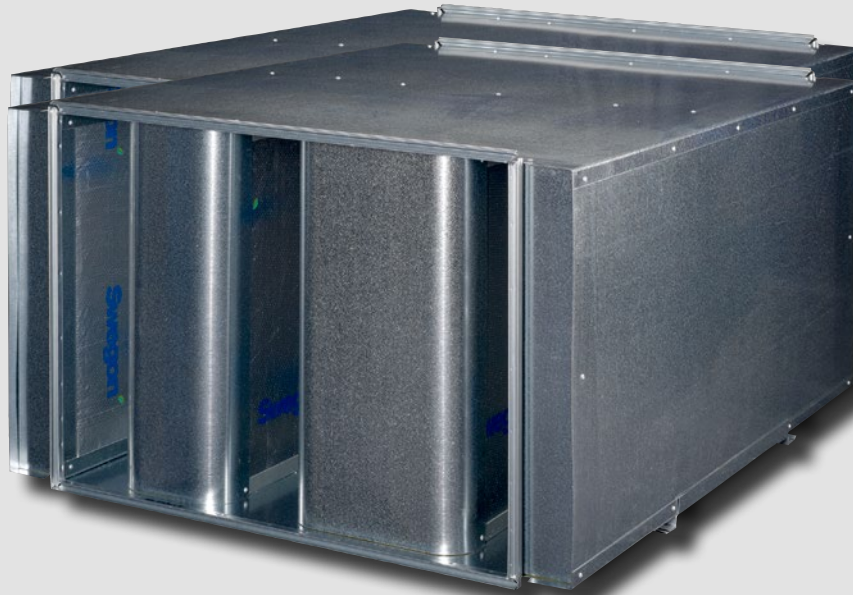


CALMO

Sound attenuator with recessed connection for rectangular ducts



QUICK FACTS

- Remarkably space-saving rectangular sound attenuator
- Excellent aerodynamic characteristics
- Extremely low pressure drop via tapered acoustic baffle surfaces
- Type-approved, environmentally friendly sound attenuating material, ISOVER Cleantec® PLUS
- ISOVER Cleantec® PLUS is cleanable using a wet method
- Available with cleaning cover
- Available in an insulated version with 50 mm thick fire-resistant stone wool
- Connection sizes ranging from 400x300 to 2200x2200
- Included in the MagiCAD database

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Technical description

Function

The sound attenuator's low pressure drop has been achieved by designing the acoustic baffle elements completely according to the basic laws of aerodynamics. In order to further optimize the sound attenuator with regard to pressure drop, a part of the sound attenuator's active section has been arranged outside the connection. This solution has also contributed towards increasing the integral attenuation of the product.

The low pressure drop can e.g. be utilised for the following:

- For reducing the space requirement in that a smaller sound attenuator can be selected.
- For reducing the pressure rise in the fan if the size is maintained.
- For reducing the inherent sound generation in the system thanks to lower velocity and lower pressure rise.
- For adapting the sound attenuator more easily to the connected duct system.

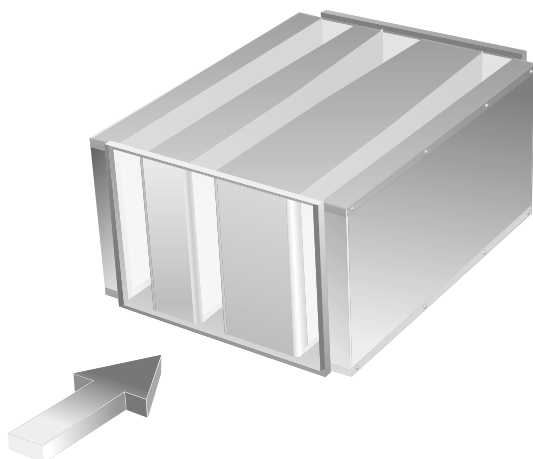


Figure 1. The acoustic baffles are designed according to the basic laws of aerodynamics. This together with the design feature, wherein a portion of the sound attenuator's active part has been arranged outside the connection, has reduced the pressure drop considerably as compared to conventional sound attenuators.

