a perfect partner in performance...

Airwellcare

A complete range of engineered noise control for Air Handling Systems

Management System ISO 9001:2008

TÜVRheinland CERTIFIED

www.tuv.com ID 9105080818

SOUND ATTENUATORS

Our Product Ranges

Dampers

1 Fire Dampers
2 Fire / Smoke Dampers
3 Volume Control Dampers
4 Motorized Control Dampers
5 Pressure Relief Dampers /Non Return Dampers

Variable Air Volumes

6 Pressure Independent VAV
7 Constant Air Volume VAV
8 By Pass VAV

Louvers

9 Sand Trap Louvers
10 Acoustic Louvers
11 Stationery Louvers / Architectural Louvers
12 Storm Louvers
13 Weather Louvers

Sound Attenuators

14 Rectangular Sound Attenuators
15 Circular Sound Attenuators
16 Crosstalk Attenuators

Electric Duct Heaters

17 Flange & Slip 'n' Type
18 Modulating & On/Off Type

Air Outlets

19 Registers & Grilles
20 Diffusers (Linear Diffusers, Sq. & Rect. Ceiling Diffusers, Round Diffusers, Jetflow Diffusers
21 Swirl Diffusers & Disc Valves
22 Drum Louvers

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At a Glance

HVAC equipment for a building is one of the major sources of interior noise, and its effect on the acoustical environment is important. Further, noise from equipment located outdoors often propagates to the community.

Therefore, mechanical equipment must be selected, and equipment spaces designed, with an emphasis on both the intended uses of the equipment and the goal of providing acceptable sound levels in occupied spaces of the building and in the surrounding community.

The source of the sound is the noise-generating mechanism. The sound travels from the source via a path, which can be through the air (airborne) or through the structure (structureborne), or a combination of both paths, until it reaches the receiver (building occupant or outdoor neighbor).

There are many possible paths for airborne and structure-borne sound and vibration transmission between a sound source and receiver.

Sound Attenuators applications :

- Generator Rooms in Commercial & Industrial Sectors
- Cooling Towers & Chiller Yards
- Attenuators for Fans & Blowers
- Acoustic enclosure ventilations
- Electrical Substations
- Barrier Wall Systems
- Commercial and Industrial Duct Systems

Selection & Design

Airwellcare facilities for manufacturing of Attenuators are one of the key strengths of our business and enable us to produce high quality attenuator products at the lowest manufacturing costs in local & International markets. The processing speed through our factory also provides large production capacity and short lead times, which can be of significant benefit to our clients.

All units are designed and manufactured to the highest quality standards and incorporate such features as to provide clear unrestricted airway passage.

Noise control involves

(1) selecting a quiet source

(2) optimizing room sound absorption,

(3) designing propagation paths for minimal noise transmission.

Paths of Noise & Vibration propagation in HVAC System

- Structure borne path through floor.
- Airborne path through supply air system.
- Duct break out from supply air duct.
- Airborne path through return air system.
- Airborne path through mechanical equipment Room wall.

Selecting Adequate & Economic Silencers

Selecting the proper Airwellcare Silencer will ensure adequate and economical sound attenuation for your application.

How to select

1. The first step is to analyze your system and determine the amount of noise reduction required. This is expressed as insertion loss in decibels when referring to silencer acoustical performance data.
2. You will also need to know the maximum amount of resistance you can add to the air flow that your system can handle. This is expressed as static pressure drop.
3. Additional resistance for the fan or air moving equipment in the system will have to be able to overcome to maintain the same air flow and efficiency.

Data required for selecting proper Attenuator

1. The design insertion losses (IL) at each octaveband frequency, ranging from 63 Hz up to 8000 Hz.
2. The design airflow rate through each silencer with the maximum permissible pressure drop across each silencer.
3. Duct connection size, and the maximum permissible length for the silencer (if applicable).
4. Maximum static pressure drop.
5. Room Dimensions (W x H x L)

Note -1 : If the information is NOT available on S.No.1 above, fan sound power spectrum and the design noise criteria (NC) shall be required. Under this condition, Airwellcare make scertain assumptions while selecting the attenuators. Please note that the selection made by Airwellcare must be checked and approved by the design consultant in the absence of the required/specified IL. As an equipment manufacturer, Airwellcare is NOT responsible for the system design.

Note -2 : Please note that Airwellcare's standard silencer lengths are 600, 900, 1200, 1500, 1800, 2100 & 2400mm long.

Once you have this information you will be able to simply select the silencer size and model that matches your criteria.

Software enabled selection programme

- Select attenuators from the Airwellcare range, and choose construction features and options for each attenuator.
- Select attenuators based on various parameters of input data such as attenuator or duct size, air volume, pressure loss, insertion loss etc.
- Choose the most appropriate attenuator from a list of selections that meet the input criteria.

Attenuator Features

Key Elements of Attenuator Manufacturing

Once the Sales Order is generated, this data is stored within a Production Schedule, which manages the production process and also provides labour and material requirements planning. When attenuators are loaded onto the shop floor a series of Batch Instructions are compiled that contain all the necessary information to produce that group of items. A unit label is also printed for each attenuator that clearly shows key identification and manufacturing details, such as the project name, item reference and description, model code, size, etc.

As an attenuator batch moves through production its progress is tracked on the Production Schedule, which can be viewed from our sales office. This enables us to provide very accurate feedback to clients on the anticipated delivery date for their order.

When a batch is completed a further package of documentation is produced to control dispatch and delivery of the attenuators. The documentation that we use throughout the attenuator production process is an integral part of our Quality Management System.

These systems contribute significantly in helping us to produce and deliver attenuators as efficiently and quickly as we can. The systems should also give clients confidence in our ability to deliver quality goods on time.

Airwellcare Sound Attenuators design flexibility and Sound Calculations allows to adjust :

- Attenuator Splitter Thickness
- Airway Gap between splitters
- Acoustic Filling Properties
- Length to Suit application of Attenuators

Optional Construction

In addition to the attenuators constructed from galvanised sheet steel, Airwellcare can also provide attenuators constructed from a range of other materials where required :

- **Casing** : where more thickness is required apart from standard thick. of 1.0 mm & 1.2 mm for high pressure duct systems.
- **Stainless steel**: for duct systems handling corrosive chemically laden air, or with high standards of cleanliness, or for external applications, etc.
- **Heavy duty galvanised steel** : for industrial applications, or where casings need to be welded for very high pressure duct systems, etc.

Melinex Protected Infill

Melinex protected infill is an option available for all attenuator models, where fibre egress must be negligible for clean applications, such as clinical areas in hospitals, pharmaceutical clean rooms, laboratories, etc. Melinex should also be used when the attenuator will be handling moisture or chemically laden air, or when cleaning will be required, so that the infill is protected.

Attenuator Paint Options

Colour Paint Finish for internal & external surfaces respectively. The attenuators are polyester powder coated to a standard colours, to provide protection against corrosive atmospheres, such as swimming pools, coastal locations, etc.

Noise Definitions

Sound Power Level (SWL) Vs Sound Pressure Level (SPL)

The difference between SPL and SWL: **SPL is the sound pressure level** =20 log P/Pref. P is sound pres-sure in N/m2 and Pref = 20 x 10-6 N/m2, while **SWL is sound power level** = 10 log W/Wref, where W is sound intensity in Watts and Wref = 10-12 Watt. The sound is is coming out from the source as SWL and when it travels spherically its intensity will be distributed over sphere area which makes it pressure SPL.

Octave Bands

An octave band is a frequency band where the highest frequency is twice the lowest frequency. For example, an octave filter with a centre frequency of 1 kHz has a lower frequency of 707 Hz and an upper frequency of 1.414 kHz. In HVAC Industry, the octave bands in general comprising 63, 125, 250, 500, 1K, 2K, 4K & 8K Hz.

Frequency (Hz)

The pitch of sound. The number of sound pressure waves arriving at a fixed point per second.

Insertion loss

Insertion Loss is the reduction in the sound power level at the receiver after the silencer is installed (inserted) in the system. Insertion loss is measured as a function of frequency and commonly published in full octave bands ranging from 63 to 8000 Hz.

A silencer's insertion loss varies depending on whether sound is traveling in the same or opposite direction as airflow. Silencer performance changes with absolute duct velocity.

However, airflow velocity generally does not significantly affect silencers giving a pressure drop of 0.35 in. of water or less, including system effects.

Decibel (dB)

The decibel (dB) is used to measure sound level. The dB is a logarithmic way of describing a ratio. The ratio may be power, sound pressure, voltage or intensity or other.

Background Noise & Breakout Noise

Background Noise is the irreducible noise level measured in the absence of any building occupants when all of known sound sources have been turned off.

Breakout noise is the transmission of mechanical equipments or air system noise through duct walls.

