water or solids. When a sound source (e.g. crying baby) vibrates its vocal chords, it causes air particles to radiate out in all directions. These radiating air particles continue to exert force on other air particles, causing more vibrations, which in turn, collide with more air particles.

What is sound?

The human eardrum is a remarkable appendage that interprets a wide spectrum of sounds that can soothe us or alarm us. Cooing baby versus crying baby.

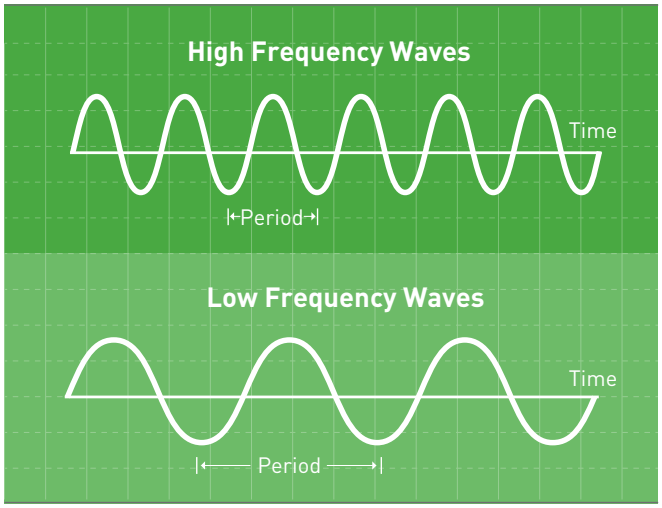
A sound wave explanation

This fast radiating movement, called sound waves, continues until the sound energy from the source is eventually absorbed or dissipated. When the human ear is within range of the source vibration, (e.g. ringing cell phone) the changes in air pressure vibrate your eardrum, where nerve signals are sent to your brain and interpreted as sound. Our brain further interprets this with "Quick, pick up and answer."

If the sound waves are blocked by another object (e.g. briefcase/insulated wall/ceiling) our ears pick up a softer, muffled sound, depending on the object's absorption capacity to dampen the vibration.

When the vibrations travel fast, it creates a high note (e.g. car horn.) When the vibrations are low, it creates a low note (e.g. email swoosh.)

Sound Waves



How fast sound travels

Sound travels through air at approximately 767 miles (1230 km) per hour, depending on such factors as temperature and pressure. Sound travels through water about four times faster, at approximately 3068 miles (4937 km) per hour. On the moon, sound doesn't travel at all, because of a vacuum and no air to transmit the sound.

Sound wave frequency

What humans hear

A sound wave demonstrates two characteristics important to understanding how sound travels to our ears: frequency and amplitude.

Frequency (or pitch) refers to how often, or the number of times per second, that a sound wave cycles from positive to negative to positive again. Frequency is measured in cycles per second, or hertz (Hz) from wave trough to wave crest. Technically, 1Hz describes one complete cycle per second of a sound wave.

The faster the cycle frequency, the higher the pitch, and vice versa.

What dogs hear

Most humans have a range of hearing from 20 Hz (low) to 20,000 Hz (high), although the range of frequencies is influenced by age and environmental factors such as temperature and humidity. Frequencies beyond this range exist, but are mostly inaudible to humans. (Many animals, including dogs, hear higher frequencies than humans.)

It's interesting to note that contrary to popular thinking, hearing does not abruptly stop at 20 Hz. Measurements show that the human ear can register sounds low as 1Hz if certain conditions are present. This has a bearing on insulation products such as ROXUL SAFE'N'SOUND that can reduce low frequency sounds within the home environment.

Low frequency sound is often "felt" rather than heard

Low frequency sound (LFS) has a long wavelength and low material absorption rate, which gives it the capacity to travel vast distances. For example, blue whales, which emit low frequency sounds, are known to hear and communicate over distances up to 1000 miles.

Low frequency sound is non-directional in how it radiates its sound waves. To a human, this means you can hear the sound, but can't exactly tell where the source is coming from. From a home environment perspective, think about the incessant drone from the air conditioning or heating system. Or the dull buzz from the self-propelled vacuum cleaner.

Because low frequency sounds seem to bypass the ear and are more "felt" than heard, this can lead to physical and physiological effects that are difficult to quantify, but easy to justify as responsible for feelings of anxiety and stress. Human disgruntlement is a tangible by-product.

