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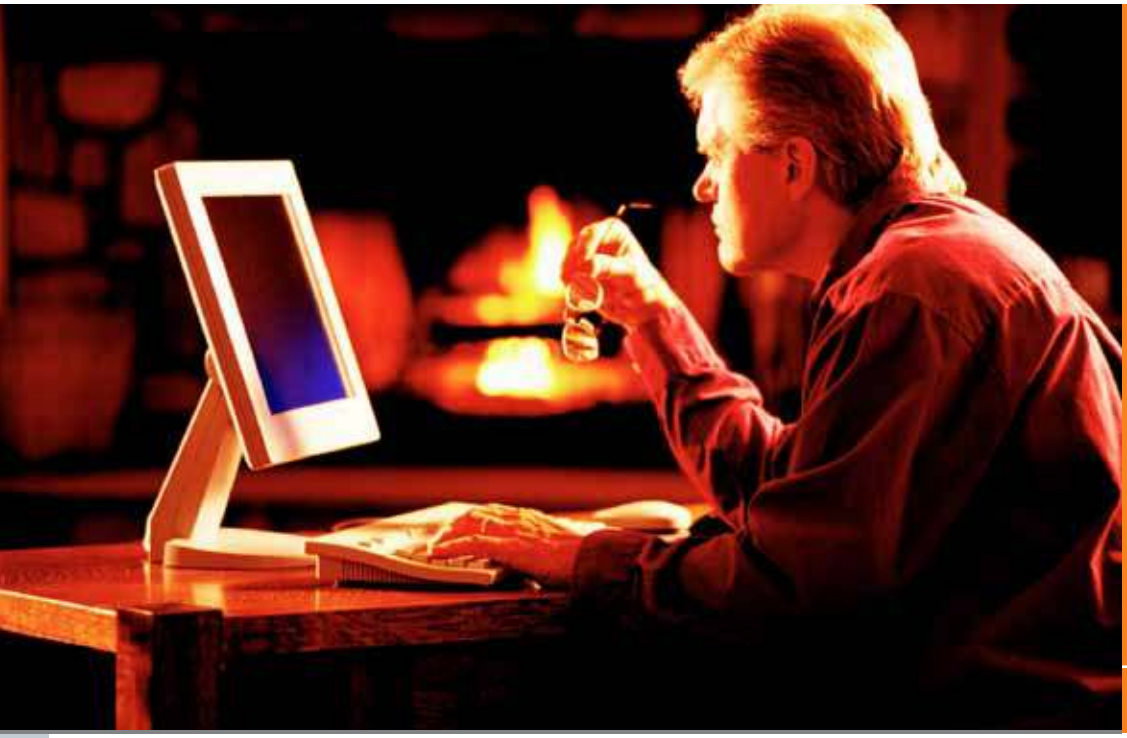

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Acoustical Performance of the Knauf Insulation EcoSeal® System

EcoSeal® & Knauf Insulation Glasswool Products

AN ECOSEAL® WHITE PAPER

Acoustical Performance of the EcoSeal® System

There are two primary means for sound to travel through walls, floors and ceilings. Sound induced vibrations travel through and are dampened by solid materials, such as gypsum board, sheathing, studs and joists. These types of paths are called structure-borne. The other path for sound travel through construction is airborne. In this case, air molecules in framing cavities and unsealed seams or gaps are excited by acoustic vibrations. Both modes of sound transmission are important in determining how well a wall or ceiling assembly will dampen acoustic energy (noise) passing through it. The Knauf Insulation (KI) EcoSeal® system, combining EcoSeal sealant with KI EcoBatts® or Premium Blowing Wool insulation provides a systems approach to sealing detrimental air leaks and absorbing sound energy.

One of the most efficient and cost effective means to control sound in walls, floors and ceilings is through the use of cavity insulation. Sound waves transport energy by momentum exchanges between particles of air. Once set in motion, these particles move back and forth. When the space contains a porous material such as glass wool, the vibrating particles create drag over and around the many fibers. As a result, the acoustic energy is attenuated through conversion to heat. The key to effective sound attenuation is the total surface area of the fibers over which the air particles vibrate. The greater the number of fibers and fiber surface area, the greater the sound attenuation (transmission loss). For fibrous materials, the overall weight of the material does not influence the sound transmission loss, but the fiber size, quantity and uniformity do. Open cell foams (density ~ 0.5 pcf) installed in a cavity can also provide a tortuous path for vibrating air particles and thus act somewhat like glass wool. Closed cell foams (density ~ 2.0 pcf) restrict the interaction of air and insulation, but support mechanical waves, more like a solid material. Mechanical waves are attenuated (dampened) by elastomeric properties of the foam wall.