Regenerated Noise

Regenerated Noise is the sound generated by the duct due to air flow in dB (ref 10-12 watt).

Moreover, regeneration of sound caused by passing of air through duct elements such as dampers, Air outlets, splitters and other installed mechanical components in the Duct.

Reverberant Time

This is the plus or minus contribution of the room reflections (reverberation) in dB.

Total Pressure Loss

Total pressure loss is determined by substracting the differential pressure across the attenuator from the differential pressure across the substitution duct.

A total pressure loss coefficient is calculated for each attenuator by measuring the total pressure loss at five different airflow rates.

Attenuator Ranges & Models

Rectangular Straight line Attenuators

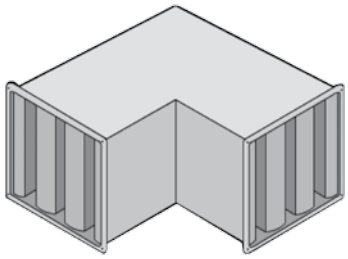
Model : AHS 75/100/150 RSA

Where space is of a premium, this standard design can be incorporated

Circular Sound Attenuators

Model : AHS 200 CSA

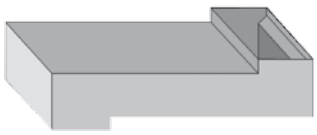
A circular duct attenuator constructed from galvanised sheet steel, with a peripheral, out of air stream acoustic lining. Larger units also available with a central acoustic pod. End connections can either be spigots or end ring flanges with threaded inserts for direct connection to plant, such as axial flow fans, etc.



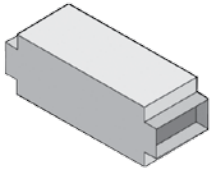
Square Bend Attenuators

Model : AHS 300 SBA

Square bend attenuators requiring high degrees of attenuation within minimum space requirements



Type A



Type B

Crosstalk Attenuators

Model : AHS 400 CRA & AHS 400 CRB

Crosstalk attenuators, specifically designed and tuned to suit all sorts of speech privacy situations

Airwellcare offers all the above Types & Models of Attenuators with a dedicated experience team who can undertake all aspects of computerized sound analysis & do calculate technically to produce a highly engineered solution to your unwanted noise problem and any noise control issue.

Attenuator Constructional Specification

Rectangular Straight Line Attenuators MODEL : AHS 75/100/150 RSA

Casing

Casing is made of 1.0mm Thick (20 Gauge) galvanized steel. Casing provided with 30mm flanges as standard.

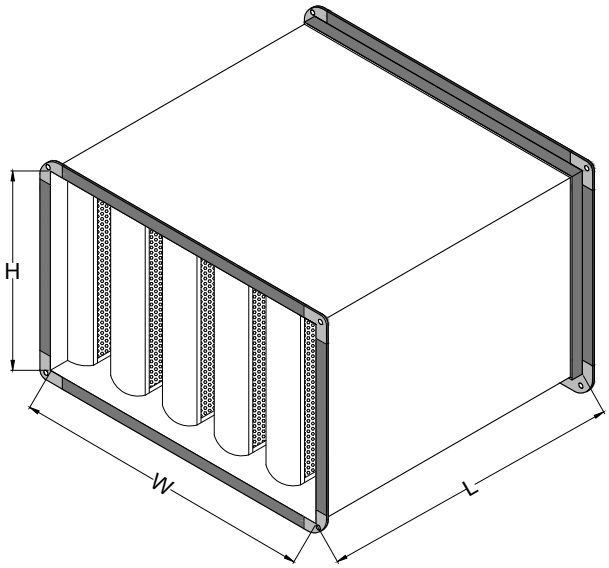
High-pressure duct sealant is applied inside the casing along the length of each seam, and for rectangular casings behind each flanged corner that coincides with a seam, to provide an airtight seal.

Splitters

Splitters are made of 0.8mm Thick high quality Galvanized Perforated Sheets, which are internally insulated with acoustic fiberglass material.

Splitters are formed to thickness options from 75 to 400mm wide centre splitters with different Airway area from 50mm to 250mm. The Attenuator shall be provided with Side Splitters.

All internal splitters having aerodynamic shaped fairings, being mechanically lock-formed to the perforated metal splitter casing and stiffened in such a way as to eliminate splitter deformation.



Airway Area & Width

Airway area & Width may differ based on technical calculations & Attenuator final dimensions.

Flanges

Attenuators fitted with external galvanized steel flanges of 30mm with Corners of 105mm will help in arresting leakages, which also provides firmness & stability to Ducts, thereby creating effective barrier against pressure drop. Flange corner holes fitted with M8 nutserts to enable easy connection.

Single & Multiple Section Assembly

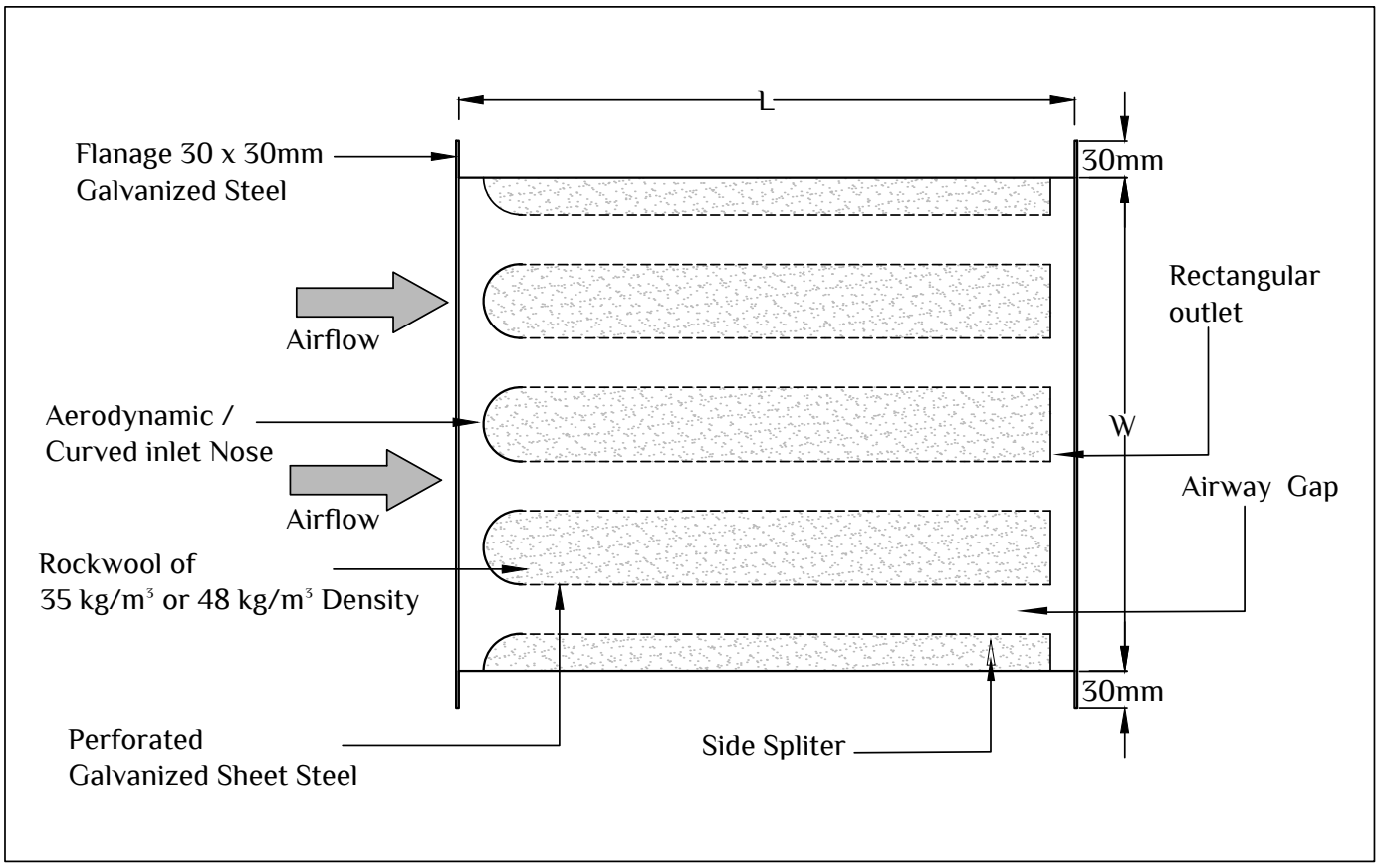
Airwellcare attenuators are supplied in Multiple Sections, when any of the below dimensions are exceeded :

