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# SOUND ATTENUATOR



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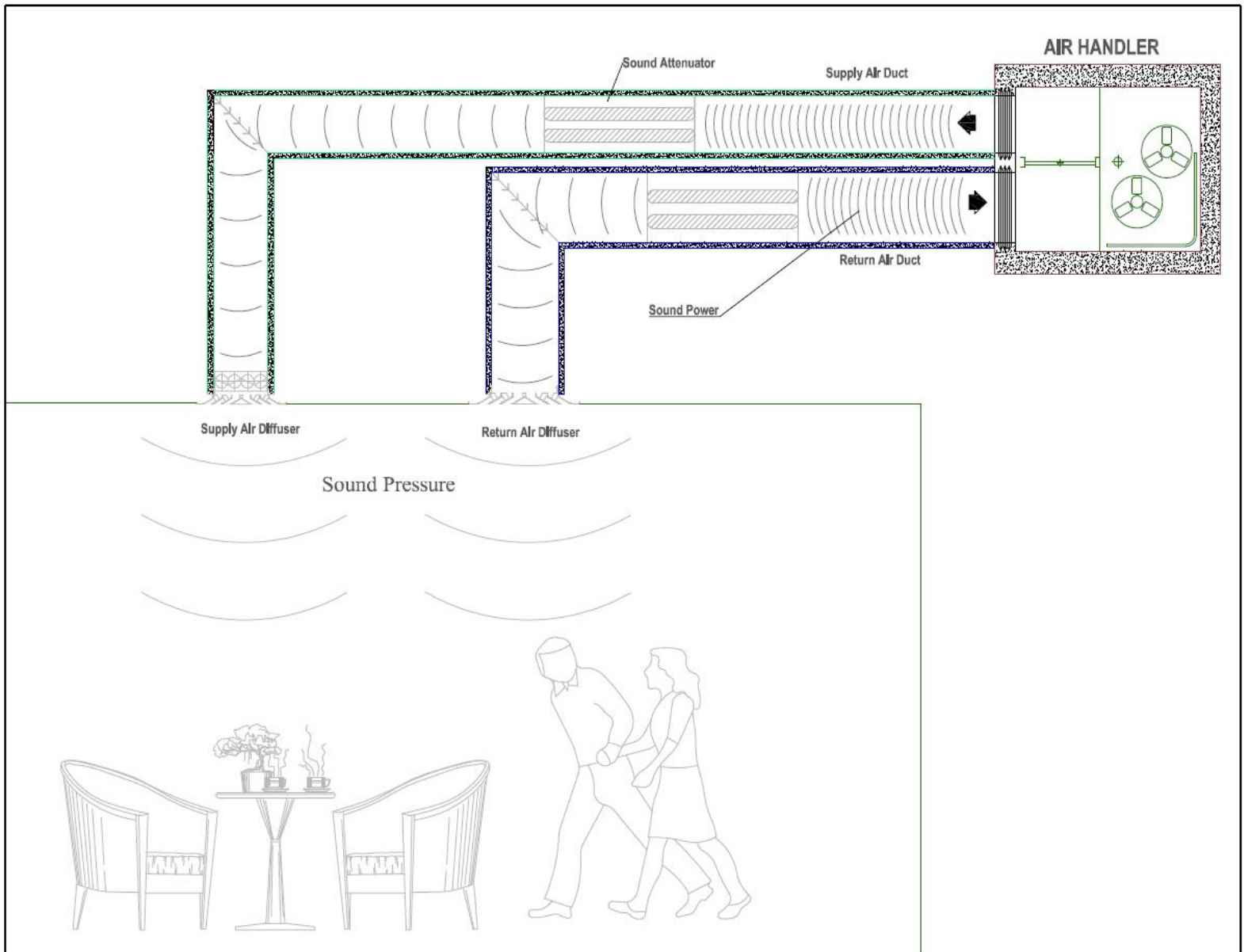
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Cover Page Photo

German University - Oman

## SILENCER TERMINOLOGY OVERVIEW

In a HVAC system, the potential noise sources are AHU, terminal units and room air outlets. The sound wave generated by these sources transfer its energy throughout the duct and to the occupant's area as shown below.



