INSULATION FACTS #58

NAIMA
North American Insulation Manufacturers Association

The Facts About the Acoustical Performance of Metal Building Insulation

Metal Building insulation greatly reduces the level of both exterior and interior noise by preventing transmission of exterior sounds to the interior of the building and absorbing reverberating sounds within the building. This fact sheet discusses the fundamentals of acoustical performance and shows how to improve sound control in typical wall and roof assemblies through the use of fiber glass insulation.

Metal building insulation has been used for many years to thermally insulate the walls and roofs of metal buildings. An additional benefit is that it provides a better acoustical environment both inside and outside the building. Metal building insulation can absorb interior noise to provide a quieter work environment. It can also decrease the amount of noise transmitted into or out of a building.

Because of the porous nature of metal building insulation, it is an excellent absorber of sound. It can reduce noise levels in a building up to 5-6 dB. This same sound absorbing property is used to reduce the amount of sound that is transmitted through a wall or roof. Thus, it can reduce equipment noise transmitted to neighbors. It can also reduce outside noise so that building occupants are not disturbed by exterior noise sources such as traffic.

Sound Absorption Coefficient

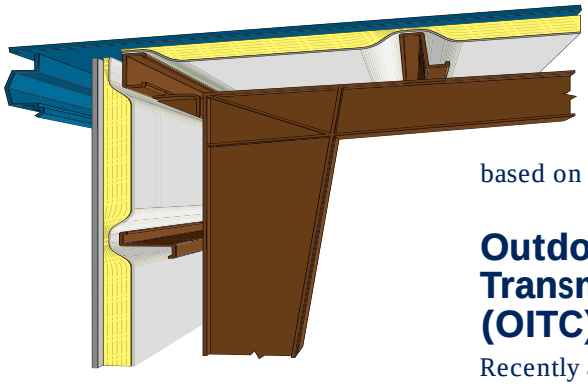
The sound absorption properties of a material are expressed in terms of a sound absorption coefficient. This coefficient typically ranges from 0.05 to 1.20. The higher the coefficient the better the material absorbs sound.

Sound absorption coefficients are measured at several frequencies since it varies with frequency. A material with an absorption coefficient of 0.66 at a particular frequency, means that 66% of the sound that strikes that material is absorbed or conversely 34% of the sound is reflected back into the room.

Metal building insulation is an excellent sound absorber with coefficients ranging from 0.20 to 1.20.

Noise Reduction Coefficient (NRC)

A single number rating has been established to express the ability of a material to absorb sound at multiple frequencies. This single number rating is called the noise reduction coefficient (NRC). Again, the higher the NRC value, the better a material absorbs sound. NRC values for faced metal building insulation range from about 0.75 to 0.90.



Sound Transmission Loss

The ability of a wall or roof to reduce the amount of sound transmitted through it is called sound transmission loss. Sound transmission loss is expressed in decibels (dB) and it also varies with frequency. Most materials and constructions reduce the transmission of high frequency sounds more than low frequency sounds.

When building a wall or roof it is imperative that there are no air (sound) leaks in the construction. Sound leaks can drastically reduce the effectiveness of a wall to reduce the transmission of sound from one space to another. The construction should be as tight as possible. Where gaps exist, they should be filled with a flexible sealant such as a non-curing Butyl, siliconized acrylic latex or an acrylic latex.

Sound Transmission Class (STC)

A single number rating system used to express the sound transmission loss properties of a wall or roof is the sound transmission class (STC). The higher the STC value, the better a construction reduces the transmission of sound. In a typical metal building construction the values for STC range from a low of about 20 to a high of 55. The STC rating has been in existence for many years and is based on speech sounds.

Outdoor-Indoor Transmission Class (OITC)

Recently a new single number rating has been introduced. It is called the outdoor-indoor transmission class (OITC). It is used to specify the sound transmission loss properties of exterior building elements such as walls and windows. The OITC uses outside noise sources such as traffic, aircraft and trains to calculate a single number rating. The OITC is the preferred rating for exterior walls and roofs of metal buildings.

