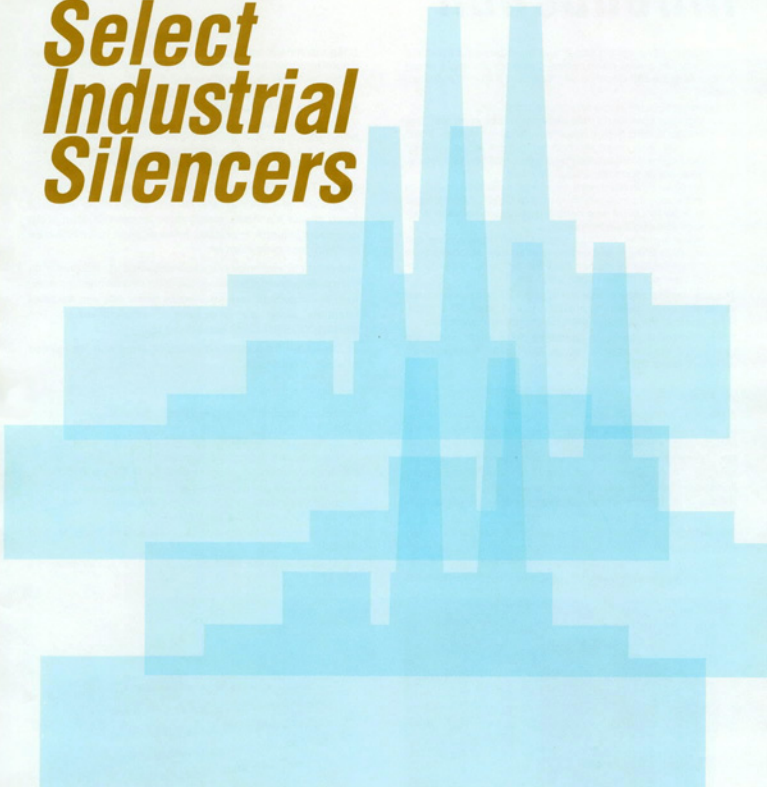


# How to Select Industrial Silencers



1-800-VIA-AERO  
(842-2378)



Made With Pride  
In The U.S.A.

# Introduction

The modern trend toward larger and more powerful industrial machinery will, unless noise control measures are taken, result in objectionable and illegal noise levels in and around industrial plants.

These objectionable noise levels can result in:

- Vigorous complaints from plant neighbors, often resulting in legal actions to shut down the offending machine. There are now legal noise level codes in most areas, defining the maximum allowable noise levels that you can legally generate at your plant boundary line.
- Noise levels in plant work areas higher than those defined as the maximum legally allowable by OSHA. This can lead to fines by OSHA and compensatable worker claims for work induced hearing damage.
- Noise levels in buildings below OSHA requirements but still high enough to interfere with spoken and telephone conversations or higher than the NC level required for efficient use of the space involved.

The solution to a noise problem is to install proper noise control equipment on the offending machinery or in some plant situations, enclose the operator within a soundproof enclosure.

If the machine is already in operation, noise levels generated by it can be measured with a sound level meter equipped with an octave band filter.

## A. FANS

A fan radiates noise equally through its inlet and its discharge. Usually either the inlet or outlet of a fan is connected to some sort of equipment which absorbs the noise from that side of the fan. Normally only the inlet or the discharge side has to be silenced. One exception is that type of air conditioning system in which both the fan inlet and discharge are ducted into occupied spaces. In these installations silencers are often required on both the inlet and discharge sides of the fan.

The AEROACOUSTIC Corp. has designed five series of fan silencers in a wide variety of sizes and capacities which are compatible with popular size airfoil blade and other type fans to reduce fan noise to required or legal levels. Also available are

If the machine is new, an estimate must be made of the noise levels, by octave bands, that will be generated by this machine. These estimates can be supplied by the builder of the machine. These machine noise levels must be measured or estimated at any location in which problems may develop as mentioned above. The above estimated or measured noise levels then can be compared with applicable criteria to determine whether noise controls are required and, if so, what noise reduction, by octave band, the noise control equipment must provide.