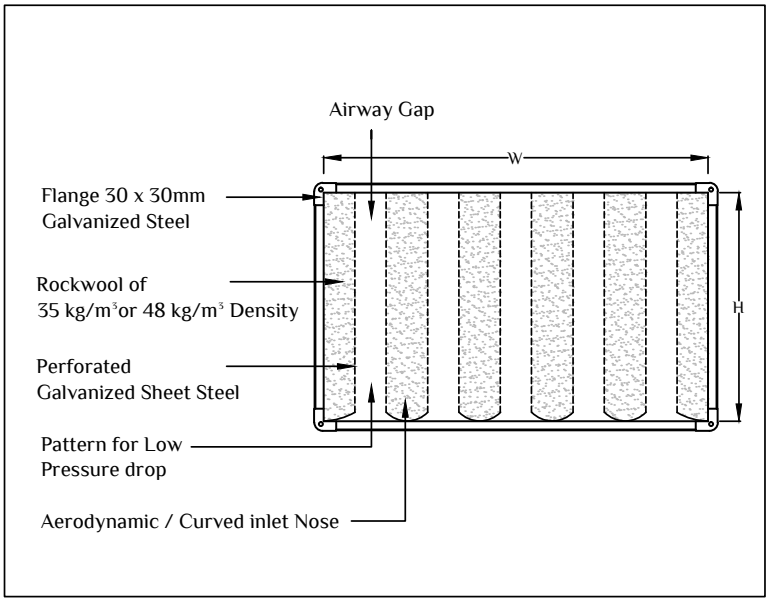
W=2100, H= 1800 L = 2100mm.

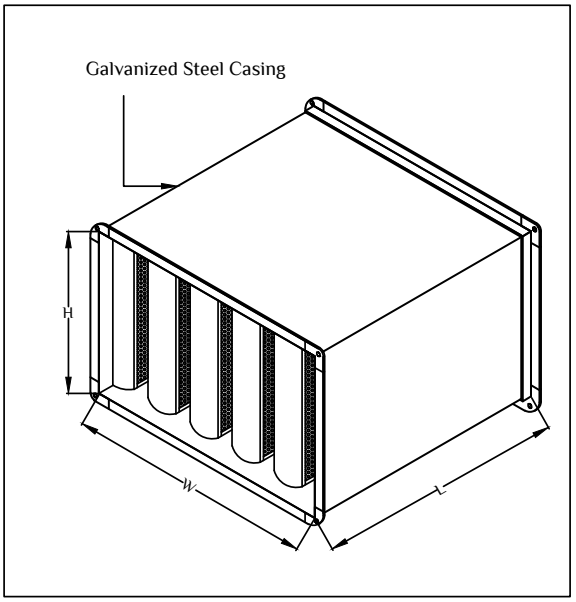
The assembly of multiple section attenuators will be carried out by others at site, based on the manufacturers instruction & guidelines.

Attenuator Dimensional Details

Rectangular Straight Line Attenuators MODEL : AHS 75/100/150 RSA







Attenuator Constructional Specification

Square Bend Attenuators Model : AHS 300 SBA

Casing

Casing is made of 1.0mm Thick (20 Gauge) galvanized steel. Casing provided with 30mm flanges as standard.

High-pressure duct sealant is applied inside the casing along the length of each seam, and for rectangular casings behind each flanged corner that coincides with a seam, to provide an airtight seal.

Splitters

Splitters are made of 0.8mm Thick high quality Galvanized Perforated Sheets, which are internally insulated with acoustic fiberglass material.

Splitters are formed to thickness options from 75 to 400mm wide centre splitters with different Airway area from 50mm to 250mm. The Attenuator shall be provided with Side Splitters.

All internal splitters having aerodynamic shaped fairings, being mechanically lock-formed to the perforated metal splitter casing and stiffened in such a way as to eliminate splitter deformation.

Vertical or Horizontal Splitter orientations.

Airway Area & Width

Airway area & Width may differ based on technical calculations & Attenuator final dimensions.

Flanges

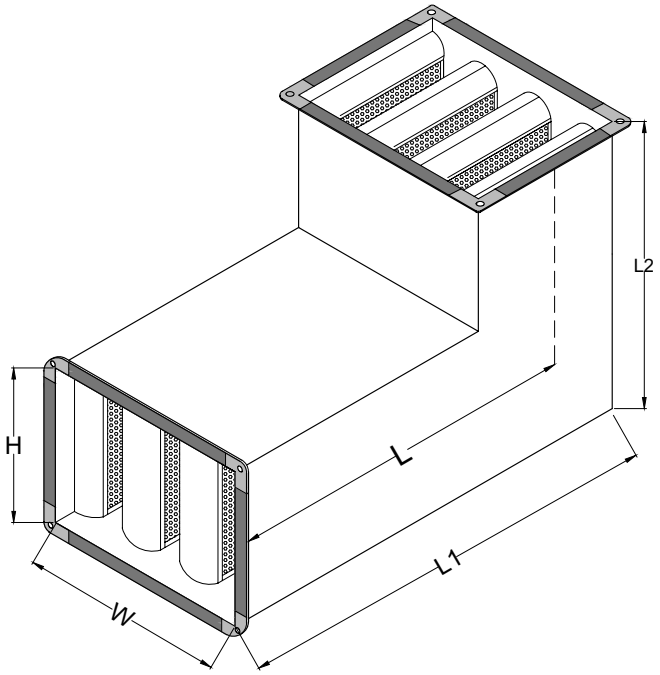
Attenuators fitted with external galvanized steel flanges of 30mm with Corners of 105mm will help in arresting leakages, which also provides firmness & stability to Ducts, thereby creating effective barrier against pressure drop. Flange corner holes fitted with M8 nutserts to enable easy connection.

Single & Multiple Section Assembly

Airwellcare attenuators are supplied in Multiple Sections, when any of the below dimensions are exceeded :

W=2100, H= 1800 L = 2100mm.

The assembly of multiple section attenuators will be carried out by others at site, based on the manufacturers instruction & guidelines.



Attenuator Dimensional Details

Square Bend Attenuators Model : AHS 300 SBA

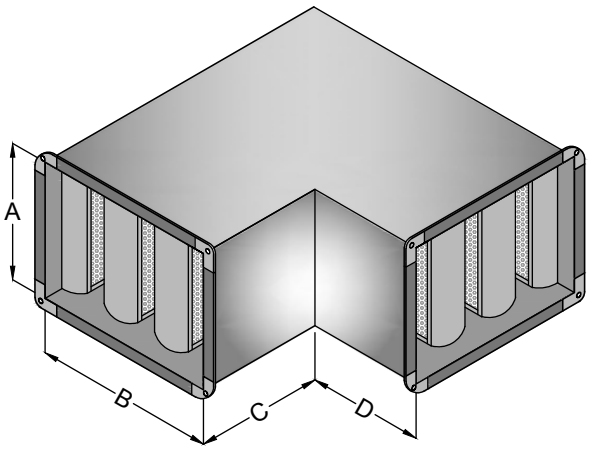
Sizing / Dimensions

Dampers, duct bends and other equipment in the vicinity of the sound attenuator will increase its inherent sound generation and pressure drop. The specified data are based on a uniform air stream in and out of the sound attenuator.

If perforated sheet steel covers the baffle surfaces, this increases the level of inherent sound generation.

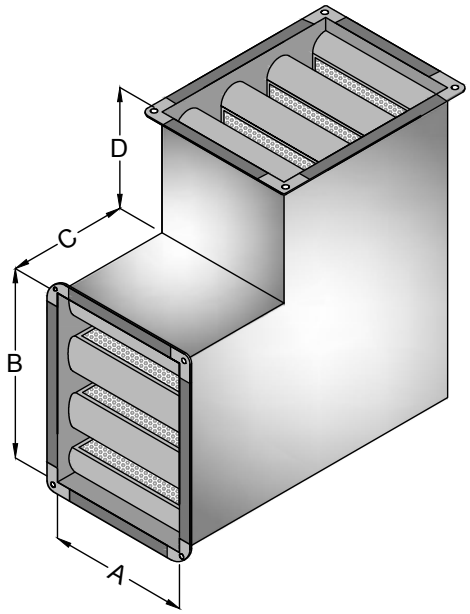
In the standard version, Airwellcare has outer dimensions equivalent to the connection size. The outer dimensions are specified in the Technical Data Table.

If recessed connections are selected, this design will decrease the p value (and thus the pressure drop) of the sound attenuator. The advantages achieved by placing a part of the sound attenuator's active section outside the airflow enable not only a lower pressure drop, but also a more favourable velocity profile.



B dimensions corresponds to the width of the duct

A dimensions corresponds to the height of the duct



B dimensions corresponds to the height of the duct

A dimensions corresponds to the width of the duct

B dimensions

400, 500, 600, 700, 800, 900, 1000, 1200, 1400, 1600, 1800, 2000

A dimensions

300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000

C + D Dimension

The smallest dimension for C & D is 150 mm

Attenuator Constructional Specification & Dimensional Details

Circular Sound Attenuators Model : AHS 300 CSA

Airwellcare Circular Sound Attenuator constructed from Galvanized sheet steel, with a peripheral out of airstreams acoustic lining. Casing provided with end ring flanges suitable for direct connection to circular fans or flanged ducts.

