



AEROGRAMMI S.A.

DESIGN AND MANUFACTURE OF GRILLES AND SPECIAL AIR CONDITINING COMPONENTS



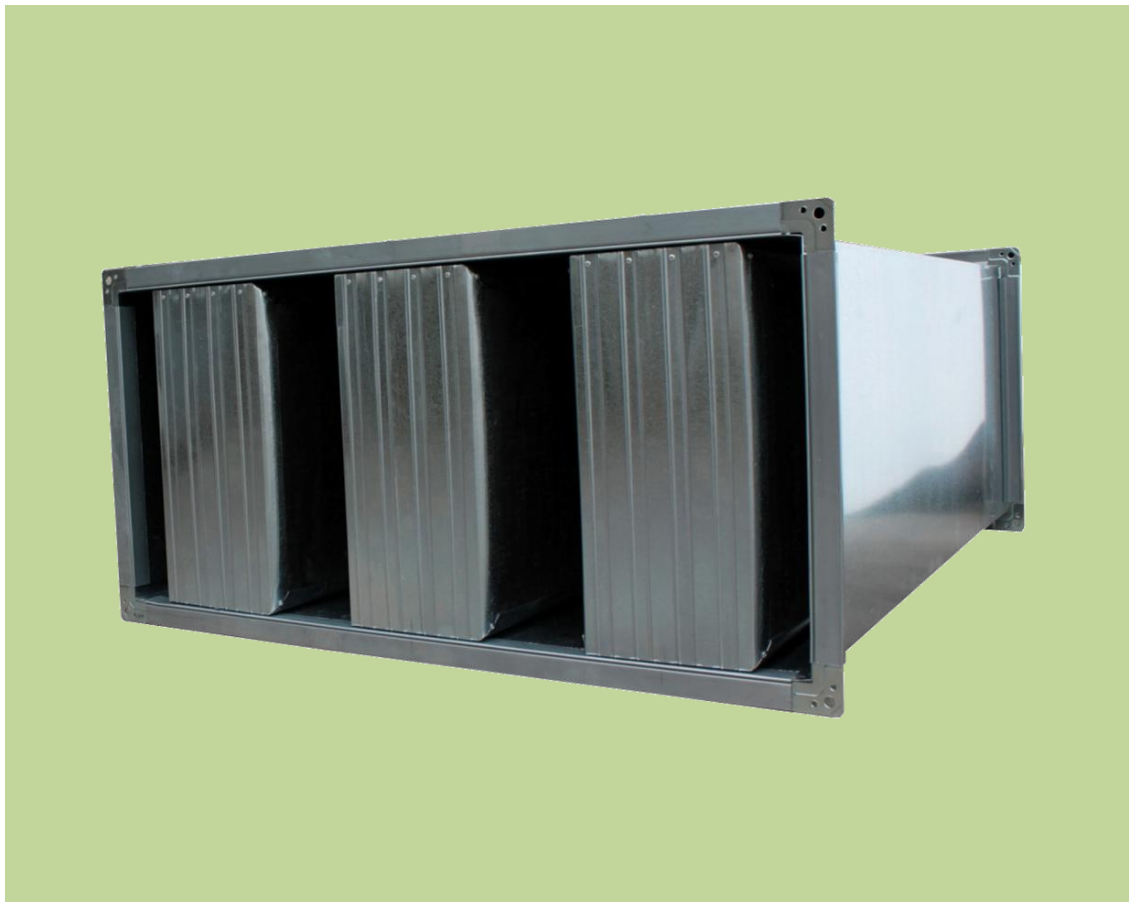
ACOUSTIC SPLITTERS

SAP

&

SILENCERS

SAS



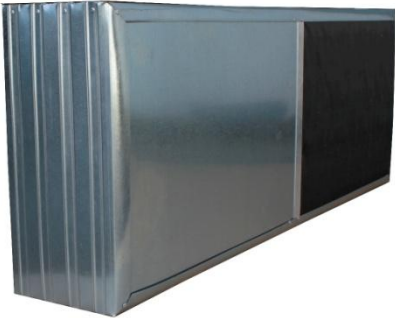
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GENERAL

For the reduction of the noise which is produced in an air conditioning or ventilation system from the fan and the air flow in the air ducts we use acoustic splitters (SAP). If the acoustic splitters are installed in a piece of air duct then we have a silencer (SAS).

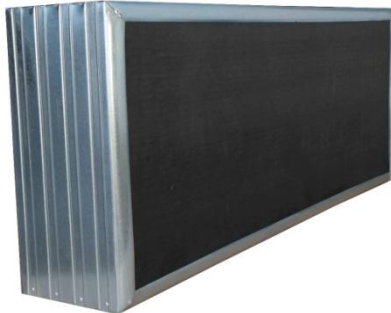
1. ACOUSTIC SPLITTERS

A) SAP-A: The acoustic splitters SAP-A are consistent from a frame profile with aerodynamic design for reduction of the pressure drop, made of galvanized sheet steel. In the internal there is sound absorbing material (mineral fibre) which is covered in the two sides by glass silk. The sound absorbing material is not flammable class A1 according to EN 13501 and the glass silk is not flammable class A2 according to EN 13501. The half surface of the glass silk is covered by galvanized sheet steel with thickness $t=0,5$ mm. The sound absorption achieved by absorption and resonance.



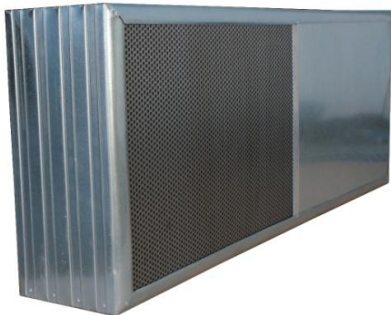
They are manufactured in thickness 100mm (SAP-A-100) and 200mm (SAP-A-200). Best efficiency in the frequency area 63-500Hz.

B) SAP-B: The acoustic splitters SAP-B are consistent from a frame profile with aerodynamic design for reduction of the pressure drop, made of galvanized sheet steel. In the internal there is sound absorbing material (mineral fibre) which is covered in the two sides by glass silk. The sound absorbing material is not flammable class A1 according to EN 13501 and the glass silk is not flammable class A2 according to EN 13501. The sound absorption achieved by absorption. They are manufactured in thickness 100mm (SAP-B-100) and



200mm (SAP-B-200). Best efficiency in the frequency area 500-8000Hz.

