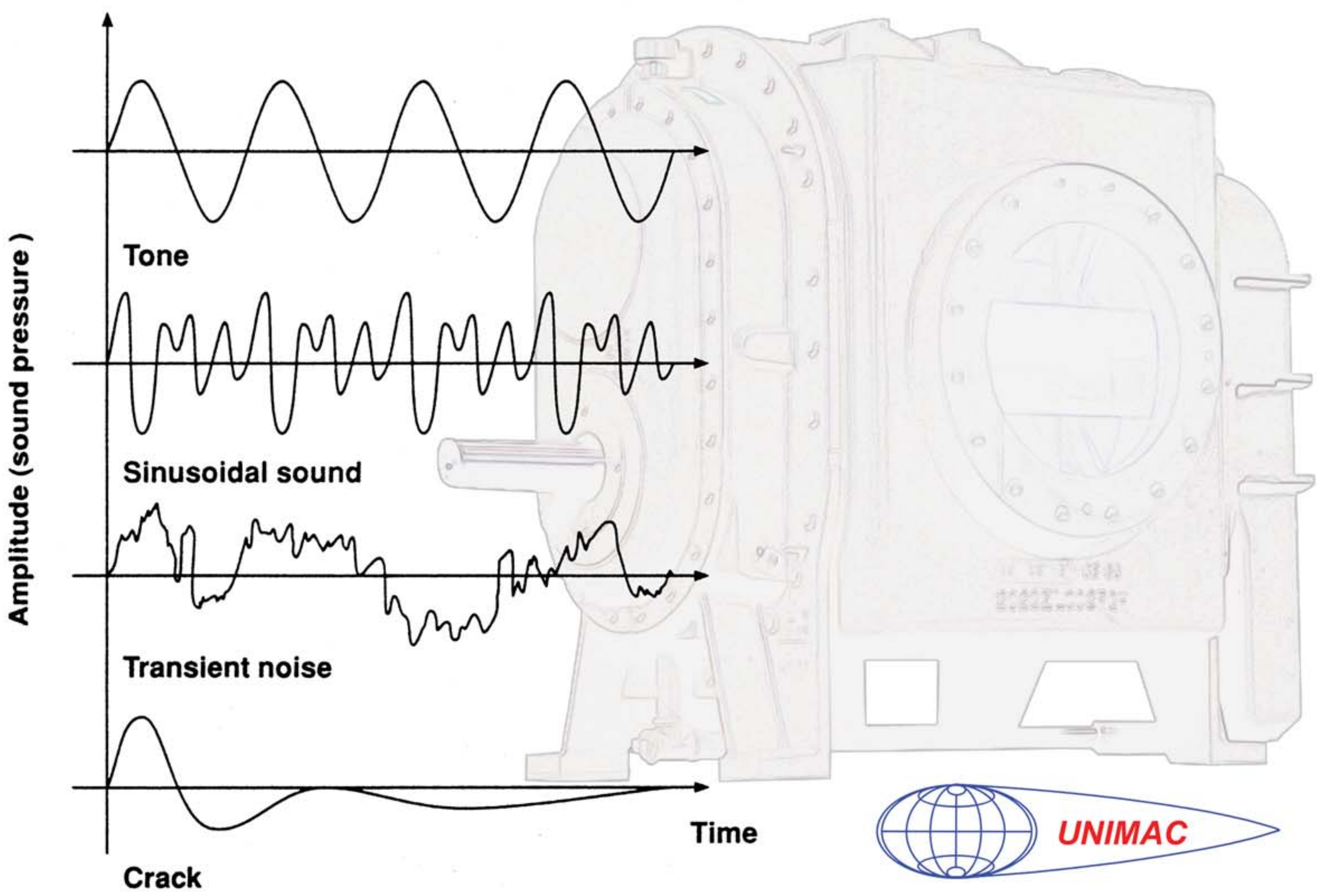
UNIMAC

Noise Control for Blowers

Premium quality blower packages through innovative design and superior construction.



Noise is unwanted sound

Sound is the sensation of hearing............. noise is unwanted sound. Sound waves spread in solid bodies liquids and gases in the form of pressure fluctuations. If the vibrations are emitted from ambient air they are known as ***airborne sound***. If solid objects transmit the vibrations they are known as ***structure-borne sound***. There are connections between sound vibrations coming from the sound source and the human perception of sound.

The physical characteristics of sound waves are as follows.

- Pitch, tone or ***frequency***, are normally measured in Hz (vibrations per second).
- Loudness (intensity) is the ***amplitude*** deviation that occurs in a sound wave.
- Quality or vibration ***wave form*** causes different impression of sound.