The CALMO contains all the positive characteristics that previous Swegon sound attenuators have offered. By taking the properties of relevant materials into account and utilising the basic laws of aerodynamics, Swegon has optimized its sound attenuators with regard to the following factors:

- The acoustic properties of the sound attenuating materials.
- The thickness of the acoustic baffles.
- The width of the spaces between baffles.
- The length of the acoustic baffles.
- The surface covering.

By combining the factors above, Swegon can always offer the best sound attenuation with the lowest pressure drop to satisfy client requirements.

General

The CALMO is, due to its unique design with connections facing the side baffles, suitable for use both in ducts and in direct connection to ventilation units.

Design

- The CALMO is made as standard of galvanized sheet steel to Environment Class C2 (corresponds to M according to Swedish VVS-AMA 98 Standard).
- The ISOVER Cleantec® PLUS sound attenuating material has been granted type approval. (Type approval no. 2706/92 with regard to cleaning, fibre entrainment, resistance to ageing emissions, washable surfaces, etc.)
- The standard CALMO is supplied with slip clamp connections.

Maintenance

The CALMO is under normal operating conditions a maintenance-free sound attenuator. If there are requirements for cleanability, the CALMO can be ordered with factory-mounted cleaning cover. See Accessories. The cleaning cover then covers all the airflow passages to provide the best service accessibility. In many applications, it may however be appropriate to position the cleaning cover in the duct near the sound attenuator.

Environment

The declaration of construction materials is available for downloading from our website or can be ordered from one of our sales offices.

Installation

The slip-clamp flanges on this product are intended for use as connection pieces for ducts only. The product should be suspended with a support beam under its entire width.

Sound attenuator kit, final installation at the site

The CALMO can be supplied in kit form. It is then supplied in parts with pre-assembled acoustic baffles and loose clamps. The CALMO in kit form makes it possible to also transport large sound attenuators through narrow passageways at a building site undergoing renovation, for instance. The final assembly work can then take place at the site according to the enclosed assembly instructions. For further details, contact Swegon.

Special version

In addition to the accessories and variants described in the catalogue there is scope for customised variants if required. For example, the CALMO is available with side connections and horizontal acoustic baffles.

Swegon can then in consultation with the customer optimize the sound attenuator in relation to sound attenuation, size, air handling unit adaptation and choice of material (example: stainless steel, aluminium zinc, etc). Please get in touch with Swegon for further information.

Accessories

Cleaning covers T1 and T2

For certain applications, a cleaning cover is required on or by the connection to the sound attenuator. For the CALMO, this is available as CALMO T1 accessory with cover which enables access to all the air passages between the baffles.

The technical data do not change if the CALMO T1 accessory is used.

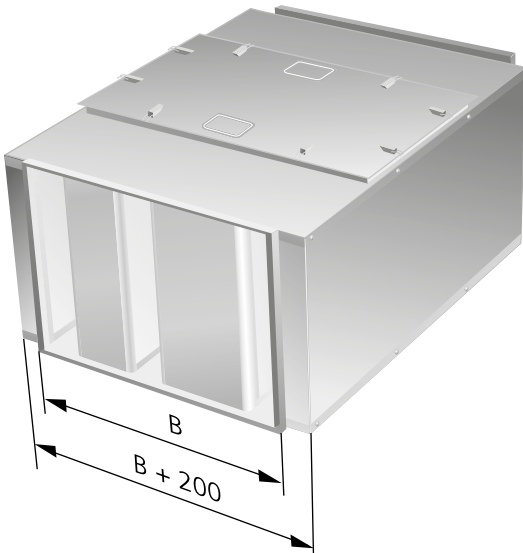


Figure 2. CALMO with cleaning cover, CALMO T1.

In applications in which the CALMO must be equipped with a cleaning cover, this means that the cover will be located on the top/bottom of the sound attenuator (i.e. the B dimension is defined as the width). Where, for example, due to restricted space the cleaning cover needs to be on the side, the B dimension should then be defined as the height (see figure above).

Sufficient open space must be provided so that the cover can be opened. CALMO T1 requires approx. 300 mm open space to make it possible to dismantle it. CALMO T2 requires fully open a distance of 700 mm.

