NAP SILENTFLO

Rectangular Silencers

Noise control for air handling systems

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THE EXPERTS IN NOISE CONTROL

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Introduction

NAP Silencers are used wherever it is necessary to control the passage of noise along an airpath. They control the noise of ventilation and air-conditioning systems in office buildings, lecture theatres, conference rooms, hotels, hospitals, radio and television studios and wherever air-conditioning and ventilation systems are installed.

In industrial applications, NAP Silencers control noise from fans and blowers, cooling towers, dust extraction systems and the like. They are also used as a means of providing ventilation openings in acoustic enclosures around compressors, rod mills, jet engines, generators, turbines and similar.

NAP Silencers have a sheet metal outer casing that resembles a conventional piece of ductwork. Inside this case there are a number of splitters that divide the silencer into separate airways. As the air passes through these airways, sound is attenuated by the absorbent infill in the splitters. The shape of the splitters is designed to minimise the resistance to airflow, whilst maximising the acoustic performance.

The NAP design features specially formed splitter nose and tail sections with parallel airways.

The specially formed nose section incorporates a non-cylindrical profile, which provides a larger acoustic splitter whilst retaining a low pressure loss entry.

Construction

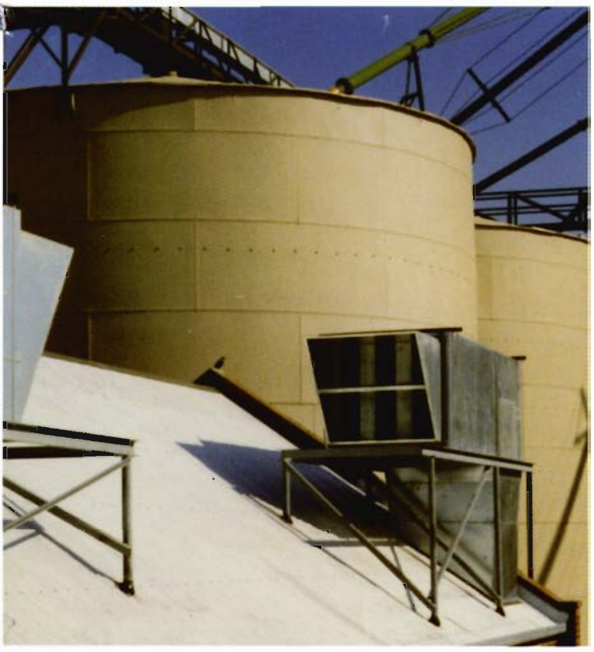
NAP Silencers consist of a galvanised sheetmetal case containing side splitters and typically one or more full splitters. Standard low pressure silencers typically use folded seams for casing joints, for higher system pressures the seams are sealed with duct sealant to ensure that the silencer case is airtight. The splitters have a specially formed aerodynamic solid nose profile made from galvanised sheetmetal, followed by a perforated galvanised sheetmetal facing.

The sound absorptive infill in the splitters is glass fibre or mineral fibre and is retained by perforated galvanised steel sheet that protects the infill from erosion for channel velocities up to 25m/s. The standard acoustic infills are suitable for continuous exposure up to 350°C. Alternative acoustic infills and stainless steel construction is available for temperatures up to 650°C.

In some special applications, a polyester membrane is placed behind the perforated facing to prevent the ingress of dust, water and/or grease into the absorptive infill. Examples are cooling tower exhausts, kitchen extraction, clean room and hospital ventilation.

For passage velocities in excess of 25m/s, special facings such as fibreglass cloth and stainless steel wire meshes are used in addition to the perforated facing to prevent erosion of the absorptive infill.

For many industrial applications, heavier construction and enhanced corrosion resistance may be required. NAP Silentflo's engineers will be pleased to discuss your specific project needs regarding acoustic, structural and corrosion protection requirements.



Sizes

No limit is placed on the available cross-section size of the silencers which may be as small as 275mm x 150mm, or of several metres in cross-section. Very large duct silencers are made up from several smaller silencers to reduce the transport and handling difficulties. It is preferable for the width of a silencer to be a multiple of the module width.

Heat Test

NAP Silentflo Duct Silencers have been subjected to a heat test conducted by an independent laboratory. It demonstrated that NAP silencers of galvanised steel construction are able to withstand 250° for one hour without change in the physical dimensions.

Silencer Types

Silencers are available in standard lengths of 900, 1200, 1500, 1800, 2400 and 3000mm. Other lengths are also available upon request. Increasing the silencer length increases the sound attenuation with a corresponding increase in pressure drop.

There are three different NAP Silencer 'Series'. These are the D, E and H series. All have different splitter thicknesses and airway spacing between the splitters, resulting in different percentage open areas.

