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Aldes ME Flash

N°30 – September 2011

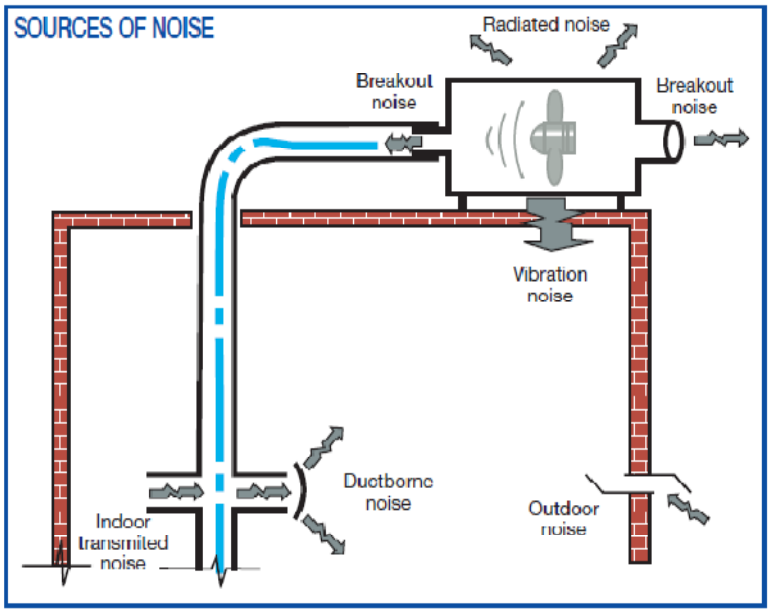
Technical Information

How to select a sound attenuator?

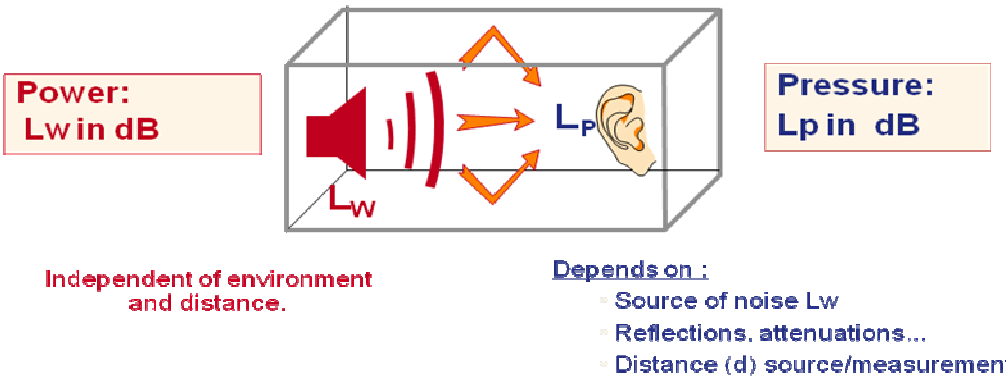
Introduction

Noise is defined as any **unwanted sound** perceived by the hearing sense of a human being. Excessive noise can impair hearing and may also put stress on the heart, the circulatory system, and other parts of the body. Worker exposure to excessive noise over an extended period may result in a permanent loss of hearing. The introduction of a noise source into a given environment can be potentially hazardous, as well as objectionable to nearby tenants and residents – depending on its sound level.

Every situation in noise control involves a system composed of three basic elements: **Source, Path** and **Receiver**. Before a solution to a complex noise problem can be designed, **the dominant source of the noise must be known**, the characteristics of the **significant transmission path must be understood**, and **acceptable noise level must be available**.



Sound power (Lw) and Sound Pressure (Lp)



Sound attenuators

In ventilation systems, noise stems from a variety of components such as the fans or the fire dampers. To comply with a **specified noise level**, **sound attenuators** are installed at suitable locations in the ventilation system. The sound attenuators should have adequate silencing capabilities, low air resistance and be as small as possible.

Type of sound attenuators

Rectangular
→ for attenuation of noise propagating through **rectangular ducts**.
- Straight case
- Vertical & Horizontal bend type

Circular
→ for attenuation of noise propagating through **circular ducts**.
-Without central pod
- With central pod

Cross Talk
→ to prevent transfer of noise between adjacent spaces.