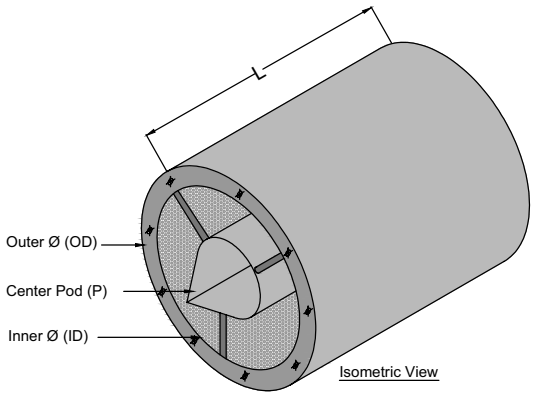
Casing

Casing is made of 1.0mm Thick (20 Gauge) galvanized steel. Casing provided with 30mm flanges as standard which will be sealed with Mastic Sealant to prevent leakage of Air.

Circular Sound Attenuators are constructed with the following dimensions :

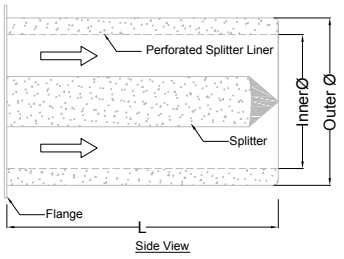
Inner Dia— 300 to 1000 mm
Outer Dia— 435 to 1200 mm

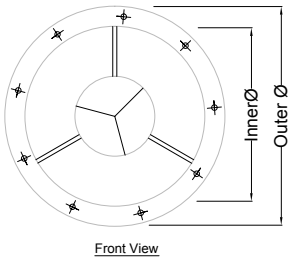
High-pressure duct sealant is applied inside the casing along the length of each seam, and for rectangular casings behind each flanged corner that coincides with a seam, to provide an airtight seal.



Flanges

Attenuators fitted with external galvanized steel end ring flanges suitable for direct connection to cicular fans or flanged ducts.





Available Sizes

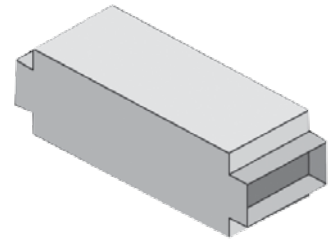
Internal Diameter	Outer Diameter	POD Diameter	Standard Length							
ID	OD	P	L1 (mm)							
315	435	170	500	650	800	950	1100	1250	1400	1550
355	475	170	500	650	800	950	1100	1250	1400	1550
400	520	210	500	650	800	950	1100	1250	1400	1550
450	600	210	500	650	800	950	1100	1250	1400	1550
500	650	265	500	650	800	950	1100	1250	1400	1550
550	700	265		650	800	950	1100	1250	1400	1550
630	780	335			800	950	1100	1250	1400	1550
700	850	335			800	950	1100	1250	1400	1550
800	950	420				950	1100	1250	1400	1550
900	1100	420				950	1100	1250	1400	1550
1000	1200	500					1100	1250	1400	1550

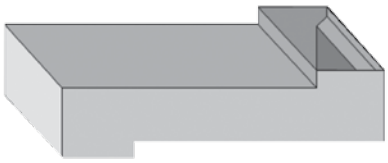
Attenuator Constructional Specification

Crosstalk Attenuators Model : AHS 400 CRA & AHS 400 CRB

Casing

Casing is made of 1.0mm Thick (20 Gauge) galvanized steel. Casing provided with 30mm flanges as standard which will be sealed with High-pressure duct sealant.





Selection of Crosstalk Attenuators

For an accurate and quick selection of Crosstalk attenuators, it is necessary to consider the following aspects :

A. The level of speech reaching the receiving room:

The source of crosstalk noise assumed to be raised speech, for which the average sound pressure level is (500-4K-Hz) is 70 dB.

The room to room acoustic loss for a typical common ductwork system or via the ceiling void is approximately 7dB, therefore the average speech level within the receive room is taken to be 70- 7 = 63 dB.

B. The Noise criteria for the design of mechanical services in each space being considered :

- If crosstalk is being assessed between two adjacent room areas with different noise criteria, then the lowest criteria should be used.
- Substract the required NC level from the received speech level to give the additional average insertion loss requirement.

Example :

Air volume 0.09 m3/s ducted crosstalk attenuation required between NC 45 Toilet areas.

Attenuator cross-section required to maintain 1.5 m/s is calculated by (Volume / face velocity) 0.09 / 1.5 = 0.05 m2.

Typical Attenuator cross-sections for 0.06m2 face area :

300 x 200, 400 x 150mm.

For NC 45 areas, insertion loss requirements = 63 - 45 = 18 dB, therefore, 600mm long attenuator is selected.

Crosstalk path	Room NC	Received speech level minus lowest	Attenuator Length Required
	(NC)	(NC)	(mm)
Conference Room to Conference Room	30 to 30	63 - 30 = 33	1200
Conference Room to Cellular office	30 to 35	63 - 30 = 33	1200
Open plan office to cellular office	35 to 38	63 - 35 = 28	900
Cellular office to corridor	38 to 45	63 - 38 = 25	900
Male to Female Toilet	45 to 45	63 - 45 = 18	600

Compliance & Standards

- All sound calculations meet international standards ASTM E90,STM E477, ISO 7235, ISO 3741, ISO 140, ISO 3744, ISO 3746, ISO 6798, ISO 8528-10, ASHRAE Handbook & Sound Research Laboratory.
- The Construction of all Airwellcare Attenuators are in compliance with SMACNA & DW 144 Standards, ASTM E477, ASTM E84, NFPA 255, UL-723 and silencer dynamic insertion loss and pressure drop ratings in accordance with AMCA & applicable building codes.
- Attenuators Acoustic in-fill enveloped with a Melinex Polyester Film coating, which prevents erosion of acoustic fill and/or absorption of moisture by insulation, Bacterial or microbial growth within silencer, as an alternative optional construction, apart from standard supply.
- The design flexibility and calculations are based on Attenuator Application & nature of project.

Attenuator casings will comply with one of following pressure classifications:

- **3 - High Pressure** for Class C ductwork systems operating at static pressures between - 750 and + 2000 Pa.
- **2 - Medium Pressure** for Class B ductwork systems operating at static pressures between - 750 and + 1000 Pa.
- **1 - Low Pressure** for Class A ductwork systems operating at static pressures between - 500 and + 500 Pa.
- **0 - Zero Pressure** for static or very low velocity applications where attenuators do not require a pressure classification.

Acoustic Property

- Fiberglass / Rockwool of 32-35 or 48Kg/M3 Density.
- Thickness & density can be changed according to the Technical Calculations, to obtain the optimum performance of the Attenuators.
- Non combustible when tested in accordance with BS 476 : Part 4: 1970, ASTM E-136, NFPA255 and UL 723 testing methods.
- Fill material is class-1 as tested in accordance with ASTM-84.
- Fiberglass shall be density calculated to provide the acoustic and aerodynamic performace.
- Tested for Temp. upto 750° C in accordance with DIN 52271.
- Meet the requirements of BS 2972 Sec.22 & ASTM C-871, ASTM-C-795, ASTM C-692. ASTM C-177/C-518 & DIN 52612 for low thermal conductivity.
- Sound absorption in accordance with BS 3638 & ISO 0354.
- Inert, vermin-proof, weather rated non combustible acoustic infill.
- The acoustic infill material complies with Class 'O' of the U.K.'s Building Regulations.

Combustion Ratings

Combustion ratings for acoustic media shall be equal to or less than the combustion ratings noted below when tested in accordance with ASTM E84, UL723 and NFPA255.

Flame Spread Classification: < 30

Smoke Development Rating: < 25

Quick Attenuator Selection Guide

Airwellcare Attenuator Selection Method stipulated on the below table shall be kept for an easy & quick assistance to the Design Engineer to carry out a quick selection for the attenuators at preliminary design stage, based on the design Noise Criteria of NC 40. This method should only be used when the required insertion loss has not been determined.

Method	Description
Method -1	Select an attenuator based on the permissible static pressure across the attenuator and duct size based on NC40.
Method -2	check for the recommended maximum attenuator face velocity to meet NC 40.
Method -3	Select a cross-section area for the attenuator to suit the required flow rate and to satisfy the maximum desirable face velocity and pressure drop.
Method -4	Select the desired insertion loss from the table.