Sound Power and Sound Pressure are different in that **Sound Power** is a measure of total energy per unit time emitted by the source in all directions. **Sound pressure** is a measure of pressure variation at the receivers location.

**Sound Pressure** is dependent on the acoustic environment. The factors involved include the effects of nearby reflecting surfaces, receiver distance, type of space, the amount of location in the space, the presence of barriers, and the intrusion of ambient sounds. Therefore, the sound pressure resulting from a given AHU – generated sound power depends on :

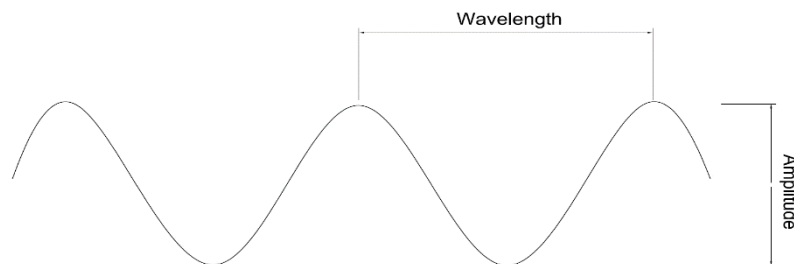
- Distance from the AHU to the room
- The size of the room
- The absorptive properties of interior furnishings
- Attenuating elements such as silencers, duct liner, duct branches, elbows , etc

## Sound Power Output

AHU equipment supplier provides sound power data as given in below table. The quietest sound we might measure is  $10^{-12}$  Watts (0dB) and the loudest noise is that of space shuttle during take off which is  $10^8$  Watts (200 dB)

Source	W Exponential	Decibel Ref $10^{-12}$ w
Power Generator	$10^{-2}$	100
Air Handling Unit	$10^{-3}$	90
Voice, Conversation level	$10^{-5}$	70
Exhaust Fan	$10^{-6}$	60
Air Diffuser	$10^{-7}$	50
Voice, Soft Whisper	$10^{-9}$	30
Threshold of Hearing	$10^{-12}$	0