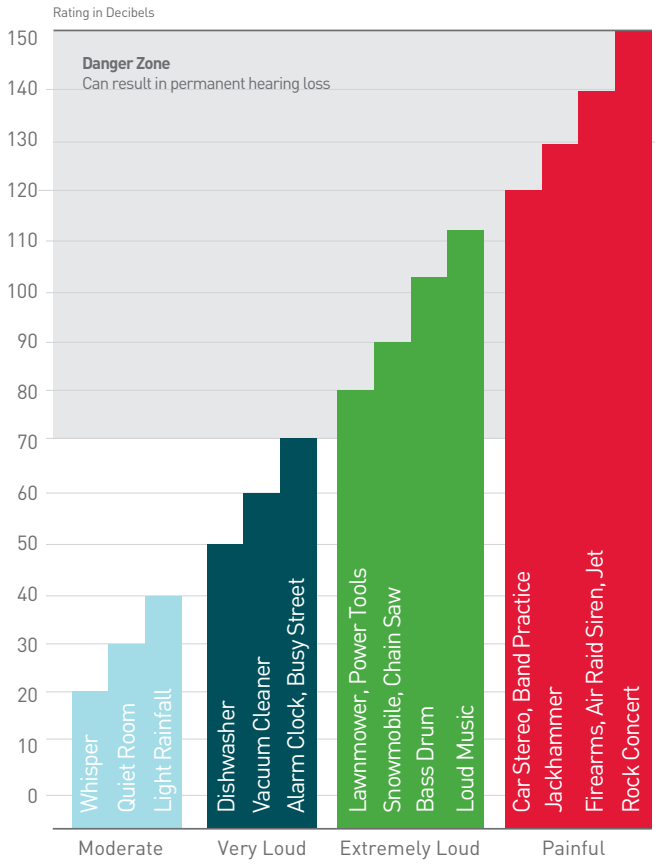
Frequencies below 20 Hz are generally "felt" rather than heard: e.g. lowest pedal notes on a pipe organ. Frequencies above 20,000 Hz can sometimes be sensed by young people, which may explain their love for mega loud concerts.

Amplitude is the strength of a sound wave

Amplitude, (also called intensity) refers to the strength of a sound wave, which the human ear interprets as volume or loudness. Humans have an almost infinite capacity to detect a wide amplitude of sounds, from a fingertip brushing over your skin to a jet engine, which is a remarkable range of audible sounds.

Noise pollution experts often use audiometers to quantify the sound levels, using a logarithmic scale (decibels) as a unit of measure.

Typical sound rating in decibels



What is a decibel: a sound comparison

The perceived loudness or intensity of a sound is measured in a unit called the decibel (dB), named after Alexander Graham Bell, inventor of the telephone. Technically, a bel is a base-ten logarithm of the ratio between two signals.

On the decibel scale, the smallest audible sound is 0 dB, which is near total silence, sometimes called white noise. A sound 10 times more powerful is 10 dB. A sound 100 times more powerful than near total silence is 20 dB. For comparison purposes, a whisper comes in at 15 db, normal conversation 60 db, while a car horn measures 110 dB, and a rock concert or jet engine measures 120 dB. A blue whale can emit sounds at 188 dB, making it the loudest creature on earth.

Any prolonged exposure to sounds above 85 dB can cause hearing loss.

Loudest noise on earth

On August 26-27, 1883, the huge volcanic eruption on the island of Krakatoa created a monumental explosion of low frequency sound. The apocalyptic blast, which was heard and felt nearly 4500 km away, is considered the loudest noise on earth.

Impact noise versus airborne noise

Properly insulating your walls and ceilings with ROXUL SAFE'N'SOUND™ will make your home a more peaceful and quiet haven because it will help ensure that sounds won't travel from the outside, or to and from other rooms.

Before soundproofing a ceiling or wall, consider the kind of noise problem you're trying to solve. Is the problem impact noise or airborne noise, or both?

Impact noise refers to the sound made when one object strikes another object on a hard surface. In the home, impact noise can come from the sound of footsteps, the slamming of doors, furniture dragging or items dropped onto the tile or hardwood floor above.

These low frequency sounds can be a major source of annoyance. Adding extra sound dampening mass such as carpeting can alleviate the problem, or resilient channels can be installed in order to de-couple the drywall from the studs. De-coupling methods such as this can help to diminish the transfer of impact noises from one room to another.

Airborne noise, on the other hand, refers to the sound travelling from outside (aircraft, cars, lawnmowers,) or (inside) from the sound of voices, music and appliances from the above floor, or from adjacent rooms. In this scenario, adding sound-deadening elements such as extra mass, (e.g. SAFE'N'SOUND insulation and air space in the wall or ceiling assembly) can reduce the transmission of airborne noise.

Impact noise

Airborne Noise

Combining the use of resilient channels and high density insulation like SAFE'N'SOUND can be effective against both airborne noise and impact noise."