## SOLUTION TO NOISE PROBLEMS

In principle the solution to the noise problem is simple—the noise levels of your machinery merely must be reduced down to the applicable criterion. In practice, however, some noise reduction problems are quite complex.

The most efficient noise reduction solution depends greatly on the machine being silenced. Rather than discuss machine noise reduction in general, we have listed, by type of machine, the usual offenders along with the general solutions which The AEROACOUSTIC Corp. has worked out.

In Table 6 we have listed actual cases along with the method of noise control used.

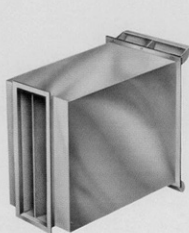
rainhoods, flow measuring piezometer tubes, and filter assemblies.

A discussion of methods for computing fan silencing requirements and listings of standard centrifugal fan inlet & discharge silencers is given in **Bulletin B-729A or B-929**.

In addition, fans are sometimes enclosed in acoustical (**B-235**) or concrete enclosures with splitter silencers (**B-433**) quieting the air inlet ducts to the enclosures.

If the fan discharges into a stack, a stack stuffer may be used (**B-238**).

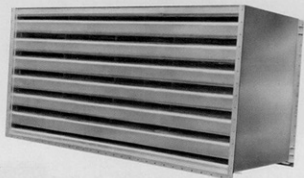
Large axial fans are silenced by means of splitter silencers (**B-433**).



Model IB  
Sound Trunks  
for a Centrifugal Fan



Silentstack™  
Stack Stuffer Silencer  
(installed in existing stack)

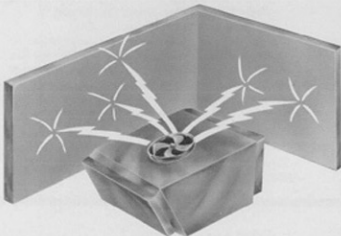


Silentflow®  
Splitter Silencer

### B. NOISY MACHINERY

A large variety of machinery requires to be acoustically isolated but not enclosed. The *Silentbarrier*<sup>™</sup> absorbs noise and casts an acoustical shadow between the source and the receiver. See *Bulletin B-234* for noise level reduction and *Silentbarrier*<sup>™</sup> height calculations.

For outdoor installations the *Silentbarrier*<sup>™</sup> is structurally designed for the wind load conditions.

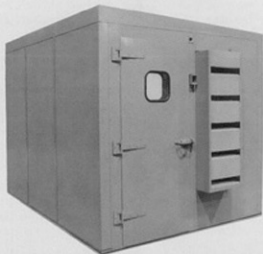


*Silentroom*<sup>™</sup>  
Gas Turbine Enclosure &  
Machinery and Equipment Enclosure

### C. NOISY MACHINERY

Many manufacturing processes develop large amounts of mechanical noise. Machines such as plastic dicers and pelletizers, ball bearing lines, internal combustion engines, gas turbines, etc., radiate sufficient mechanically generated noise to cause neighborhood complaints or worker-hearing damage and fatigue.

The solution to these problems is provided by enclosing the machinery in a soundproof enclosure. See *Bulletin B-235* for standard sizes. We can also supply non-standard sizes, odd shapes, silenced ventilation and material intake and discharge openings for our soundproof rooms.

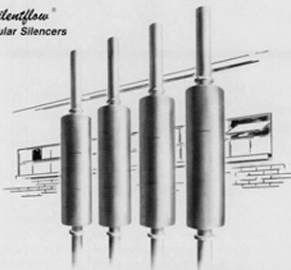


### D. POSITIVE DISPLACEMENT BLOWERS AND COMPRESSORS (Screw, Lobe, Vane and Piston Type)

These units are characterized by large amounts of low frequency noise at the piston, vane or lobe frequency. Positive displacement blowers are much noisier than centrifugal compressors of the same capacity. When choosing between centrifugal and positive displacement (vane, screw or piston) blowers you should include the cost of noise reduction equipment in your comparison.