## Sound Wave



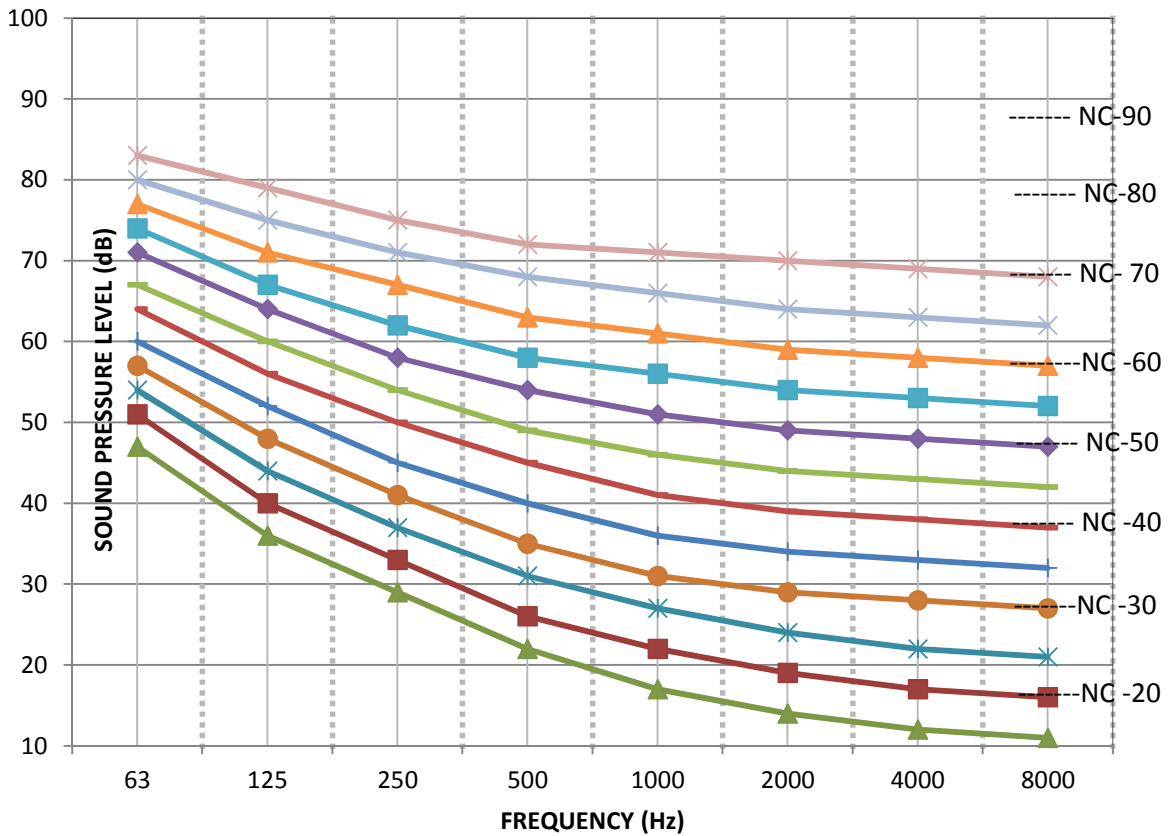
**Insertion loss** is the decrease in sound pressure levels that can be expected when a silencer is inserted into the path between the source and the receiver.

**Pressure Drop** is the difference in static pressure from the inlet to the outlet.

**Regenerated Noise** is the sound power created when airflows through a silencer at a given velocity and direction (forward or reverse).

**Noise Criteria (NC)** is a single number rating derived from sound pressure levels in all eight octave bands, and is intended to predict an occupant's response to the overall sound level. The critical octave bands for evaluating sound performance ranges from 63 to 8000 Hz. To determine C rating value, sound pressure levels are plotted with a family of criterion curves shown in Figure. The level which intersects the highest curves determines the overall NC rating.

### NC DIAGRAM



### dB Level Increase for Equal Sound Sources

Sound Sources	Level Increase in dB
1	0
2	3.0
3	4.8
4	6.0
5	7.0
6	7.8
7	8.5

Sound Sources	Level Increase in dB
8	9.0
9	9.5
10	10.0
12	10.8
16	12.0
20	13.0

## Calculating an NC Value

The NC rating can be obtained by plotting the octave band levels for a given noise spectrum against the NC curves.

In this example, the following 1:1 octave bands have been measured:

Frequency Hz	63	125	250	500	1000	2000	4000	8000
Octave Band Level dB	74.1	75.3	68.9	59.6	49.3	42.9	41.0	35.8

These values can be compared to those in the NC data table and a value obtained for each octave band. The NC value is the lowest NC curve which is not exceeded by each individual frequency band.

Frequency Hz	63	125	250	500	1000	2000	4000	8000
Octave Band Level dB	74.1	75.3	68.9	59.6	49.3	42.9	41.0	35.8
NC Value	NC 55	NC65	NC65	NC60	NC50	NC45	NC45	NC40

The highest of these is the 125Hz band with an NC value of 65 and therefore the overall NC for this measurement is NC 65.