Example :

If the design flow rate is 4.5 m/s and the maximum permissible pressure drop across the attenuator is 80 Pa with a room design NC of 40, AHS 150 for a duct size of 1100 mm x 600 mm (H) from Table 3 will meet the requirement.

To maintain a Noise Criteria of NC 40 in the occupied space, it is advisable that the air velocity in the main duct, branch duct and final duct connection should not exceed 9.0, 7.0 and 5.0 m/s respectively.

Table -1 : **Quick Attenuator Dynamic Selection Guide (AHS 75)**

Width (mm)	Height (mm)	Module	Airflow (M^3/S)	Pressure Drop (△Pa)	Airflow (M^3/S)	Pressure Drop (△Pa)
			Vmax (NC 35)		Vmax (NC 40)	
300	100	Single	0.11	90.0	0.15	134.0
	200		0.22	85.0	0.25	118.0
550	200	2 Modules	0.43	85.0	0.53	120.0
	300		0.65	84.0	0.77	120.0
	400		0.85	80.0	1.00	116.0
	500		1.10	80.0	1.28	116.0
825	300	3 Modules	0.95	80.0	1.15	118.0
	400		1.27	81.0	1.53	118.0
	500		1.58	81.0	1.95	118.0
	600		1.90	81.0	2.30	116.0
1100	300	4 Modules	1.25	82.0	1.55	120.0
	500		2.10	81.0	2.55	120.0
	700		2.95	81.0	3.55	116.0
	900		3.77	80.0	4.57	115.0
1400	400	5 Modules	2.10	83.0	2.53	115.0
	600		3.15	81.0	3.84	116.0
	800		4.20	81.0	5.10	116.0
	1000		5.24	80.0	6.34	114.0
	1200		6.30	80.0	7.60	114.0

- The Length of above Attenuator Dimensions (W x H) is based on 600mm.

Quick Attenuator Selection Guide

Table -2 : Quick Attenuator Dynamic Selection Guide (AHS 100)

Width (mm)	Height (mm)	Module	Airflow (M^3/S)	Pressure Drop (△Pa)	Airflow (M^3/S)	Pressure Drop (△Pa)
			Vmax (NC 35)		Vmax (NC 40)	
300	100	Single	0.16	82.0	0.18	98.0
	200		0.31	77.0	0.35	96.0
	300		0.46	75.0	0.52	98.0
600	200	2 Modules	0.62	75.0	0.70	96.0
	400		1.25	74.0	1.38	95.0
	600		1.82	73.0	2.10	95.0
900	300	3 Modules	1.37	75.0	1.55	97.0
	600		2.70	74.0	3.10	94.0
	900		4.10	74.0	4.63	97.0
1200	300	4 Modules	1.82	73.0	2.10	95.0
	600		3.64	74.0	4.15	94.0
	900		5.41	74.0	6.17	94.0
	1200		7.22	70.0	8.25	98.0
1500	300	5 Modules	2.26	75.0	2.58	95.0
	600		4.52	73.0	5.15	95.0
	900		6.77	73.0	7.75	94.0
	1200		9.00	71.0	10.25	94.0
	1500		11.27	71.0	12.85	94.0

- The Length of above Attenuator Dimensions (W x H) is based on 600mm.

Table -3 : Quick Attenuator Dynamic Selection Guide (AHS 150)

Width (mm)	Height (mm)	Module	Airflow (M^3/S)	Pressure Drop (△Pa)	Airflow (M^3/S)	Pressure Drop (△Pa)
			Vmax (NC 35)		Vmax (NC 40)	
350	100	Single	0.25	62.0	0.30	85.0
	200		0.50	60.0	0.55	79.0
	300		0.70	60.0	0.82	77.0
700	200	2 Modules	0.95	61.0	1.10	80.0
	400		1.90	58.0	2.17	75.0
	600		2.82	55.0	3.24	73.0
1100	300	3 Modules	2.12	56.0	2.45	74.0
	600		4.25	56.0	4.85	74.0
	900		6.35	56.0	7.30	75.0
1400	300	4 Modules	2.82	60.0	3.25	76.0
	600		5.65	55.0	6.50	76.0
	900		8.45	55.0	9.71	73.0
	1200		11.25	56.0	12.95	73.0
1800	300	5 Modules	3.55	58.0	4.05	76.0
	600		7.05	58.0	8.10	76.0
	900		10.60	58.0	12.15	73.0
	1200		14.10	55.0	16.18	71.0
	1500		17.60	55.0	20.23	71.0

- The Length of above Attenuator Dimensions (W x H) is based on 600mm.

Quick Attenuator Selection Guide

Attenuator Selection

The attenuator selector software has been developed by our well known Acoustic Consultant to bring together all Airwellcare's attenuator construction and performance knowledge into one place. Working in consultation with our software developer, Airwellcare offers with a suitable and unique selection criteria for attenuators to our clients.

Final Technical Submittal

Manufacturer's performance data for Resultant Noise, Dynamic insertion loss, Generated noise, Air Volume, Air way Velocity, Pressure drop etc. shall be provided and obtained through Software enabled Programe. Data for each scheduled silencer shall be provided and appears on the final Technical Attenuator Calculations & Schedule.

Model	Criteria	Fan Static Pressure (Pa)			Fan Static Pressure (Pa)		
		250	500	1000	250	500	1000
		Attenuator Length (mm)			Attenuator Length (mm)		
AHS - AW 100	NC 45	900	900	900	900	900	1200
AHS - AW 150		900	1200	1200	1200	1500	1800
AHS - AW 100	NC 40	900	900	1200	1200	1200	1500
AHS - AW 150		1200	1500	1800	1500	1800	2100
AHS - AW 100	NC 35	1200	1200	1500	1500	1500	1800
AHS - AW 150		1500	1800	2100	1800	2100	2400

Model	Criteria	Fan Static Pressure (Pa)			Fan Static Pressure (Pa)		
		250	500	1000	250	500	1000
		Attenuator Length (mm)			Attenuator Length (mm)		
AHS - AW 100	NC 45	900	1200	1500	1200		
AHS - AW 150		1500	1800	2100	1800		
AHS - AW 100	NC 40	1200	1500	1500	1500		
AHS - AW 150		1800	2100	2100	2100		
AHS - AW 100	NC 35	1500	1800	1800	1800		
AHS - AW 150		1800	2100	2400	2400		

Engineering Guidelines - Insertion Loss

Model		Length (mm)	Octave Band (Centre) Frequencies in Hz							
			62.5	125	250	500	1K	2K	4K	8K
AHS 75 RSA	Splitter Thick 200mm	600	7	9	16	21	30	30	25	23
		900	9	14	20	27	44	43	31	26
		1200	11	16	24	33	50	48	37	29
		1500	12	19	29	40	50	50	43	30
		1800	13	22	34	45	50	49	45	35
		2100	16	25	36	50	50	51	51	38
		2400	17	27	42	51	51	50	47	39

Model		Length (mm)	62.5	125	250	500	1K	2K	4K	8K
AHS 100 RSA	Splitter Thick 200mm	600	7	11	15	21	30	30	23	19
		900	8	14	21	28	44	42	29	23
		1200	9	17	24	34	48	48	34	25
		1500	9	20	30	41	50	50	41	30
		1800	11	24	35	46	49	50	45	31
		2100	11	26	36	49	50	50	47	34
		2400	11	27	42	49	51	51	46	38

Model		Length (mm)	62.5	125	250	500	1K	2K	4K	8K
AHS 150 RSA	Splitter Thick 200mm	600	8	12	17	34	44	28	23	22
		900	7	14	20	37	47	32	26	24
		1200	9	15	23	40	50	36	29	26
		1500	10	17	26	43	53	40	32	28
		1800	11	18	29	46	57	44	35	31
		2100	11	20	32	49	40	48	38	33
		2400	12	21	35	50	50	50	41	35

We are confident that the data given against the Attenuator performance is more accurate. However, our estimated measurement uncertainties are shown below :

Estimates of Expanded measurement uncertainty	Octave Band (Centre) Frequencies in Hz							
	62.5	125	250	500	1K	2K	4K	8K
Static Insertion Loss	2	2	2	2	3	3	3	3
Dynamic Insertion Loss	2	2	2	2	3	3	3	3
Flow generated Lw	3	3	3	3	4	4	4	4
Total Pressure Loss	Within 5 Pa							

Crosstalk Attenuator Insertion Loss (AHS 400CR-A & AHS 400 CR-B)

The following tables provide a guide to rectangular crosstalk attenuator selection, based on a 35% free area.

