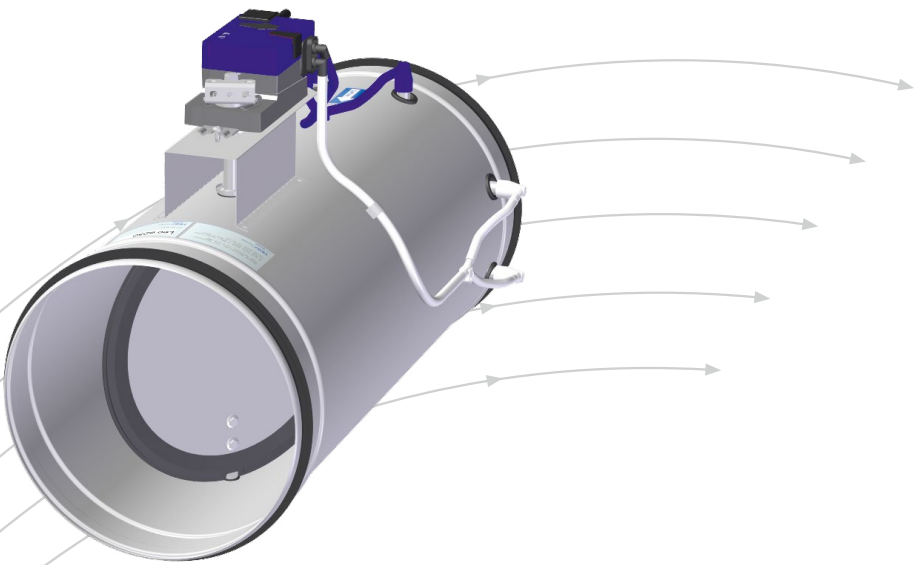
GB0814
04.24

Leo

VAV controller



- New regulator handles larger working area
- Low noise level
- Pressure independent
- Short overall length
- High measurement accuracy
- Can be installed directly in bend
- Flexible sound attenuator choice

TROX Auranor AS

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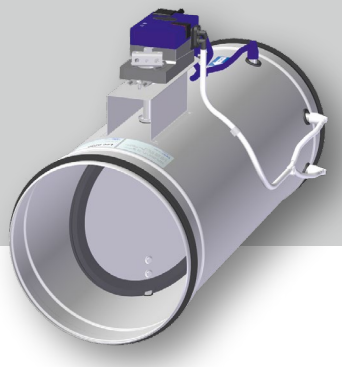
Leo



APPLICATION

Leo is a volume flow controller which works independently of the duct pressure. It is the desired air flow rate at choked damper that determines the duct pressure required for the applicable unit/string. The VAV unit is based on dynamic measurement of volume flows, and controls the damper position to maintain the air flow rate required. When a change in duct pressure occurs, such as when other volume flow controllers on the branch open or close, the unit will compensate by adjusting the damper until the correct volume flow has been restored. The required air flow rate can, for example, be provided as a 0-10V signal from room thermostat / CO^2 sensor in the occupied zone covered by the unit.
Minimum and maximum air flow rates can be set at the factory or during installation by using a service tool from Belimo or Siemens.
The VAV unit is designed to provide comfort ventilation at temperature conditions of between 0°C and 50°C and a relative humidity between 5% and 95% without condensation. A 4-conductor cable connects the controller to various control equipment in the room. Consistent use of a common reference system for all equipment is important. For the VAV controller, cable no. 1 is system-0. All control and measurement signals are linked up in accordance with this.
Wiring diagram for Leo in combination with various room control equipment is available at our website www.trox.no
For energy-efficient operation, VAV systems are equipped with pressure sensors in the ductwork, which transmit control signals to branch dampers or to the fan frequency control. Please see schematic diagram in fig.1.

Explanation to fig. 1

1) Pressure sensor for fan control
2) VAV unit
3) Motorised damper with pressure control system
4) Pressure sensor
5) Fan

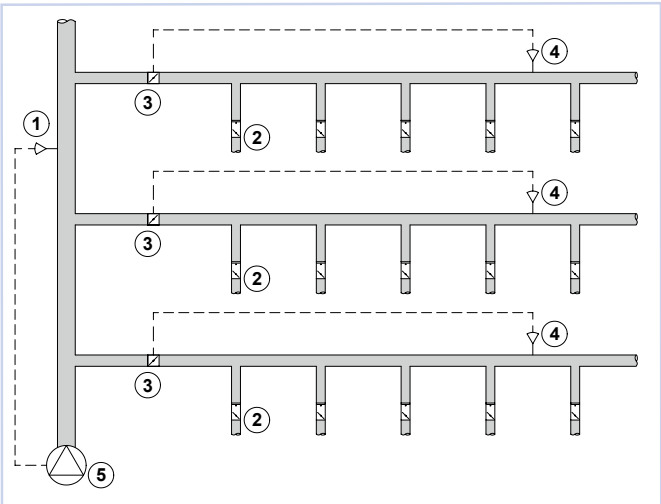


Fig. 1: Pressure conditions in VAV system

FUNCTION

Leo will always adjust to the air flow rate consistent with the signal transmitted from the room control equipment. The VAV unit comprises an adjustable damper and measuring station for air flow rate, and the measurement principle is dynamic measurement of the air flow. In the damper motor's control unit, should the admission for the damper is regulated according to the desired should-value. Leo has an adjustment range shown in table 2.
Deviation for working range 10 - 20% of Vnom:±25%
20 - 40%: <±10%
40 -100%: <±4%
If T-pipes are used, a spacing of at least 5 x ØD is recommended in order to maintain the measurement accuracy.