### NC DATA TABLE

Noise Criterion	Octave Band Center Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
	Sound Pressure Levels (dB)							
NC-15	47	36	29	22	17	14	12	11
NC-20	51	40	33	26	22	19	17	16
NC-25	54	44	37	31	27	24	22	21
NC-30	57	48	41	35	31	29	28	27
NC-35	60	52	45	40	36	34	33	32
NC-40	64	56	50	45	41	39	38	37
NC-45	67	60	54	49	46	44	43	42
NC-50	71	64	58	54	51	49	48	47
NC-55	74	67	62	58	56	54	53	52
NC-60	77	71	67	63	61	59	58	57
NC-65	80	75	71	68	66	64	63	62
NC-70	83	79	75	72	71	70	69	68

## Indoor Design Goals for Air Conditioning Sound Control (As Per ASHRAE 2001, Fundamentals, Chapter 7, Table 11.)

Type of Area	Recommended NC Criteria Range
Private Residences	25-30
Hotel Meeting Rooms	25-30
Office Conference Rooms	25-30
Office Computer Equipment Rooms	40-45
Hospital Wards	30-35
Hospital Operating Rooms	35-40
Mosque	25-30
School Lecture And Class Rooms	25-30
School Open – Plan Classrooms	30-35
Libraries	35-40
Concert Halls	30-35
Legitimate Theatres	30-35
Recording Studios	30-35
Movie Theatres	30-35
Laboratories With Fume Hoods	30-35

SOUND ATTENUATOR  
RECTANGULAR**CONSTRUCTION:**

**Casing:** High quality galvanized steel sheet of 0.9mm thickness (standard); up to 1.2mm for bigger sizes.

**Splitters/Baffles:** “Bull-Nose” construction using high quality perforated galvanized steel sheet of 0.7mm thickness. 200mm splitter width is standard.

**Acoustic Media:** Inorganic, fire resistant, vermin and moisture proof sound absorbent rock wool of 64kg/m<sup>3</sup> or 50kg/m<sup>3</sup> density.

**Liner:** Single faced to prevent the media from entering into the air stream.

**Flange:** Duct mate flange of 35mm width.

**Description:**

- Aerodynamically designed to ensure maximum insertion loss and minimal pressure drop. Air-gap and length of silencer are selected to meet the required NC level.
- Sturdy construction and high noise absorbing capacity to obtain required insertion loss without compromising performance. Manufactured to ensure long and maintenance free service.
- Splitters are radiused at both ends giving a bell mouth entry-exit to minimize self generated noise and pressure loss.
- Full width splitters in the middle and half width side splitters.
- Casing construction with lock formed seams meet SMACNA standards thus providing excellent strength and rigidity. Thoroughly sealed to prevent air leakage.
- Duct mate flange connection (standard) on both ends in compliance with DW144 standards.
- Acoustic infill media is of superior quality non combustible & have fungi resistant characteristics meeting the requirements of **EN ISO 1182 and ASTM C665** respectively. It has excellent noise reduction coefficient characteristics with an additional qualification of being biologically inert.
- Tested and certified by Intertek USA (NVLAP accredited laboratories) in accordance with ASTM standard E477-06a, entitled “standard method of testing duct line material and prefabricated silencers for acoustical and airflow performance”.