Air infiltration and sound transmission through walls, floors and ceilings occur in the same fashion, meaning that if air can penetrate a wall assembly then sound will too. In fact, it takes very little air leakage to cause significant sound leakage. For example, an opening or crack equal to 1/100th of 1% of a total wall's surface area can reduce the sound transmission loss (TL) of a wall from 50 to 39 dB. That's a significant 11 dB drop in the ability of the construction to control unwanted sound.

To better understand the relative performance of various insulation treatments, Knauf Insulation conducted transmission loss testing (ASTM E90) on residential wall constructions at Riverbank Acoustical Laboratory (RAL). The walls were 2x4 construction, 16" o.c., with ½" gypsum on the interior and 7⁄16" OSB covered with building paper and covered on the outside by vinyl siding. The walls were constructed by commercial contractors and were insulated by professional insulation contractors. For this series of tests, a consistent ⅛" gap was intentionally created at both the bottom and the top of the wall using a spacer to introduce controlled leak points for each test. The test series included R-15 glass wool without sealing and with EcoSeal, KI Blown in Batt (BIB), 2pcf foam and 0.5 pcf foam. For both of the foams, the foam acted as the sealant at the ⅛" gaps.

The results for the transmission loss testing are summarized below:

Transmission Loss Data Summary			
Construction Description	**STC Class (ASTM E 413)**	**Outdoor-Indoor Transmission Class (OITC)**	**Average TL 60 to 4000 Hertz**
R-15 EcoBatt, no sealant	27	23	27
R-15 EcoBatt, with EcoSeal	37	25	37
Jet Stream BIB with EcoSeal	35	25	37
2 pcf Foam	30	24	30
0.5 pcf Foam	34	25	34

These STC results show clearly that sealing is critical to achieving sound control. All of the insulated assemblies were better than the unsealed wall. When looking at STC data, a difference of 7 is considered by acousticians to be clearly significant, while a difference of 3 is considered marginally significant. Both Ecobatts with EcoSeal and JetStream® with EcoSeal were found to be clearly superior to the unsealed wall and to the 2 pcf foam. The 0.5 pcf spray foam was also shown to be clearly better than the unsealed wall, better than 2 pcf foam, and marginally inferior to the Knauf Insulation glass wool systems.

STC values are often driven by transmission loss values at lower frequencies around 125 Hz. The loss values around this frequency are primarily driven by the structural resonance of the studs and the rigidly attached gypsum boards. It has been shown through evaluations of human subjects that STC may not be the best predictor of perceived noise reduction. For this reason, Knauf Insulation also used the transmission loss data from these experiments to evaluate several alternate sound control ratings.

Outdoor-Indoor Transmission Class (OITC)

(OITC) ratings were designed to compare building structures exposed to transportation noise sources. Acoustical measurements are based on A-weighted sound pressure levels, which is a weighted measurement designed to reflect how the human ear responds to sound. Because transportation noise is the designated noise source in this case, decibel measurements began at a frequency lower than those of the STC and average Transmission Loss. The OITC ratings were actually very similar for all constructions.

Average Transmission Loss (TL)

For this rating, the transmission loss data for frequencies between 160 Hz and 4000 Hz was averaged. Different from STC, the Average TL takes a harder look at those frequencies most sensitive to the human ear, the “speech frequencies”. It has been reported that this measurement is the best correlation to human perception and “satisfaction” with acoustical treatments. The results from this testing showed that R-15 batts with EcoSeal and JetStream BIB with EcoSeal both had average TL’s of 37, while an insulated but unsealed wall had an average TL of 27. A 10 dB reduction is generally perceived as a halving of noise intensity, so EcoSeal is definitely providing a significant acoustic benefit. When looking at foam insulations, 0.5 pcf foam had a TL of 34 and 2.0 pcf foam had a TL of 30. A difference of 3 dB is just perceptible by the human ear while a difference of 6 dB would be equivalent to the same source of noise being located twice as far away. Thus, the Knauf Insulation glass wool systems were found to be perceptibly to very perceptibly superior to foam systems in their ability to prevent noise in the “speech frequencies” from passing through a typical residential stud and dry wall construction.

Summary

In summary, the results of this testing reinforce that EcoSeal provides excellent sealing of construction penetrations. Additionally, the acoustical benefit of Knauf Insulation glass wool insulations in combination with the excellent air sealing provided by EcoSeal was clearly demonstrated. These systems provided consistent, measurable acoustical benefits when compared against foam insulated walls or unsealed walls. Many foam manufacturers and installing contractors tout the superior acoustical performance of their systems. The results of this testing clearly show that these claims are not supported when comparable wall structures are evaluated.

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Knauf Insulation EcoSeal® System is certified for indoor air quality as a low emitting product by The GREENGUARD Environmental Institute to both the GREENGUARD Indoor Air Quality Certification Program℠ and the more stringent GREENGUARD Children & Schools standard.
www.greenguard.org