NAP Silencers are expressed as a single model number.
e.g. E38/150 - E-Series Silencer
- 38% open area
- 150cm silencer length

Acoustic Performance

The main factors that affect the acoustic performance of a silencer are the silencer length, open area and splitter thickness. Typically the longer the sound absorptive section of the splitter, the better the acoustic performance of the silencer. To maximise the acoustic performance, the NAP Silentflo splitter nose is characterised by a specially formed non-cylindrical profile.

The sound insertion loss for the NAP range of silencers has been determined from measurements in independent certified Laboratories. The silencers have been tested to BS4718 and AS1277.

The following tables indicate the insertion loss (dB) figures associated with different series and models. For non standard silencer lengths please contact NAP Silentflo.

D-SERIES INSERTION LOSS

Octave Band Centre Frequency (Hz)

MODEL	Module	63	125	250	500	1k	2k	4k	8k
D27/90	275	5	10	18	33	42	32	28	20
D27/120	275	5	13	23	40	47	36	32	23
D27/150	275	6	16	28	45	53	42	33	24
D27/180	275	7	18	33	52	54	49	36	26
D27/240	275	10	24	43	60	60	60	40	30
D27/300	275	11	28	48	60	60	60	43	32

MODEL	Module	63	125	250	500	1k	2k	4k	8k
D33/90	300	4	9	17	31	40	29	24	17
D33/120	300	5	11	21	36	45	33	26	19
D33/150	300	6	14	26	42	49	39	28	21
D33/180	300	6	16	31	48	53	45	31	23
D33/240	300	8	21	41	57	60	56	35	26
D33/300	300	9	24	44	60	60	57	40	29

MODEL	Module	63	125	250	500	1k	2k	4k	8k
D38/90	325	4	8	16	29	35	25	19	14
D38/120	325	5	10	20	33	39	29	21	16
D38/150	325	6	13	25	39	44	33	23	18
D38/180	325	6	15	30	44	49	38	26	20
D38/240	325	8	19	41	57	57	47	30	23
D38/300	325	9	22	44	60	60	54	34	26

MODEL	Module	63	125	250	500	1k	2k	4k	8k
D43/90	350	3	6	14	26	29	21	14	11
D43/120	350	4	8	18	30	33	24	16	13
D43/150	350	5	11	24	35	38	27	18	15
D43/180	350	5	14	30	40	44	31	20	17
D43/240	350	7	18	41	49	55	37	24	20
D43/300	350	9	20	44	55	59	44	27	22

MODEL	Module	63	125	250	500	1k	2k	4k	8k
D47/90	375	3	6	13	23	26	18	12	9
D47/120	375	4	8	17	27	30	21	14	12
D47/150	375	5	10	22	31	35	24	16	13
D47/180	375	5	13	27	36	40	27	19	15
D47/240	375	7	16	36	45	50	33	24	18
D47/300	375	8	19	38	49	54	39	27	20

MODEL	Module	63	125	250	500	1k	2k	4k	8k
D50/90	400	3	6	12	20	23	15	9	6
D50/120	400	4	8	15	23	27	17	12	10
D50/150	400	5	10	19	27	31	20	15	11
D50/180	400	5	11	23	32	36	23	18	12
D50/240	400	6	13	30	40	45	29	24	16
D50/300	400	7	17	32	43	48	33	27	18

Technical Description

E-SERIES INSERTION LOSS

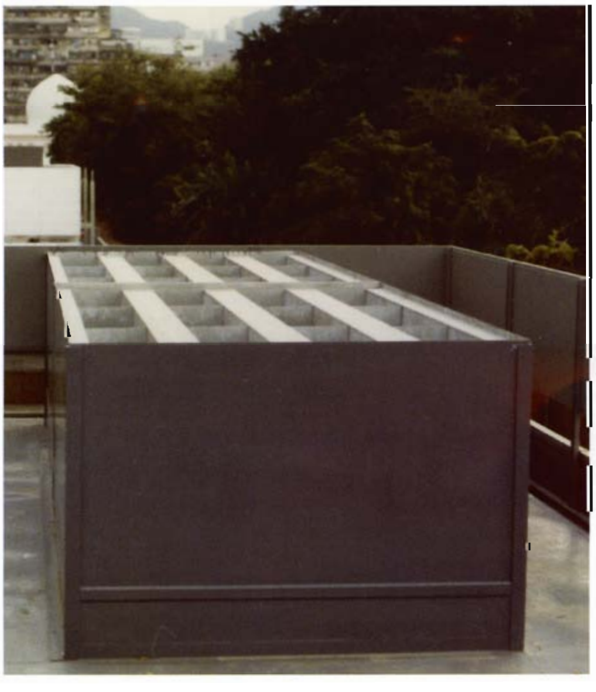
Octave Band Centre Frequency (Hz)