C) SAP-C: The acoustic splitters SAP-C are consistent from a frame profile with aerodynamic design for reduction of the pressure drop, made of galvanized sheet steel. In the internal there is sound absorbing material (mineral fibre) which is covered in the two sides by glass silk. The sound absorbing material is not flammable class A1 according to EN 13501 and the glass silk is not flammable class A2 according to EN 13501. The half surface of the glass silk is covered by galvanized sheet steel with thickness $t=0,5$ mm. The other half is

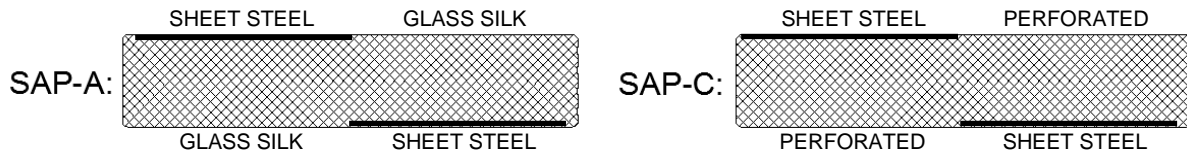


covered by galvanized perforated sheet steel with thickness $t=0,6$ mm. The sound absorption achieved by absorption and resonance. They are manufactured in thickness 100mm (SAP-C-100) and 200mm (SAP-C-200). Best efficiency in the frequency area 63-500Hz.



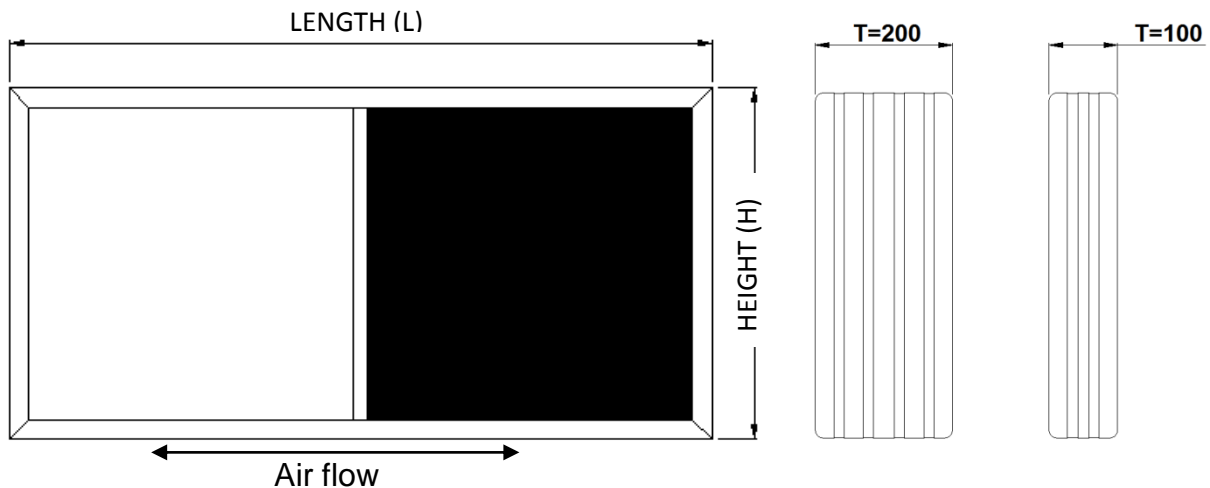
D) SAP-D: The acoustic splitters SAP-D are consistent from a frame profile with aerodynamic design for reduction of the pressure drop, made of galvanized sheet steel. In the internal there is sound absorbing material (mineral fibre) which is covered in the two sides by glass silk. The sound absorbing material is not flammable class A1 according to EN 13501 and the glass silk is not flammable class A2 according to EN 13501. The glass silk is covered by galvanized perforated sheet steel with thickness $t=0,6$ mm. The sound absorption achieved by absorption. They are manufactured in thickness 100mm (SAP-D-100) and 200mm (SAP-D-200). Best efficiency in the frequency area 500-8000Hz.

2. STRUCTURE OF ACOUSTIC SPLITTERS SAP-A AND SAP-C



DIMENSIONS OF ACOUSTIC SPLITTERS

The dimensions of an acoustic splitter are the length (L), the height (H) and the thickness (T). The length (L) of the acoustic splitter is always parallel to the direction of the air flow (Be careful when there is vertical installation!) and the height (H) always vertical to the direction of the air flow. The thickness (T) is 100mm or 200mm.



3. SILENCERS

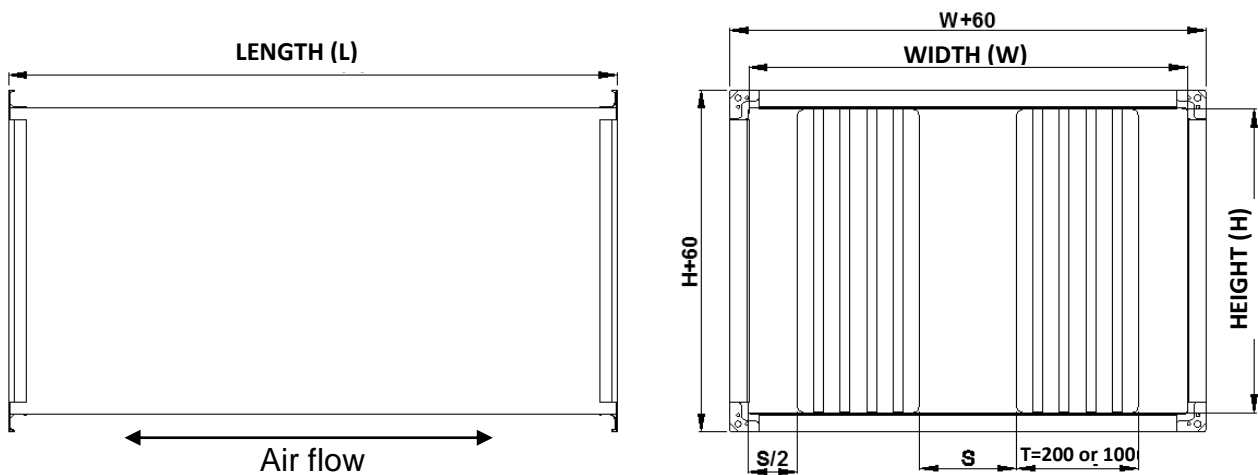
The silencers characterized by the type of the acoustic splitters they contain, so we have the following types:

- SAS-A:** With acoustic splitters type SAP-A
- SAS-B:** With acoustic splitters type SAP-B
- SAS-C:** With acoustic splitters type SAP-C
- SAS-D:** With acoustic splitters type SAP-D

The characteristics of the silencers had been measured in external laboratory according to EN ISO 7235.

DIMENSIONS OF SILENCERS

The length of the silencers (L) and their height (H) is the same with this of the acoustic splitters where they contain, their width (W) is depended on the number of the acoustic splitters (n), their thickness (T) and the gap (S), $W=n*(S+T)$.