Noise is typically a complex sound mixture of many different frequencies not harmonically related.

Sound Measurement

BEL- is a dimensionless, logarithmic unit by which noise is measured and evaluated. ***DECIBEL (dB)***, 1/10 BEL is the most common unit, usually expressed in terms of ***Sound Pressure Level*** (Lp). Decibels are measured on a logarithmic scale, each increase of 10 on the scale represents a tenfold increase in loudness. (20 dB is 10 times as loud as 10 dB)

dBA	Perception
140	Unbearable
130	Pain Threshold
100	Very Loud
90	Loud
80	Busy Street
70	Commercial Area
60	Normal Conversation
50	Comfortable
20	Barely Audible
15	Hearing Threshold

Workplace Noise

Noise has long been recognized as one of the most prevalent workplace hazards. It is well known that excessive noise induces hearing loss. Evidence has also shown that high levels of noise contribute to industrial accidents. In the United States industrial plants are responsible for worker safety, including control and abatement of excessive noise. OSHA and NIOSH provide numerous reports, articles and studies on noise control. One popular OSHA publication, “Noise Control: A Guide for Workers and Employers”, is available off the internet.

Blower Noise

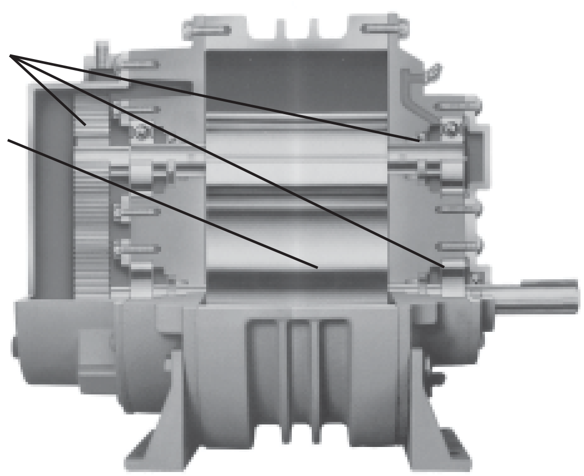
Rotary Lobe blower noise levels vary greatly. Blower size, operating pressure, speed, noise control components installed, and environment are primary factors effecting the overall noise level. Both the noise and pulsation produced are functions of the timing gear velocity, which is equal to the product of gear circumference and speed (RPM). Noise characteristics can range across a broad band, from low-amplitude high-frequency to high-amplitude low-frequency noise.

Structural and Airborne Noise are generated in a Rotary Lobe blower.

Structural / Mechanical noise generated by timing gears, bearings, and drive components.

Airborne / Pulsation from the rotating lobes disturbs the air causing pressure waves.

- Low frequency pulsation
- High frequency air velocity in pipes



Blower sound pressure levels are usually given in decibels (dB) in the scale of A, in a free field environment at a distance of one meter (3’) mounted on a concrete pad with premium grade inlet and discharge silencers installed.

Since blower noise characteristics vary from application to application, the most effective solutions and methods to control the noise also vary.

Noise Control for Rotary Lobe Blowers

When developing solutions to noise problems in your plant it is important to evaluate the total system. Noise can be controlled at the source (the blower and drive) where it is produced, along the paths that it travels (enclosures and barriers), or at the receiver (ear plugs or earmuffs). A brief description of the more common noise control methods is below. Determining which combination of methods is best for your situation depends on site specific conditions, we can help you analyze your problem and recommend cost effective solutions.

Equipment Selection

Start at the source in controlling noise. When evaluating a blower for an application specify the target noise level in addition to other performance criteria (scfm, PSIG, "Hg, F, etc). Most blower packagers will do a computer selection model which provides the estimated noise level for a specific blower operating at the specified conditions. Using a larger blower turning slower will generally be quieter. Make sure the entire package is designed with noise control in mind, what type of silencers? Flexible connectors? Drive components? Reflective metal surfaces?

Silencers

The most common device installed on blower packages for noise control is the silencer (muffler), placed in the inlet and discharge piping. Reactive-type silencers generally use multiple chambers interconnected with perforated, ported or slotted pipes to reflect and change the sound energy, and are best used on low frequency applications. The dissipative-type silencer depends on fibrous sound absorbing material to dissipate and absorb the sound energy. The combination reactive / dissipative silencer is functionally a reactive silencer with absorptive material to provide high-frequency noise reduction. Silencer performance, stated as Dynamic Insertion Loss, is the difference in dB between two sound pressure levels measured at the same point under the same conditions and is a function of input noise amplitude, frequency, size, and flow velocity.