MODEL	Module	63	125	250	500	1k	2k	4k	8k
E29/90	350	6	11	18	31	36	27	24	17
E29/120	350	7	13	23	37	41	34	28	20
E29/150	350	8	16	28	43	46	41	31	23
E29/180	350	10	18	33	49	50	47	35	25
E29/240	350	12	22	43	58	56	60	41	29
E29/300	350	14	27	49	60	60	60	47	33

MODEL	Module	63	125	250	500	1k	2k	4k	8k
E38/90	400	5	8	14	25	27	21	15	12
E38/120	400	6	11	20	30	33	25	18	14
E38/150	400	7	14	25	35	38	29	21	16
E38/180	400	8	17	31	40	44	33	23	19
E38/240	400	10	21	41	49	55	41	31	23
E38/300	400	13	24	47	57	59	50	35	27

MODEL	Module	63	125	250	500	1k	2k	4k	8k
E44/90	450	5	7	13	22	24	16	12	10
E44/120	450	6	10	17	26	29	19	13	12
E44/150	450	7	12	21	31	33	22	17	13
E44/180	450	7	14	25	35	38	26	19	14
E44/240	450	9	17	33	44	46	33	25	18
E44/300	450	10	21	39	49	52	39	28	20

MODEL	Module	63	125	250	500	1k	2k	4k	8k
E50/90	500	3	7	11	18	20	12	9	7
E50/120	500	3	9	14	22	23	13	10	8
E50/150	500	4	10	17	26	27	16	13	9
E50/180	500	6	11	21	29	30	20	15	10
E50/240	500	8	14	27	38	39	25	19	14
E50/300	500	10	18	32	43	46	29	21	16



H-SERIES INSERTION LOSS

Octave Band Centre Frequency (Hz)

MODEL	Module	63	125	250	500	1k	2k	4k	8k
H33/90	450	8	13	17	22	27	21	16	14
H33/120	450	9	15	22	27	32	26	20	16
H33/150	450	10	17	27	32	37	31	24	19
H33/180	450	12	20	32	38	43	36	28	21
H33/240	450	14	24	42	48	53	46	36	26
H33/300	450	18	29	52	59	60	56	44	31

MODEL	Module	63	125	250	500	1k	2k	4k	8k
H40/90	500	7	11	14	25	28	17	15	14
H40/120	500	8	13	19	30	32	21	17	15
H40/150	500	9	15	23	35	36	25	19	16
H40/180	500	10	17	28	39	40	29	21	17
H40/240	500	12	21	37	48	48	37	26	20
H40/300	500	14	25	47	55	56	45	30	22

MODEL	Module	63	125	250	500	1k	2k	4k	8k
H45/90	550	3	9	13	20	20	14	14	9
H45/120	550	4	11	17	25	24	17	15	10
H45/150	550	6	13	21	30	29	20	16	12
H45/180	550	8	15	25	35	34	23	17	14
H45/240	550	11	19	33	45	43	29	20	17
H45/300	550	14	23	41	50	52	35	22	20

MODEL	Module	63	125	250	500	1k	2k	4k	8k
H50/90	600	3	7	12	17	14	12	11	10
H50/120	600	4	11	16	22	18	14	12	11
H50/150	600	5	12	19	26	24	16	14	12
H50/180	600	6	13	22	30	30	19	15	13
H50/240	600	9	16	29	39	41	25	17	14
H50/300	600	12	19	36	43	47	28	18	16

Aerodynamic Performance

NAP Silentflo Duct Silencers are designed to keep pressure drop to a minimum. The pressure drop of NAP Duct Silencers is based on the results of tests performed in a registered laboratory.

The steps for determining the pressure drop are as follows:-

1. *Select the silencer model and determine the associated loss coefficient, K in the Table below.*
2. *Determine the face velocity by dividing airflow (m^3/s) by the silencer face area, W x H (m^2).*
3. *Determine the pressure drop by multiplying the loss coefficient, K by the square of the face velocity, v (m/s).*

Δp (Pa) = Kv^2

where Δp = pressure drop (Pa)
K = loss coefficient
v = face velocity (m/s)

The above equation is based on air at standard conditions where $\rho = 1.21\ kg/m^3$

Note that this pressure drop calculation provides the silencer in-duct pressure loss. For silencers that are not connected to ductwork systems please contact NAP Silentflo.

Loss Coefficient, K

Silencer Length (mm)

MODEL	900	1200	1500	1800	2400	3000
D27	4.52	4.60	4.68	4.76	4.93	5.09
D33	2.60	2.64	2.68	2.73	2.81	2.89
D38	1.71	1.73	1.76	1.78	1.83	1.88
D43	1.22	1.24	1.25	1.27	1.30	1.33
D47	0.92	0.93	0.94	0.96	0.98	1.00
D50	0.72	0.73	0.74	0.75	0.77	0.79
E29	4.21	4.27	4.32	4.38	4.49	4.60
E38	1.96	1.99	2.01	2.03	2.07	2.11
E44	1.16	1.17	1.18	1.19	1.22	1.24
E50	0.78	0.78	0.79	0.80	0.81	0.83
H33	2.93	2.95	2.98	3.01	3.06	3.12
H40	1.72	1.74	1.75	1.76	1.79	1.82
H45	1.15	1.16	1.17	1.18	1.20	1.21
H50	0.83	0.84	0.85	0.85	0.87	0.88

Airflow Generated Noise

Airflow generated noise, often termed regenerated noise, can have an adverse impact on the performance of a silencer.