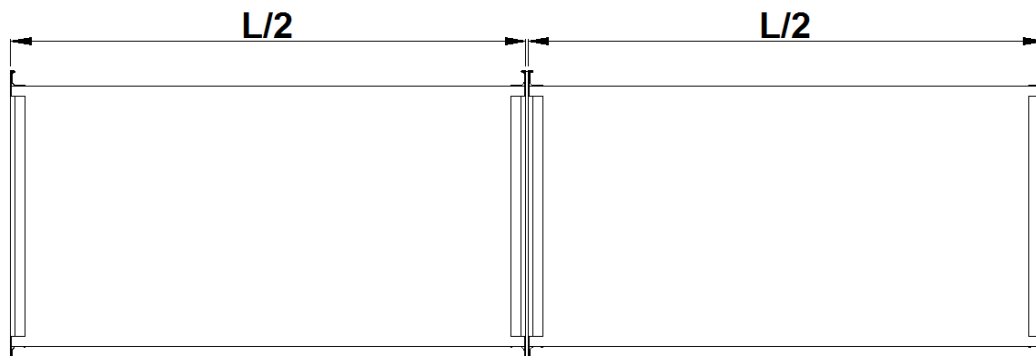


MATERIALS - CONSTRUCTION OF SILENCERS

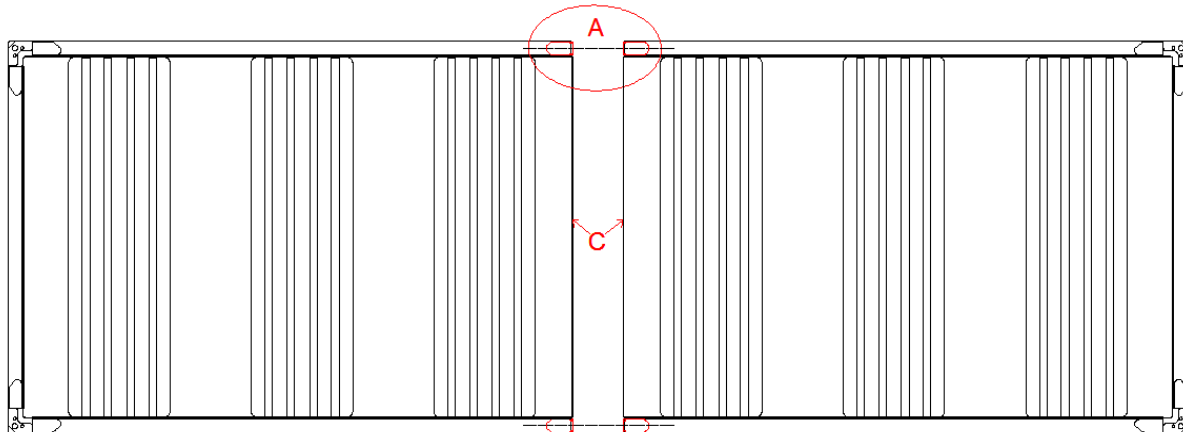
The shell is manufactured by galvanized sheet steel with thickness 1mm at least. In the two edges is installed a frame consisted by profile SB30 and corners S30 for easy and without leakages connection with the air ducts.

BIG SILENCERS

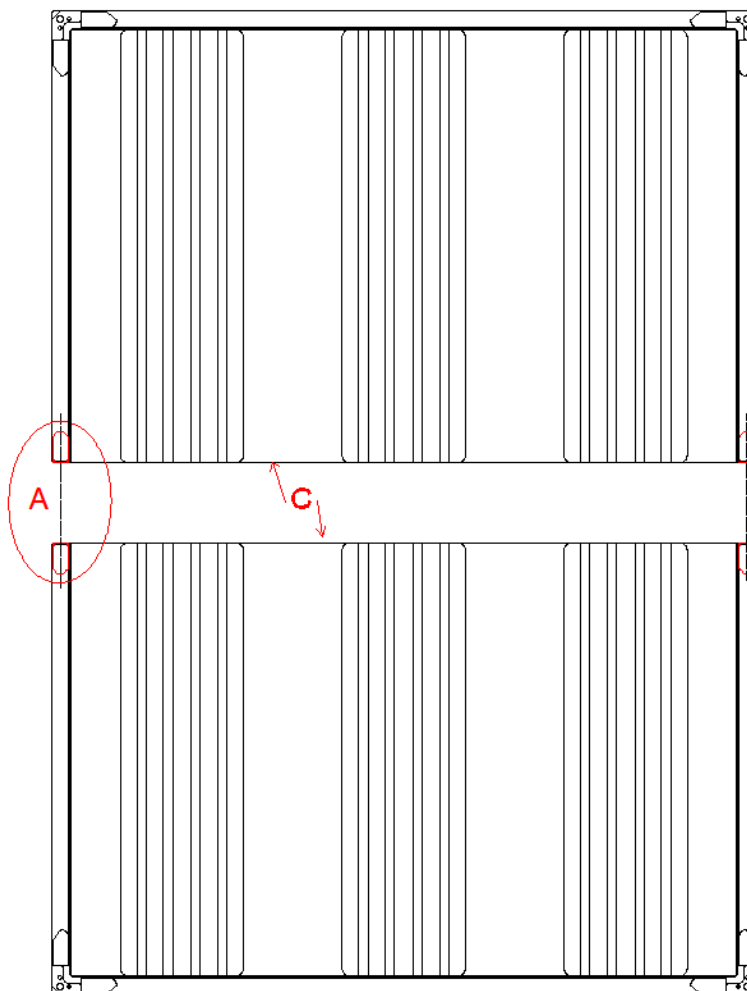
a) In the case where we have a silencer with big length (L) which is impossible to manufacture in one piece in length, then we manufacture two pieces with length $L/2$.



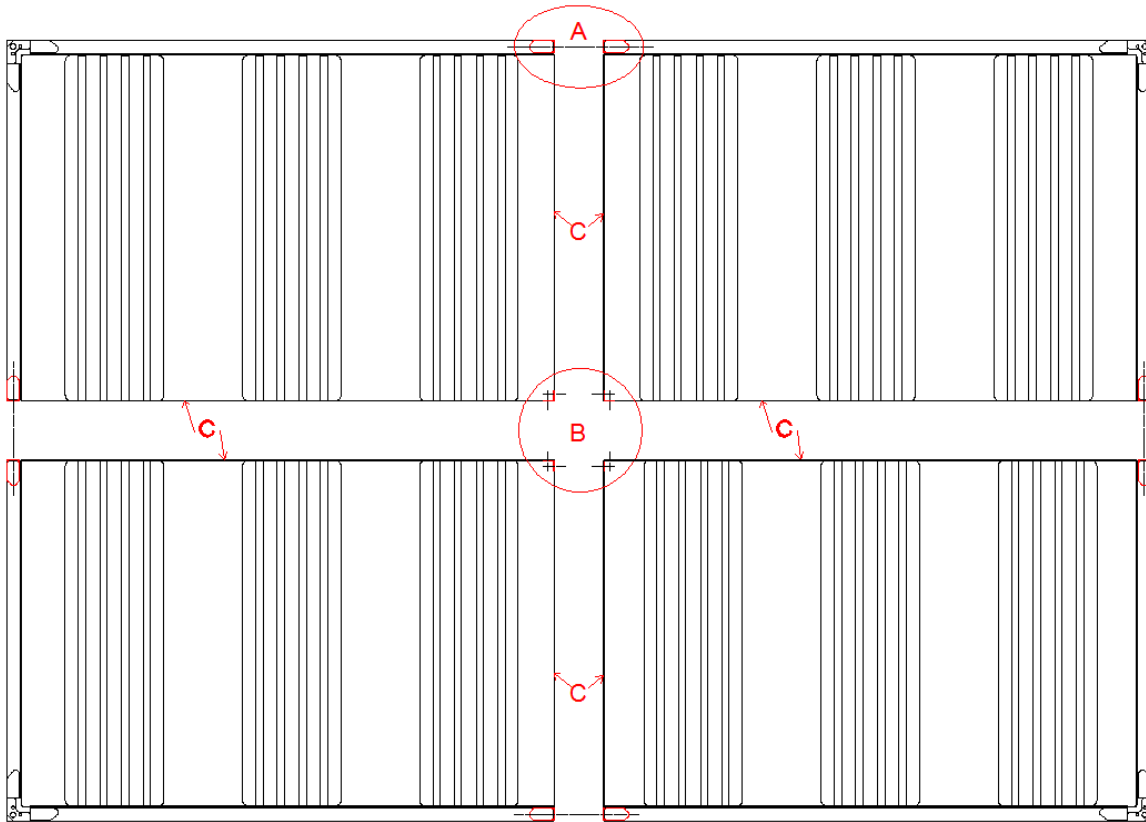
b) In the case where we have a silencer with big width (W) which is impossible to manufacture in one piece, in width, then we manufacture two pieces with width $W/2$ if we have even number of acoustic splitters or in two pieces with width W_1 and W_2 ($W_1 + W_2 = W$) if we have odd number of acoustic splitters.