Conclusion

Noise is becoming an indoor environmental pollution issue as it can effect the health and performance of the building occupants. Construction techniques to reduce sound are becoming increasingly important and many builders and architects are looking for cost-effective ways to further reduce sound transmission in metal buildings.

Adding faced metal building insulation alone to the metal building construction can reduce noise levels in a metal building by 5-6 dB. However, construction techniques do impact the way sound travels. To maximize a metal building's acoustical performance, the wall and/or roof panels should include at least one layer of faced metal building insulation, and one layer of unfaced metal building insulation. Additionally, the construction should be tight, with attention to detail such as filling gaps with flexible sealants to assure that sound does not transit via air leaks from one space to another.

Vapor Retarder Facing	Noise Reduction Coefficients (NRC)
PSK Light Duty	.85
PSK Standard Duty	.85
PSK Heavy Duty	.75
FSK Heavy Duty	.80
PSF	.90
Vinyl	.85

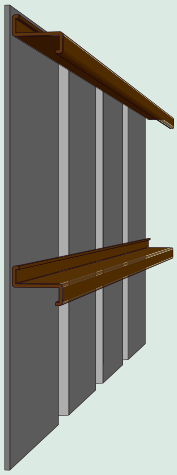
NRC rating is for facing laminated to R10 and R19 fiiber glass.
Tested in accordance with ASTM C423 on an "A" mounting.

STC and OITC Ratings for Typical Metal Building Constructions

Walls

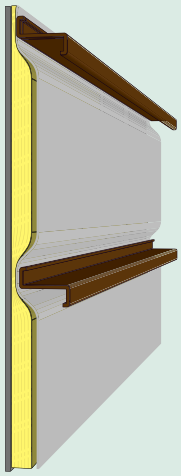
STC 21 / OITC 17

No Insulation



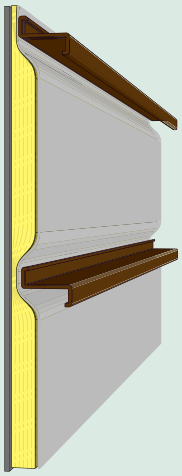
STC 28 / OITC 20

R-10 Faced 202-96 Insulation
Over the Girts



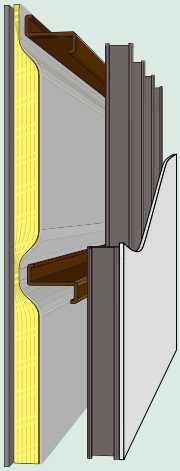
STC 29 / OITC 20

R-13 Faced 202-96 Insulation
Over the Girts



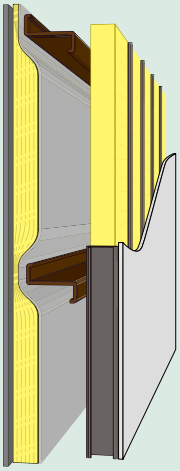
STC 50 / OITC 35

R-13 Faced 202-96 Insulation
Over the Girts
3 5/8" Steel Studs on
24" Centers with
1/2" Gyp. Board on Interior



STC 54 / OITC 39

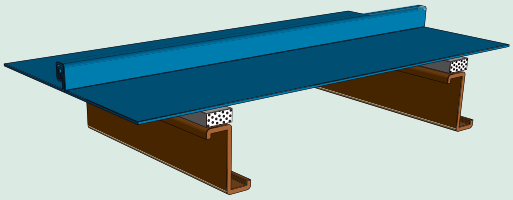
R-13 Faced 202-96 Insulation
Over the Girts
3 5/8" Steel Studs on
24" Centers with
R-11 Batts and
1/2" Gyp. Board on Interior



