SILENCER SYSTEM EFFECTS

VIBRO-ACOUSTICS by Swegon

THE FOLLOWING are guidelines to estimate increased pressure losses due to varying silencer inlet and discharge conditions. These should be considered only as very approximate guidelines. Substantial variations can occur depending upon the type of silencer, its internal geometry, size of silencer, size of duct, airflow turbulence, etc.

Note: the factors shown do NOT include pressure drops of the duct element. These must be added separately.

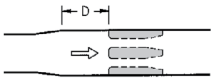
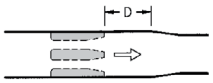
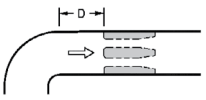
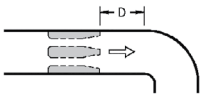
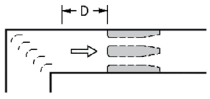
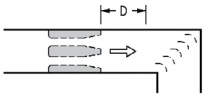
To determine the allowable silencer catalog pressure drop for selection and specification purposes:

Allowable Catalog Silencer PD =

Total Allowable Silencer Pressure Drop including System Effects

(Inlet System Effect Factor x Outlet System Effect Factor)

Vibro-Acoustics' V-A Design allows the user to evaluate system effects when selecting silencers. More information on V-A Design.

Duct Element	Silencer system effect factor duct element on...	
	Silencer Inlet	Silencer Discharge
Transitions		
7-1/2 degrees per side Distance of transition from silencer		
D1 = 1	1.0	1.0
D = 2	1.1	1.1
D = 3	1.2	1.1
25 degrees per side Distance of transition from silencer		
D = 1	1.3	1.1
D = 2	1.6	1.1
D = 3	1.8	1.1
45 degrees per side Distance of transition from silencer		
D = 1	1.7	1.1
D = 2	1.9	1.1
D = 3	2.0	1.1
Elbow - radius type Distance of radius elbow from silencer		
D = 0	1.2	1.4
D = 1	1.1	1.2
Elbow - mitered type with short turning vanes Distance of mitered elbow from silencer		
D = 0	1.2	1.1
D = 1	1.2	1.1
D = 2	1.2	1.2

[1] D is the diameter of round duct or equivalent diameter of rectangular duct.

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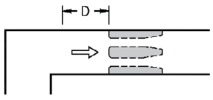
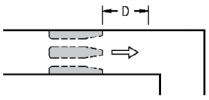
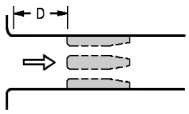
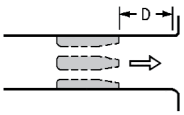
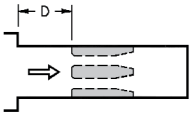
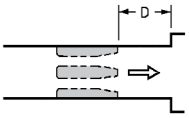
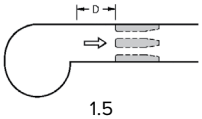
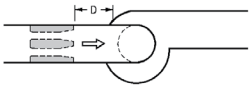
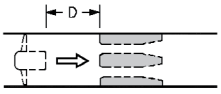
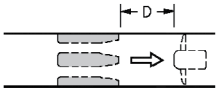
Duct Element	Silencer system effect factor duct element on...	
	Silencer Inlet	**Silencer Discharge**
Elbow - mitered type with no turning vanes Distance of mitered elbow from silencer		
D[1] = 0	1.2	2.9
D = 1	1.0	1.8
D = 2	1.1	1.4
Abrupt entry or exit **Smooth Inlet or Discharge** Distance of entry or exit from silencer		
D = 0	1.1	1.8
D = 1	1.0	1.4
D = 2	1.0	1.1
D = 3	1.0	1.0
Abrupt entry or exit **Sharp Inlet or Discharge** Distance of entry or exit from silencer		
D = 0	1.2	2.0
D = 1	1.1	1.5
D = 2	1.0	1.2
D = 3	1.0	1.0
Centrifugal fan Distance of centrifugal fan from silencer		
D = 0	1.5	2.0
D = 1	1.2	1.7
D = 2	1.1	1.5
D = 3	1.0	1.2
Axial fan (Also see below - effect of silencer on fan) Distance of axial fan from silencer		
D = 0	1.5	2.0
D = 1	1.2	1.7
D = 2	1.1	1.5
D = 3	1.0	1.2

[1] D is the diameter of round duct or equivalent diameter of rectangular duct.

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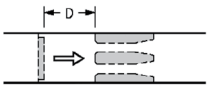
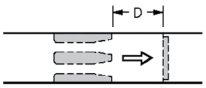
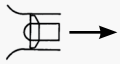
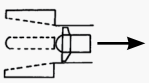
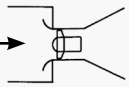
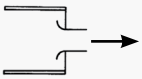
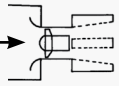
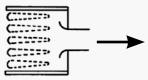
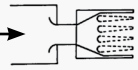
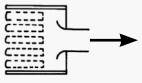
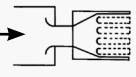
Duct Element	Silencer system effect factor duct element on...	
	Silencer Inlet	Silencer Discharge
Coils or filters		
Distance of coils or filters from silencer		
D[1] = 0	1.6	1.6
D = 1	1.0	1.3
D = 2	1.0	1.1

[1] D is the diameter of round duct or equivalent diameter of rectangular duct.

AXIAL/FAN SILENCER SYSTEM EFFECTS

The effects of various Free Air Silencer Inlets/Discharges upon horsepower consumed by an Axial Fan in a Constant System with Constant Air Flow. Percentages are indicative only, and would differ in different systems.

FREE INLET		H.P. CONSUMED			FREE DISCHARGE
Standard Bellmouth Inlet		Constant System 100%	100% Constant System		Abrupt fan discharge to room ❹
❶ Inlet cone silencer well matched to fan hub		Constant System 99%	97% Constant System		Fan manufacturer's evase
Acoustic plenum		Constant System 105%	97% Constant System		Discharge cone Silencer well matched to fan motor hub ❺
❷ Plenum with aerodynamic low turbulence splitters		Constant System 106%	99% Constant System		Non-aerodynamic evase (typical) & aerodynamic splitters
❸ Plenum with blunt turbulent splitters		Constant System 110%	104% Constant System		Non-aerodynamic evase (typical) & blunt non-aerodynamic splitters ❻

SEE DIAGRAM

❶ Inlet Cone Silencer must be aerodynamically matched to fan hub, otherwise H.P. consumed increases considerably to 105% - 110% or more!

❷ Splitters designed so turbulent wake is gone before reaching plane of the fan blades, for lowest fan noise.

❸ Blunt, untapered splitters with either radius or sharp edged tails, create excess turbulence & fan noise from turbulence.

❹ Although unlikely in practice, this was chosen as the reference configuration.

❺ Discharge Cone Silencers must be matched to fan motor hub, or fan H.P. can be well in excess of 100%!

❻ Blunt, untapered splitters do not allow pressure/velocity recovery before dumping air to the room causing excessive, abrupt expansion pressure losses.

General Notes: A. If a fan consumes less horsepower, it generates less noise and therefore needs less silencing.
B. Turbulence allowed to impinge upon the plane of the axial fan blades can create 10-15 dB or more excess fan sound power.