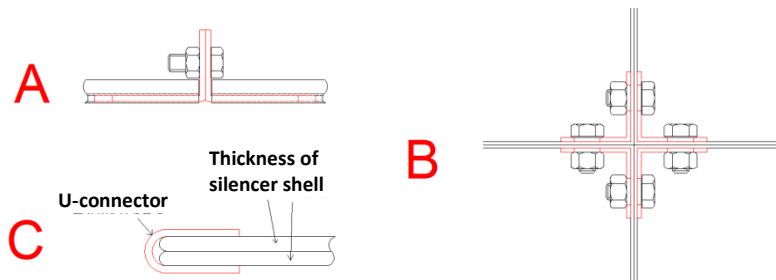
c) In the case where we have a silencer with big height (H) which is impossible to manufacture in one piece, in height, then we manufacture two pieces with height $H/2$.



δ) In the case where we have a silencer with big height (H) and width (W) which is impossible to manufacture in one piece, in height and in width, then we manufacture four pieces with height H/2 and width W/2 or W_1 και W_2 ($W_1 + W_2 = W$).

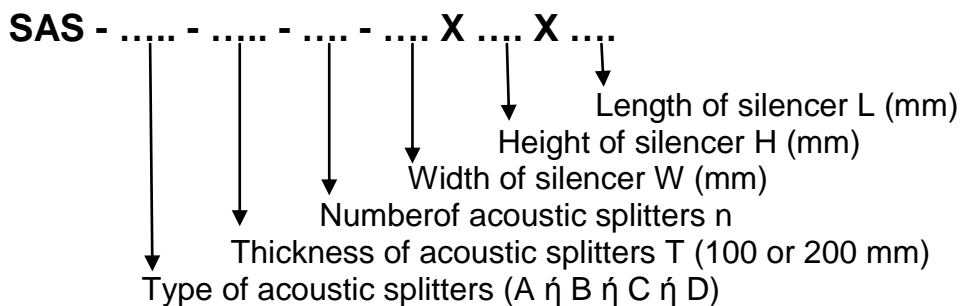


In the positions A, B and C the connection are made with parts and screws provided by AERGRAMMI.



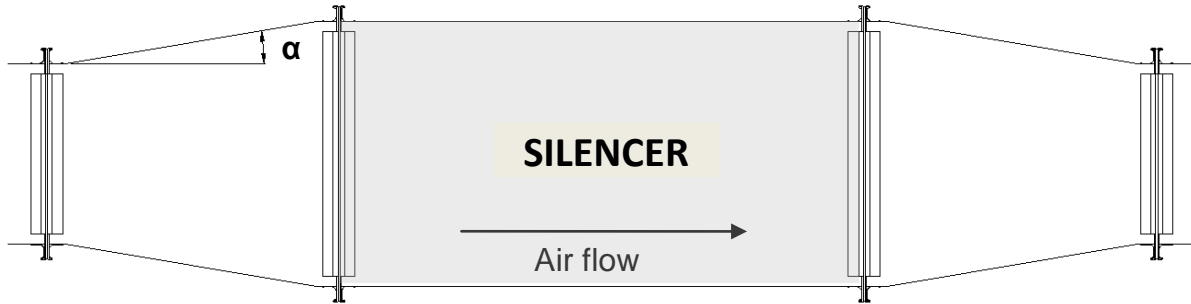
WAY OF ORDER OF SILENCERS

For the order of the silencers SAS the following combination of letters and numbers is used:

