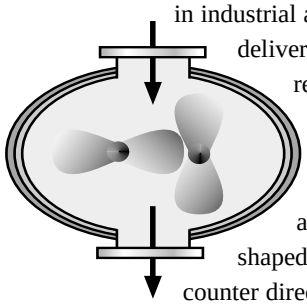
Silex

Blower silencing technology

Introduction

Operation

The rotary positive or positive displacement blower is used in industrial applications where a high delivery of oil free air or gas at a relatively constant volume is required. This is achieved through the blower cycle in either a pressure or vacuum application. Two figure 8 shaped impellers are rotated in a counter direction. As each lobe or impeller passes the inlet connection, air is drawn into the blower cavity. The air is transferred around the perimeter of the cavity and is discharged through the discharge port on the opposite side of the blower housing. The rotational speed on the impellers can exceed 5000 RPM depending on the manufacturer and blower design and selection.



Applications

Typical applications are vacuum processing and conveying, pneumatic conveying, aeration and backwashing, gas collection and sparging. Blowers are used in a wide variety of industries such as milling and baking, resin and plastics, dry bulk handling, chemical processing, waste water treatment, pulp and paper and oil and gas.

Pitch Line Velocity - Transition Speed

The pitch line velocity (PLV) or transition speed of a blower is defined as the circumferential velocity of the timing gears. Generally, the larger the timing gear and the greater the rotational speed of the blower, the larger the resulting sound power generated by the blower. In the past, the PLV has been used to establish the type of silencer used on the inlet and discharge of a blower. It has been recognized by the silencing industry that the critical PLV for a blower is 3300 FPM for the inlet and 2700 FPM for the discharge. Below these transition speeds, chamber type silencers have been used on the blower intake and discharge. Above these transition speeds, combination reactive/absorptive silencers are generally used.

Silencing System Parameters

The selection of the size and model of the silencing system depends on a number of parameters relating to the blower, the blower installation and the site conditions.

Equipment

The silencing system should be designed such that the required noise levels at the intake and discharge to the blower are attained without affecting the operation of the blower itself. For this purpose, the following information is analyzed:

1. Blower timing gear diameter
2. Blower capacities expressed in CFM at blower inlet port
3. Blower rotational speed in RPM
4. Blower allowable pressure drop
5. Blower Pitch Line Velocity (transition speed) FPM
6. Blower intake/discharge connection size
7. Blower orientation (vertical or horizontal)
8. # of lobes on the blower

Installation

Intake and discharge silencers should be installed as close to the blower as possible. In most blower applications, silencers are attached to the blower ports either directly or after flexible connections. The following information is relevant to the blower system installation:

1. Size and length of intake and discharge piping
2. Piping configurations (i.e, number of elbows etc.)
3. Mounting arrangements of silencers
4. Blower application (e.g. food processing)

Site Conditions

Each application presents a unique set of circumstances depending on the acoustical environment, the vicinity of the blower, other local noise sources, length of pipe runs and so on. All relevant parameters should be considered to ensure that the noise level in the vicinity of the blower meets the design criteria. A blower may require other silencing techniques as well as various options and accessories depending on the application.

A number of options are available to reduce pipe and shell radiated noise in the vicinity of the blower. Consult a Silex Application Engineer for recommendations on appropriate techniques.

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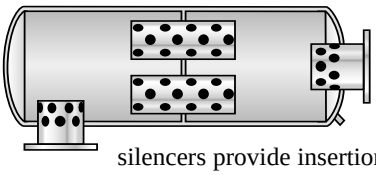
Silencer Types

In selecting silencers, blower capacity and silencer design are the critical issues. The silencer is sized in accordance with the blower capacity in order to accommodate the air or gas volume at the operating conditions of the blower. The silencer design is based on the blower size and operating speed. The four types of silencers typically used on the intakes and discharges of positive displacement blowers are:

1. Reactive
2. Combination reactive/absorptive
3. Straight through absorptive
4. Active noise cancellation

Reactive

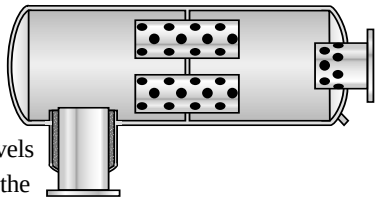
The reactive or chamber type silencer is used when the blower is operating below the transition speed and where the required noise reduction is not critical. This type is designed with a series of expansion chambers connected with non-resonating tubes which reduce the blower flow sound power by creating a series of cross-sectional discontinuities that, in effect, reflect the sound back towards the source. This design is generally more effective in the lower acoustical frequency ranges. Pressure drops across the units are in the order of 5" to 15" W.G. Reactive silencers provide insertion loss levels from 10 to 40 dB across the various frequency bands. For critical noise applications, reactive silencers are often connected in series with the straight through absorptive type silencer. Silex designs custom reactive silencers when the application requires insertion loss values higher than those produced by standard units.