Cleaning cover accessory

- CALMO T1: Uninsulated cleaning cover
- CALMO T2: Fire-resistant insulated cleaning cover

Fire-resistant insulation T3

In many applications, sound attenuators are installed in fire-resistant insulated duct systems. In applications in which ventilation ducts are to be insulated with 50 mm thick fire-resistant stone wool, you can either install external insulation over the sound attenuator directly at the building site or place an order for the factory-insulated variant.

For the CALMO, the factory-insulated variant is available as an accessory.

You can choose to insulate the cleaning cover only (CALMO T2) or insulate the whole sound attenuator (CALMO T3)).

The acoustic data and pressure drop do not change if the CALMO T2 accessory or the CALMO T3 accessory is used.

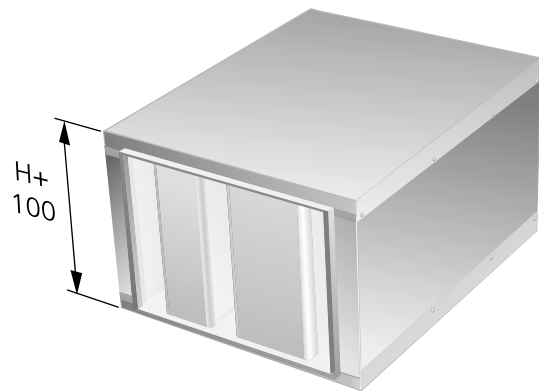


Figure 3. CALMO insulated with 50 mm thick fire-resistant stone wool.

Fire-resistant insulation accessory

- CALMO T3: The sound attenuator is supplied insulated with 50 mm thick fire-resistant stone wool. N.B.! The sound attenuator's H dim. should then be increased by 100 mm.

Perforated sheet metal lining T4

If the air contains a high concentration of particles or if for some other reason a more robust design is required, the acoustic baffles can be covered with perforated sheet steel over the ISOVER Cleantec® PLUS insulation, CALMO T4.

The acoustic data and pressure drop are affected when

the CALMO T4 accessory is used.

Sheet metal lining accessory

- CALMO T4: Perforated sheet metal lining.

Sizing

General

All specified technical data apply to CALMO in the standard version. 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. See also the section on System effect and pressure drop.

If perforated sheet steel covers the acoustic baffle surfaces, this increases the inherent sound generation. See the section on Inherent sound generation.

For standard connection, the sound attenuator's total dimensions project 200 mm outward from the B dimension. If the application requires connection to the outer casing of the sound attenuator (B dim. then becomes the same as the sound attenuator's total width), select the CADENZA sound attenuator.

Dimensions

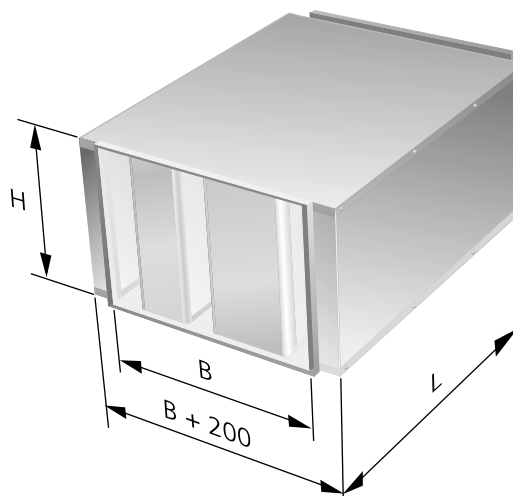


Figure 4. Dimension print

B dim.: **400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1800, 2000, 2200**

H dim.: **300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2200**

The B and H dim. with grey marking and bold type are standard; products with other dimensions are available to special order.

L = see Technical Data Table

Weight = Contact your nearest Swegon Representative.