Wrapping & Lagging Pipe

Acoustic lagging of piping or equipment prevents the radiation of noise to the surrounding area. The wrapping material is generally fiberglass or mineral wool with a density of 2.5 to 8 lbs. per cu. ft. and a jacket of 16-20 ga. aluminum or 26-28 ga. steel sheet metal. The inner layer serves as a sound absorber and the outer layer as a barrier. The effectiveness of the lagging depends on the weight of the jacket, thickness of the porous layer, stiffness of the porous layer, and the frequency to be attenuated.

Enclosures

Acoustic enclosures surround and contain the noise source. If there are gaps noise escapes. They are typically constructed of multiple panels providing both sound energy absorption and noise transmission loss with connecting components such as a support frame. Two basic panel styles are common. One uses a 16 to 18 ga. solid steel exterior, lined with 4 lb density mineral wool and a perforated 20 to 22 ga. interior skin. The other uses a 16 to 18 ga. solid steel exterior and is lined with an open cell acoustic foam. Enclosures should be designed to allow quick service access and must provide ample ventilation for cooling. Enclosure performance or Attenuation is the difference in dB between two points in and along the path of sound.

Absorptive Materials and the Room

Sound within a room is reflected by the walls, floors and ceiling. The reflected noise is known as reverberation. The sound absorption characteristics of a surface effects the reverberant field noise. A concrete wall reflects a large amount of sound. Highly absorptive materials have soft porous surfaces and vary in both depth and density. Open cell acoustic foam with a pyramid shaped surface covering significant portions of a room greatly reduces the reflected noise.

Active Noise Control

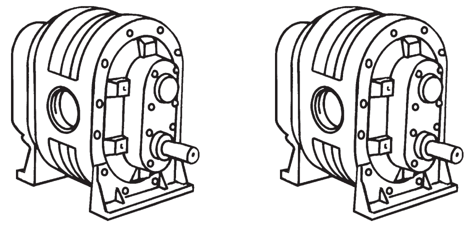
Active (or electronic) noise control is not a new concept; however advances in adaptive digital processing have made the use of active noise control more applicable in a broader range of applications. In short, active noise control uses an input microphone to feed a power amplifier that drives a speaker. An electrically generated sound is used to destructively interfere with and cancel a portion of the unwanted sound.

Permissible noise exposure levels, OSHA standards

Hours per day	*dBA*	*Hours per day*	*dBA*
8	*90*	*2*	*100*
6	*92*	*1*	*105*
4	*95*	*.5*	*110*
3	*97*	*.25*	*115*

Combining sources with equal dB levels

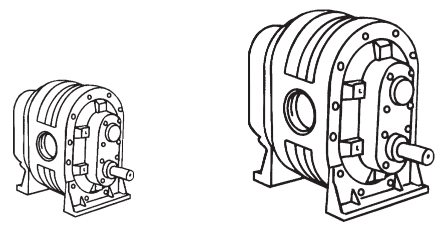
# of Sources	*add dBA*
2	*3*
3	*5*
4	*6*
5	*7*
6-7	*8*
8	*9*
9-10	*10*



example: two blowers, each generating 85 dBA, combined sound pressure level 88 dBA (85 + 3)

Combining sources with different dB levels

dBA difference	*add dBA*
0-1	*3*
2-4	*2*
5-9	*1*
>9	*0*



example: two blowers, one 85 dBA, one 88 dBA, combined sound pressure level 90 dBA (88 + 2)

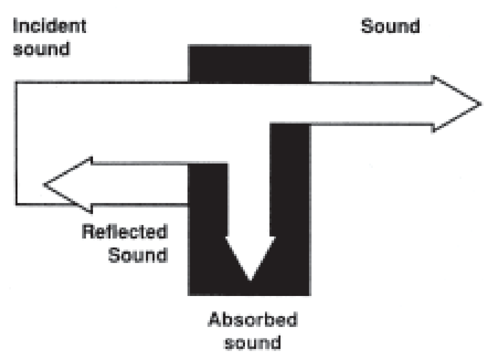
Sound diminishes with increasing distance

distance	*reduce dBA*
3'	*0*
6'	*5*
16'	*12*
33'	*16*
82'	*23*
164'	28

example: Blower sound pressure level at 3' is 90 dBA, at 16' the same blower is 78 dBA

Reflection and Absorption

Noise levels are normally given in a free field without obstructions or reflections. Sound in a building is reflected or reverberated. Materials with smooth surfaces such as brick, concrete, steel and glass reflect a large amount of sound. Damping of airborne sound is achieved by porous or fibrous absorption materials with a low elasticity module and a large area mass. The extent to which the sound is dampened depends on the frequency of the sound.



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