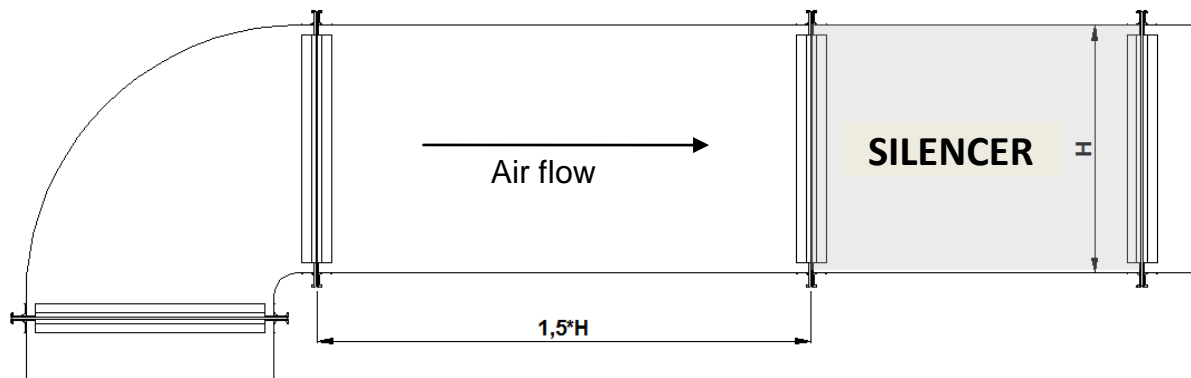


4. INSTALLATION OF SILENCERS

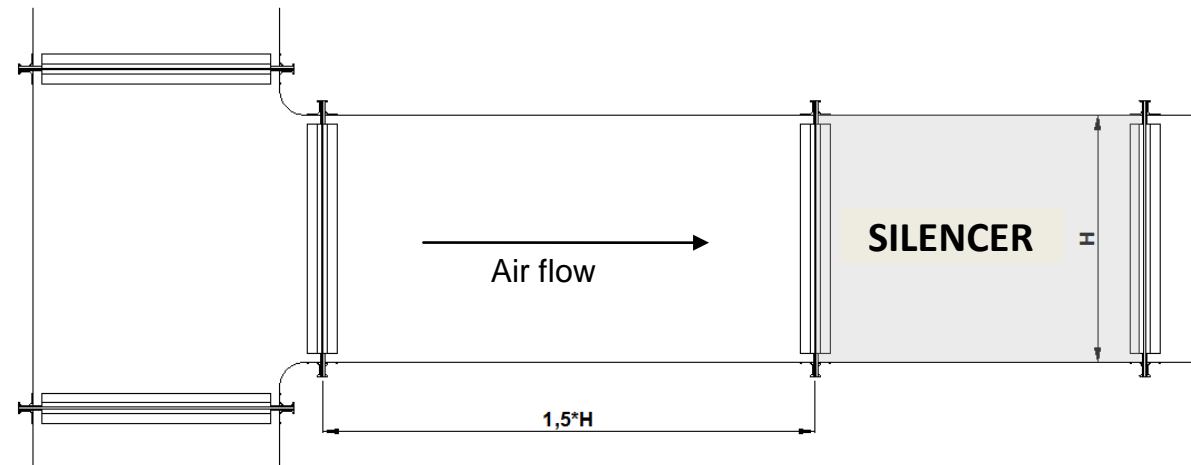
The silencers, usually, they have dimensions bigger from the air duct where they are connected. In the expansions the angle α must be smaller than 15° (even smaller if the air velocity in the air duct is high) because else we have high pressure drop and noise at this point. In the reducers we can use bigger angles.



When the silencer is installed after a 90° corner, then must be in distance at least equal to $1,5 \cdot H$ from the end of the corner (H: height of the silencer).



When the silencer is installed in a branch of a main air duct then must be in distance at least equal to $1,5 \cdot H$ from the start of the branch (H: height of the silencer).



CALCULATION OF SILENCERS

Values definitions:

Download from: <http://www.aerogrammi.gr/silhelpen.xlsx> the file silhelpen.xlsx. This file helps you to make the silencers selection easier.

W	Width (mm)
H	Height (mm)
L	Length (mm)
n	No of acoustic splitters
T	Thickness of acoustic splitter (mm)
S	Gap between acoustic splitters (mm)
Q	Air supply (m ³ /h)
u _f	Air velocity in the silencer (m/s)
Δp	Pressure drop (Pa)
f _m	Octave centre frequency (Hz)
Di	Sound absorption (dB)
Lw	Flow regenerated sound power level (dB) (Lw = Lw1 + k)
Lw1	Flow regenerated sound power level for silencer with area WxH 1m ² (dB)
L _{WA}	A-weighted flow regenerated sound power level (dBA)
A _s	Free area of the silencer (m ²)
k	Correction factor Lw for silencers with area WxH different from 1m ² (dB)

CALCULATION EXAMPLE:

A fan has air supply Q=8.000 m³/h and generates noise (sound power level), according to the manufacturer as shown in table A. The silencer must have maximum Δp=50Pa and maximum L=1500mm. We want the noise (sound power level) after the silencer to be less or equal from the table B. So we want the sound absorption of the silencer to be equal or bigger from the table C (C=A-B).

Table A:

f _m (Hz)	63	125	250	500	1K	2K	4K	8K
dB	83	85	93	85	83	81	74	67

Table B:

f _m (Hz)	63	125	250	500	1K	2K	4K	8K
dB	80	72	70	65	63	62	60	58

Table C:

f _m (Hz)	63	125	250	500	1K	2K	4K	8K
dB	3	13	23	20	20	19	14	9

From the sound absorption tables Di (page 10,11,13,14) we select the combination of type of the acoustic splitters, length of the silencer L and the gap S which covers the needed sound absorption. In our case we select SAP-A-200 (T=200mm) for length L=1500mm and gap S=120mm (page. 13) with sound absorption Di:

Table D (Di):

f _m (Hz)	63	125	250	500	1K	2K	4K	8K
dB	4	14	26	30	34	21	15	12

We select the number of the acoustic splitters n=2, so the width of the silencer will be $W=n*(T+S)=2*(200+120)=640\text{mm}$. We select the height of the silencer H=800mm. The free area of the silencer is $A_s=n*S(m)*H(m)=2*0,12*0,8=0,192\text{m}^2$. The air velocity in the silencer is $u_f=Q/(3.600*A_s)=11,57\text{m/sec}$. From the pressure drop table for T=200mm (page 15), silencer length L=1500mm, and gap S=120mm we see that for u_f=10m/sec, Δp= 36Pa and for u_f=12m/sec, Δp= 53Pa, so for u_f=11,57m/sec we have Δp= 49,35Pa which is lower from our limit. (GO TO page 16)

SAP-A & SAP-C: ABSORPTION Di (dB), SPLITTERS THICKNESS 100mm

f _m (Hz)	Di (dB) for SAP-A/SAP-C 100						
	LENGTH L=500mm						
	GAP S (mm)						
	40	50	60	70	80	90	100
63	4	3	3	2	2	2	2
125	14	10	9	8	6	4	3
250	25	19	15	13	12	11	10
500	26	22	21	20	19	19	18
1000	27	26	25	24	23	22	21
2000	28	27	26	17	16	13	11
4000	19	16	15	14	13	12	10
8000	13	11	10	9	8	7	7

f _m (Hz)	Di (dB) for SAP-A / SAP-C 100						
	LENGTH L=1000mm						
	GAP S (mm)						
	40	50	60	70	80	90	100
63	5	4	2	3	2	2	2
125	16	14	13	12	10	7	6
250	34	27	22	20	18	17	16
500	35	31	29	26	25	24	23
1000	38	37	36	35	34	32	31
2000	38	36	35	25	23	20	17
4000	27	22	20	19	18	17	14
8000	21	17	15	14	12	11	10

f _m (Hz)	Di (dB) for SAP-A/SAP-C 100						
	LENGTH L=1500mm						
	GAP S (mm)						
	40	50	60	70	80	90	100
63	6	5	4	4	3	3	3
125	19	15	14	13	12	10	8
250	43	35	30	26	23	22	21
500	45	40	37	33	32	31	29
1000	48	47	46	45	44	43	42
2000	48	45	43	33	30	27	24
4000	35	29	27	25	23	21	18
8000	29	24	22	19	16	14	12

f _m (Hz)	Di (dB) for SAP-A/SAP-C 100						
	LENGTH L=2000mm						
	GAP S (mm)						
	40	50	60	70	80	90	100
63	7	6	5	5	4	4	4
125	22	18	17	16	14	12	10
250	50	43	38	33	29	27	26
500	50	49	46	41	39	37	34
1000	50	50	50	50	50	50	49
2000	50	50	50	41	38	34	30
4000	43	37	33	30	28	25	21
8000	37	31	28	24	20	17	15

f _m (Hz)	Di (dB) for SAP-A/SAP-C 100						
	LENGTH L=2500mm						
	GAP S (mm)						
	40	50	60	70	80	90	100
63	9	7	6	6	5	5	5
125	25	21	19	18	17	14	12
250	50	50	50	40	34	32	30
500	50	50	50	48	45	43	40
1000	50	50	50	50	50	50	50
2000	50	50	50	47	45	40	36
4000	49	44	40	36	33	30	25
8000	45	40	34	29	24	20	18

f _m (Hz)	Di (dB) for SAP-A/SAP-C 100						
	LENGTH L=3000mm						
	GAP S (mm)						
	40	50	60	70	80	90	100
63	10	9	8	7	6	6	6
125	28	23	21	20	19	16	14
250	50	50	50	46	40	37	35
500	50	50	50	50	50	49	45
1000	50	50	50	50	50	50	50
2000	50	50	50	49	48	47	43
4000	50	48	44	42	38	34	29
8000	50	45	41	34	28	23	20