Effects of living in a noise-filled world

Recent studies have confirmed what many of us have suspected: unwanted noise negatively affects the sleep patterns and quality of our lives, and according to environmental research conducted at Cornell University, even the learning ability of children.*

Blame it on the electronic age. Around home, we find a jump in the number of gadgets, tools and appliances that blare, rattle and whir, increasing our stress and reducing our peace and quiet. The League for the Hard of Hearing recently produced a fact sheet, Noise in the Home, which reported that dishwashers, vacuum cleaners, and hair dryers can produce sounds that exceed 90 dB. That is 5 decibels higher than how the National Institute for Occupational Safety and Health (NIOSH) defines hazardous noise, a level that can impair our hearing.

If you live near an airport, rail line or freeway, or even a shopping mall or school, the long-term damage from airborne sounds is even greater. Cornell University environmental psychologists Gary Evans and Lorraine Maxwell published a 1997 study that reported "the constant roar of jet aircraft could cause higher blood pressure, boosted stress levels, and other effects with potential life-long ramifications among children living in areas under the flight paths of airport."* Airborne noise is a serious problem that isn't going away.

Other studies on humans and animals also have linked prolonged noise exposure to long-term changes in blood pressure and heart rate. Sonic pollution is a chronic environmental heath issue we must deal with if we want to enjoy a healthier, more satisfying life.

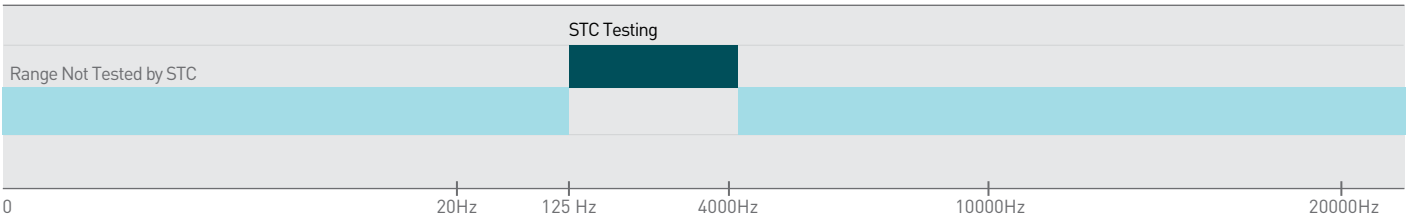
*http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1253729/

Sound transmission class (STC) rating: let's talk about its shortcomings

Every material (and wall) has a sound transmission rating (STC), single-number rating that ranks its ability to resist the transfer of airborne sound between the frequencies of 125Hz to 4000 Hz. In general, a higher STC rating blocks more noise from transmitting through a material or wall.

The STC test for materials and walls was developed in the 1960s, long before the prevalence of modern electronic devices, tools and appliances like whirring mixers, air-blasting dryers, ringing cell phones, pinging computers, booming home theatre rooms. Back then, even urban traffic certainly sounded less congested and blaring.

STC test range



Modern reality of STC ratings

While a STC value measures the frequencies of sound between 125Hz to 4000 Hz, the normal human ear can hear sounds in the range of 20 Hz to 20000 Hz. And in some cases, humans can register sounds low as 1Hz if certain conditions are present.

With the growing number of modern technologies and products that transmit low frequency sounds, some acoustic experts are beginning to question the true validity of the STC rating, given the 21st century we live in.

> *"STC rating is not a panacea and cannot be easily used for comparisons purposes."*
>
> –Ramani Ramakrishnan Ph.D.P Eng, Aislos Enginneering Corp.

Problem: STC ratings don't recognize low frequency sounds (LFS)

Current STC value doesn't take into account lower frequency sounds (LFS), which can negatively affect the vibration between walls and the peace and quiet in a room. But as noted, low frequency sounds are more prevalent in the home and workplace than ever before.

Solution:

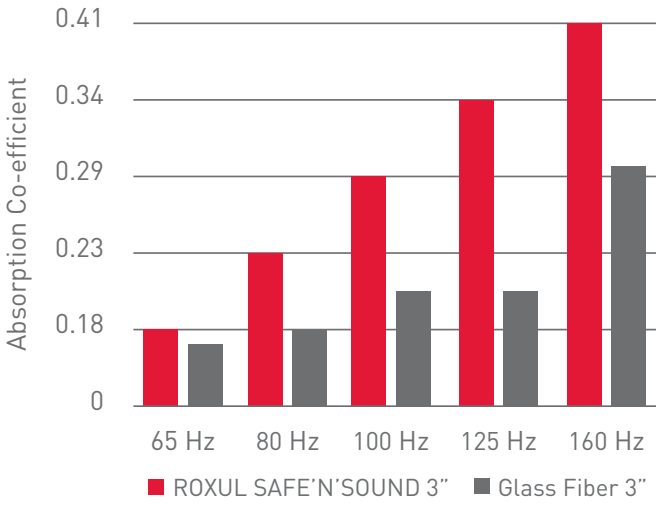
Due to its higher density, ROXUL SAFE'N'SOUND has been proven to be have better absorption at low frequencies than fiberglass.