Attenuator Length	Average Insertion Loss (500 - 4kHz) dB
600	25
900	30
1200	36
1500	42
1800	48

Engineering Guidelines - Insertion Loss

Model AHS 300 SBA

M dim.	I+U	Octave Band (Centre) Frequencies in Hz								P-value
(mm)	(mm)	63	125	250	500	1K	2K	4K	8K	
400	300	4	8	14	21	28	22	21	19	2.2
400	600	5	10	17	27	35	27	22	20	2.4
400	900	6	11	21	33	41	31	23	21	2.5
500	300	7	12	18	23	32	27	22	21	4.3
500	600	8	15	22	29	39	32	23	22	4.5
500	900	9	17	27	35	47	37	25	24	4.6
600	300	7	12	22	35	42	46	33	26	8
600	600	8	15	28	44	50	50	39	30	8.5
600	900	9	12	32	50	50	50	44	33	9
700	300	6	12	20	30	38	35	25	21	3.8
700	600	7	14	24	37	47	37	28	23	4
700	900	8	16	28	45	50	50	31	25	4.2
800	300	6	10	18	27	34	26	20	18	2.4
800	600	7	12	22	33	42	31	21	19	2.5
800	900	8	14	25	39	49	35	22	20	2.6
800	300	6	12	21	31	38	36	26	21	3.8
800	600	7	14	25	38	48	38	29	23	4
800	900	8	16	29	46	50	50	32	25	4.2
900	300	8	15	26	42	46	50	37	28	8.5
900	600	9	18	30	50	50	50	42	31	9
900	900	10	20	36	50	50	50	47	34	9.5
1000	300	8	15	24	40	50	46	32	25	5
1000	600	9	17	29	47	50	50	36	27	5.3
1000	900	10	19	34	50	50	50	40	29	5.6
1000	300	9	16	26	31	42	34	23	22	4.6
1000	600	10	19	30	37	49	38	24	22	4.8
1000	900	11	22	34	42	50	42	25	23	5
1200	300	11	22	39	50	50	50	42	33	8.8
1200	600	12	25	45	50	50	50	46	35	9.4
1200	900	13	28	49	50	50	50	50	33	10
1200	300	9	18	33	50	50	50	30	24	4
1200	600	10	20	36	50	50	50	34	27	4.1
1200	900	11	22	39	50	50	50	38	30	4.3
1400	300	8	16	26	45	50	48	29	23	4.3
1400	600	9	18	32	50	50	50	32	25	4.5
1400	300	10	21	34	41	50	46	27	23	6.8
1400	600	12	26	38	49	50	48	29	24	7
1600	300	8	15	25	40	50	36	21	18	2.8
1600	600	9	17	28	46	50	39	23	20	2.9
1600	300	9	16	26	35	46	42	25	21	3.4
1600	600	10	19	31	49	50	46	27	23	3.5
1800	300	9	18	33	50	50	50	30	24	4
1800	600	10	20	36	50	50	50	34	27	4.1
1800	300	12	27	41	50	50	50	33	28	8.5
1800	600	14	31	48	50	50	50	37	30	9
2000	300	12	26	40	50	50	48	26	23	5
2000	300	16	34	49	50	50	50	50	40	10

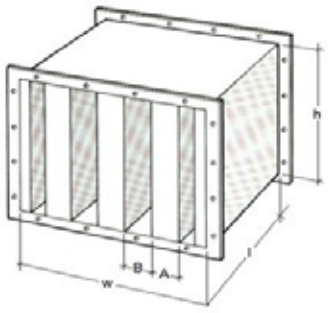
Attenuator Software Selection Program

Project Name: **Date:**

What you want to do? Design Inlet Attenuator — *Discharge to room*

Inleat Head: Curved — r/A= 0.16 — C_o = 0.06 — ASHRAE 200

Exit Head: Rounded



Reverb Room Data

Enter room average absorption coefficients:

Enter values for average room absorption coefficients: *If unknown use ALPHA tool*

Hz	62.5	125	250	500	1000	2000	4000	8000
α' (known)	0.254	0.461	0.667	0.634	0.627	0.583	0.515	0.395

Engine SPL/SWL

Enter machine surface noise in dB: Select **SPL** If SPL then at: 1 m

Machine Dimensions:	H	W	L	
	1.90	1.80	3.80	m

Measuring Surface Area = 77.7 m²

ISO-3744/ISO-6798 Method 18.9 dB

Hz	62.5	125	250	500	1000	2000	4000	8000	Hz
SPL	71.2	90.8	89.9	93.5	95.1	95.0	92.1	104.8	dB

Attenuator Design Parameters

r_1 (Distance from enclosure wall,m):		d_h (hydraulic diameter):	
r_2 (Distance from the source,m):		k (Duct Roughness):	
H (Room height,m):		ρ (Air density):	
W (Room width,m):		V_o (Kinematic viscosity):	
L (Room length,m):		k/d_h (Relative roughness):	
Q (Total air flow,m^3/sec):		λ (Friction coefficient):	
h (Aperture height,m):		q (Air flow per air way):	
w (Aperture width,m):		Air way area:	
No of air ways:		V (Air Way velocity):	
B (Air way width,m):		R_e (Reynold number):	
l (Air way length,m):		A (Splitter thickness 2/):	
T_i (Inlet air temp, deg C):		Room volume:	
ΔT (Maximum temp Rise, deg C):		Room surface area:	
Filling Material Density (Kg/m^3):		Note: Perforation percentage (P) MUST be > 22% and TI > 800	
Filling Material Used:			
Face Velocity (m/sec):	2.22	Mean flow number (M) :	-0.03

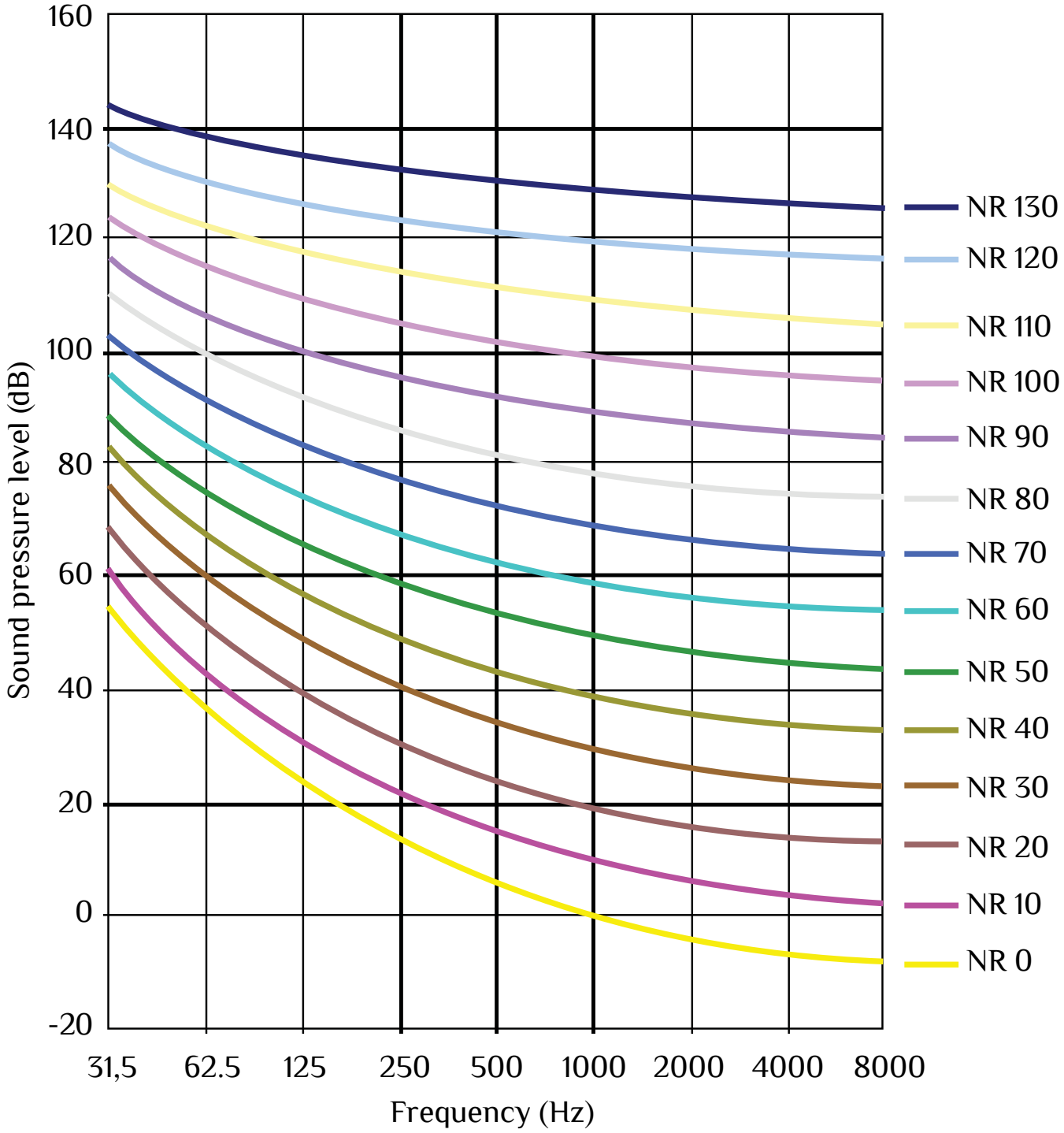
Results

Resultant Noise SPL =	**35**	**dBA**	Friction Loss =	26.2	Pa	0.105 inch w.g
at:	**3.0**	**meter**	Dynamic Press Drop =	34.8	Pa	0.140 inch w.g
			Total Press Drop =	**61.0**	Pa	**0.245** inch w.g

