

LENTO

Angle sound attenuator for rectangular ducts



QUICK FACTS

- Remarkably space-saving rectangular sound attenuator
- Excellent aerodynamic characteristics
- Very low pressure drop – acoustic baffles serve as guide vanes
- 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 a version insulated with 50 mm thick fire-resistant stone wool
- Connection sizes ranging from 400x300 to 2000x2000
- Available with flange connection
- Included in the MagiCAD database

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Technical description

General

The LENTO 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.

Function

The LENTO's low pressure drop has been achieved by designing the acoustic baffle elements completely according to the basic laws of aerodynamics. To achieve this, the acoustic baffles are utilized according to the principle for deflecting the air stream by means of guide vanes. The means in many cases that the LENTO can replace a rectangular bend (without guide vanes) with maintained or even lower pressure drop.

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.

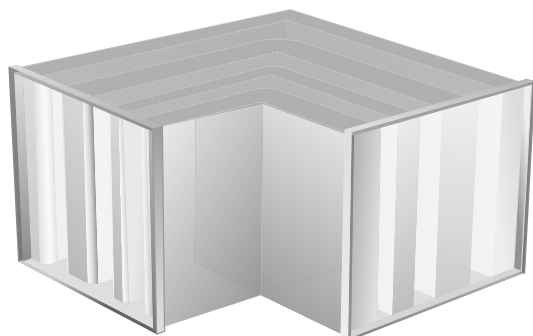


Figure 1. The LENTO produces a uniform velocity distribution downstream of the bend by utilizing the acoustic baffles as guide vanes.

The LENTO 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.

Design

- The LENTO is made as standard of galvanized sheet steel to Corrosivity class C3 (VVS-AMA 2019 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 LENTO is supplied with slip clamp connections.

Maintenance

The LENTO is under normal operating conditions a maintenance-free sound attenuator. If there are requirements for cleanability, the LENTO 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.

Special versions

In addition to the accessories and variants described in the catalogue there is scope for customised variants if required.

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 LENTO, this is available as accessory LENTO T1 with cover which enables access to all the air passages between the baffles.

The technical data do not change if the LENTO T1 or LENTO T2 accessory is used.

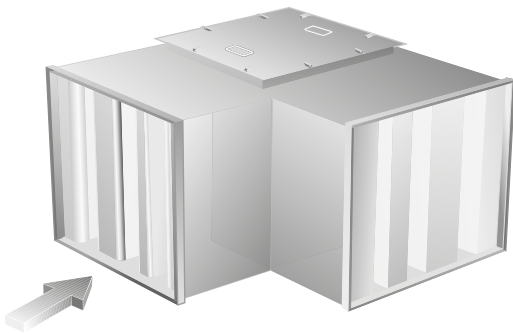


Figure 2. LENTO equipped with cleaning cover that covers all the airflow passages. LENTO T1-3 accessory

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, the fitter 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 LENTO, the factory-insulated variant is available as an accessory.

The pressure drop does not change if the LENTO T3 accessory is used.

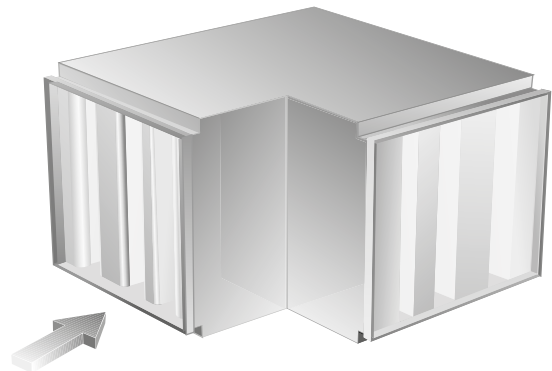


Figure 3. LENTO insulated with 50 mm thick fire-resistant stone wool.