ORDER CODE, LEO

Leo - 0 - 0 - 1 - 160 - 0

Product:

Type:
0 = Not Encased
D = Encased

Controller Option:
0 = Belimo MP-Bus
3 = Belimo MOD-Bus
4 = Belimo BACnet
7 = Belimo KNX
8 = MOD-Bus for XAC
9 = XAC-ZM MOD-Bus
9.1 = XAC-ZM MOD-Bus w/light relay
9.2 = XAC-ZM MOD-Bus w/heating-cooling relay
9.3 = XAC-ZM MOD-Bus w/light, heating-cooling relay
9.4 = XAC-ZM MP-Bus
10 = Siemens KNX
11 = Siemens BACnet

MS = Labeling scheme

Dimension: Ø100 – Ø630

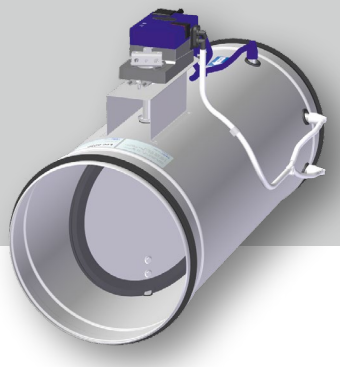
Plug:
0 = Without plug
1 = Wago 4. Pol Midi, Grey *
2 = Wago 4. Pol Midi, Green **

* Only for controller option 0

** Only for controller option 3, 4, 7, 10, 11

Example:
Leo-0-0-1-160-0
Explanation:
Leo not encased, with Belimo MP-Bus, Wago-plug mounted, dim. Ø160, without labeling scheme.

Leo



DESIGN

Leo VAV is a complete measuring and control unit where the air flow rates in ventilation systems can be set as required. At the measuring station, the differential pressure is measured via measuring rod integrated in the unit. The unit is installation-friendly in terms of straight ducting, and can thus be mounted in most ductwork sections. It is fully compliant with air permeability class 4 for damper in closed position, and class C for leakage to the surroundings. Leo is equipped with VAV controller from Belimo or Siemens.
Belimo LMV-D3-FK AU is used from dim. 100 to dim.400.
Belimo NMV-D3 AU is used from dim. 500 to 630.
Siemens GDB181.1E is used from dim. Ø100 to dim. Ø400.
Siemens GLB181.1E is used from dim. Ø500 to dim. Ø630.
Controller specifications are provided in table 1.
Full technical documentation can be downloaded from our website www.trox.no.
Belimo LMV/NMV-D3 is used as analog control or for MP-bus.
Belimo MOD/BACnet controller or Siemens BACnet controller is also available. For KNX, Belimo LMV-D3-KNX and NMV-D3-KNX or Siemens GDB181.1E/KN and GLB181.1E/KN is available.

If additional protection against structure-borne noise is required, e.g. for open installation, the unit can be delivered with external insulation and casing. This will reduce the level of noise emitted from the actual unit at high choke pressure and high velocity past the damper. However, this should be followed up with additional protection against structure-borne noise from the duct at both sides of the unit. Please see acoustic datasection. The LEV sound attenuator is designed for VAV systems, and is available in 500mm and 1000mm lengths. LEV has a full attenuator cross-section, and this ensures a low-level pressure loss. It is insulated with mineral wool featuring a reinforced top layer to prevent fibres breaking away with the supply air.
An extraction unit with mesh grille, ASN, in the same design as LEV is also available. Leo-D, LEV and ASN can be delivered pre-assembled with ducting clips.

MATERIALS AND SURFACE COATING

Leo comes in a galvanized steel design. The measurement unit is in aluminium. Tubing, nipples and motor casing are in plastic. Leo's connection collars are fitted with EPDM rubber gaskets.
LEV is made of galvanised steel, and comes with mineral wool and a glass fibre layer as attenuation material. Connection collars are fitted with EPDM rubber gaskets.
ASN is made of galvanised steel and is equipped with an EPDM rubber gasket on the connection collar.

Manu-facturer	Actuator	Operating voltage	Power con-sumption	Dim. effect
Belimo	LMV-D3-MP/MOD/ BAC/KNX	AC 24 V 50/60 Hz, DC 24 V	2W	4 VA (max. 8 A @ 5 ms)
Belimo	NMV-D3-MP/ MOD/BAC/KNX	AC 24 V 50/60 Hz, DC 24 V	3W	5 VA (max. 8 A @ 5 ms)
Siemens	GDB181.1E/KN (5 Nm)(KNX)	AC 24 V 50/60 Hz	2.5W	3 VA
Siemens	GLB181.1E/KN (10 Nm)(KNX)	AC 24 V 50/60 Hz	2.5W	3 VA
Siemens	GDB181.1E/BA (5 Nm)(BACnet)	AC 24 V	0.5 W	1 VA
Siemens	GLB181.1E/BA (10 Nm)(BACnet)	AC 24 V	2.5 W	3 VA

Table 1: Technical specifications, Belimo VAV controller

QUICK SELECTION

Leo	[m^3/h]	
Dim.	Max [V_{nom}]	Min
100	170	17
125	265	26
160	434	43
200	700	70
250	1060	106
315	1750	175
400	3619	361
500	5655	565
630	8973	897

Table 2: The table shows max. and min. air volumes.