If you must silence a positive displacement compressor, the Model T tubular silencer (B-136) is the best solution. Also, if you are pumping solids along with the air, these will pass through the unobstructed internal passages of the Model T silencer.

*Silentflow*<sup>®</sup>  
Tubular Silencers



## E. HIGH PRESSURE GAS

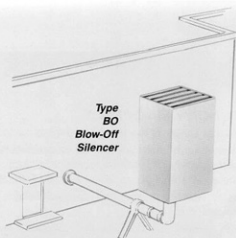
### DISCHARGES (BLOW OFF'S)

(Power Control Valves, Pressure Relief Valves, Snort Valves, Wind Tunnel Discharges, Pneumatic Actuator Exhausts, Etc.)

When a gas (air, steam or other) discharges to atmosphere at or over approximately 15 PSIG, the flow is supersonic and very noisy. The amount of noise generated can be calculated from the velocity (or pressure) temperature and volume flow. We can calculate noise levels from gas discharges for you.

Silencing is usually required for any high pressure discharge.

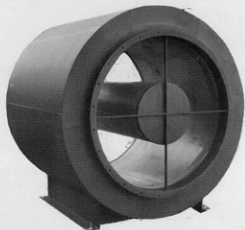
Special BO silencers have been developed for this use (B-332A).



## F. VANEAXIAL FANS

The AEROACOUSTIC *Silentflow*<sup>™</sup> vaneaxial fan silencers are acoustically and aerodynamically correct for reducing the noise emanating from the inlet and/or discharge of vaneaxial fans. These new silencers are exactly tuned for the very specific noise characteristics of vaneaxial fans. Over two years of Research and Development have gone into our proprietary fluid flow diffuser design. This new fluid flow diffuser design assures MINIMUM flow resistance and MAXIMUM static pressure system regain.

See **Bulletin B-137**.



## G. STACK NOISE AND SCRUBBERS

Often excessive noise is emitted from a stack which is connected to the noise generating machinery.

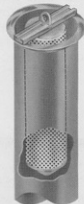
In this case, the best solution is often a *Silentstack*<sup>™</sup> Stack Stuffer or silencer designed to drop in to the stack itself.

This type of silencer is considerably less expensive than a normal silencer because the walls of the stack form the shell of the silencer. These are described in **Bulletin B-238**.

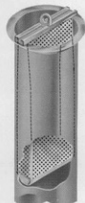
*Silentstack*<sup>™</sup>

Stack Stuffer  
Silencer  
(installed in  
existing stack)

Options also available  
with stack extension.



circular

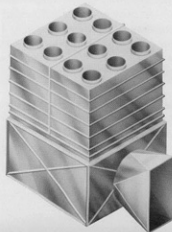


rectangular

## H. GAS TURBINES

Gas Turbine inlets and exhausts are very noisy and normally require silencing. Also, noise radiated from the turbine and gas generator case generally require that the whole machine be enclosed in a soundproof housing.

Our *Silentflow*<sup>®</sup> tubular type Gas Turbine Exhaust Silencing System, featuring long life and improved low frequency suppression, is described in **Bulletin B-131**. Inlet silencers for use with gas turbines are listed in the splitter silencer **Bulletin B-433**. Acoustic housings suitable for gas turbine enclosures are listed in **Bulletin B-235**. How To Silence Your Small Gas Turbine, **Bulletin B-67**.



*Silentflow*<sup>®</sup>  
Gas Turbine  
Exhaust Silencers

## I. JET ENGINE TEST CELLS

The AEROACOUSTIC Corp. has developed a very effective and long lived jet engine test cell exhaust treatment. This AEROACOUSTIC tubular treatment has solved the exhaust treatment life problem which formerly plagued users of jet engine test cells. Our original cells were installed in 1959 and have been in constant use, quieting afterburning jet engines ever since. No major maintenance has been required in these or our more than 70 other test cell exhaust treatments.