Cleaning cover accessory

- LENTO T1-1 = Uninsulated cleaning cover, vertical, right-hand
- LENTO T1-2 = Uninsulated cleaning cover, vertical, left-hand
- LENTO T1-3 = Uninsulated cleaning cover, horizontal, upper
- LENTO T1-4 = Uninsulated cleaning cover, horizontal, lower

- LENTO T2-1 = Fire-resistant insulated cleaning cover, vertical, right-hand
- LENTO T2-2 = Fire-resistant insulated cleaning cover, vertical, left-hand
- LENTO T2-3 = Fire-resistant insulated cleaning cover, horizontal, upper
- LENTO T2-4 = Fire-resistant insulated cleaning cover, horizontal, lower

Fire-resistant insulation accessory

- LENTO T3: Sound attenuator, insulated with 50 mm thick fire-resistant stone wool

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 outside the ISOVER Cleantec® PLUS insulation, LENTO T4. The acoustic data and pressure drop are affected when the LENTO T4 accessory is used.

Sheet metal lining accessory

- LENTO T4: Perforated sheet metal lining

Flange connection T5

Available as an alternative to slip-clamp connection. Has robust flanges made of galvanized angle steel, with oval bolt holes designed to facilitate installation.

Flange connection accessory

- LENTO T5: Flange connections

Sizing

General

The specified technical data apply to the LENTO 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 entitled: System effect and pressure drop.

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

In the standard version, the LENTO 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. For details of recessed connections, see the LARGO sound attenuator. See also under Sizing, Dimension.

Dimensions

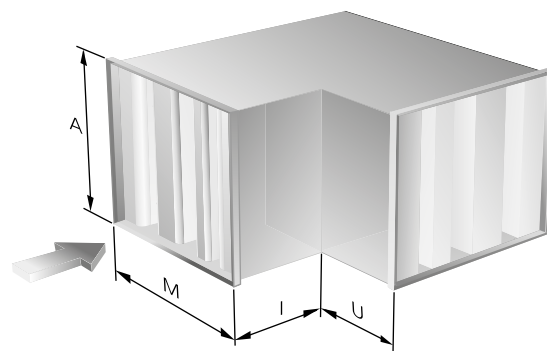


Figure 4a. horizontal installation:

M dim. corresponds to the width of the duct.

A dim. corresponds to the height of the duct.

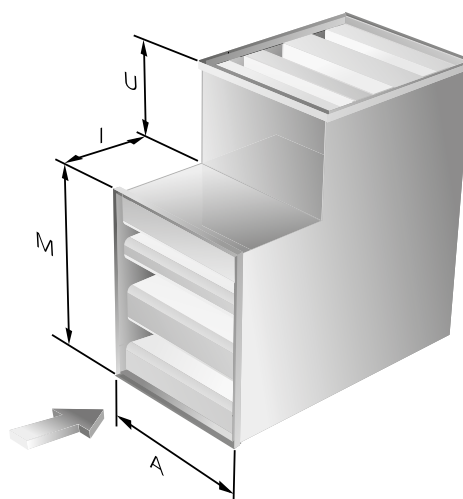


Figure 4b. Vertical installation:

M dim. corresponds to the height of the duct.

A dim. corresponds to the width of the duct.

LENTO with standard connections:

M dim.: 400, 500, 600, 700, 800, 900, 1000, 1200, 1400, 1600, 1800, 2000

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

I+U dim.: The smallest dimension for I and U is 150 mm.

Weight = Contact your nearest Swegon Representative.