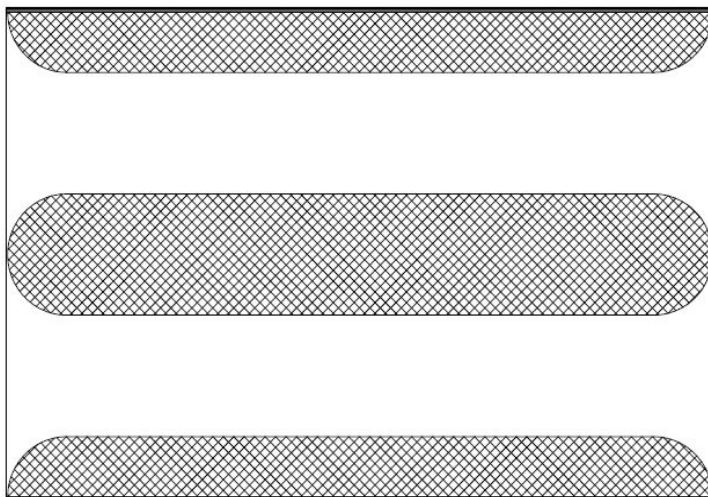
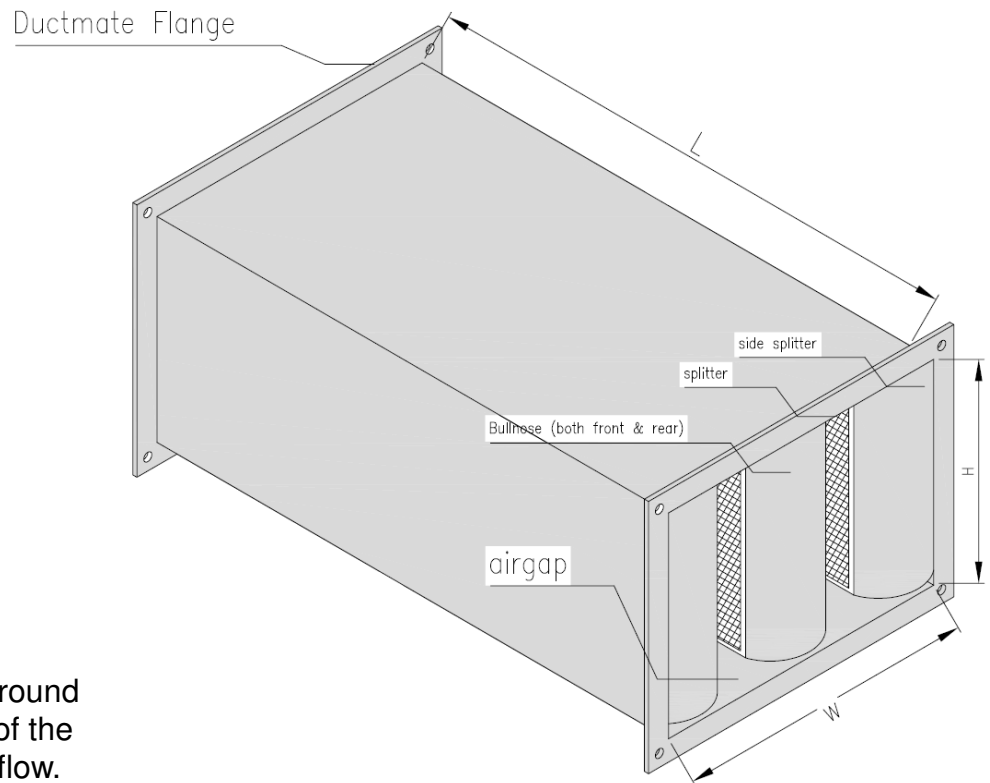


## Low Pressure Drop Rectangular Type Sound Attenuator

- **Silencer Splitter** is constructed of solid and perforated metal that is located inside the silencer which protrudes into the air stream and house the acoustic media.

- **Air gap** is a gap between two splitters, standard available gaps are 75,100,125,150,175 & 200mm

- **Bull nose** is constructed as round convex shape on both side of the splitter to provide smooth airflow.



# SOUND ATTENUATOR RECTANGULAR

## Options Available Upon Request (Non Standard)

- Flange : M.S angle frame
- Flange width : 30mm or 40mm
- Media : Fiber glass woven glass fabric as liner
- Air gap: From 50mm – 250mm to suit product requirement
- Casing Material: Stainless steel or Aluminium.
- Baffle thickness : 100mm or 300 mm

## Product Summary:

Model	Product Description	Remarks
ARL	Rectangular Silencer	

## Installation Guide:

- Do not place the silencer immediately after the noise source like air handler or blower in order to allow uniform flow profile to develop. Leave at least 2-5 duct diameters in the upstream and downstream of the silencer for better silencer efficiency.
- Do not expose the silencer to dirt or excess humidity while installation or during storage.
- The HVAC system should be designed meticulously for proper dehumidification and air- filtration to prevent microbial growth within the silencer and the duct system.
- It is recommended to install the silencer after the volume control damper to prevent regenerated noise.