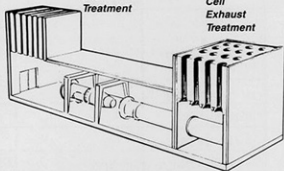
The AEROACOUSTIC Tubular Exhaust Treatment is described in **Bulletin B-51**, and **Bulletin B-51 Supplement A**. We also build a companion test cell inlet treatment. (B-433) Please consult us for your test cell requirements.

*Silentjet*<sup>TM</sup>

Splitter  
Type  
Test  
Cell  
Inlet  
Treatment

and

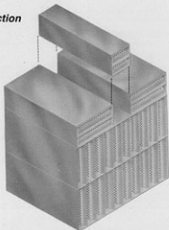
Model  
ST  
Tubular  
Test  
Cell  
Exhaust  
Treatment



## J. LARGE OPENINGS

Noise attenuation of large openings, with air flow, is accomplished by installing industrial splitter silencers, or light-weight duct silencers in modular form. See **Bulletin B-433** for industrial splitter silencers and **Bulletin AC-101** for duct silencers.

Modular Construction



Splitter  
or Duct  
Silencers

## K. DIESEL POWERED COMPRESSORS, GENERATORS, ETC.

The AEROACOUSTIC Corp. builds complete silencing packages for these units including cooling air inlet and exhaust silencers, and the acoustic housing itself.

These are designed to meet EPA or other acoustic criteria (B-148).

*Silentroom*<sup>®</sup>



Diesel Generator Enclosure

## L. ELECTRIC MOTOR SILENCERS

Large electric motors, especially TEFC motors are noisy and exceed OSHA requirements. The AEROACOUSTIC electric motor silencer reduces electric motor noise levels to OSHA requirements. (B-49).

Cooling Air  
Inlet Silencer



Cooling Air  
Exhaust Silencer

**TABLE 1  
RECOMMENDED INDOOR DESIGN GOALS FOR  
AIR-CONDITIONING SYSTEM SOUND CONTROL<sup>a</sup>**

TYPE OF AREA	RECOMM. RC OR NC CRITERIA RANGE	TYPE OF AREA	RECOMM. RC OR NC CRITERIA RANGE
1. Private residences	25 to 30	5. Hospitals and clinics	
2. Apartments	25 to 30	a. Private rooms	25 to 30
3. Hotels/motels		b. Wards	30 to 35
a. Individual rooms or suites	30 to 35	c. Operating rooms	35 to 40
b. Meeting/banquet rooms	25 to 30	d. Corridors	35 to 40
c. Halls, corridors, lobbies	35 to 40	e. Public areas	35 to 40
d. Service/support areas	40 to 45	6. Churches	25 to 30 <sup>b</sup>
4. Offices		7. Schools	
a. Executive	25 to 30	a. Lecture and classrooms	25 to 30
b. Conference rooms	25 to 30	b. Open-plan classrooms	30 to 35 <sup>b</sup>
c. Private	30 to 35	8. Libraries	35 to 40
d. Open-plan areas	35 to 40	9. Concert halls	15 to 20
e. Computer equipment rooms	40 to 45	10. Recording studios	15 to 20
f. Public circulation	40 to 45	11. Movie theaters	30 to 35

<sup>a</sup>Design goals can be increased by 5 dB when dictated by budget constraints or when noise intrusion from other sources represents a limiting condition.

<sup>b</sup>An acoustical expert should be consulted for guidance on these critical spaces.

