HUNTSMAN

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Acoustical Properties of Expandable Polystyrene

I. GENERAL

A. Nature of Sound

Sound, a sensation detected by the auditory nerves, is caused by vibrations, which travel through media - usually air. The vibration of a body alternately compresses and expands the layers of air adjoining it. These variations in air pressure above and below the prevailing atmospheric pressure produce spherical sound waves. The loudness of any sound is proportional to the distance of the hearer from the generating source and to the amplitude of the original sound.

A vibrating body moves from a neutral position to one side and then to the opposite and back to the neutral position. One complete set of such movements is known as a cycle. The number of cycles per second (Cps) is known as the frequency. The pitch of sound depends on the frequency of the vibration of the sound source: when the frequency of a musical sound is doubled, the pitch is raised one octave. The frequency range of audible sounds is about 20 to 20,000 Cps, or about ten octaves.

The variation in the ambient atmospheric pressure caused by the sound wave is known as the sound pressure. The unit sound pressure (the microbar) is about one-millionth of normal atmospheric pressure (1 bar). The better-known unit of sound pressure is the decibel, which is a function of the square of the sound pressure.

Sound Pressure Levels (SPL) are quite often expressed in decibels (DB); for sound measurements, a reference level of 0.0002 microbar is used. This level is about the smallest degree of sound that a person with normal hearing can detect and is equivalent to zero decibels. The sound pressure and frequency determine the quantity of sound detected and is a measure of the loudness of the sound. Roughly, a SPL increase of 10 DB doubles the loudness.

B. Sound / Noise Control

Noise is an undesirable sound regardless of the origin and usually consists of a random mixture of frequencies. When a sound emanates from within a room it travels in spherical waves from the origin until striking some restraint such as the walls of the room. At this point the waves are partially absorbed, transmitted or reflected back. If the sounds do not dissipate rapidly and new sounds emanate, an unpleasant and distracting environment is created.

There are two types of transmitted sounds: airborne and impact. Impact sounds are caused by walking or by dropping an object on the floor, by slamming doors, and by vibrating parts of a building caused by operating machinery. The distinction between the two types must be clearly understood, for the methods of eliminating or deadening undesirable noise are markedly different.

To eliminate or minimize airborne sound originating within a closed space, sound absorbing materials are placed within the room. To minimize transmission of sound from or into a space caused by vibration of structural members, sound insulation materials and a suitable method of construction are employed.

C. Sound Transmission Class (STC)

A widely accepted system for classifying walls or partitions for sound insulation value is the Sound Transmission Class (STC) of a structure. This method is described in detail in ASTM E-90. Essentially, it compares the sound deadening of a structure at various test frequencies against a standard. A high STC number indicates a more efficient sound absorber.

The following table gives some idea of the practical meaning of these numbers.

STC 25:	Normal speech can be understood easily through a wall.
STC 30:	Loud speech can be understood fairly well.
STC 35:	Loud speech audible but generally not intelligible.
STC 42:	Loud speech now is audible as a murmur.
STC 45:	You need to strain to hear loud speech at all.
STC 48:	Some loud speech is barely audible.
STC 50:	Loud speech is not audible.

The second type of sound, caused by impacts like footsteps or the dropping an object on a floor are express as Impact Sound Pressure Level (ISPL). The standard for the maximum acceptable Impact Sound Pressure Level (ISPL) varies from country to country, although the differences in general are minimal. Testing consists of a standard impact device striking the overhead floor system at different frequencies. Sound Pressure Levels (SPL) are measured in the room below and a curve of frequency versus SPL is obtained. The test results are then compared to a standard acceptable curve.

II. ACOUSTICAL PROPERTIES OF EPS CONSTRUCTION SYSTEMS

The resistance to airborne sound transmission is not only dependent upon the characteristics of the material placed in the path of the sound waves but also upon the method of construction of the system. Expanded polystyrene, ***when used in combination with other building materials can effectively reduce the transmission*** of airborne sound through partitioned walls, ceilings and floors.

The use of expanded polystyrene in wall construction may, ***when tested as a system***, increase STC rating. EPS has the advantage of being light-weight and effective in thickness as low as 1/4 inch, replacing thicker, heavier materials.

We recommend that a reputable testing laboratory with experience in the sound transmission testing field be contacted if the rating of a system is desired.