Technical Data

B dim. (mm)	Code	Length (mm)	Static integral attenuation, (dB) to ISO 7235								P-value
			63	125	250	500	1K	2K	4K	8K	
400	0411	650	4	8	13	21	28	26	17	13	1.8
	0421	1250	5	11	23	36	46	42	28	19	2.0
	0431	1850	6	13	31	50	50	48	34	23	3.5
	0412	650	5	10	15	22	27	26	16	14	4.0
	0422	1250	7	14	24	36	45	40	24	18	5.0
	0432	1850	10	17	32	49	50	45	32	21	8.0
500	0511	650	4	9	15	22	28	24	16	13	1.8
	0521	1250	5	12	23	36	41	36	23	18	2.0
	0531	1850	7	15	31	46	49	43	28	23	3.5
	0512	650	6	10	16	25	30	29	18	14	4.0
	0522	1250	8	16	26	39	46	41	28	20	5.0
	0532	1850	10	20	33	48	50	46	35	26	8.0
600	0611	650	4	10	15	23	27	27	15	10	1.8
	0621	1250	7	15	24	39	45	40	23	17	2.0
	0631	1850	8	19	32	48	50	45	30	22	3.5
	0612	650	4	8	12	18	22	20	11	8	1.3
	0622	1250	5	12	19	32	37	31	15	11	1.7
	0632	1850	7	15	26	44	48	38	19	16	2.7
	0613	650	6	10	16	25	30	29	18	14	4.0
	0623	1250	8	16	26	39	46	41	28	20	5.0
	0633	1850	10	20	33	48	50	46	35	26	8.0
700	0711	650	3	6	9	14	18	16	8	5	1.2
	0721	1250	4	10	16	28	33	27	9	6	1.4
	0731	1850	5	12	21	42	45	34	12	10	1.9
	0712	650	6	8	14	20	25	23	13	11	1.5
	0722	1250	8	12	21	35	40	35	20	15	2.0
	0732	1850	10	16	29	46	48	40	26	19	3.0
800	0811	650	4	9	14	21	27	26	16	14	1.8
	0821	1250	6	13	23	35	45	40	24	18	2.1
	0831	1850	7	16	31	48	50	45	32	21	3.5
	0812	650	4	8	12	17	20	15	11	10	1.2
	0822	1250	5	11	18	28	32	22	13	12	1.4
	0832	1850	6	14	25	37	42	27	15	15	1.9
	0813	650	5	10	15	22	27	26	16	14	2.8
	0823	1250	7	14	24	36	45	40	24	18	3.2
	0833	1850	10	17	32	49	50	45	32	21	5.2
900	0911	650	4	6	10	13	16	13	8	8	1.0
	0921	1250	5	9	17	22	27	19	12	11	1.1
	0931	1850	6	12	22	32	35	23	13	13	1.5
	0912	650	5	9	16	23	30	27	18	16	2.8
	0922	1250	7	14	25	38	44	39	27	21	3.2
	0932	1850	10	18	34	47	50	45	33	26	5.2

Technical Data

B dim. (mm)	Code	Length (mm)	Static integral attenuation, (dB) to ISO 7235								P-value
			63	125	250	500	1K	2K	4K	8K	
1000	1011	650	5	9	16	23	30	27	18	16	2.8
	1021	1250	7	14	25	38	44	39	27	21	3.2
	1031	1850	9	18	34	47	50	45	33	26	5.2
	1041	2450	12	24	38	50	50	50	42	32	6.6
	1012	650	4	6	10	12	16	12	9	8	0.9
	1022	1250	5	9	16	20	24	17	12	11	0.9
	1032	1850	6	11	21	28	30	20	13	12	1.1
	1042	2450	7	14	26	36	37	23	15	13	1.2
	1013	650	5	8	13	19	23	20	12	9	1.4
	1023	1250	7	11	20	33	38	32	17	13	1.8
	1033	1850	8	15	26	44	48	39	21	18	3.0
1043	2450	11	20	31	50	50	46	28	21	3.6	
1100	1111	650	5	10	15	23	27	27	15	10	1.8
	1121	1250	6	15	24	39	45	40	23	17	2.1
	1131	1850	8	19	32	48	50	45	30	22	3.5
	1141	2450	10	24	38	50	50	50	40	26	4.2
	1112	650	5	9	16	23	30	27	18	16	4.0
	1122	1250	7	14	25	38	44	40	27	21	5.0
	1132	1850	10	19	34	47	50	45	33	26	8.0
	1142	2450	12	24	38	50	50	50	42	32	10.0
1200	1211	650	4	7	10	14	17	13	8	8	1.1
	1221	1250	5	10	17	24	28	20	12	10	1.2
	1231	1850	6	11	22	33	38	25	14	11	1.6
	1241	2450	6	13	27	42	48	31	17	11	1.9
	1212	650	6	10	15	19	23	21	13	11	1.4
	1222	1250	8	14	24	33	40	35	20	15	1.8
	1232	1850	10	18	31	46	50	42	25	18	3.0
	1242	2450	13	23	34	50	50	49	30	21	3.6
	1213	650	6	11	16	24	30	28	17	13	4.0
	1223	1250	9	16	25	39	46	40	27	20	5.0
	1233	1850	11	19	32	48	50	45	34	26	8.0
	1243	2450	14	28	36	50	50	50	44	31	10.0
1300	1321	1250	5	12	19	29	35	27	16	13	1.7
	1331	1850	6	16	26	40	44	34	18	16	2.4
	1341	2450	7	20	31	46	50	40	20	19	3.0
	1322	1250	7	14	25	38	44	39	27	21	5.0
	1332	1850	10	18	34	47	50	45	33	26	8.0
	1342	2450	12	24	38	50	50	50	42	32	10.0
1400	1422	1250	5	11	18	27	32	22	13	12	1.4
	1432	1850	6	14	25	38	42	27	15	15	1.9
	1442	2450	8	17	29	49	50	33	18	17	2.3
	1423	1250	7	12	21	33	39	33	18	14	1.9
	1433	1850	8	15	28	44	48	40	23	18	3.2
	1443	2450	11	21	33	50	50	47	30	22	3.9