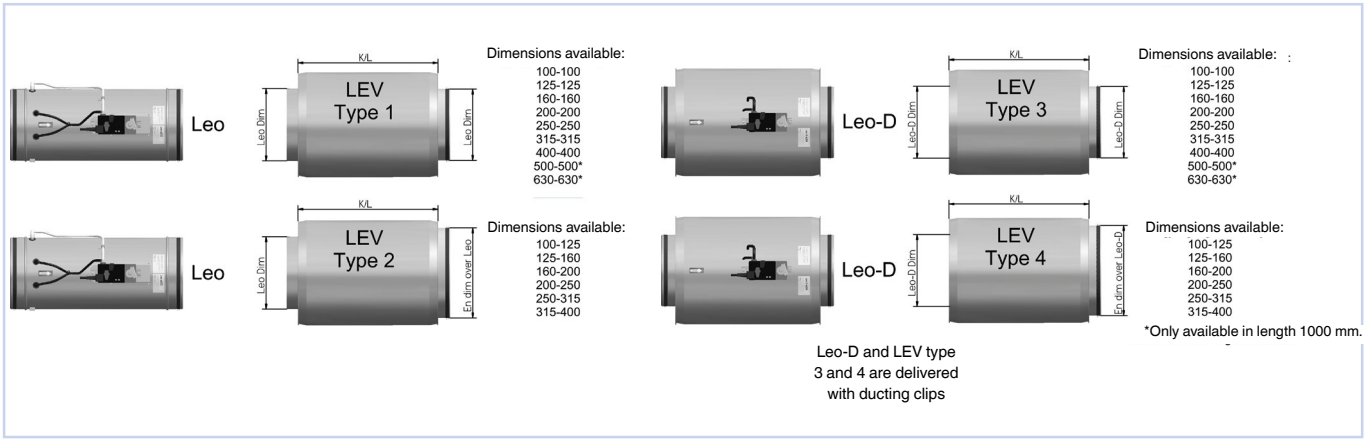
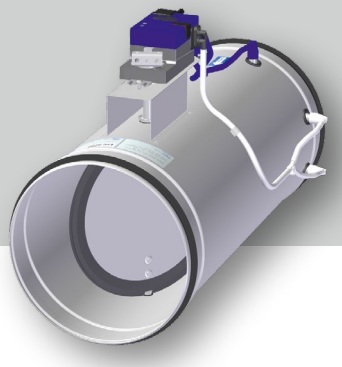


Fig. 2

Leo



DIMENSIONS AND WEIGHT

Dim.	D	DA	B	L
100	99	102	220	400
125	124	127	245	400
160	159	162	280	400
200	199	202	320	400
250	249	252	370	600
315	314	317	435	600
400	399	402	520	600
500	499	502	620	705
630	629	632	750	835

Table 3

	Weight [kg]				
Dim.	Leo	Leo-D	LEV-500	LEV-1000	ASN
100	1,6	3,2	3,3	5,8	1,5
125	1,8	3,5	3,8	6,6	1,8
160	2,1	4,1	4,5	7,8	2,1
200	2,5	4,9	5,3	9,0	2,5
250	3,8	8,0	6,4	11,0	3,1
315	4,8	9,8	7,2	12,4	3,9
400	6,0	12,0	9,6	15,6	5,0
500	9,7	23,0	–	18,8	6,5
630	12,5	28,0	–	23,1	8,7