## Product Order Checklist:

- Required room sound criteria.
- Airflow data for each silencer
- Duct size and maximum length available for silencer to fit in.
- Details of the air-handling units with its noise levels.
- CAD drawings with clear details of duct routing from each unit and duct- size till the first air outlet.

## CONSTRUCTION:

**Casing:** High quality galvanized steel sheet of 0.9mm thickness (standard); up to 1.2mm for bigger sizes.

**Splitters/Pod:** Centre splitter (Pod) construction using high quality perforated galvanized steel sheet of 0.7mm thickness.

**Acoustic Media:** Inorganic ,fire resistant , vermin and moisture proof sound absorbent rock wool of 50kg/m<sup>3</sup> density.

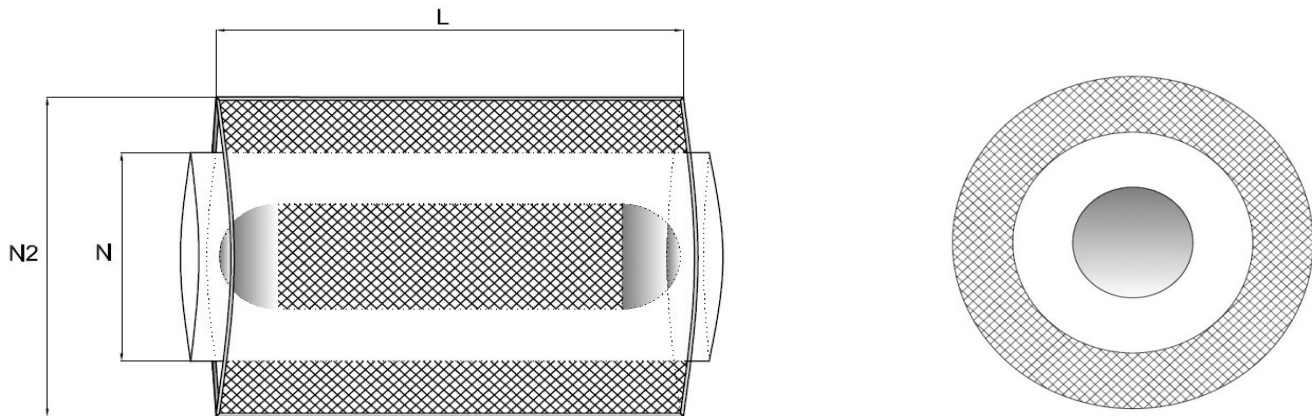
**Liner:** Single faced to prevent the media from entering into the air stream.

**Flange:** Slip connections on both ends.

## Description:

- Circular silencer construction provides maximum acoustical performance , while minimizing system pressure drop even at high velocities . Desired aerodynamic performance is achieved by avoiding the need for square to round reducers that will increase the pressure drop.
- Sturdy construction and high noise absorbing capacity to obtain required insertion loss without compromising performance . Manufactured to ensure long and maintenance free service.
- Centre splitter (Pod) are radiused at both ends to minimize self generated noise and pressure loss.
- Full width splitter in the middle and half width side splitters at the circumference .
- Casing construction with lock formed seams meet SMACNA standards thus providing excellent strength and rigidity . Thoroughly sealed to prevent air leakage.
- Slip connection on both ends in compliance with DW144 standards.
- Acoustic infill media is of superior quality non combustible & have fungi resistant characteristics meeting the requirements of **EN ISO 1182 and ASTM C665** respectively. It has excellent noise reduction coefficient characteristics with an additional qualification of being biologically inert.