Technical Data

B dim. (mm)	Code	Length (mm)	Static integral attenuation, (dB) to ISO 7235								P-value
			63	125	250	500	1K	2K	4K	8K	
1500	1521	1250	5	12	19	32	37	31	15	11	1.7
	1531	1850	7	15	26	44	48	38	19	16	2.7
	1541	2450	9	20	32	50	50	46	26	17	3.2
1600	1621	1250	7	15	24	39	45	40	23	17	2.0
	1631	1850	9	19	32	48	50	45	30	22	3.5
	1641	2450	11	24	38	50	50	50	40	26	4.2
	1622	1250	4	9	16	21	25	18	11	11	1.0
	1632	1850	5	11	21	30	33	21	13	13	1.4
	1642	2450	6	15	27	38	40	25	15	14	1.7
1800	1821	1250	6	13	20	31	37	31	16	14	1.7
	1831	1850	8	17	28	42	45	38	21	17	2.7
	1841	2450	10	21	33	47	50	46	25	20	3.2
	1822	1250	5	9	15	26	31	25	8	6	1.3
	1832	1850	6	11	20	40	44	33	10	9	1.7
	1842	2450	7	16	25	49	51	43	17	10	2.0
2000	2022	1250	5	11	18	27	32	22	13	12	1.4
	2032	1850	6	14	25	38	42	27	15	15	1.9
	2042	2450	8	17	28	50	50	33	18	17	2.3
	2023	1250	7	12	21	34	39	34	19	15	1.9
	2033	1850	8	16	28	45	48	40	24	19	3.2
	2043	2450	11	21	33	50	50	47	31	23	3.9
2200	2221	1250	7	14	22	35	40	36	20	15	1.9
	2231	1850	9	18	30	46	47	43	26	19	3.2
	2241	2450	10	24	35	50	50	50	33	23	3.9
	2222	1250	4	9	17	22	27	19	12	11	1.1
	2232	1850	6	12	22	32	35	23	13	13	1.5
	2242	2450	7	15	28	39	43	28	15	14	1.8

Dimension/Sound attenuation

- Calculate the required sound attenuation manually or use Swegon's ProAc acoustic calculation software (available at our home page).
- Select sound attenuators that manage the calculated need for sound attenuation in the low frequencies (mainly 125 Hz) under Technical Data. Also check the sound attenuation in the higher frequencies.
- Check the H dimension of the sound attenuator to optimize the pressure drop; also observe the system effect.
- The p-value read under Technical Data is used for determining the pressure drop of the sound attenuator. The higher the p value, the higher the pressure drop, see Nomogram 1.
- Check the sound attenuator's level of inherent sound generation.