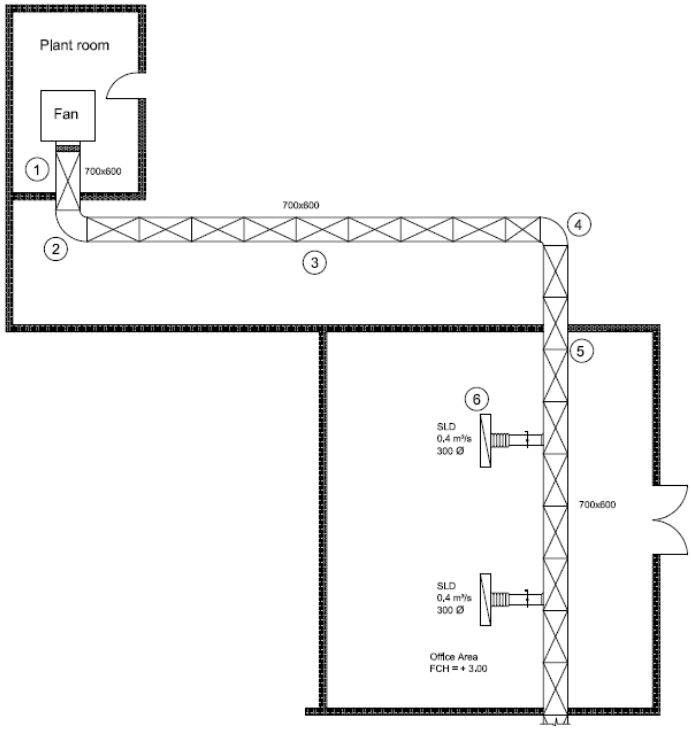
Insertion Loss (dB)

Insertion loss of a sound attenuator is the difference between the noise levels measured **before** and **after** the insertion of a sound attenuator.

Procedure to calculate required insertion loss & select a sound attenuator

System layout with different elements

Ref	Type	W	H	Length/Type
1	Duct	700	600	2 m
2	Bend	700	600	Radiussed
3	Duct	700	600	12 m
4	Bend	700	600	Radiussed
5	Duct	700	600	5 m
6	Outlet	3-slots	diffuser	1200 mm long



Sound power of fan (manufacturer's data)

Fan type: Centrifugal
Duty: 2.5 m^3/s
Sound power level at mid frequency octave bands

Hz	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
dB	85	90	86	91	87	87	80	72

Critical room details

Room volume : 300 m^3
Room height : 3 m
Outlet : 3 slot diffuser 1200 mm long each slot diffuser handles 0.4 m^3/s

Critical room noise criterion

Office Area : NC 35 @ 1.5m from the noise outlet

Procedure in Aldes sound attenuators calculation & selection software

1 Calculating Sound Power Level (SWL) leaving system

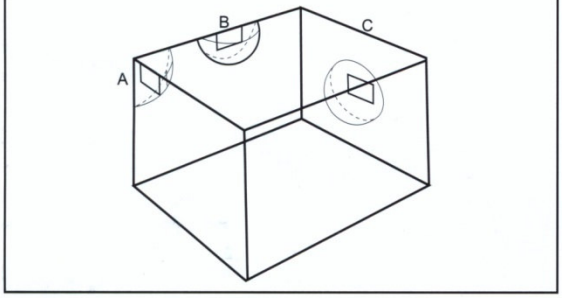
- Enter the sound power level and airflow of the noise source (fan) in the selection software.
- Identify the critical outlet, trace-out the path from source to the critical outlet in critical room and enter the sizes & lengths of ducts, branches, elbows etc.
- Enter the size of the critical outlet.

2 Calculating Direct Sound Pressure Level (SPL)

- Enter the airflow coming out of the critical outlet.
- Enter the distance from critical outlet to the listener.
- Select the position of the critical outlet (Directivity) as per below table.