Table 4

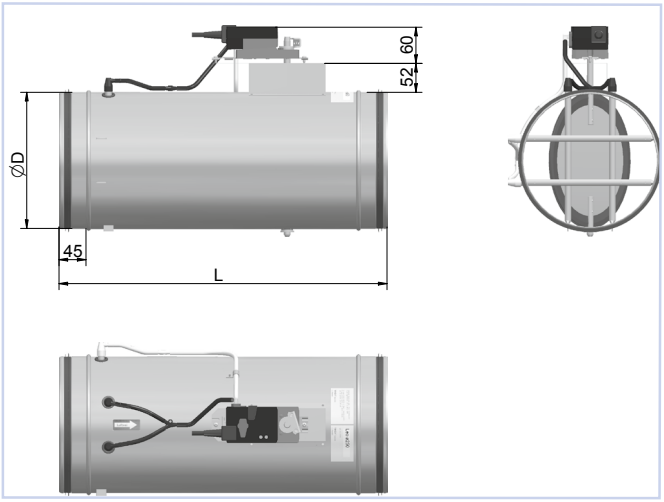


Fig. 3, Leo

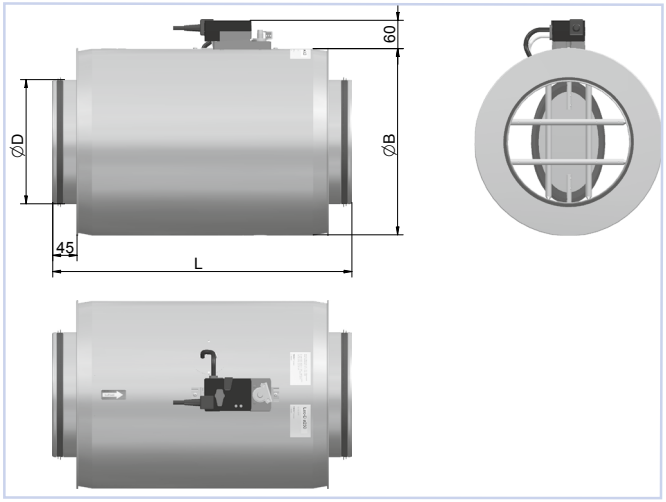


Fig. 4, Leo-D

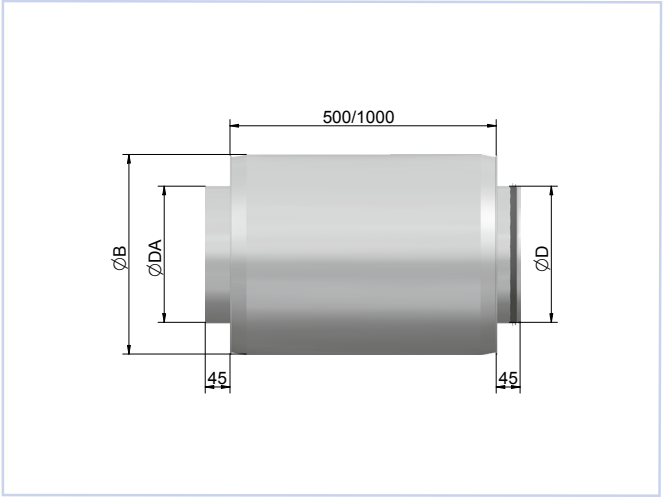


Fig. 5, LEV

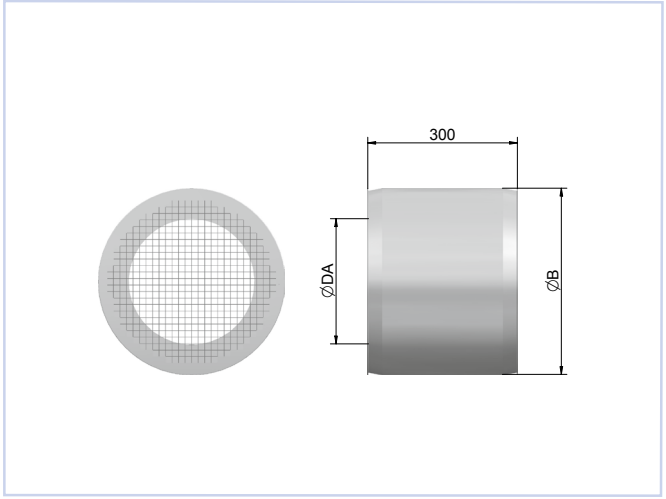


Fig. 6, ASN (extraction unit)

ACOUSTIC DATA

The diagrams provide a summary of the A-weighted sound power level from damper to duct, L_{WA}.
Correction factors in the tables are used to calculate emitted sound power level at the respective frequencies, $L_W = L_{WA} + KO$. KO for two different damper settings is provided, the right pressure drop line is for totally open damper while the left pressure drop line indicates strongly choked damper. Since the damper may be used to shut down completely, it is added dashed lines in the diagram.
Intermediary points for LEO can be estimated as shown in the example.

Example:

Leo Ø160 with short attenuator and maximum airflow of 80 l/s, and it is calculated that the damper must be choked to 50Pa.
According to diagram 8, L_{WA} = 44 dB(A). We aim to find emitted sound power level at 250 Hz.
Corectionfactors provided in table 6, page 10, for closed damper is -4 dB, and 1 dB for open damper. As our point is nearest to open damper, we will use 0 dB. Emitted sound power level at 250 Hz is thus:
$L_W = L_{WA} + KO \Rightarrow 44 + 0 = 44$ dB

