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UBP Acoustical Enclosures

Universal Blower Pac has nearly 30 years experience engineering and producing acoustical enclosures for our customers. Noise regulations are much more prevalent than when we started and workplace safety has arisen as a key issue to private and public entities alike. Additionally, noise pollution has become a community concern and, in turn, its reduction a factor in the buying process of almost all customers.

Universal Blower Pac has addressed these concerns with continued testing and refinement of our custom sound enclosures built to meet your specific needs. We offer a wide variety of options available for almost any attenuation application. I have prepared a short introduction to common noise concepts and photographs of our enclosures, as well as performance descriptions.

Sound Levels

Below can be found the OSHA requirements for noise levels encountered in the workplace.

Duration per day, hours	Sound level dBA slow response
8.....	90
6.....	92
4.....	95
3.....	97
2.....	100
1 1/2	102
1.....	105
1/2	110
1/4 or less.....	115

Footnote(1) When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions: $C(1)/T(1) + C(2)/T(2) + C(n)/T(n)$ exceeds unity, then, the mixed exposure should be considered to exceed the limit value. Cn indicates the total time of exposure at a specified noise level, and Tn indicates the total time of exposure permitted at that level. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

Fig 1: Permissible Noise Levels, [1]



Next, you will find a table of average sound levels of machinery and noise encountered in everyday life.

Threshold of hearing	0 dB	Motorcycle (30 feet)	88 dB
Rustling leaves	20 dB	Foodblender (3 feet)	90 dB
Quiet whisper (3 feet)	30 dB	Subway (inside)	94 dB
Quiet home	40 dB	Diesel truck (30 feet)	100 dB
Quiet street	50 dB	Power mower (3 feet)	107 dB
Normal conversation	60 dB	Pneumatic riveter (3 feet)	115 dB
Inside car	70 dB	Chainsaw (3 feet)	117 dB
Loud singing (3 feet)	75 dB	Amplified Rock and Roll (6 feet)	120 dB
Automobile (25 feet)	80 dB	Jet plane (100 feet)	130 dB

Fig 2: Typical Average Levels of Sounds, [2]

Environmental Effects

Sound levels perceived by the human ear depend upon the environment, such as topography, atmospheric conditions, and obstructions. Since field measurements are hardly uniform, we have to use mathematical corrections to determine what the sound level of an object would be in the laboratory. The levels perceived also depend upon the number of sources and the distance from the source.

Distance From Source

“The law by which the mean-square [SOUND PRESSURE LEVEL](#) varies inversely as the square of the distance from the source. The general rule of thumb is that, under ideal conditions (no reflecting surfaces or other background sound or interference), a sound level drops 6 dB for every doubling of the distance from the source. If the two distances in question are d_1 and d_2 , then the decibel difference DD is seen in the following equation.” [2]

$$DD = 10 \log (d_1/d_2)^2 = 20 \log (d_1/d_2)$$

Equation 1: Inverse Square Law, [2]



This equation can be used to show that in a free field with a starting decibel level of 80 dBA at 3' there will be a measured sound level of roughly 50 dBA at 100', which equates to the sound level of a quiet street from fig 2. See the following work.

$$dBA_2 - dBA_1 = 10 * \log\left(\frac{d_1}{d_2}\right)^2$$

$$dBA_2 - 80 = 10 * \log\left(\frac{3ft}{100ft}\right)^2$$

$$dBA_2 = 80 + 10 * \log(9E - 4)$$

$$dBA_2 = 49.54dBA$$



Our Sound Attenuation

From empirical data gathered during tests of our sound enclosures, we have found that we can reach 80 dBA with an enclosure from an unenclosed starting value of 105 dBA, all in a free field environment devoid of obstructions of course.

Due to the logarithmic nature of sound intensity to human perception in decibels, the 25 dBA attenuation from a starting level of 105 dBA will be less when the starting level is 90 dBA. In fact, at 90 dBA we expect attenuation from our enclosures to be 15 dBA on average. To provide an exact attenuation of the final sound level, after our enclosures are installed at your facility, would require on-site noise measurements and use of ASME testing procedures so we could properly estimate the effect of the surroundings on machinery noise.

Acousti-Pac Partial Enclosure

The greatest contributor to noise emanating from a blower system is the blower itself. This comes from gear contact and an equalization of pressure as the blower impeller tips pass the discharge port multiple times per revolution. We've found that an acoustical enclosure around the blower combined with acoustical treatment on the drive guard and an additional absorptive insulation layer around the discharge silencer can give us significant attenuation for minimal cost. Please see the following figure.