## Circular Silencer Dimensional Details



## Model ACL with 50mm Side Splitter

N (mm)	N2 (mm)
200	300
250	350
300	400
350	450
400	500
450	550
500	600
550	650
600	700
650	750
700	800
750	850
800	900
850	950
900	1000
950	1050
1000	1100

## Model ACL with 100mm Side Splitter

N (mm)	N2 (mm)
200	400
250	450
300	500
350	550
400	600
450	650
500	700
550	750
600	800
650	850
700	900
750	950
800	1000
850	1050
900	1100
950	1150
1000	1200

- Available Standard Length 600,900,1200,1500mm

\* Please contact airmaster sales team for further details.

## Options Available Upon Request (Non Standard)

- Flange : M.S angle frame
- Flange width : 30mm or 40mm
- Media : Fiber glass woven glass fabric as line
- Air gap: From 50mm – 250mm to suit product requirement
- Casing Material: Stainless steel or Aluminium.
- Baffle thickness : 100mm or 300 mm

## Product Summary:

Model	Product Description	Remarks
ACL	Circular Silencer	

## Installation Guide:

- Do not place the silencer immediately after the noise source like air handler or blower in order to allow uniform flow profile to develop. Leave at least 2-5 duct diameters in the upstream and downstream of the silencer for better silencer efficiency.
- Do not expose the silencer to dirt or excess humidity while installation or during storage.
- The HVAC system should be designed meticulously for proper dehumidification and air- filtration to prevent microbial growth within the silencer and the duct system.
- It is recommended to install the silencer after the volume control damper to prevent regenerated noise.

## Product Order Checklist:

- Required room sound criteria.
- Airflow data for each silencer
- Duct size and maximum length available for silencer to fit in.
- Details of the air-handling units with its noise levels.
- CAD drawings with clear details of duct routing from each unit and duct- size till the first air outlet.

SOUND ATTENUATOR  
CROSS TALK

## CONSTRUCTION:

**Casing:** High quality galvanized steel sheet of 0.9mm thickness (standard); up to 1.2mm for bigger sizes.

**Splitters/Baffles:** Construction using high quality perforated galvanized steel sheet of 0.7mm thickness.

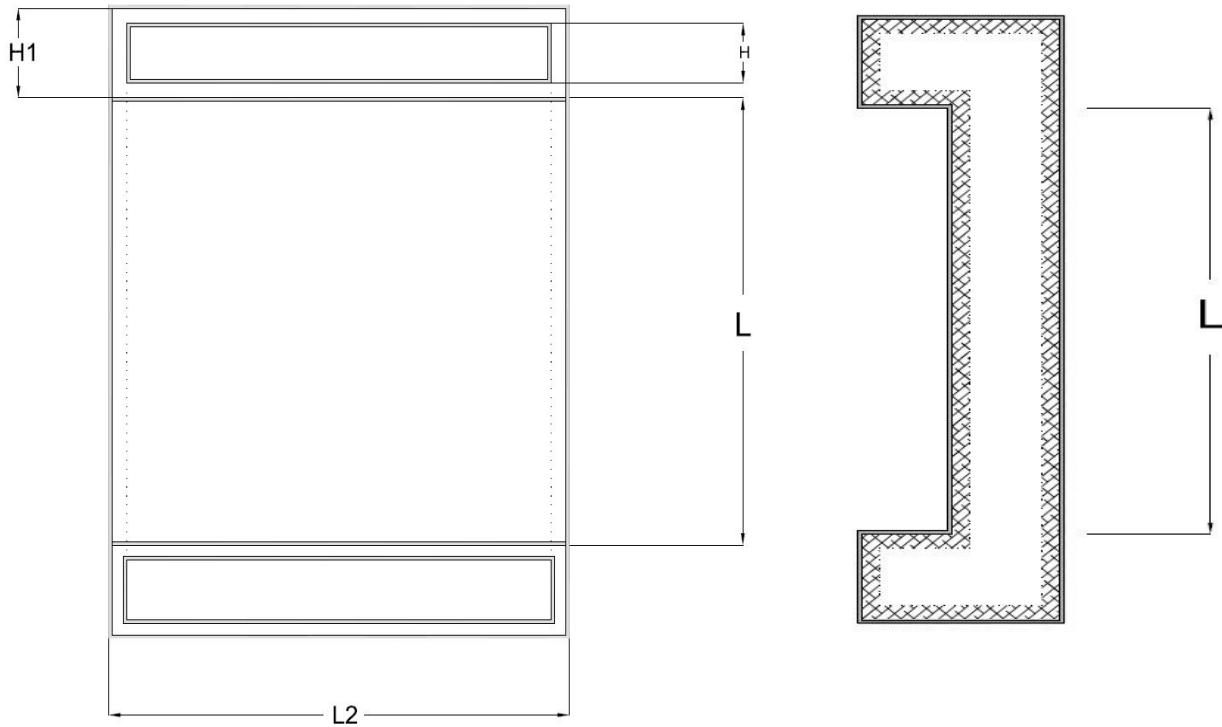
**Acoustic Media:** Inorganic ,fire resistant , vermin and moisture proof sound absorbent rock wool of 50kg/m<sup>3</sup> density.