Pressure drop

- Calculate the gross face area, B x H (m²).
 - Find the contemplated airflow in Nomogram 1.
 - Go vertically upward to the p-value obtained for the selected sound attenuator under Technical data.
 - Read the pressure drop that refers to duct/duct installation.
 - If you select an alternative other than duct/duct, correct the pressure drop using Diagram 1.
- Multiply the pressure drop in Nomogram 1 by the value obtained from Diagram 1 depending on how the sound attenuator is to be installed.

Example:

A sound attenuator is located by a ventilation unit in a fan room. The airflow is 4 m³/s and the sound attenuator is mounted in a duct having a width of 1800 mm.

Sound attenuator CALMO 1841 with a p-value of 3.2 has been selected from Technical Data. The sound attenuator is 1800 mm wide and 600 mm high. The gross face area will be 1.08 m². Nomogram 1 gives a pressure drop of approx. 26 Pa.

If the sound attenuator is instead installed in a duct/plenum, multiply the pressure drop by 2.2 according to Diagram 1. You will then obtain a pressure drop of approx. 57 Pa.

Nomogram 1. Determining the pressure drop

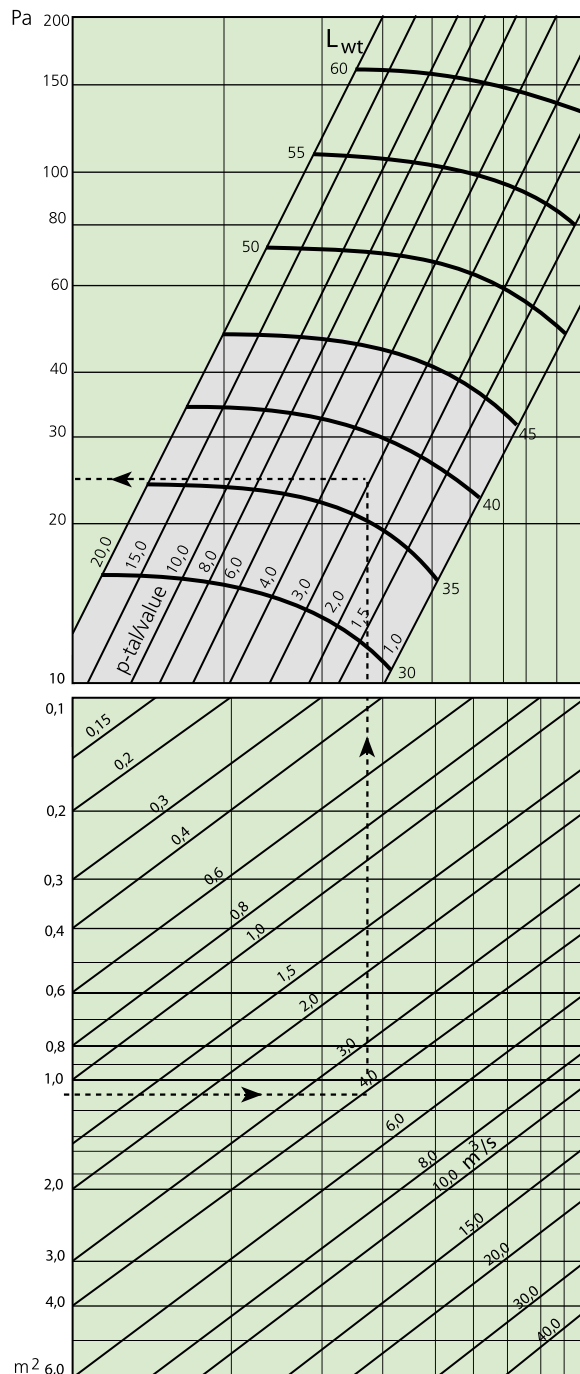
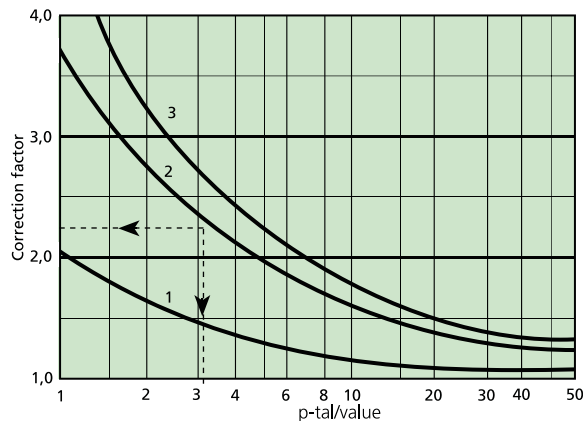