Fig 3: Acousti-Pac Partial Enclosure

The enclosure is constructed of galvanized steel, powder coated steel, or aluminum and high density acoustical foam backing. It is cooled by one or two small electric fans, depending on the size of the application. The enclosure is suitable for outdoor operation. It allows for greater maintenance accessibility to the unit and ancillary equipment. Additionally, this enclosure allows for lower blower operating temperatures because the discharge piping is entirely external to the unit. In some applications where the units are very large it is also beneficial to enclose the motor and drive assembly along with the blower. Please see an internal view of the enclosure in the following figure.

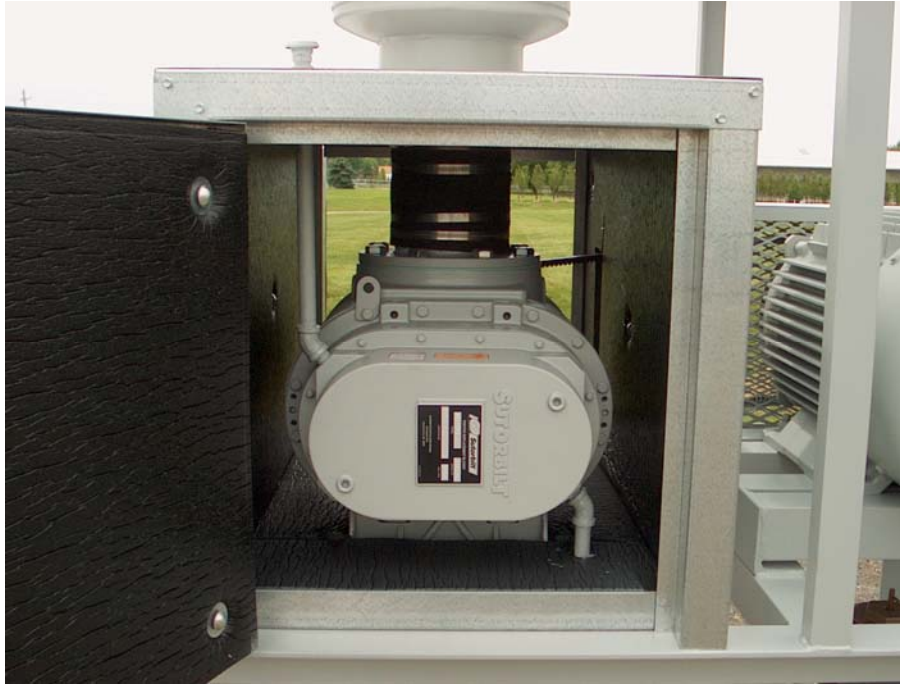


Fig 4: Acousti-Pac Interior

Attenu-Pac Full Enclosure



Fig 5: Attenu-Pac Full Enclosure

The Attenu-Pac enclosure provides the user with a very high amount of noise attenuation for the system. As you can see from figure 5, the package is still configured with large multi-chamber/absorptive inlet and discharge silencers. These combine chambers, which are specifically configured to provide destructive interference of low frequency noise, and absorptive material to attenuate high frequency noise. This results in much lower noise levels than smaller combination inlet/filter silencers. The Attenu-Pac acoustical enclosure is constructed of galvanized steel, powder coated steel, or aluminum and is backed with high density acoustical foam. It is suitable for outdoor operation. Please see additional enclosures in figure 6.



Fig 6: Attenu-Pacs in the Field

All Attenu-Pac enclosures UBP produces are custom built and sized for their specific application. Ventilation boxes can be fitted externally or internally to the package depending upon the space available. We also produce enclosures for existing units currently in the field with specific dimensional requirements.



Please contact our local representative with your specific application and noise requirements. It is likely that one of our enclosure solutions will provide enough attenuation to quiet your machinery to low levels for plant personnel and the surrounding area. We'd be happy to write a blower package / enclosure specification tailored to you needs.

Sincerely,

Andrew Placek
Universal Blower Pac



Sources

- [1] US Department of Labor, "Occupational Noise Exposure 1910.95", www.osha.gov, 2006.
- [2] Traux, Barry. Handbook for Acoustic Ecology, 2nd Edition, Cambridge Street Publishing, 1999.