Stone wool absorbs low frequency noises better than fiberglass

At the frequency ranges within the generally accepted STC test (125Hz to 4000Hz) stone wool continually outperforms fiberglass. However, at low frequency levels, studies completed by third party testing facilities demonstrate that is significantly better than fiberglass and much better at absorbing low frequency sound.

Furthermore, the absorption coefficient, which measures the absorptive properties of a material at varying frequencies, demonstrate that compared to fiberglass, stone wool is much better at absorbing sounds at low frequency bass levels. And this makes for a more soundproof environment.

Sound absorption coefficients

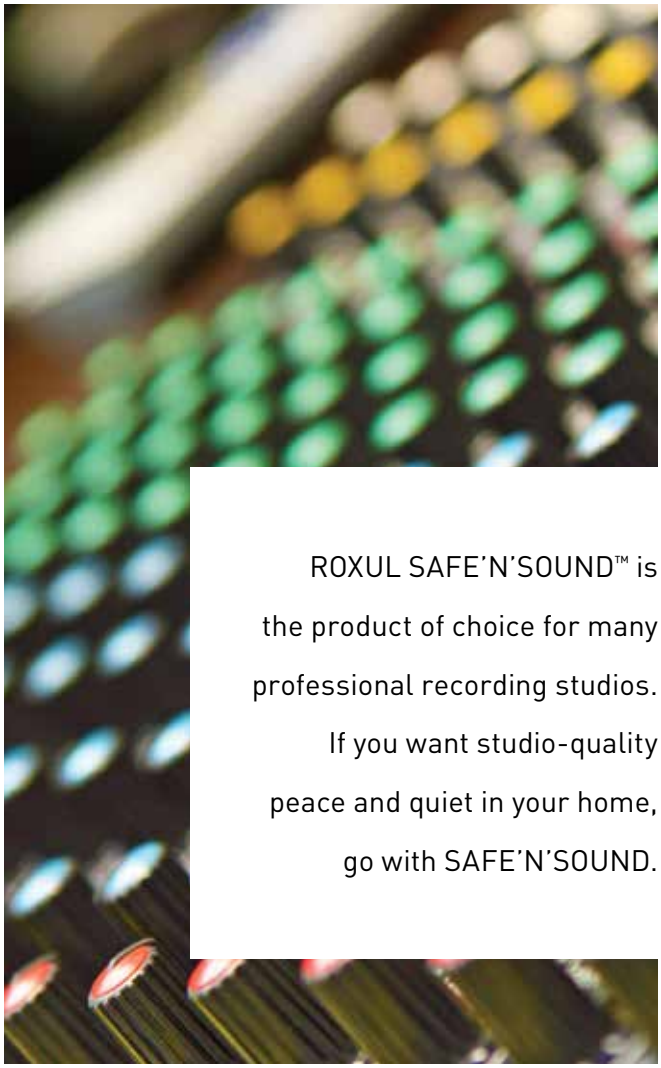


Testing based on 3" thick insulation batts

10 dB reduction in sound is half the sound intensity level. Eg. a 40 dB sound intensity level is half as loud as a 50 dB intensity level.

Typical household applications for soundproofing include:

- Home theatre
- Basements (ceilings)
- Home office
- Laundry room
- Bathroom
- Furnace room



ROXUL SAFE'N'SOUND™ is the product of choice for many professional recording studios. If you want studio-quality peace and quiet in your home, go with SAFE'N'SOUND.

Features and benefits that set ROXUL SAFE'N'SOUND™ apart

Fire resistant

The combination of stone wool and recycled content makes ROXUL SAFE'N'SOUND™ insulation fire resistant. This non-combustible product does not develop smoke or promote flame spread when exposed to fire, making SAFE'N'SOUND a critical line of defense in fire protection. In fact, studies have shown that stone or mineral wool insulations provide a 54% increase* in overall fire resistance rating compared to non-insulated walls.

Water repellant

ROXUL SAFE'N'SOUND insulation repels water or and moisture, thereby maintaining its shape within the wall cavity for delivery of maximum sound and fire performance. SAFE'N'SOUND will not corrode and does not promote fungi growth.