SAP-B & SAP-D: ABSORPTION Di (dB), SPLITTERS THICKNESS 100mm

f _m (Hz)	Di (dB) for SAP-B / SAP-D 100						
	LENGTH L=500mm						
	GAP S (mm)						
	40	50	60	70	80	90	100
63	4	3	3	3	3	3	2
125	7	6	6	5	5	4	3
250	11	10	9	8	7	6	5
500	16	15	14	13	12	12	11
1000	37	34	31	29	26	25	22
2000	44	40	37	29	25	22	19
4000	32	28	20	16	13	11	10
8000	21	17	16	14	12	11	9

f _m (Hz)	Di (dB) for SAP-B / SAP-D 100						
	LENGTH L=1000mm						
	GAP S (mm)						
	40	50	60	70	80	90	100
63	6	5	5	4	4	4	3
125	10	9	9	8	7	7	6
250	20	19	18	17	14	13	9
500	27	25	24	23	21	20	19
1000	45	43	41	38	36	34	31
2000	50	48	46	39	35	34	30
4000	40	36	28	25	22	19	18
8000	30	25	21	19	17	15	14

f _m (Hz)	Di (dB) for SAP-B / SAP-D 100						
	LENGTH L=1500mm						
	GAP S (mm)						
	40	50	60	70	80	90	100
63	7	6	6	5	5	5	4
125	13	12	11	10	9	8	7
250	28	26	25	23	20	18	14
500	37	34	33	32	29	28	26
1000	50	50	48	47	45	44	41
2000	50	50	50	47	46	45	42
4000	48	44	36	33	30	28	27
8000	38	33	26	24	22	21	20

f _m (Hz)	Di (dB) for SAP-B / SAP-D 100						
	LENGTH L=2000mm						
	GAP S (mm)						
	40	50	60	70	80	90	100
63	8	7	7	6	6	6	5
125	16	14	13	12	11	10	8
250	36	34	32	29	25	22	18
500	47	44	42	41	37	36	34
1000	50	50	50	50	50	50	50
2000	50	50	50	50	50	50	50
4000	50	50	49	47	42	37	36
8000	46	41	38	35	30	27	26

f _m (Hz)	Di (dB) for SAP-B / SAP-D 100						
	LENGTH L=2500mm						
	GAP S (mm)						
	40	50	60	70	80	90	100
63	10	9	8	7	7	7	6
125	19	17	16	14	12	11	9
250	44	41	39	35	31	27	23
500	50	50	50	49	45	43	41
1000	50	50	50	50	50	50	50
2000	50	50	50	50	50	50	50
4000	50	50	50	50	49	45	44
8000	50	50	47	40	37	33	31

f _m (Hz)	Di (dB) for SAP-B / SAP-D 100						
	LENGTH L=3000mm						
	GAP S (mm)						
	40	50	60	70	80	90	100
63	11	10	10	9	8	8	7
125	22	20	18	16	14	12	10
250	50	48	46	41	36	32	27
500	50	50	50	50	50	50	48
1000	50	50	50	50	50	50	50
2000	50	50	50	50	50	50	50
4000	50	50	50	50	50	48	46
8000	50	50	50	47	40	38	36

PRESSURE DROP Δp (Pa), SPLITTERS THICKNESS 100mm

Δp (Pa) for T=100mm							
U_f (m/s)	<u>LENGTH L=500mm</u> GAP S (mm)						
	40	50	60	70	80	90	100
4	5	6	5	4	4	3	3
6	16	12	10	9	9	9	7
8	27	21	18	18	17	15	15
10	40	32	29	27	26	24	22
12	55	45	40	38	36	34	33
14	70	58	54	52	48	45	44
16	86	74	69	65	63	60	58
18	109	94	89	86	78	76	71
20	135	115	108	102	97	94	92

Δp (Pa) for T=100mm							
U_f (m/s)	<u>LENGTH L=1000mm</u> GAP S (mm)						
	40	50	60	70	80	90	100
4	7	7	6	5	5	3	3
6	20	15	12	11	10	10	9
8	35	26	23	21	20	18	17
10	53	40	36	32	30	28	26
12	73	57	50	46	42	39	37
14	94	75	66	63	56	52	50
16	118	96	85	82	74	69	66
18	149	122	108	103	92	88	85
20	183	151	136	126	115	109	105

Δp (Pa) for T=100mm							
U_f (m/s)	<u>LENGTH L=1500mm</u> GAP S (mm)						
	40	50	60	70	80	90	100
4	9	8	7	6	5	4	4
6	25	18	15	13	12	11	10
8	43	32	27	24	22	20	19
10	65	49	42	37	34	31	29
12	90	69	59	53	48	44	42
14	118	92	79	73	65	60	57
16	149	118	101	95	85	79	75
18	188	149	129	120	107	100	95
20	232	185	160	147	132	124	118

Δp (Pa) for T=100mm							
U_f (m/s)	<u>LENGTH L=2000mm</u> GAP S (mm)						
	40	50	60	70	80	90	100
4	11	10	9	7	6	5	4
6	29	21	17	15	14	13	11
8	51	37	31	28	25	23	21
10	77	57	49	43	39	35	32
12	108	82	69	61	54	50	47
14	142	108	92	83	73	67	63
16	180	140	118	108	96	88	83
18	227	177	150	137	121	112	105
20	280	219	186	168	149	139	131

Δp (Pa) for T=100mm							
U_f (m/s)	<u>LENGTH L=2500mm</u> GAP S (mm)						
	40	50	60	70	80	90	100
4	13	11	10	7	7	5	5
6	34	24	19	17	15	14	12
8	58	43	35	31	28	25	23
10	89	66	55	48	43	39	35
12	125	94	78	68	61	55	51
14	166	125	105	94	82	74	69
16	211	162	135	122	107	98	91
18	267	205	171	154	135	124	116
20	329	254	212	189	167	154	144