CALCULATION DIAGRAMS

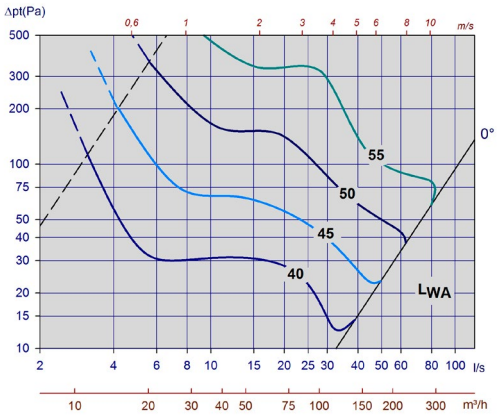


Diagram 1: Ø100 without sound attenuator

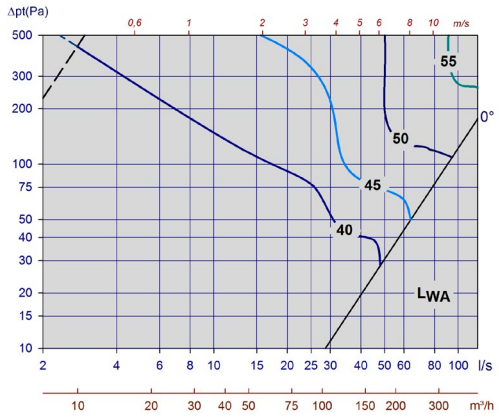


Diagram 2: Ø100 with short sound attenuator

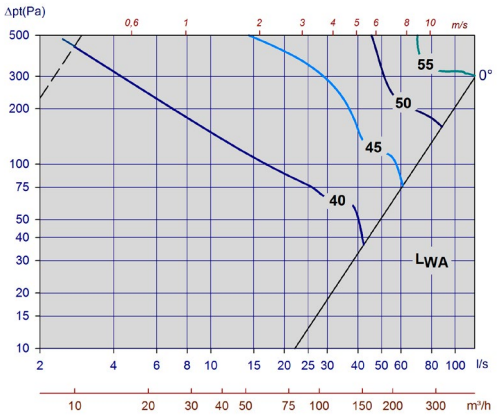


Diagram 3: Ø100 with long sound attenuator

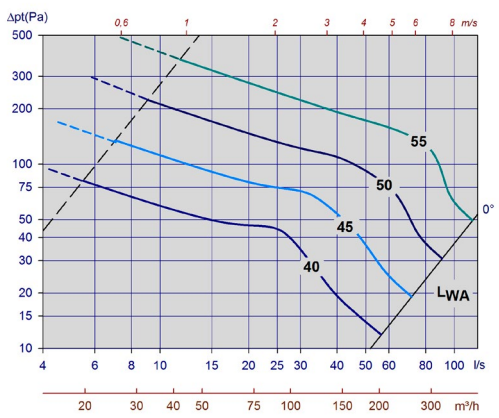


Diagram 4: Ø125 without sound attenuator

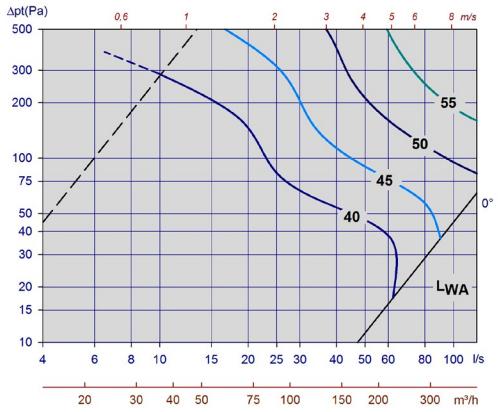


Diagram 5: Ø125 with short sound attenuator

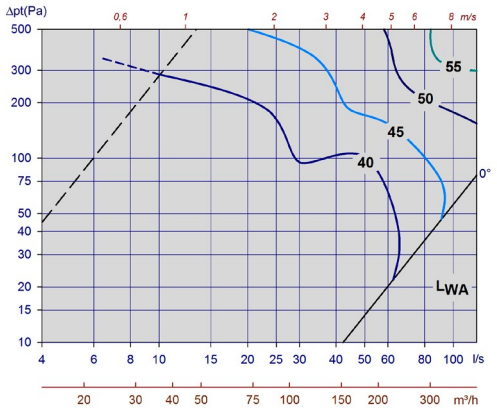


Diagram 6: Ø125 with long sound attenuator

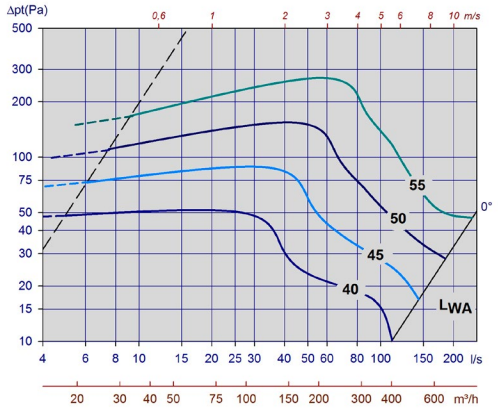


Diagram 7: Ø160 without sound attenuator

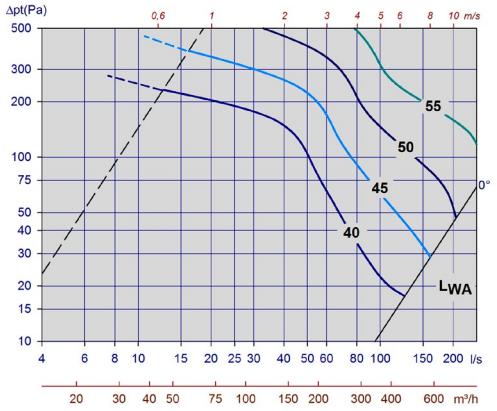


Diagram 8: Ø160 with short sound attenuator

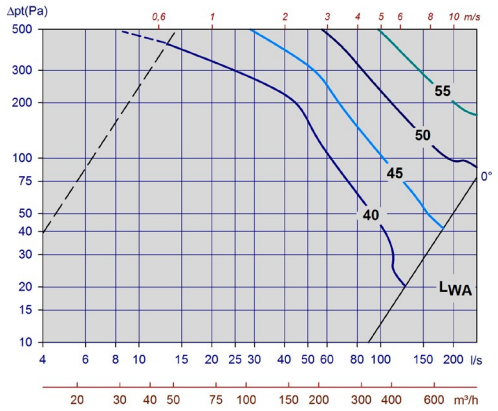


Diagram 9: Ø160 with long sound attenuator

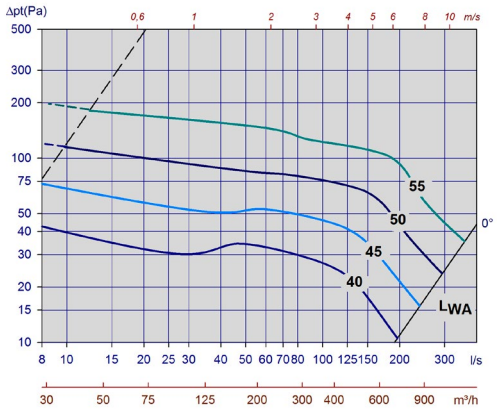


Diagram 10: Ø200 without sound attenuator

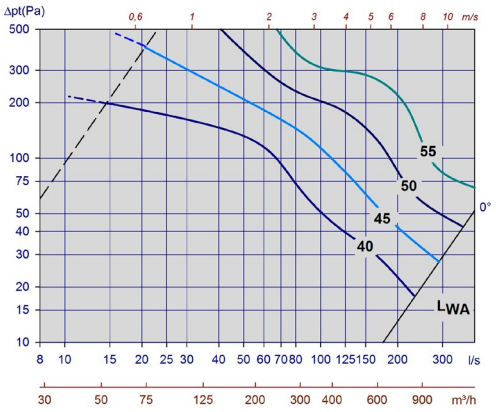


Diagram 11, Ø200 with short sound attenuator

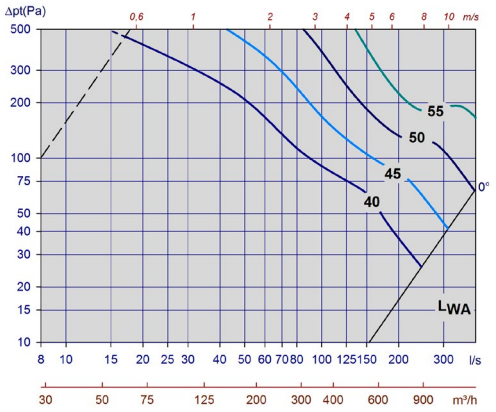


Diagram 12, Ø200 with long sound attenuator