Technical Data

M dim. (mm)	Code	I+U (mm)	Static integral attenuation, (dB) to ISO 7235								P-value
			63	125	250	500	1K	2K	4K	8K	
400	0431	300	3	8	14	21	28	22	21	20	2.2
400	0461	600	4	10	17	27	35	27	22	21	2.4
400	0491	900	5	11	21	33	41	31	23	22	2.5
500	0530	300	6	12	18	23	32	27	22	22	4.3
500	0560	600	7	15	22	29	39	32	23	23	4.5
500	0590	900	8	17	27	35	47	37	25	25	4.6
600	0630	300	6	12	22	35	42	46	33	27	8.0
600	0660	600	7	15	28	44	50	50	39	31	8.5
600	0690	900	8	18	32	50	50	50	44	34	9.0
700	0730	300	5	12	20	30	38	35	25	22	3.8
700	0760	600	6	14	24	37	47	37	28	24	4.0
700	0790	900	7	16	28	45	50	50	31	26	4.2
800	0831	300	5	10	18	27	34	26	20	19	2.4
800	0861	600	6	12	22	33	42	31	21	20	2.5
800	0891	900	7	14	25	39	49	35	22	21	2.6
800	0833	300	5	12	21	31	38	36	26	22	3.8
800	0863	600	6	14	25	38	48	38	29	24	4.0
800	0893	900	7	16	29	46	50	50	32	26	4.2
900	0931	300	7	15	26	42	46	50	37	29	8.5
900	0961	600	8	18	30	50	50	50	42	32	9.0
900	0991	900	9	20	36	50	50	50	47	35	9.5
1000	1031	300	7	15	24	40	50	46	32	26	5.0
1000	1061	600	8	17	29	47	50	50	36	28	5.3
1000	1091	900	9	19	34	50	50	50	40	30	5.6
1000	1032	300	8	16	26	31	42	34	23	23	4.6
1000	1062	600	9	19	30	37	49	38	24	23	4.8
1000	1092	900	10	22	34	42	50	42	25	24	5.0
1200	1231	300	10	22	39	50	50	50	42	34	8.8
1200	1261	600	11	25	45	50	50	50	46	36	9.4
1200	1291	900	12	28	49	50	50	50	50	34	10
1200	1233	300	8	18	33	50	50	50	30	25	4.0
1200	1263	600	9	20	36	50	50	50	34	28	4.1
1200	1293	900	10	22	39	50	50	50	38	31	4.3
1400	1431	300	7	16	26	45	50	48	29	24	4.3
1400	1461	600	8	18	32	50	50	50	32	26	4.5
1400	1432	300	9	21	34	41	50	46	27	24	6.8
1400	1462	600	11	26	38	49	50	48	29	25	7.0
1600	1631	300	7	15	25	40	50	36	21	19	2.8
1600	1661	600	8	17	28	46	50	39	23	21	2.9
1600	1633	300	8	16	26	35	46	42	25	22	3.4
1600	1663	600	9	19	31	49	50	46	27	24	3.5
1800	1831	300	8	18	33	50	50	50	30	25	4.0
1800	1861	600	9	20	36	50	50	50	34	28	4.1
1800	1832	300	11	27	41	50	50	50	33	29	8.5
1800	1862	600	13	31	48	50	50	50	37	31	9.0
2000	2031	300	11	26	40	50	50	48	26	24	5.0
2000	2032	300	15	34	49	50	50	50	50	41	10

Dimension/Sound attenuation

- Calculate the required sound attenuation manually or use Swegon's ProSilencer acoustic calculation software (available at our home page).
- Determine how the angle sound attenuator should angle off – horizontally or vertically. In the horizontal version the acoustic baffles are standing and in the vertical version they are lying.
- Proceed from the M dimension, (see Technical Data) and select sound attenuators on the basis of required sound attenuation. Check also what I+U dimension the sound attenuator will have.
- To standard, the legs of the angle are equally long: i.e. I=U
- (I= inlet, U= outlet viewed in direction of airflow).
- Check the A dimension of the sound attenuator to optimize the pressure drop. Take the system effect into consideration.
- 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, $M \times A$ (m²).
- Find the contemplated airflow in Nomogram 1 (m³/s).
- 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 connection alternatives other than standard, correct the pressure drop using Diagram 1.

Multiply the pressure drop in Nomogram 1 by the value you have obtained in Diagram 1 in relation to how the sound attenuator is to be installed.

Example 1:

An angle sound attenuator in the horizontal version is positioned 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 1000 mm. LENTO 1031 sound attenuator (M=1000) with a p-value of 5.0 has been selected from Technical Data.

The sound attenuator has connection dimensions: M dim. = 1000 mm and A dim. =1300 mm. This provides outer dimensions of 1000x1300 mm and the gross face area will then be 1.3 m². Nomogram 1 gives a pressure drop of approx. 28 Pa.