**TABLE 2  
SOUND PRESSURE LEVELS ASSOCIATED WITH THE NC CURVES**

NOISE CRITERION CURVE	OCTAVE BAND CENTER FREQUENCY — Hz								OVERALL SPLA dBA
	62.5	125	250	500	1000	2000	4000	8000	
	SOUND PRESSURE LEVEL — dB								
NC-15	47	36	29	22	17	14	12	11	27
NC-20	51	40	33	26	22	19	17	16	31
NC-25	54	44	37	31	27	24	22	21	35
NC-30	57	48	41	35	31	29	28	27	40
NC-35	60	52	45	40	36	34	33	32	44
NC-40	64	56	50	45	41	39	38	37	49
NC-45	67	60	54	49	46	44	43	42	53
NC-50	71	64	58	54	51	49	48	47	58
NC-55	74	67	62	58	56	54	53	52	62
NC-60	77	71	67	63	61	59	58	57	67
NC-65	80	75	71	68	66	64	63	62	72

**TABLE 3**  
**NEMA (National Electrical Manufacturers Association)**  
**RECOMMENDED OUTDOOR NOISE CRITERIA**

NOTE: For use when no state or local ordinances prevail

NEMA - Criteria (See Code Key Below)	OCTAVE BAND CENTER FREQUENCY — Hz								OVERALL SPLA dBA
	62.5	125	250	500	1000	2000	4000	8000	
	SOUND PRESSURE LEVEL — dB								
A	58	44	37	32	28	25	22	20	37
B	63	50	43	37	34	31	28	25	42
C	67	56	48	43	39	36	33	31	47
D	71	60	53	47	44	41	38	35	52
E	75	65	58	53	49	46	43	41	57
F	79	70	62	57	54	51	48	45	62
G	83	74	68	63	59	55	52	50	67
H	87	79	72	67	64	61	57	55	72

**Urban—Residential**

Peaking—daytime only F  
 Peaking—nighttime only D  
 Continuous—daytime only E  
 Continuous—day and night C

**Urban—Nearby Industry**

Peaking—daytime only G  
 Peaking—nighttime only E  
 Continuous—daytime only F  
 Continuous—day and night D

**Area of Heavy Industry**

Peaking—daytime only H  
 Peaking—nighttime only F  
 Continuous—daytime only G  
 Continuous—day and night E

**Suburban—Residential**

Peaking—daytime only E  
 Peaking—nighttime only C  
 Continuous—daytime only D  
 Continuous—day and night B

**Very Quiet Suburban or Rural Residential**

Peaking—daytime only D  
 Peaking—nighttime only B  
 Continuous—daytime only C  
 Continuous—day and night A

**TABLE 4**  
**OSHA (Occupational Safety & Health Administration)**  
**FEDERAL REGULATIONS FOR HEARING CONSERVATION**

	OCTAVE BAND CENTER FREQUENCY — Hz								OVERALL SPLA dBA
	62.5	125	250	500	1000	2000	4000	8000	
	SOUND PRESSURE LEVEL — dB								
8 Hour daily exposure limit for heavy conversation	95	91	87	83	79	75	71	67	85
8 hour daily exposure limit where noise control is required	100	96	92	88	89	80	76	72	90
2 hour daily exposure limit	110	106	102	98	94	90	86	92	100
15 minute (¼ hr) daily exposure limit	125	121	117	113	109	105	101	97	115

**TABLE 5**  
**AEROACOUSTICS RECOMMENDED SPEECH**  
**INTELLIGIBILITY CRITERIA**

SPEECH INTELLIGIBILITY AT DISTANCE 4 FT.	OCTAVE BAND CENTER FREQUENCY — Hz								OVERALL SPLA dBA
	62.5	125	250	500	1000	2000	4000	8000	
	SOUND PRESSURE LEVEL — dB								
Excellent conversation conditions	69	59	51	45	42	40	39	38	51
Satisfactory conditions using normal vocal effort	79	69	61	55	52	50	49	48	61
Minimally acceptable conditions for short periods with raised vocal effort	89	79	71	65	62	60	59	58	71
Unacceptable conditions - shouting required	100	90	82	76	73	71	70	69	82