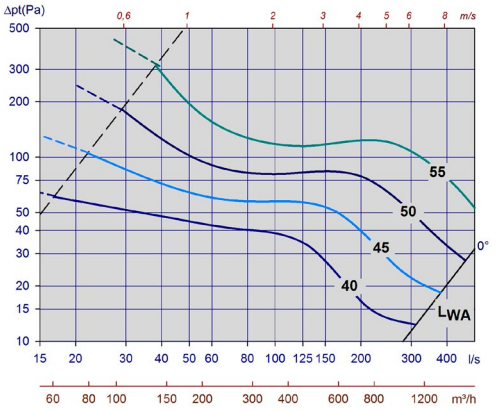


Diagram 13, Ø250 without sound attenuator

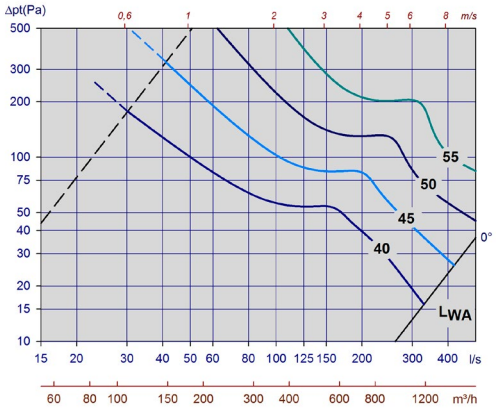


Diagram 14, Ø250 with short sound attenuator

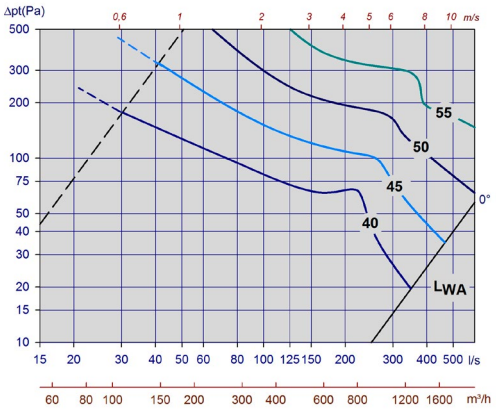


Diagram 15, Ø250 with long sound attenuator

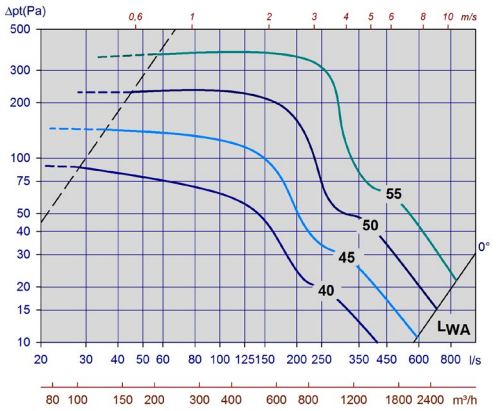


Diagram 16, Ø315 without sound attenuator

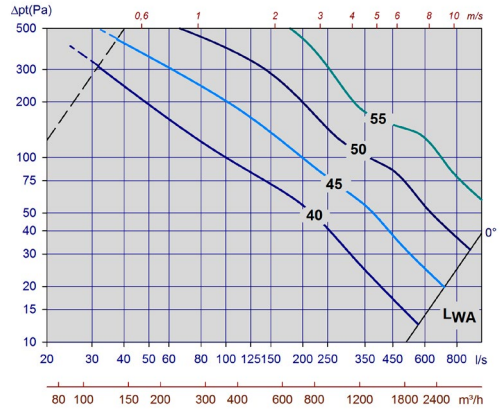


Diagram 17: Ø315 with short sound attenuator

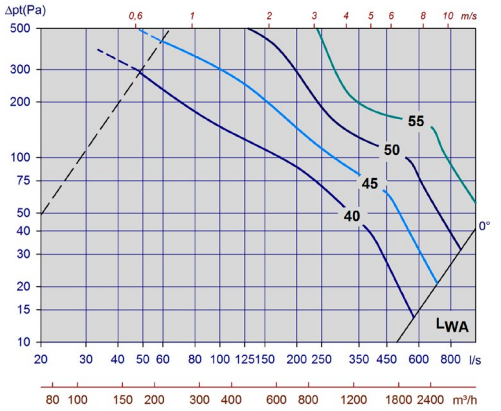


Diagram 18: Ø315 with long sound attenuator

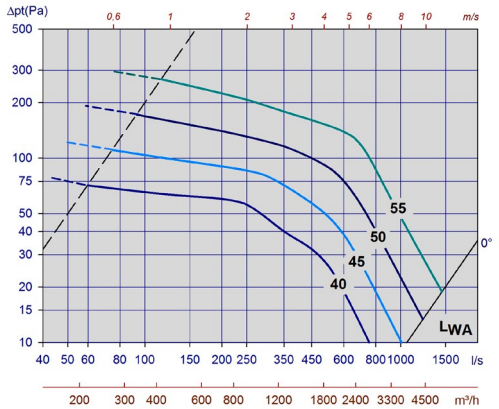


Diagram 19: Ø400 without sound attenuator

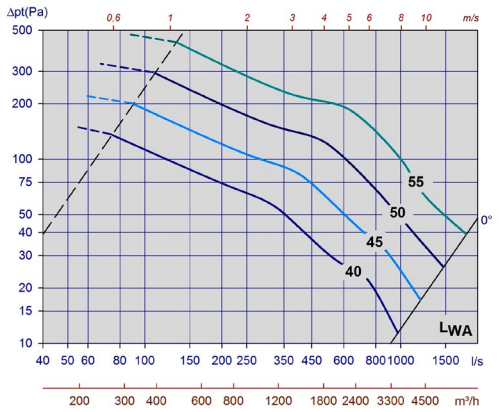


Diagram 20: Ø400 with short sound attenuator

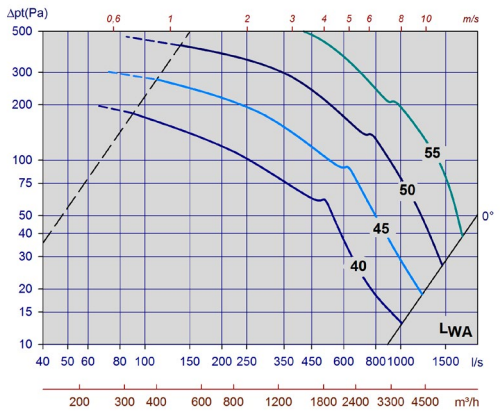


Diagram 21: Ø400 with long sound attenuator

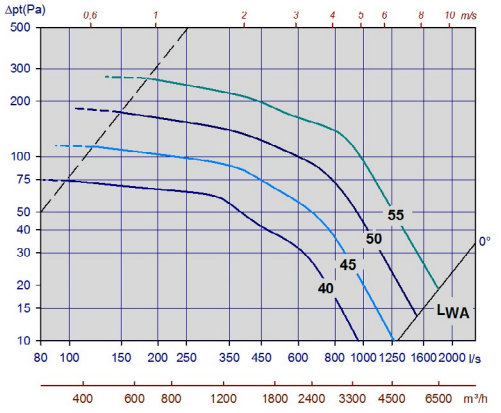


Diagram 22 Ø500 without sound attenuator

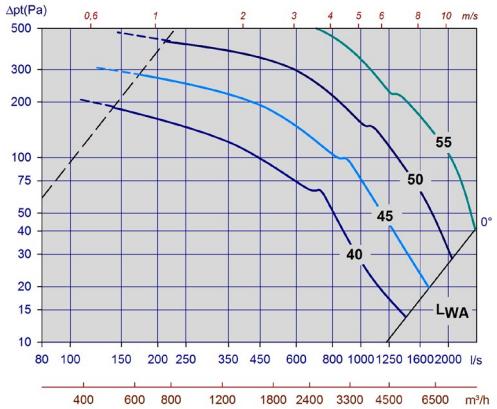


Diagram 23 Ø500 with long sound attenuator

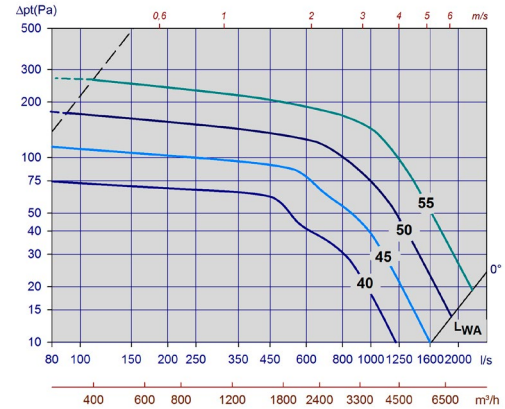


Diagram 24 Ø630 without sound attenuator