NAP rectangular silencers have been tested for regenerated noise. A simplified formula is provided for the prediction of the regenerated sound power level of silencers.

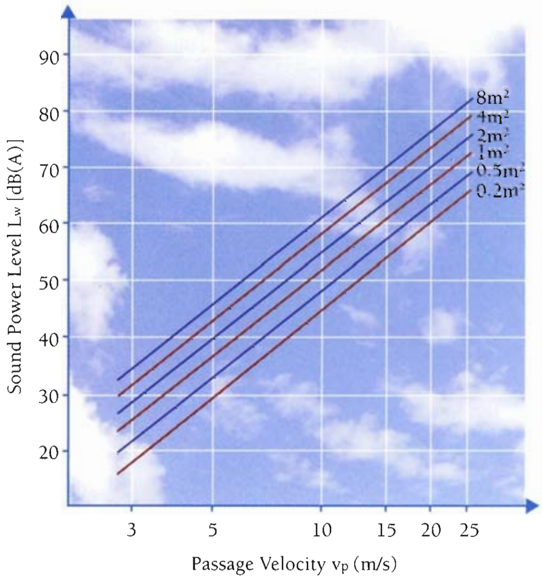
Once a silencer is selected it's regenerated noise can be determined using the following procedure:-

1. *Determine the silencer airway or passage velocity by using the following formula:-* $v_p = Q/(A \times OA)$

   where,
   v_p = silencer passage velocity (m/s)
   Q = flow rate (m^3/s)
   A = silencer face area [ie. width x height] (m^2)
   OA = silencer open area = %OA/100
   %OA = silencer percentage open area

The silencer percentage open area is contained in the silencer model number, it is the first two numbers that follow the model series letter. For example a D33 model silencer has a percentage open area of 33%.

2. *Determine the overall A- weighted regenerated noise sound power level using the following chart:-*



Example: For a passage velocity of 15m/s and a face area of 1 m^2 the overall sound power level is 60 dB(A).

3. *Add the Spectrum Correction and silencer Model Correction factors to the overall sound power level. The Spectrum Correction and Model Correction factors are contained in the following tables:-*

Spectrum Correction Factor

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
D Series	12	6	0	-3	-4	-6	-12	-18
E Series	13	3	-1	-3	-4	-7	-11	-17
H Series	14	1	-2	-4	-5	-7	-9	-16

Model Correction Factor

D Series	D27	D33	D38	D43	D47	D50
Correction	0	-3	-5	-6	-8	-9
E Series	E29	E38	E44	E50		
Correction	-1	-4	-7	-9		
H Series	H33	H40	H45	H50		
Correction	-3	-5	-7	-9		

Example

For a 1m wide and 1m high H40/150 silencer with a passage velocity of 15 m/s the regenerated noise is determined as follows:-

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Overall Sound Power Level (dB)	60	60	60	60	60	60	60	60
Spectrum Correction Factor	14	1	-2	-4	-5	-7	-9	-16
Model Correction Factor	-5	-5	-5	-5	-5	-5	-5	-5
Regenerated Noise Level L_w (dB)	69	56	53	51	50	48	46	39

Please note that the above method is only an approximate calculation technique. NAP engineers can provide more accurate data by using our proprietary calculation method based on our comprehensive test data.

Installation

When used in mechanical services and air conditioning systems, silencers are best installed where the ductwork passes through plant room, studio or other building walls and where the ductwork upstream of the silencer is free of bends so that the airflow into the silencer is uniform. Should a silencer be installed after a bend, the silencer should be orientated so that splitters are in the same plane as the bend.

Silencers should not be installed close to the inlet of fans as this increases the level of turbulence at the fan inlet. This can have the effect of increasing the fan noise by up to 15dB. Therefore silencers should be placed approximately two rotor diameters from the fan itself.

In some applications when the adjoining ductwork is thermally insulated, allowance should be made for thermally insulating the silencer as they are not externally insulated in standard form.

Flexible couplings should be used between the silencer and adjoining ductwork where there is a risk of vibration transmission or flanking. The material of the flexible coupling should be non-sound transparent that permits vibration isolation whilst minimising the sound leakage into or out of the ductwork.

NAP engineers can provide assistance in selecting the optimal silencers and providing installation procedures for your application.

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