**TABLE 6  
TYPICAL SILENCER APPLICATIONS**

<b>Item Silenced</b>	<b>Flow, <math>\Delta</math>P, etc.</b>	<b>Criterion</b>	<b>Silencer Used</b>	<b>Bulletin</b>
Electronic Cooling Blower	1000 CFM @ 9"	65 db. at 10'	Splitter 12"x12" Model SPD-5	B-433
High Pressure Fan (Car Wash)	17,000 CFM @ 55"	Houses at 500' 45dBA	DF-18-4B	B-729A
High Pressure Fan (Pneumatic Conveyor)	10,000 CFM @ 45"	Hospital in same	DF-13-4B	B-729A
Low Pressure Fan (Air Conditioning System)	50,000 CFM @ 6"	Occupied Areas (NC35 in offices)	Splitter 38"x96" Model YY5	AC-101
Blower Powered Chip Conveyor (Roots Blower)	18,000 CFM + Plastic Chips	Houses at 500' 45dBA	Tubular Model 10T8	B-136
Forced Draft Fan-Centrifugal (Power Plant)	286,000 CFM @ 55"	Houses at 1000' 45dBA	Two Model 1B-150-4B	B-729A
High Pressure Fan (Industrial Application)	10,000 CFM @ 40"	In Plant Personnel 85dBA	CI-13-4B	B-729A
Cooling Tower Exhaust	70,000 CFM @ 25"	Office Bldg.— Tower in air shaft	Splitter 7'x7' Model Y4	AC-101
Cooling Tower Exhaust	90,000 CFM @ 25"	Apartment at 200'	Splitter 10'x10' Model SPE-3	AC-101
Gas Turbine Inlet	196,000 CFM	NEMA D @ 400'	Splitter 6'x10' Model SPB-10	B-433
Gas Turbine Exhaust	325 lbs./sec.	NEMA D @ 400'	<i>Silenflow</i> ® G.T. Exhaust	B-131
Scrubber	285,000 CFM @ 60"	Houses at 500' 45dBA	9'x40' Stack Stuffer Model SSA5	B-238
Scrubber	11,000 CFM @ 82"	Houses at 500' 45dBA	3'x15' Stack Stuffer Model SSA5	B-238
Jet Engine Test Cell Inlet	JT3D Engine	Houses at 2000' 45dBA	Splitter Inlet Treatment, 20'x20' Model SPB-10	B-433
Jet Engine Test Cell Exhaust	JT8D Engine	Houses at 2000' 45dBA	Tubular Exhaust Treatment, 24'x24' Model ST10	B-51
Jet Engine Test Cell Exhaust	F-100 "AB" Engine	45dBA—2000'	Tubular Exhaust Treatment, 20'x29' Model ST-14	B-51
High Pressure Air Discharge (Wind Tunnel)	126 lb./sec. @ 3000 p.s.i.	Houses at 500' 45dBA	Blowoff Type BO-20-3	B-332A
High Pressure Steam Discharge (Power Plant Power Relief Valve)	220,600 PPH @ 2695 p.s.i.	Quiet Suburban Area at 2000' dBA	Blowoff Type BO-50-3	B-332A
Dicing Machine	Cumberland Dicer	Workers' Hearing 90dBA	Special Enclosure-Model 4PH	B-235
Diesel Generator Set	8V71	75 dBA—7 meters	Model DH-8	B-148
Portable Compressors—Diesel	12V71	75 dBA—7 meters	Model DH-12	B-148
300 BHP TEFC Motor		90 dBA—1 meter	Electric Motor Silencer EM-400	B-49

Manufacturing  
3300 Corporation Way  
Darlington, SC 29532  
Fax 843-398-0660  
Tel 843-398-1006



**THE  
AEROACOUSTIC  
CORP.**

1-800-VIA-AERO

(842-2376)

Manufacturing & Accounting Div.  
169-193 Highland Parkway  
Roselle, New Jersey 07203  
Fax 908-241-8818  
Tel 908-241-8600