Table 7 : Directively factors, dB

Type A	Junction of three room surfaces = + throughout

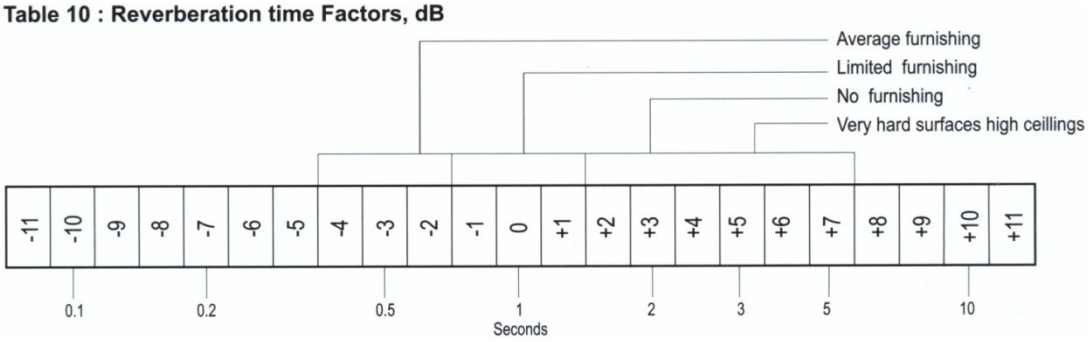


Type B	Junction of two room surface			Octave centre frequency in Hz	Type C	Centre of one room surface			
Outlet area, cm^2					Outlet area, cm^2				
10	100	1000	10000		10	100	1000	10000	
+6	+7	+8		63	+3		+4	+5	+6	+7
+6	+7	+8		125	+3		+4	+5	+6	+7	+8
+6	+7	+8	+9	250	+3	+4	+5	+6	+7	+8	+9
+6	+7	+8	+9	500	+3	+4	+5	+6	+7	+8	+9
+7	+8	+9		1k	+4	+5	+6	+7	+8	+9	
+7	+8	+9		2k	+5	+6	+7	+8	+9		
+7	+8	+9		4k	+7	+8	+9				
+8	+9			8k	+8	+9					

3 Calculating Reverberant Sound Pressure Level (SPL)

- Enter the total airflow in the critical room.
- Enter the concerned room dimensions (Area & Height)
- Select the appropriate reverberation time as per below table.

Table 10 : Reverberation time Factors, dB



4 Calculating Combined Sound Pressure Level (SPL)

It is the sum of Direct SPL and Reverberant SPL by decibel addition as per below given table.

Table 11: Addition of Sound Pressure Levels, dB

Differences in SPLs	Add to Larger SPL
0,1	+3
2,3	+2
4,5,6,7,8,9	+1
10+	+0

5 Required Insertion Loss

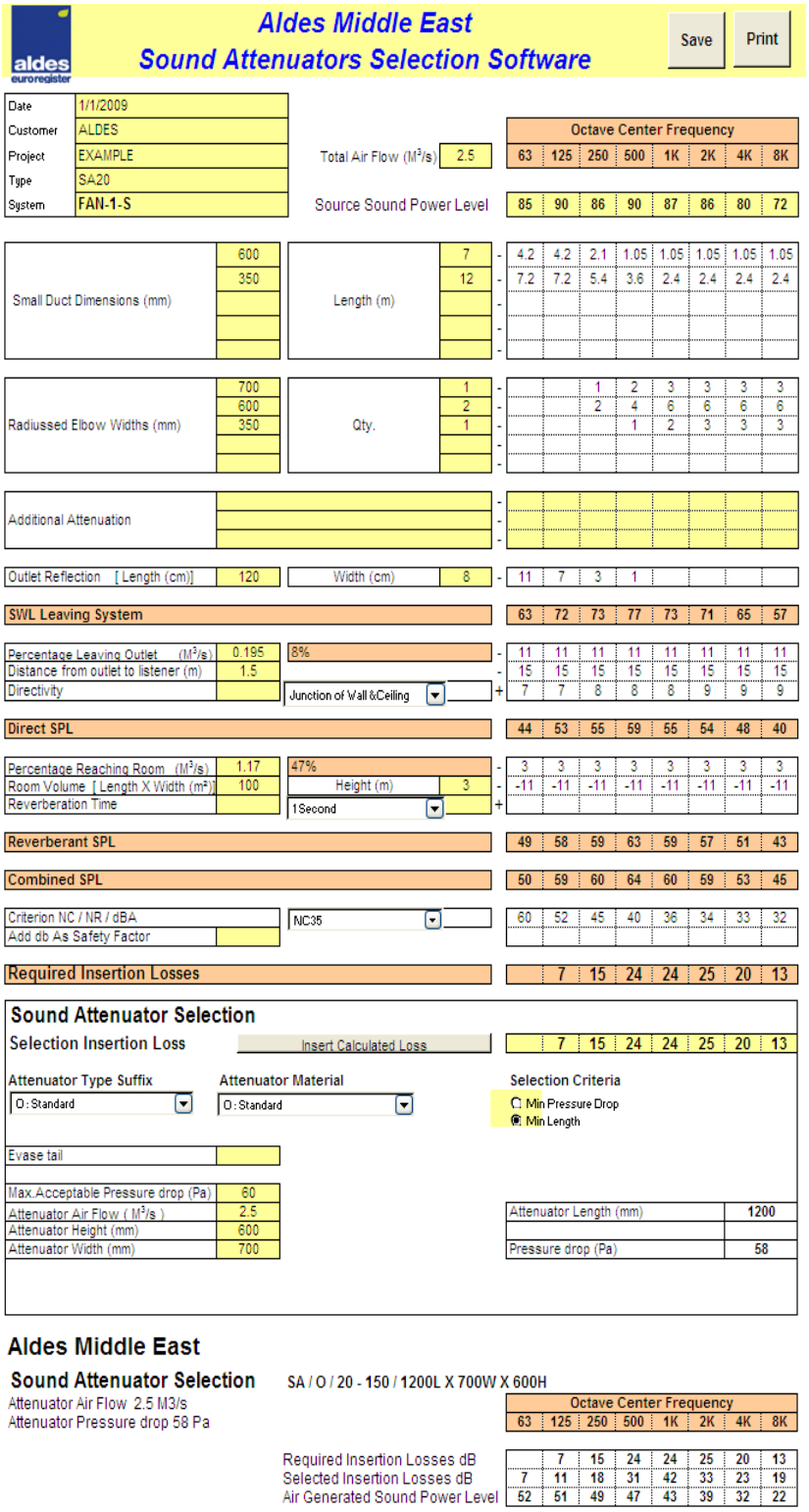
- Select the **required Room Criterion** e.g. NC 35.
- Required insertion losses are calculated automatically by deducting **Room Criterion** from ***Combined SPL***.

