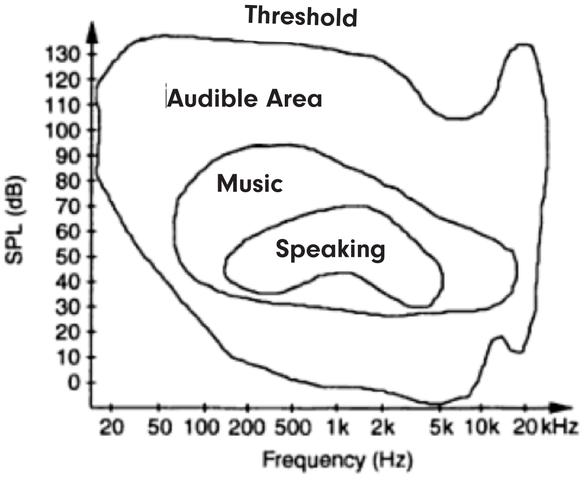
Sound Insulation

When we talk about sound, the vibrations traveling in the atmosphere come to mind. An object vibrating in the atmosphere moves the surrounding air molecules. The circular movement of the air molecules creates pressure change waves sensible by ears.

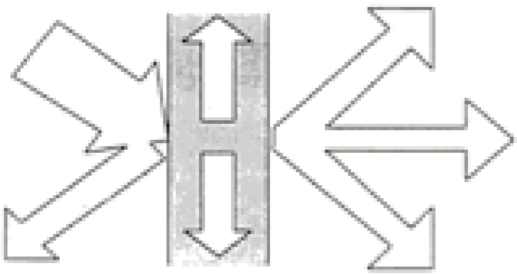
The basic characteristic of the sound is frequency. The reason why we hear different sounds from the objects that emit different vibrations is the frequency difference between sound waves. A human can hear the sounds between 20 to 20.000 Hertz. The pressure level of the sounds is measured with decibel (dB).



The sound insulation must be performed in the areas where protection against the hazardous effects of noise must be maintained or in the areas to avoid the noise emission to the environment. In most of the countries, there are regulations on sound that have been prepared through taking the following factors into consideration;

- The sound emitted from industrial buildings to the environment
- Traffic sounds entering into the buildings
- Sound levels within the buildings
- Sound insulation between the rooms of the building

The parameters required for sound insulation of the roof and wall coatings and the calculation methods can be determined during the design phase. A certain part of sound waves crashing a surface is reflected, some are absorbed and the remaining part is transmitted. Reflection, absorption and transmission rates depend on the shape of the surface, the sound absorption capacity of the material and the frequency of the sound. The sound absorbing materials have pores or fiber and they become effective by means of transforming a part of the acoustic energy into heat energy by causing frictional loss through the air penetrating holes in their structure.



The polyurethane-filled sandwich panels have the appropriate sound absorption characteristic in the normal industrial buildings according to the requirement of the building; however, they are not sufficient for the regions or offices that are very sensitive to sound and therefore additional solutions may be required.

Variation of Sound Transmission Loss As a Function of Frequency (dB)

PUR Thick.	Frequency (Hz)																			
		125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000
50	mm	7,3	9,3	11,7	8,5	11,4	12,3	13,3	14,1	14,7	15,9	15,3	11,5	11,8	23,4	29,2	32,4	29,8	32,5	36,9
60	mm	8,1	22,1	14,2	14,5	13,0	13,9	13,8	14,6	15,3	16,0	15,3	13,0	18,3	24,2	29,2	32,5	29,8	32,5	36,9

Variation of Sound Absorption Coefficient As a Function of Frequency (dB)

PUR Thick.	Frequency (Hz)												
	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	
50	mm	0,08	0,11	0,22	0,20	0,05	0,59	0,09	0,11	0,04	0,07	0,18	0,07
60	mm	0,14	0,21	0,25	0,49	0,06	0,69	0,12	0,12	0,22	0,08	0,20	0,11

The tests have been performed at ITU Faculty of Mechanical Engineering Mechanical Dynamics Laboratory of Vibration and Acoustics.

Sample Calculation

What is the sound transmission loss of 70 dB noise at 630 Hz frequency at 60 mm polyurethane-filled sandwich panel?
By benefiting from the table showing the variation of the sound absorption coefficient by frequency;
70 dB x 0.49 = **34.3** dB
Decreases to 70 dB – **34.3** dB = **35.7** dB sound level.

Reference: 1. Assan Panel Studies 2. Lightweight Sandwich Construction, J.M. Davies 3. ITU Technical Report