Sound Attenuation Calculations

Octave Band Frequencies	62.5	125	250	500	1000	2000	4000	8000	Hz
Machine SWL_o	90.1	109.7	108.8	112.4	114.0	113.9	111.0	123.7	dB
Room volume correction	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	dB
Reverberation Time (sec)	0.6	0.3	0.2	0.2	0.2	0.3	0.3	0.4	sec
Rev time correction	-2.4	-4.9	-6.5	-6.3	-6.3	-6.0	-5.4	-4.3	dB
Source SPL_{rev}	78.8	95.8	93.3	97.1	98.8	99.0	96.6	110.5	dB
Aperture area correction	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	dB
Non-reverberant correction	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	dB
SWL (Aperture)	76.3	93.4	90.8	94.7	96.3	96.5	94.2	108.0	dB
Aperture directivity correction	7.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	dB
Distance correction (r_1)	-20.5	-20.5	-20.5	-20.5	-20.5	-20.5	-20.5	-20.5	dB
Surface directivity	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	dB
Near filed correction	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	dB
SPL at receiver (rev path) dB	61.8	79.8	78.3	82.1	83.8	84.0	81.6	95.5	dB
Distance correction (r_2)	-29.1	-29.1	-29.1	-29.1	-29.1	-29.1	-29.1	-29.1	dB
Direct path surface correction	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	dB
SPL at receiver (direct path) dB	66.1	85.7	84.8	88.4	90.0	89.9	87.0	99.7	dB
Duct noise SWL	60.0	47.0	44.0	42.0	41.0	39.0	37.0	30.0	dB
SPL at receiver (Total) dB	68.2	86.7	85.6	89.3	90.9	90.9	88.1	101.1	dB
Static insertion Loss (SIL)	17	19	30	44	57	60	60	60	dB
Dynamic insertion Loss (DIL)	18	20	32	46	50	50	50	50	dB
SPL at receiver (SPL_2) dB	50.3	66.5	53.9	43.6	40.9	40.9	38.1	51.1	dB
dBA scale weigtings	-26.0	-16.0	-9.0	-3.0	0.0	1.0	1.0	-1.0	dB
Resultant SPL_2 (dBA)	24.3	50.5	44.9	40.6	40.9	41.9	39.1	50.1	dBA

Noise Rating Diagram



Recommended Noise Criteria For Various Zones

Area Description	Location	NC
STUDIOS & AUDITORIUMS	Sound Broadcasting Areas (TV, Radio Station etc).	15 – 20
	Concert Hall & Theaters	20 – 25
	Lecture Theatre & Cinemas	25 – 30
HOSPITALS	Audiometric Room	20 – 25
	Operation Theatres, Single Bed Ward	30 – 35
	Multi Bed Ward, Waiting Room	35
	Corridor & Laboratory	35 – 40
	Wash Room, Toilet & Kitchen	35 – 45
	Staff Room & Recreation Room	30 – 40
HOTELS	Individual Room & Suite	20 – 30
	Ballroom & Banquet Room	30 – 35
	Corridor & Lobby	35 – 40
	Kitchen & Laundry	40 – 45
RESTAURANTS & SHOPS	Restaurant, Departmental Store	35 – 40
	Clubs, Public House, Cafeteria, Canteen, Retail Store	40 – 45
OFFICES	Boardroom & Large Conference Room	25 – 30
	Small Conference Room, Executive Office & Reception Room	30 – 35
	Open Office	35
	Drawing Office & Computer Suite	35 – 45
PUBLIC BUILDINGS	Court Room	25 – 30
	Assembly Hall	25 – 35
	Library Hall	30 – 35
	Wash Room, Toilet	35 – 45
	Swimming Pool & Sports Arena	40 – 50
	Garage & Car Park	55
ECCLESIASTICAL & ACADEMIC BUILDINGS	Churches & Mosques	25 – 30
	Class Rooms, Lecture Rooms	25 – 35
	Laboratory & Workshops	35 – 40
	Corridor & Gymnasium	35 – 45
INDUSTRIAL	Warehouses & Garages	45 – 50
	Workshop (Light Engineering)	45 – 55
	Workshop (Heavy Engineering)	50 – 65
PRIVATE DWELLING / VILLAS	Bed Room	25
	Living Room	30

Installation Details and Guidelines

Rectangular sound attenuators are supplied in multiple modules of many different sizes for convenience and economy in transport, handling and installation. When sound attenuator banks are large, multiple modules are supplied loose for erection at the job site. To avoid possible leaks and damage, two factors need to be considered.

The first, fastening the individual sound attenuator modules together, and the second, sealing the joints between assembled modules to prevent leakage. There are many methods of assembling and sealing multiple modules.

Attachment to Duct Work

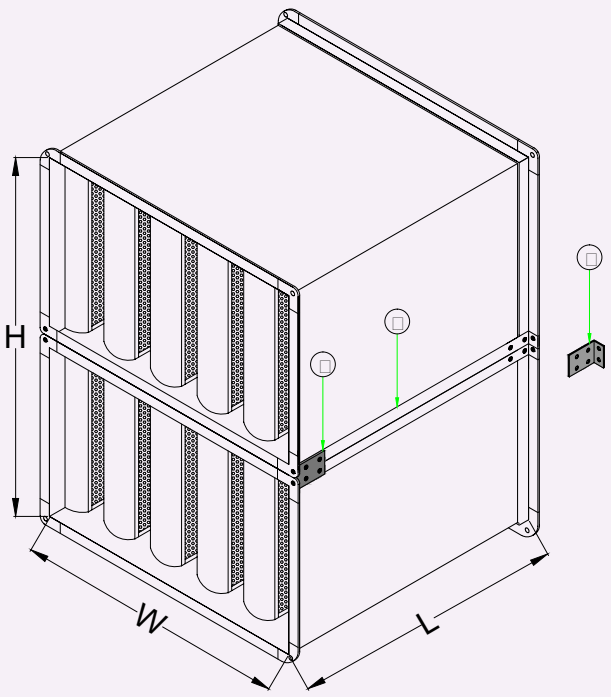
Attachment to ductwork can be achieved by one of the following methods:

- S-clip with sheet metal screws and tape.
- Slip or lap joint with sheet metal screws and tape.
- Angle flanges with gaskets and bolts.

A) Joining adjacent Sections.

1. Lay out and align the sections so that the external rails on each sections are on the correct and matching faces (1).
2. Bring adjacent modules together, with the rails abutting. Use speed clamps or G-Clams or similar as required to ensure tight fit.
3. The modular joining Brackets (2) can then be fixed to the rails and to the flanges of adjacent modules using the supplied M8 countersunk screws.
4. Fixings are made through the brackets into nutserts in each of the mating rails on the adjacent attenuator modules. Two fixings are then made through the flange corner holes into the nutserts in the bracket.

Each Modular Joining Bracket (2) incorporates slots for four fixings and nutserts for two fixings. This allows for fixings into the rails through the flanges of adjacent modules as shown. Fix the screws loosely first until all fixings are in and the units have been correctly positioned and aligned. The screws should then be tightened.