Roofs

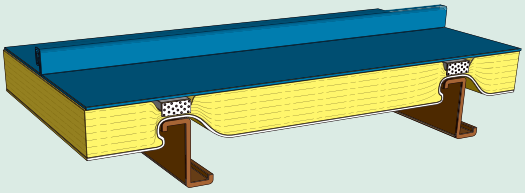
STC 24 / OITC 18

No Insulation



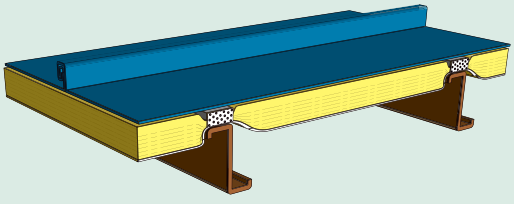
STC 32 / OITC 22

R-19 Faced Insulation Over the Purlins



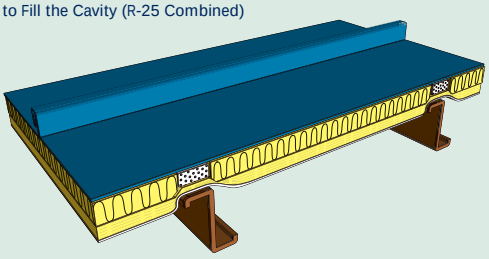
STC 29 / OITC 20

R-10 Faced 202-96 Insulation
Over the Purlins



STC 36 / OITC 24

202-96 Insulation Over and Between the Purlins
to Fill the Cavity (R-25 Combined)



Assemblies tested in accordance with ASTM E 90.
STC rating determined in accordance with ASTM E 413.
OITC ratings determined in accordance with ASTM E 1332.
Roof Construction is 24 ga. standing seam roof with 8" Z purlins on 5' centers.
Wall Construction is 26 ga. wall panels screwed to 8" Z purlins on 7' centers.

Metal Building Acoustical Performance

Sound Transmission Loss

	Construction Type	Transmission Loss -dB at Octave Band Frequencies 125	250	500	1000	2000	4000	STC Rating	OITC Rating
Roofs	No Insulation	12	13	19	24	30	32	24	18
	R-10 Faced 202-96 (Rev. 2000) insulation over the purlins	12	16	26	37	45	49	29	20
	R-19 Faced 202-96 (Rev. 2000) insulation over the purlins	13	20	30	41	49	51	32	22
	202-96 (Rev. 2000) insulation over the purlin and between the purlin to fill the cavity (R25 combined)	14	24	34	44	53	56	36	24
Walls	No Insulation	12	14	19	19	20	27	21	17
	R10 faced 202-96 (Rev. 2000) insulation over the girts	13	16	25	32	37	46	28	20
	R13 faced 202-96 (Rev. 2000) insulation over the girts	13	17	26	33	36	47	29	20
	R13 faced 202-96 (Rev. 2000) insulation over the girts, 3 5/8" steel studs on 24" centers with 1/2" gyp. board on interior	26	40	51	60	64	65	50	35
	R13 faced 202-96 (Rev. 2000) insulation over the girts, 3 5/8" steel studs on 24" centers with R-11 Batts and 1/2" gyp. board on interior	31	43	55	68	73	75	54	39

Sound Transmission Class (STC) in accordance with ASTM E 90.

Roof construction is 24 ga standing seam roof with 8" Z purlins on 5' centers.

Wall construction is 26 ga wall panels screwed to 8" Z girts placed on 7' centers.

Interior metal furring wall studs were 3 5/8" by 25 ga on 24" centers.

Sound Absorption

R19 Insulation Laminated with Vapor Retarder Facing	Absorption Coefficients @ Octave Band Frequencies 125	250	500	1000	2000	4000	NRC
PSK Light Duty Facing	1.06	1.2	0.93	0.8	0.51	0.3	0.85
PSK Standard Duty Facing	1.04	1.23	0.91	0.78	0.49	0.28	0.85
PSK Heavy Duty Facing	1.07	1.17	0.83	0.63	0.35	0.2	0.75
FSK Heavy Duty Facing	1.06	1.17	0.89	0.72	0.43	0.24	0.80
PSK Facing	1.06	1.22	0.93	0.83	0.57	0.34	0.90
Vinyl Facing	0.95	1.2	0.94	0.73	0.52	0.37	0.85
Unfaced	0.89	1.22	1.02	0.98	1.01	1.00	1.05

Sound Absorption Coeffiicient in accordance with ASTM C 423 using an "A" mounting.

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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