If the sound attenuator is instead installed in a duct/plenum, multiply the pressure drop by 1.9 according to Diagram 1. You will then obtain a pressure drop of approx. 53 Pa.

Nomogram 1. Determining the pressure drop

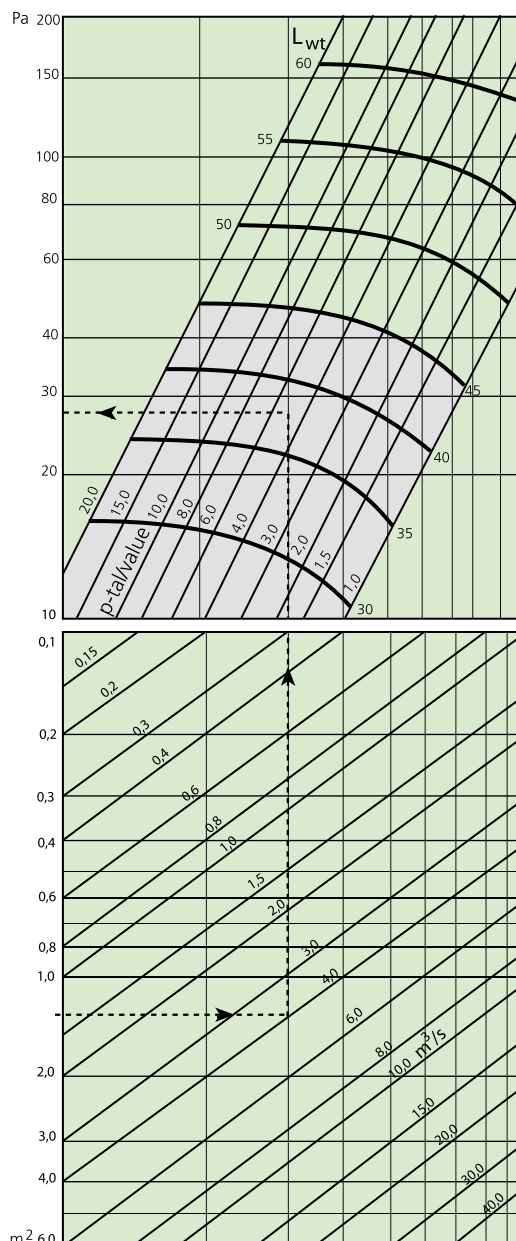
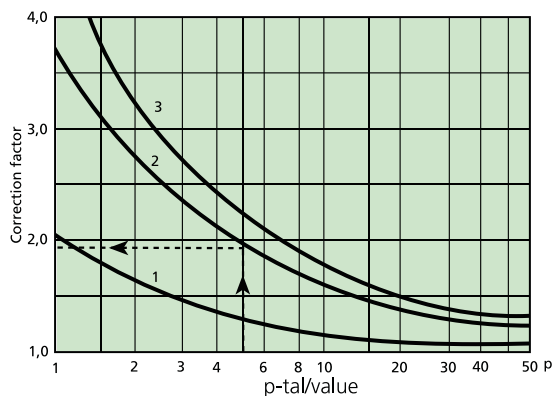


Diagram 1. Correction for different connection



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 there are no problems if the recommended operating range marked in Nomogram 1 is observed.

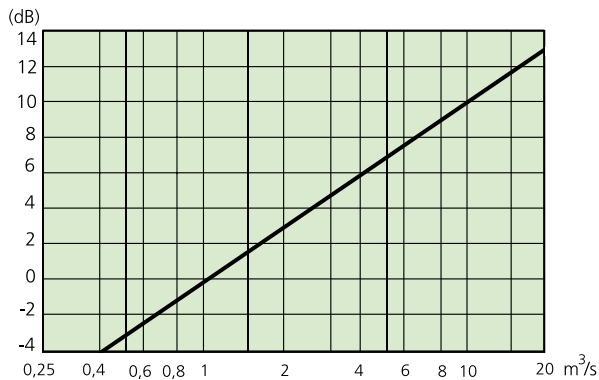
Flow-generated sound curves have been plotted in Nomogram 1 as an aid for accurate calculations. You are welcome to use ProSilencer in which we not only specify inherent sound but also pressure drop. Specified L_{wt} -values are sound power level for LENTO with reference value 10^{-12} W for an airflow of $1 \text{ m}^3/\text{s}$. By correcting L_{wt} with K_1 for the LENTO, you can obtain the sound power level in each octave band. For LENTO 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

Correction for airflows other than $1 \text{ m}^3/\text{s}$ should be done through Diagram 2 below.