6 Selection of Sound Attenuator

- Select the attenuator type suffix e.g. standard, bend horizontal, bend vertical, …
- Select the attenuator material e.g. standard, SS 304, SS 316, …
- Enter the maximum acceptable pressure drop.
- Enter the maximum airflow through the sound attenuator.
- Selection is done by clicking on Insert Calculated Loss tab.
- Select the optimum length & pressure of the attenuator by manipulating in between different width and height combinations to get required insertion loss.

Aldes sound attenuators Calculation & Selection software

Screen shot



Aldes Middle East
Sound Attenuators Selection Software

Save | Print

Date	1/1/2009
Customer	ALDES
Project	EXAMPLE
Type	SA20
System	FAN-1-S

Total Air Flow (M^3/s): 2.5

	Octave Center Frequency							
	63	125	250	500	1K	2K	4K	8K
Source Sound Power Level	85	90	86	90	87	86	80	72
Small Duct Dimensions (mm) 600 × 350, Length (m) 7	4.2	4.2	2.1	1.05	1.05	1.05	1.05	1.05
Small Duct Dimensions (mm) 600 × 350, Length (m) 12	7.2	7.2	5.4	3.6	2.4	2.4	2.4	2.4
Radiussed Elbow Widths (mm) 700, Qty. 1			1	2	3	3	3	3
Radiussed Elbow Widths (mm) 600, Qty. 2			2	4	6	6	6	6
Radiussed Elbow Widths (mm) 350, Qty. 1				1	2	3	3	3
Additional Attenuation								
Outlet Reflection [Length (cm)] 120, Width (cm) 8	11	7	3	1				
SWL Leaving System	63	72	73	77	73	71	65	57
Percentage Leaving Outlet (M^3/s) 0.195 (8%)	11	11	11	11	11	11	11	11
Distance from outlet to listener (m) 1.5	15	15	15	15	15	15	15	15
Directivity: Junction of Wall &Ceiling	7	7	8	8	8	9	9	9
Direct SPL	44	53	55	59	55	54	48	40
Percentage Reaching Room (M^3/s) 1.17 (47%)	3	3	3	3	3	3	3	3
Room Volume [Length X Width (m^2)] 100, Height (m) 3	-11	-11	-11	-11	-11	-11	-11	-11
Reverberation Time: 1 Second								
Reverberant SPL	49	58	59	63	59	57	51	43
Combined SPL	50	59	60	64	60	59	53	45
Criterion NC / NR / dBA: NC35	60	52	45	40	36	34	33	32
Add db As Safety Factor								
Required Insertion Losses		7	15	24	24	25	20	13

Sound Attenuator Selection

Selection Insertion Loss — Insert Calculated Loss

	7	15	24	24	25	20	13

Attenuator Type Suffix: O : Standard

Attenuator Material: O : Standard

Selection Criteria: ○ Min Pressure Drop ◉ Min Length

Evase tail

Max Acceptable Pressure drop (Pa)	60
Attenuator Air Flow (M^3/s)	2.5
Attenuator Height (mm)	600
Attenuator Width (mm)	700

Attenuator Length (mm)	1200
Pressure drop (Pa)	58

Aldes Middle East

Sound Attenuator Selection SA / O / 20 - 150 / 1200L X 700W X 600H

Attenuator Air Flow 2.5 M3/s

Attenuator Pressure drop 58 Pa

	Octave Center Frequency							
	63	125	250	500	1K	2K	4K	8K
Required Insertion Losses dB		7	15	24	24	25	20	13
Selected Insertion Losses dB	7	11	18	31	42	33	23	19
Air Generated Sound Power Level	52	51	49	47	43	39	32	22