Diagram 1. Correction for different connection



Curve 1: Plenum/Duct Curve; 2: Duct/Plenum, Curve 3: Plenum/Plenum

Inherent sound generation

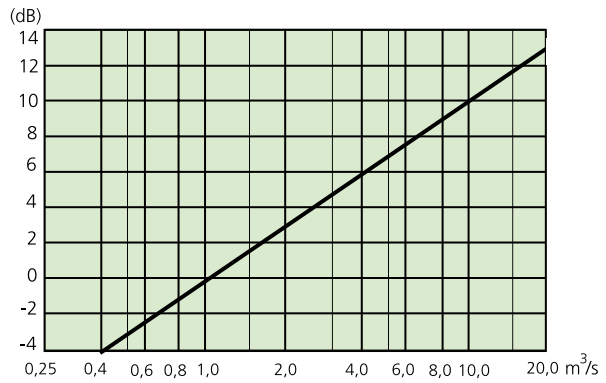
A sound attenuator not only attenuates sound, it also generates inherent sound when air passes through it at high velocity and if the pressure drop is substantial. Normally no problems will occur if you comply with the recommended operating range marked in Nomogram 1. Flow-generated sound curves have been plotted in Nomogram 1 as an aid for accurate calculations. You are welcome to use ProAc in which we not only specify flow-generated sound but also pressure drop. Specified L_{wt} values are sound power level for CALMO with reference value 10^{-12} W for an airflow of $1 \text{ m}^3/\text{s}$. By correcting L_{wt} with K_1 for the CALMO, you can obtain the sound power level in each octave band. For the CALMO with perforated sheet steel, first add 12 dB to specified L_{wt} and then correct it with K_2 .

Hz	63	125	250	500	1K	2K	4K	8K
K_1	-5	-5	-9	-11	-14	-17	-18	-20
K_2	-1	-2	-10	-17	-22	-24	-25	-20

Airflows other than $1 \text{ m}^3/\text{s}$ can be corrected using Diagram 2.

The generated inherent sound should be 8–10 dB lower in each octave band than the required sound power level downstream of the sound attenuator.

Diagram 2. Correction for other airflows



Example:

A sound attenuator is located by a ventilation unit in a fan room. The airflow is $4 \text{ m}^3/\text{s}$ and the sound attenuator is mounted in a duct having a width of 1800 mm. Sound attenuator CALMO 1841 with a p-value of 3.2 has been selected from Technical Data. For a height of 600 mm, the gross face area will be 1.08 m^2 . Nomogram 1 indicates $L_{wt} = 38 \text{ dB}$. Correct with K_1 to break down the sound into octave bands and for $4 \text{ m}^3/\text{s}$ according to Diagram 2.

Hz	63	125	250	500	1K	2K	4K	8K
L_{wt}	38	38	38	38	38	38	38	38
K_1	-5	-5	-9	-11	-14	-17	-18	-20
$4 \text{ m}^3/\text{s}$	6	6	6	6	6	6	6	6
L_w	39	39	35	33	30	27	26	24

System effect

Sound attenuator installed upstream or downstream of a bend

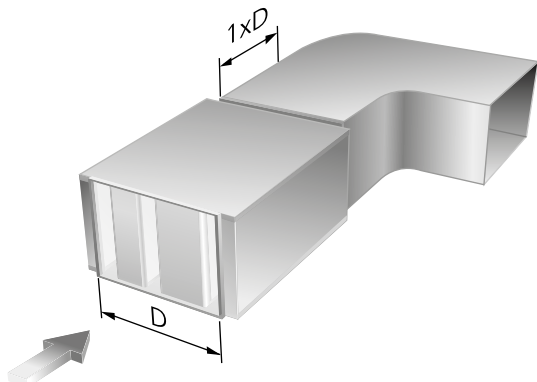


Figure 5. CALMO upstream or downstream of a bend.