Δp (Pa) for T=100mm							
U_f (m/s)	<u>LENGTH L=3000mm</u> GAP S (mm)						
	40	50	60	70	80	90	100
4	15	13	11	8	7	6	5
6	38	27	22	19	17	15	13
8	66	48	39	34	31	27	25
10	101	75	62	53	48	43	39
12	143	106	87	76	67	60	56
14	190	142	118	104	90	81	76
16	242	184	152	135	118	107	99
18	306	233	192	170	149	136	126
20	378	288	238	210	184	168	156

SAP-A & SAP-C: ABSORPTION Di (dB), SPLITTERS THICKNESS 200mm

f _m (Hz)	Di (dB) for SAP-A/SAP-C 200							
	LENGTH L=500mm							
	GAP S (mm)							
	60	80	100	120	140	160	180	200
63	4	3	2	2	2	1	1	1
125	10	9	8	7	6	5	4	4
250	15	13	12	11	10	9	8	7
500	19	16	14	13	12	11	9	8
1000	21	20	18	17	16	13	12	11
2000	18	14	11	9	8	7	6	5
4000	14	11	10	9	7	6	5	4
8000	12	10	9	8	7	6	5	4

f _m (Hz)	Di (dB) for SAP-A/SAP-C 200							
	LENGTH L=1000mm							
	GAP S (mm)							
	60	80	100	120	140	160	180	200
63	5	4	4	3	2	2	2	2
125	14	13	11	10	9	8	7	6
250	27	22	20	18	17	16	14	13
500	34	29	24	21	19	18	16	14
1000	35	33	28	26	24	20	18	16
2000	32	25	19	16	12	10	9	8
4000	21	16	13	12	10	9	8	7
8000	16	13	12	10	9	8	7	6

f _m (Hz)	Di (dB) for SAP-A/SAP-C 200							
	LENGTH L=1500mm							
	GAP S (mm)							
	60	80	100	120	140	160	180	200
63	7	6	5	4	4	3	3	3
125	19	18	15	14	13	12	10	8
250	38	32	29	26	25	23	20	19
500	47	40	34	30	26	24	22	19
1000	48	45	38	34	30	24	21	19
2000	44	33	25	21	16	14	13	11
4000	28	20	16	15	12	11	10	9
8000	21	16	14	12	11	10	8	7

f _m (Hz)	Di (dB) for SAP-A/SAP-C 200							
	LENGTH L=2000mm							
	GAP S (mm)							
	60	80	100	120	140	160	180	200
63	10	8	6	5	5	4	4	4
125	25	23	20	17	16	15	13	11
250	48	42	39	34	32	29	26	25
500	50	50	44	38	33	31	28	25
1000	50	50	48	42	36	29	25	22
2000	50	41	30	25	20	17	16	14
4000	34	24	18	17	14	13	12	10
8000	25	19	17	15	13	11	9	8

f _m (Hz)	Di (dB) for SAP-A/SAP-C 200							
	LENGTH L=2500mm							
	GAP S (mm)							
	60	80	100	120	140	160	180	200
63	12	11	9	7	6	5	5	5
125	33	30	25	22	20	19	16	14
250	49	48	47	41	39	35	31	30
500	50	50	50	47	41	38	34	30
1000	50	50	50	50	43	35	30	26
2000	50	48	37	30	23	19	17	15
4000	40	29	22	20	17	15	14	12
8000	29	22	19	16	14	13	10	10

f _m (Hz)	Di (dB) for SAP-A/SAP-C 200							
	LENGTH L=3000mm							
	GAP S (mm)							
	60	80	100	120	140	160	180	200
63	14	12	10	9	8	7	6	6
125	41	36	31	27	25	23	20	18
250	50	50	50	48	45	41	36	35
500	50	50	50	50	48	44	40	36
1000	50	50	50	50	50	41	35	30
2000	50	50	43	35	26	22	19	16
4000	45	33	26	23	20	18	16	14
8000	32	24	20	17	15	14	12	11

SAP-B & SAP-D: ABSORPTION Di (dB), SPLITTERS THICKNESS 200mm

		Di (dB) for SAP-B / SAP-D 200							
		LENGTH L=500mm							
		GAP S (mm)							
f _m (Hz)		60	80	100	120	140	160	180	200
63		4	4	3	3	2	2	2	2
125		9	8	6	5	5	4	4	2
250		14	13	12	11	10	9	8	7
500		27	22	21	20	19	18	17	15
1000		37	29	26	25	24	22	20	19
2000		35	29	23	19	17	16	15	14
4000		25	20	17	15	14	12	11	9
8000		20	17	13	12	11	10	9	7

		Di (dB) for SAP-B / SAP-D 200							
		LENGTH L=1000mm							
		GAP S (mm)							
f _m (Hz)		60	80	100	120	140	160	180	200
63		5	4	4	3	2	2	2	2
125		13	11	10	9	8	7	6	5
250		20	18	17	16	15	14	13	12
500		37	33	32	31	30	29	27	25
1000		50	48	46	43	40	35	32	29
2000		50	44	38	32	28	25	23	21
4000		32	27	24	21	19	17	15	13
8000		25	21	18	15	13	12	11	9

		Di (dB) for SAP-B / SAP-D 200							
		LENGTH L=1500mm							
		GAP S (mm)							
f _m (Hz)		60	80	100	120	140	160	180	200
63		7	6	6	5	4	3	3	3
125		18	16	14	13	11	9	8	7
250		28	26	23	22	21	19	18	16
500		50	48	47	44	41	40	36	34
1000		50	50	50	50	50	46	42	39
2000		50	50	50	44	38	33	30	27
4000		43	36	32	27	24	21	18	16
8000		30	26	22	18	15	14	13	10

		Di (dB) for SAP-B / SAP-D 200							
		LENGTH L=2000mm							
		GAP S (mm)							
f _m (Hz)		60	80	100	120	140	160	180	200
63		9	8	7	6	5	4	4	4
125		24	20	18	15	14	12	11	9
250		36	33	30	28	26	24	23	21
500		50	50	50	50	50	48	46	43
1000		50	50	50	50	50	50	49	48
2000		50	50	50	50	47	41	37	33
4000		50	45	40	33	29	25	22	18
8000		35	30	26	21	18	16	14	12

		Di (dB) for SAP-B / SAP-D 200							
		LENGTH L=2500mm							
		GAP S (mm)							
f _m (Hz)		60	80	100	120	140	160	180	200
63		11	9	8	7	6	5	5	4
125		30	26	22	19	17	14	13	11
250		43	39	35	33	30	28	26	24
500		50	50	50	50	50	50	50	50
1000		50	50	50	50	50	50	50	50
2000		50	50	50	50	50	47	43	38
4000		50	50	45	38	33	28	25	21
8000		40	34	29	23	20	18	16	13

		Di (dB) for SAP-B / SAP-D 200							
		LENGTH L=3000mm							
		GAP S (mm)							
f _m (Hz)		60	80	100	120	140	160	180	200
63		13	11	9	7	6	6	5	5
125		37	31	27	23	20	17	16	13
250		50	44	41	38	35	31	30	27
500		50	50	50	50	50	50	50	50
1000		50	50	50	50	50	50	50	50
2000		50	50	50	50	50	50	49	44
4000		50	50	50	42	36	31	27	23
8000		46	38	32	26	22	20	17	14