Combination Reactive/Absorptive

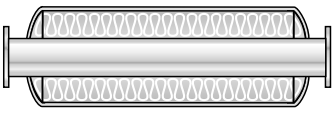
This type of silencer is used when a blower is operating above the transition speed or the required noise reduction is more critical. Acoustical sections are added to the reactive type design which reduce incident sound waves by converting into heat the acoustic energy propagating through the silencer. The addition of the acoustic sections provides improved acoustic performance in the higher frequency ranges. This feature improves the performance of reactive silencers and results in silencers that have a broad frequency range acoustic performance. The acoustic sections are typically located in the silencer nozzle adjacent to the blower.

Back pressure generated exceeds marginally those created by reactive designs and stems from the flow resistance created by the perforated liner in the acoustic section. The pressure drops across this type of silencer are in the range of 5" to 15" W.G. Acoustic performance will be higher than reactive silencers and produce insertion loss levels from 10 to 45 dB across the frequency bands. Silex designs custom reactive/absorptive silencers when the application requires insertion loss values higher then those produced by standard units.



Absorptive

This silencer is similar in design to the acoustically packed section of the combination reactive/absorptive silencers. It is typically larger in overall length and diameter then the acoustic sections thus providing increased acoustic performance over a broader frequency spectrum. Internal acoustically lined center bullets that provide additional acoustic performance are available upon request. These silencers are utilized where attenuation in the higher frequencies is required and where very low back pressure is specified. They are used quite often in series with reactive type silencers. The back pressures across these silencers will typically be less then 1" W.G. These silencers provide insertion loss levels between 10 to 45 dB across the frequency bands.



Active

The active industrial silencer is one where the sound field modification, particularly sound field cancellation, is achieved by electro-acoustical means. The system consists of a controller, one or more power amplifiers, an error microphone, a passive element, an active element (speakers) and an optional sync pickup. The controller analyzes the in-duct or exhaust noise and synthesizes an output signal that drives a speaker system to produce a sound field that is the exact mirror image of the source sound field. For additional information regarding an active noise system contact a Silex Application Engineer.

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Blower and compressor silencing products

Construction

Silex silencers are so well constructed that they are without equal in the industry.

All components are heavy gauge fully welded. The outer casing consists of two independent shells. The interior component of the shell is a heavy gauge carbon steel plate. On units up to 26” O.D., the outer component of the shell is heavy gauge aluminized steel; on units over 26” O.D., heavy gauge carbon steel. Shell components are integrally welded.

The end heads and internal heads of the silencer are a heavy gauge flanged and dished section. The inlet and outlet nozzles are manufactured from Sch. 40 carbon steel pipe. On units above 3½”, the inlet/outlet nozzles are supplied standard with 150 lb. ANSI flanges; on units 3½” and below, Sch. 40 male pipe nipples.

On combination reactive/absorptive silencers, the acoustically packed section is furnished with high temperature acoustic insulation separated from the airflow by a heavy gauge perforated lining.

Silencers are provided with a factory applied primer finish prior to shipping and shipped on individually fabricated shipping skids designed specifically for each unit.

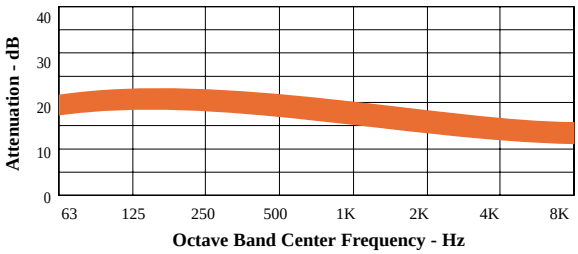
Installation

In general, silencers should be installed as close as possible to the machine on which they are used. A silencer may be installed at any angle. If installed horizontally, allow for a fall of 3/8” per foot to facilitate drainage at the lowest point of the silencer. Mounting brackets are supplied on request. Consult a Silex Application Engineer if a special silencer orientation is required.

Options and Accessories

Silex offers the broadest range of options and accessories in the industry including **mounting brackets, side inlet connections, clean out doors, rain shields, companion flanges and pressure relief connections.** Consult a Silex application engineer for special features required.

Typical Attenuation Curve



Attenuation Curves

Attenuation, insertion loss, noise reduction, transmission loss and acoustic performance are all terms used to describe the acoustic efficiency of an industrial silencer. For the purpose of this catalog, Silex has documented the acoustical specification as the “insertion loss” of the silencer. The insertion loss (IL) is defined as the change in the radiated sound pressure level resulting from the insertion of the silencer. Insertion loss is expressed as

$$IL = L_{before} - L_{after}\ dB$$

where L_{before} and L_{after} are the measured sound pressure levels at the same relative location with respect to the exhaust system outlet before and after the installation of the silencer.

Each silencer data page provides the typical insertion loss levels for each model. These levels can be used as a guideline for evaluating the noise levels of a blower after the silencers have been installed.

In applications where specific noise criteria are to be met, consult a Silex Application Engineer to ensure that all of the acoustical factors are considered including structure borne noise and silencer breakout sound. In applications when the required insertion loss of the silencer exceeds those of the standard units, Silex will design and manufacture a custom silencer to meet the specified insertion loss levels.

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