The corrections below should be multiplied by the pressure drops specified in the diagram.

Sound attenuator upstream of a bend		Sound attenuator downstream of a bend	
Distance	Corr. factor	Distance	Corr. factor
3xD	1.1	1xD	1.2
2xD	1.2	0 (direct)	1.3
1xD	1.35		
0 (direct)	1.5		

Distance and D refer to the distance between the sound attenuator and bend or the biggest side of the sound attenuator. Total pressure drop = sound attenuator's pressure drop according to Nomogram 1 x correction factor above.

Sound attenuator installed upstream or downstream of a plenum

The total pressure drop across the sound attenuator can be obtained by multiplying the correction factor according to Diagram 1 by the pressure drop according to Nomogram 1.

Sound attenuator installed upstream or downstream of a duct branch

Sound attenuator installed downstream of a duct branch can be compared with one installed downstream of a plenum. See Curve 1 in Diagram 1.

The total pressure drop across the sound attenuator can be obtained by multiplying the correction factor by the pressure drop according to Nomogram 1.

A sound attenuator installed upstream of a duct branch can correspondingly be compared to one installed upstream of a plenum. See Curve 2 in Diagram 1.

The total pressure drop across the sound attenuator can be obtained by multiplying the correction factor by the pressure drop according to Nomogram 1.

Sound attenuator installed by a ventilation unit

It is difficult to produce correct corrections for a sound attenuator installed by an air handling unit. This is mainly due to the fact that different air handling unit manufacturers have different solutions on the fan outlet. The most common solution is one where a relatively small fan outlet (produces high outlet velocity) is combined with a large duct connection (producing air velocities of approx. 4-6 m/s). Generally speaking, the angle of the transition between fan outlet and duct should not exceed 15 degrees. To ensure satisfactory distribution of the air stream, it is advantageous to utilise a diffuser.

Sound attenuator installed by a damper

A sound attenuator installed by a damper can give rise to substantial pressure drops. As the damper angle is increased, greater difference in velocity profile is generated. This increases the air velocity between the acoustic baffles of the sound attenuator and thus increases the pressure drop.

Sound attenuators connected in series

If the sound attenuators are connected in series, the basic rule should be to avoid a change in velocity profile between the dampers connected in series. If the length of straight ducting between the sound attenuators can be arranged to be sufficiently long ($4 \times D$), you can at best calculate the stated pressure drop per individual sound attenuator. An important aspect is also to make sure that the acoustic baffles of one sound attenuator do not cover the spaces between the baffles of the next sound attenuator. For advice concerning series connection, contact Swegon.

Ordering key

Product

Rectangular sound attenuator

CALMO a aaaa bbbb x cccc x dddd

Version:

Code:

Dimensions:

B x H x L

Accessories

- CALMO T1 = Uninsulated cleaning cover
- CALMO T2 = Fire-resistant insulated cleaning cover
- CALMO T3 = Sound attenuator, insulated with 50 mm thick fire-resistant stone wool
- CALMO T4 = Perforated sheet metal lining.

N.B.! If the sound attenuator is equipped with a cleaning cover, open space must be provided to enable the cover to be opened. CALMO T1 requires approx. 300 mm open space. CALMO T2 requires fully open a distance of 700 mm.

Specification text

Example of specification text to VVS AMA.

Swegon's type CALMO rectangular sound attenuators, with the following attributes:

- Aerodynamically designed acoustic baffles for extremely low pressure drop.
- Type-approved, insulation material, ISOVER Cleantec® PLUS.
- Sound attenuation in dB (specified in clear text for the various frequency bands).
- Pressure drop in Pa (to be specified in clear text).

Size	CALMO a aaaa bbbb x cccc x dddd	xx items
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Ordering example

Straight sound attenuator with code 0631 having a height of 800 mm conforming to the sound attenuating requirements that have been calculated. The sound attenuator shall be equipped with an uninsulated cleaning cover. The vertical open space available for installation is limited to max. 1300 mm which means that space is available for opening the cleaning cover (800+300 mm).

Ordering key:	CALMO a 0631 600x800x1850
	CALMO T1