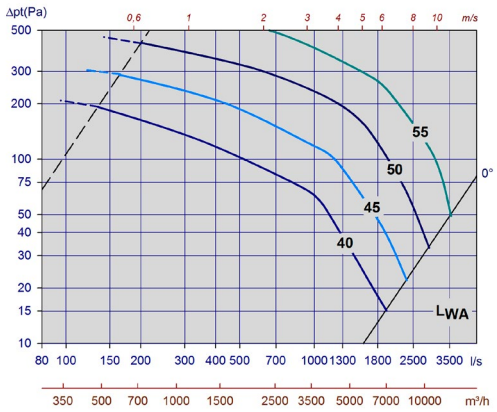


Diagram 25 Ø630 with long sound attenuator

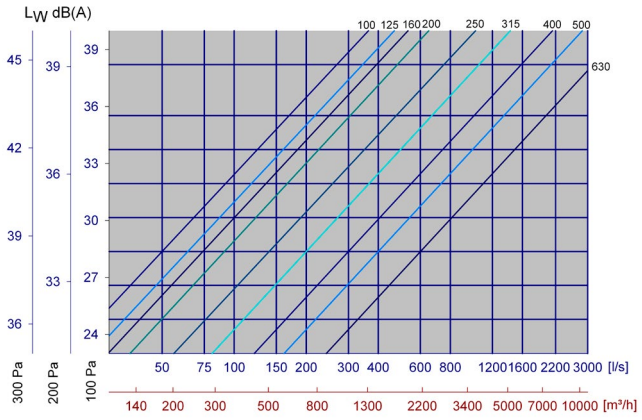


Diagram 26 Structure-borne sound for Leo VAV in standard design

STRUCTURE-BORNE NOISE

Diagram 26 shows the VAV unit's emitted structure-borne noise to the surroundings as a result of air flow rate and pressure loss over the damper (fig. 7). The noise level is shown as A-weighted sound power level from the VAV unit to the room, L_{WA}. When high-level protection against structure-borne noise is required, such as for open installation and high choke pressure over the unit, use of Leo VAV in encased and insulated design as well as measures in terms of the actual ductwork in front of and behind the unit is recommended. In order to protect against noise emission, the full length of the ductwork leading into the room must also be insulated or encased. By using ducting with double casing (fig. 8), a noise reduction of 6 -10 dB can be achieved. Installation as shown in fig. 9 provides a noise reduction of 3 – 6 dB