* Sultan, M.A. (1996), A Model for Predicting the Heat Transfer Through Non-insulated Unloaded Steel-Stud Gypsum Board Wall Assemblies Exposed to Fire, Institute for Research in Construction, National Research Council Canada, Ottawa, Ontario, Canada.

Fast, easy installation

Working with ROXUL SAFE'N'SOUND is a breeze. Simply cut with a serrated knife for quick and easy installation between studs, around electrical boxes, pipes, wiring, ductwork and between studs and joists with non-standard widths.

Sag free, tight fit

The higher density of SAFE'N'SOUND provides superior sag resistance and fit. Once installed, SAFE'N'SOUND holds its shape without sagging or slumping in the wall cavity over time to provide continuous fire protection and sound control over time.

Cracks and gaps create sound leaks that can dramatically reduce a wall's STC. A gap 1/8 inch^2 can reduce an STC by as much as 7 points. Gaps around electrical outlet can be as large as 1 inch^2 and result in drastic STC declines. Because ROXUL SAFE'N'SOUND fits snug and tight and will not sag, creaks and gaps within the wall can be minimized and effective sound control can still be achieved.

Compliance & performance specs

Compliance and Performance

CAN/ULC-S702-09	Mineral Fiber Thermal Insulation for Buildings	Type 1, Complies
ASTM C 665	Mineral Fiber Blanket Thermal Insulation	Type 1, Complies
CAN4-S114	Determination of Non-Combustibility	Non-Combustible
ASTM E 136	Determination of Non-Combustibility	Non-Combustible
CAN/ULC S102	Surface Burning Characteristics	Flame Spread = 0 Smoke Developed = 0
ASTM E 84(UL 723)	Surface Burning Characteristics	Flame Spread = 0 Smoke Developed = 0
CAN/ULC S102	Smoulder Resistance	0.09%

System Description

System Description	Sound Transmission Class (STC)	Fire Resistance
5/8" gypsum boards 3-5/8" steel studs spaced 24" centers ROXUL SAFE'N'SOUND	52	1 Hour

Above results are based upon testing using Type X gypsum board.
For additional designs, please contact ROXUL Technical Services.

Acoustical Performance

ASTM C423
CO-EFFICIENTS AT FREQUENCIES

System Description	Thickness	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	NRC
ROXUL SAFE'N'SOUND	3"	0.52	0.96	1.18	1.07	1.05	1.05	1.05

Dimensions

Steel Stud	Wood Stud
3" x 16.25" x 48" 76 mm x 413 mm x 1219 mm With flexible edges	3" x 15.25" x 47" 76 mm x 387 mm x 1194 mm With flexible edges
3" x 24.25" x 48" 76 mm x 616 mm x 1219 mm With flexible edges	3" x 23" x 47" 76 mm x 584 mm x 1194 mm With flexible edges

Density

2.5 lbs/ft^3	40 kg/m^3

A global leader

ROXUL® Inc. is part of ROCKWOOL International, the largest producer of stone wool insulation, which is made from natural basalt rock and recycled material. ROCKWOOL International was founded in 1909 and today operates worldwide withmore than 9,700 employees, with 26 factories across three continents.

ROCKWOOL has more than 40 years experience in developing and manufacturing advanced wall system products. For more than 20 years, ROXUL has been serving the North American market.

In addition to residential insulation, ROXUL also manufactures a range of other premium insulation products for commercial and industrial applications.

Environmentally sustainable

ROXUL SAFE'N'SOUND™ is an innovative insulation offering a world of green features. Our stone wool production process utilizes some of the most advanced technology available. The ROXUL facility is designed to capture and recycle rainwater, reduce energy consumption, and create zero waste to landfill by recycling raw materials back into the production process.

ROXUL insulations are created using naturally occurring, inorganic raw materials and materials with a high-recycled content. Stone wool insulation is non-combustible and achieves its thermal performance without the use of blowing agents. The products do not off-gas and are fully recyclable, therefore contributing to a sustainable environment.

ROXUL is pleased to have third-party certification of our products' recycled content for our Milton facility, completed by ICC-ES SAVE™. All ROXUL products produced at the Milton facility contain a minimum of 40% recycled content. For further details, contact your ROXUL Sales Representative. ROXUL products produced in our Grand Forks facility are currently under ICC-ES SAVE Certification review. Please visit www.roxul.com for the latest information.

Sound Absorbent | Fire Resistant | Water Repellent | Better Fit | Made from Stone | Recycled Content

ICC ES SAVE

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The Better Insulation™

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