**Liner:** Single faced to prevent the media from entering into the air stream.

**Flange:** Duct mate flange or slip connection.

- Aerodynamic design to ensure maximum insertion loss and minimal pressure drop. Air-gap and length of silencer are selected to meet the required NC level.
- Cross talk silencer is primarily used to reduce the noise interference between interconnected rooms while maintaining the smooth airflow with acceptable pressure drop level.
- Sturdy construction and high noise absorbing capacity to obtain required insertion loss without compromising performance . Manufactured to ensure long and maintenance free service.
- Splitters are radiused at both ends to minimize self generated noise and pressure loss.
- Casing construction with lock formed seams meet SMACNA standards thus providing excellent strength and rigidity . Thoroughly sealed to prevent air leakage.
- Duct mate flange or slip connection (standard) on both ends in compliance with DW144 standards.
- Acoustic infill media is of superior quality non combustible & have fungi resistant characteristics meeting the requirements of **EN ISO 1182** and **ASTM C665** respectively. It has excellent noise reduction coefficient characteristics with an additional qualification of being biologically inert.

## ACT Dimensional Details



L (mm)	L1 (mm)	L2 (mm)	H (mm)	H1 (mm)
900	300	400	150	250
900	400	500	150	250
900	500	600	150	250
900	600	700	150	250
900	700	800	150	250
900	800	900	150	250
900	900	1000	150	250
900	1000	1100	150	250
900	1100	1200	150	250
900	1200	1300	150	250

### Options Available Upon Request (Non Standard)

- Flange : M.S angle frame
- Flange width : 30mm or 40mm
- Media : Fiber glass woven glass fabric as line
- Casing Material: Stainless steel or Aluminium.

### Product Summary:

Model	Product Description	Remarks
ACT	Cross Talk Silencer	

### Installation Guide:

- Do not place the silencer immediately after the noise source like air handler or blower in order to allow uniform flow profile to develop. Leave at least 2-5 duct diameters in the upstream and downstream of the silencer for better silencer efficiency.
- Do not expose the silencer to dirt or excess humidity while installation or during storage.
- The HVAC system should be designed meticulously for proper dehumidification and air- filtration to prevent microbial growth within the silencer and the duct system.
- It is recommended to install the silencer after the volume control damper to prevent regenerated noise.

### Product Order Checklist:

- Required room sound criteria.
- Airflow data for each silencer
- Duct size and maximum length available for silencer to fit in.
- Details of the air-handling units with its noise levels.
- CAD drawings with clear details of duct routing from each unit and duct- size till the first air outlet.



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