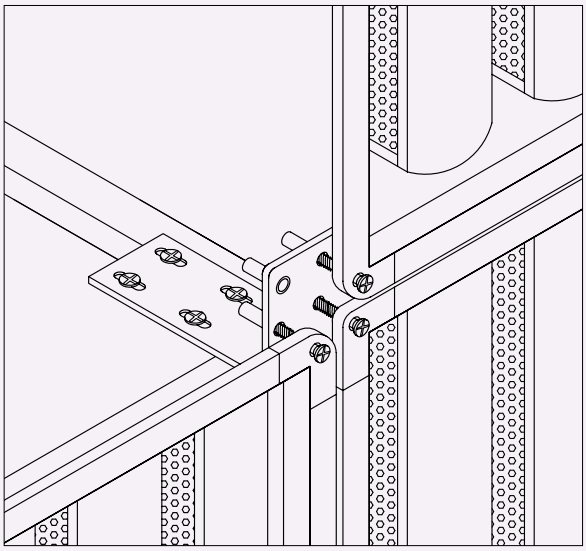


Isometric View

Installation Details and Guidelines

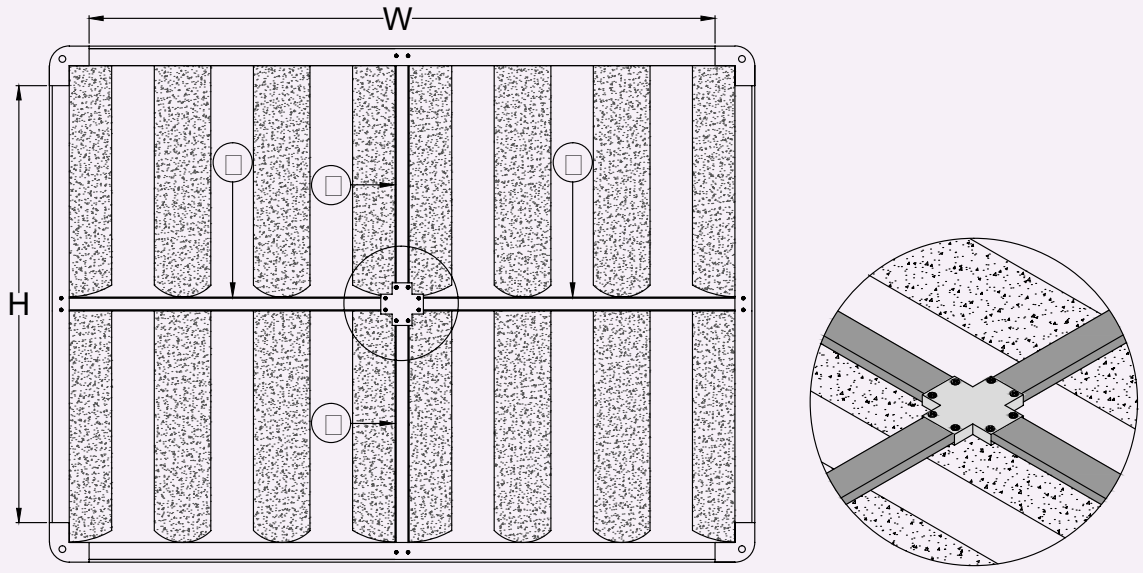
B) Joining Centre Sections

The views below given an enlarged view of a Modular Centre Joining Bracket in position. This bracket has a larger front face incorporating four nutserts to allow the joining through four separate attenuator module flanges.



C) Completion of Asembly

Once all of the sections are joined together, as shown in the view below, then a system of capping channel sections and pieces (1 and 2) can be fitted. These are used to close off the gaps between flanges in the inner sections of the modular attenuator.



Material Storage, Operation and Maintenance

Delivery, Storage & Handling

Delivery: Deliver materials to site in manufacturer's original, unopened packaging, with labels clearly indicating manufacturer and material.

Storage: Store materials in a dry area in-doors, protected from damage and in accordance with manufacturer's instructions.

Handling: Handle and lift silencers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

Duct Silencers installed Indoors

Duct silencers installed inside buildings are designed to be essentially maintenance-free for the life of the product. The same method and routine used for periodic cleaning of the ductwork will also apply to the duct silencers. The acoustic media used in duct silencers is protected by the perforated metal liner so it will not erode during normal duct cleaning with vacuum equipment.

Silencers exposed to Corrosive Elements

Silencers specified for installation in locations where the outer casings will be exposed to high temperature or corrosive elements are typically constructed with corrosive-resistant materials or finished with corrosion resistive coatings. Similarly, silencers that must convey high temperature or corrosive gases will be constructed internally with non-corrosive materials. The required maintenance and expected life time of these products will vary. Consult the factory for specific maintenance information for silencers used in such applications.

Maintenance

Airwellcare Attenuators are designed for least maintenance. Once installed it is important to ensure the Attenuators are not damaged as this may affect both their acoustic and airflow performance. The attenuators may, over time begin to collect dust and grime. The attenuators should be cleaned to refresh their visual appearance.

Airwellcare Attenuators are not designed to be used in areas, where they may be exposed to such as water treatment or cleaning chemicals. If the attenuators are exposed to such contaminants, they should be cleaned immediately to reduce the detrimental impact of the chemicals.

Weight Chart for Rectangular Straight Line Attenuator

Width (mm)	Height (mm)	Length (mm)						
		600	900	1200	1500	1800	2100	2400
300	300	21.0	27.0	36.0	42.0	49.0	56.0	63.0
300	600	34.0	42.0	55.0	65.0	75.0	88.0	98.0
600	600	50.0	66.0	87.0	73.0	118.0	134.0	150.0
600	900	60.0	87.0	113.0	134.0	155.0	176.0	197.0
600	1200	86.0	114.0	140.0	165.0	191.0	217.0	243.0
600	1500	105.0	135.0	166.0	196.0	226.0	256.0	286.0
900	600	69.0	91.0	120.0	141.0	163.0	185.0	207.0
900	900	88.0	116.0	152.0	180.0	208.0	236.0	264.0
900	1200	116.0	151.0	185.0	220.0	255.0	290.0	325.0
900	1500	137.0	178.0	220.0	259.0	300.0	341.0	382.0
900	1800	158.0	205.0	252.0	300.0	346.0	393.0	440.0
1200	600	94.0	122.0	150.0	178.0	207.0	236.0	265.0
1200	900	119.0	155.0	191.0	226.0	262.0	298.0	334.0
1200	1200	144.0	188.0	232.0	275.0	320.0	362.0	405.0
1200	1500	170.0	221.0	272.0	323.0	375.0	426.0	477.0
1200	1800	195.0	254.0	313.0	372.0	431.0	490.0	550.0
1500	900	143.0	186.0	230.0	273.0	316.0	361.0	406.0
1500	1200	172.0	223.0	278.0	330.0	383.0	436.0	188.0
1500	1500	202.0	263.0	325.0	387.0	449.0	511.0	573.0
1500	1800	231.0	302.0	377.0	443.0	518.0	593.0	754.0
1800	900	166.0	220.0	268.0	320.0	370.0	423.0	476.0
1800	1200	200.0	260.0	322.0	384.0	446.0	508.0	570.0
1800	1500	234.0	306.0	378.0	450.0	523.0	596.0	756.0
1800	1800	268.0	350.0	433.0	516.0	600.0	783.0	866.0
1800	2100	301.0	395.0	488.0	582.0	790.0	883.0	976.0
1800	2400	335.0	440.0	543.0	774.0	878.0	982.0	1086.0
2100	1800	304.0	400.0	494.0	590.0	798.0	893.0	988.0
2100	2100	342.0	450.0	556.0	791.0	898.0	1005.0	1112.0
2100	2400	380.0	498.0	618.0	878.0	996.0	1116.0	1236.0
2400	2400	425.0	558.0	850.0	983.0	1116.0	1408.0	1541.0

- The above mentioned weights are Net Weight & in Kgs.
- ± 10% Variation in Net Weights are expected to be considered.

Attenuators Ordering System

Rectangular Straight Line Attenuator	AHS 75/ 100 / 150	Material Description	Optional	Size
Circular Attenuators	AHS 200 CSA	G - Galvanized A - Aluminium S- Stainless Steel	M - Melinex Infill Cover	Width x Height x Length (mm)
Square Bend Attenuators	AHS 300 SBA			
Crosstalk Attenuators	AHS 400 CRA			
Crosstalk Attenuators	AHS 400 CRB			

Example : Circular Attenuator - AHS 200 CSA-G

a perfect partner in performance...

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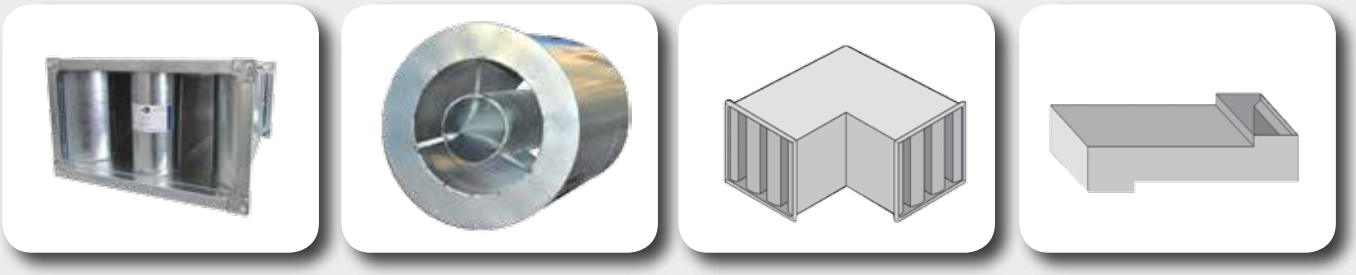

Management System
ISO 9001:2008

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