Generally speaking, the inherent sound should be 8-10 dB lower in each octave band than the requirement for sound power level downstream of the sound attenuator.

Diagram 2. Correction for airflows other than $1 \text{ m}^3/\text{s}$



Example:

A sound attenuator in the horizontal version 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 1000 mm. LENTO 1031 sound attenuator with a p-value of 5.0 has been selected from Technical Data. With a height of 1300 mm, the gross face area will be 1.3 m^2 .

Nomogram 1 gives $L_{wt}=38$ 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

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

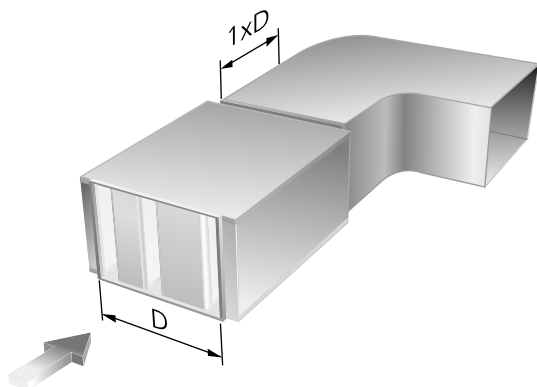


Figure 5. Sound attenuator upstream or downstream of a bend

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.

Sound attenuator installed upstream of a duct branch can in a corresponding way be compared with 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 correction factors for sound attenuators installed by ventilation units. 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 produces increased air velocity between the sound attenuator baffles 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 can be arranged to be sufficiently long (4 x 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

LENTO a aaa bbbb x cccc, dddd, eeee

Version:

Code:

According to Technical Data

Dimensions:

M x A, I, U

Accessories

- LENTO T1-1 = Uninsulated cleaning cover, vertical, right-hand
- LENTO T1-2 = Uninsulated cleaning cover, vertical, left-hand
- LENTO T1-3 = Uninsulated cleaning cover, horizontal, upper
- LENTO T1-4 = Uninsulated cleaning cover, horizontal, lower
- LENTO T2-1 = Fire-resistant insulated cleaning cover, vertical, right-hand
- LENTO T2-2 = Fire-resistant insulated cleaning cover, vertical, left-hand
- LENTO T2-3 = Fire-resistant insulated cleaning cover, horizontal, upper
- LENTO T2-4 = Fire-resistant insulated cleaning cover, horizontal, lower
- LENTO T3 = Sound attenuator, insulated with 50 mm thick fire-resistant stone wool
- LENTO T4 = Perforated sheet metal lining
- LENTO T5 = Flange connections

Specification text

Example of a specification text conforming to Swedish VVS AMA Standard.

Swegon's type LENTO rectangular sound attenuator, with the following functions:

- Type-approved, insulation material, ISOVER Cleantec® PLUS
- Low pressure drop due to the aerodynamic design of the bend.
- Sound attenuation in dB (to be specified in clear text for the various frequency bands).
- Pressure drop in Pa (to be specified in clear text).

Size	LENTO a aaa - bbbb x cccc, dddd, eeee	xx items
	LENTO T	xx items

Ordering example

The angle sound attenuator of the vertical version with code 1262 conforms to the sound attenuating requirements that have been calculated.

The sound attenuator shall be equipped with a fire-resistant insulated cleaning cover that covers all the airflow passages. Position the cover on the right hand side of the angle sound attenuator.

Ordering code:	LENTO a 1262 - 1200x1000, 300, 300
	LENTO T2-1