PRESSURE DROP Δp (Pa), SPLITTERS THICKNESS 200mm

ΔP (Pa) for T=200mm								
U_f (m/s)	<u>LENGTH L=500mm</u> GAP S (mm)							
	60	80	100	120	140	160	180	200
4	6	5	4	3	3	2	2	2
6	16	14	11	10	8	7	6	6
8	30	25	21	17	15	13	12	12
10	49	40	31	28	25	22	20	19
12	71	57	44	41	37	32	29	28
14	96	77	59	54	49	43	40	38
16	125	98	76	71	64	56	51	49
18	157	124	98	90	80	70	63	62
20	193	151	122	110	98	88	80	76

ΔP (Pa) for T=200mm								
U_f (m/s)	<u>LENGTH L=1000mm</u> GAP S (mm)							
	60	80	100	120	140	160	180	200
4	7	6	5	4	3	2	2	2
6	18	16	13	11	9	8	7	7
8	35	29	24	20	18	15	14	14
10	57	46	36	32	29	25	23	22
12	82	65	51	47	42	36	33	32
14	111	88	69	62	56	49	45	43
16	144	113	88	82	73	64	58	56
18	181	142	114	103	91	80	73	71
20	222	174	141	126	112	100	91	87

ΔP (Pa) for T=200mm								
U_f (m/s)	<u>LENGTH L=1500mm</u> GAP S (mm)							
	60	80	100	120	140	160	180	200
4	8	7	6	5	4	3	3	3
6	21	18	15	13	10	9	8	7
8	40	33	27	22	20	17	16	15
10	64	51	41	36	32	28	26	24
12	92	73	58	53	47	41	37	36
14	126	100	78	70	63	55	51	49
16	163	127	100	92	82	72	66	63
18	205	161	129	116	103	91	82	80
20	252	197	160	142	127	113	103	98

ΔP (Pa) for T=200mm								
U_f (m/s)	<u>LENGTH L=2000mm</u> GAP S (mm)							
	60	80	100	120	140	160	180	200
4	9	8	6	5	5	4	3	3
6	24	20	16	14	11	10	9	8
8	45	36	30	25	22	19	18	17
10	71	57	45	40	36	31	29	27
12	103	81	64	58	52	45	42	40
14	140	111	87	78	70	62	57	54
16	182	142	112	102	91	80	73	70
18	229	179	144	129	114	101	92	88
20	282	220	178	158	141	126	115	109

ΔP (Pa) for T=200mm								
U_f (m/s)	<u>LENGTH L=2500mm</u> GAP S (mm)							
	60	80	100	120	140	160	180	200
4	11	9	7	6	5	4	4	4
6	26	22	18	16	13	11	10	10
8	49	40	33	28	24	21	19	19
10	79	63	50	44	39	35	32	30
12	114	89	71	64	57	50	46	44
14	155	122	96	86	77	68	62	59
16	201	156	124	112	100	89	80	77
18	253	198	159	142	126	111	101	97
20	311	243	197	174	155	138	126	119

ΔP (Pa) for T=200mm								
U_f (m/s)	<u>LENGTH L=3000mm</u> GAP S (mm)							
	60	80	100	120	140	160	180	200
4	12	10	8	7	6	5	4	4
6	29	24	20	17	14	13	12	11
8	54	43	36	30	27	23	21	21
10	86	68	55	48	43	38	35	32
12	124	98	78	70	62	54	50	48
14	169	133	105	93	84	74	68	64
16	220	171	136	123	109	97	88	84
18	277	216	174	155	137	121	111	106
20	341	266	216	191	169	151	138	130

CALCULATION OF THE FLOW REGENERATED SOUND POWER LEVEL - Lw

REGENERATED SOUND Lw ₁ (dB) FOR SPLITTER THICKNESS T=100 AND 200mm AND FOR AREA WxH=1m ²									
U _f (m/s)	f _m (Hz)								LwA dB(A)
	63	125	250	500	1000	2000	4000	8000	
4	27	23	18	16	11	8	6	5	18
6	37	33	30	26	21	17	11	7	28
8	44	41	38	33	28	25	17	12	35
10	49	47	44	38	33	30	22	16	41
12	54	52	50	43	38	35	26	19	46
14	57	56	54	47	42	39	30	22	50
16	61	59	58	50	45	42	32	24	53
18	63	62	61	53	48	45	35	26	56
20	66	65	64	55	50	48	37	28	59

The characteristics of the silencers had been measured in external laboratory according to EN ISO 7235.

CORRECTION FACTOR OF THE REGENERATED SOUND – k

AREA W x H (m ²)	CORRECTION FACTOR k (dB)	AREA W x H (m ²)	CORRECTION FACTOR k (dB)	AREA W x H (m ²)	CORRECTION FACTOR k (dB)	AREA W x H (m ²)	CORRECTION FACTOR k (dB)
0,04	-14	0,5	-3	1,25	1	5	7
0,08	-11	0,6	-2,2	1,5	1,8	6	7,8
0,1	-10	0,7	-1,5	2	3	7	8,5
0,2	-7	0,8	-1	2,5	4	8	9
0,4	-4	1	0	4	6	9	9,5
						10	10

Air flow regenerated sound power level: Lw=Lw1 + k dB(A)

CALCULATION EXAMPLE:

CONTINUE FROM PAGE No 9: We calculate from the table in the top of the page 16, based on the air velocity u_f=11,57m/sec, the flow regenerated sound power level for a silencer with area WxH 1m² Lw₁. (With the help of the air velocities u_f=10m/sec and u_f=12m/sec). In our case it is:

Table E (L_{w1}):

f _m (Hz)	63	125	250	500	1K	2K	4K	8K
dB	53	51	49	42	37	34	25	18

From the 2nd table of the page 16 we calculate based on the area WxH=0,52m², the correction factor k, k=-2,9. We calculate the generated noise from the silencer with the type Lw=Lw1+k, so we have:

Table F (L_w):

f _m (Hz)	63	125	250	500	1K	2K	4K	8K
dB	50	48	46	39	34	31	22	16

The noise after the silencer is a combination of the difference between the fan noise and the sound absorption Di of the silencer: **Table G:** (Table G=Table A-Table D)

f _m (Hz)	63	125	250	500	1K	2K	4K	8K
dB	79	71	67	55	49	60	59	55

and the noise L_w of the silencer (Table F).

We apply the type $L_{\Sigma} = 10 \times \log_{10} \left(10^{\frac{D_i}{10}} + 10^{\frac{L_w}{10}} \right)$ for every frequency and we find the noise after the silencer

Table H:

f _m (Hz)	63	125	250	500	1K	2K	4K	8K
dB	79	71	67	55	49	60	59	55

This noise cover our needs (Table B).