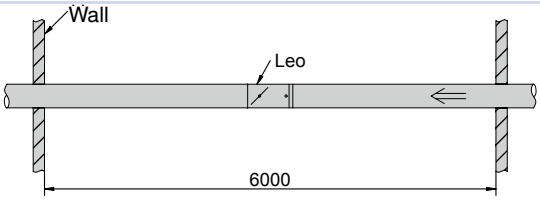


Fig. 7

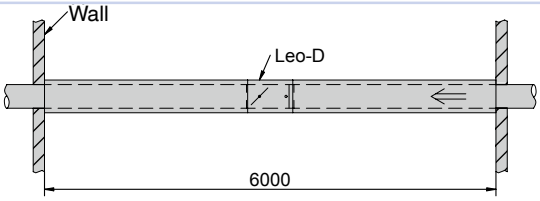


Fig. 8

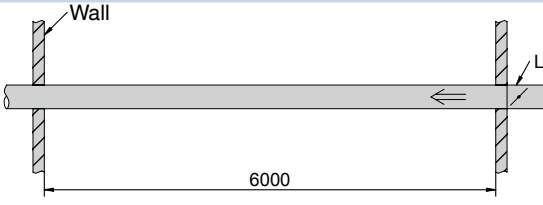


Fig. 9

Correction factor [KO], Leo – VAV without sound attenuator

	KO [dB]															
Leo	Left pressure drop line (s)								Right pressure drop line (å)							
Dim.	63	125	250	500	1K	2K	4K	8K	63	125	250	500	1K	2K	4K	8K
100	17	0	-2	-2	-5	-13	-20	-24	18	10	2	-3	-12	-20	-27	-27
125	13	-1	-7	-4	-3	-12	-15	-19	19	8	2	-4	-8	-17	-19	-19
160	17	0	-1	0	-7	-20	-22	-18	17	8	0	-6	-5	-12	-15	-17
200	12	3	-1	0	-8	-19	-26	-25	16	9	2	-5	-7	-13	-20	-21
250	17	3	0	0	-9	-18	-18	-16	16	7	1	-4	-6	-12	-16	-14
315	12	0	-1	-1	-6	-12	-14	-14	14	6	-2	-5	-6	-8	-15	-14
400	12	5	1	-3	-7	-12	-13	-12	12	4	-3	-2	-6	-9	-16	-17
500	11	4	1	-3	-6	-11	-12	-12	11	3	-4	-2	-5	-8	-16	-16
630	9	3	0	-3	-6	-11	-12	-12	9	3	0	-3	-6	-11	-12	-12

Table 5

Correction factor [KO], Leo – VAV with short sound attenuator

	KO [dB]															
Leo	Left pressure drop line (s)								Right pressure drop line (å)							
Dim.	63	125	250	500	1K	2K	4K	8K	63	125	250	500	1K	2K	4K	8K
100	22	7	2	-7	-9	-16	-16	-19	18	7	3	-3	-9	-17	-24	-25
125	19	7	-1	-8	-13	-13	-19	-7	20	6	2	-3	-10	-17	-18	-17
160	21	4	-4	-9	-13	-13	-7	-12	21	7	1	-4	-11	-18	-19	-16
200	18	3	-4	-5	-6	-9	-11	-13	21	7	1	-4	-11	-18	-19	-16
250	19	6	1	-4	-10	-13	-12	-12	15	8	2	-3	-9	-15	-16	-15
315	14	2	-1	-6	-9	-8	-8	-9	17	7	0	-3	-9	-12	-16	-14
400	9	4	1	-5	-8	-10	-9	-11	19	6	1	-4	-8	-12	-15	-13

Table 6

Correction factor [KO], Leo – VAV with long sound attenuator

	KO [dB]															
Leo	Left pressure drop line (s)								Right pressure drop line (å)							
Dim.	63	125	250	500	1K	2K	4K	8K	63	125	250	500	1K	2K	4K	8K
100	22	7	2	-7	-9	-16	-16	-19	18	6	3	-3	-9	-17	-23	-25
125	19	7	-1	-8	-13	-13	-9	-7	20	7	2	-3	-11	-18	-19	-17
160	20	7	-2	-8	-9	-11	-10	-11	21	8	2	-4	-11	-18	-19	-15
200	16	3	0	-9	-6	-8	-10	-14	17	9	3	-5	-8	-18	-22	-21
250	19	6	1	-4	-10	-13	-12	-12	19	8	0	-3	-9	-15	-17	-14
315	12	3	-3	-8	-8	-9	-7	-9	19	8	0	-4	-9	-13	-17	-15
400	11	5	0	-9	-10	-9	-7	-10	18	6	0	-3	-7	-13	-16	-15
500	11	4	1	-3	-6	-11	-12	-12	17	5	0	-3	-7	-12	-15	-14
630	8	3	-1	-9	-9	-8	-6	-9	16	5	0	-2	-6	-11	-14	-14

Table 7

Static internal damping for LEV, 500mm length

Leo	Attenuation [dB]							
Dim.	63	125	250	500	1k	2k	4k	8k
100	5	13	17	27	42	43	33	16
125	2	7	10	22	36	33	22	8
160	1	5	9	19	30	26	14	6
200	1	4	7	15	23	17	9	4
250	1	3	6	13	19	12	6	3
315	2	2	5	11	13	7	4	4
400	1	1	4	10	9	4	2	3

Table 8

Static internal damping for LEV, 1000 mm length

Leo	Attenuation [dB]							
Dim.	63	125	250	500	1k	2k	4k	8k
100	6	16	27	43	50	50	40	26
125	1	11	19	38	50	50	36	14
160	1	8	15	33	50	49	24	10
200	1	8	13	28	46	35	15	8
250	1	5	11	24	41	26	10	5
315	1	3	9	21	28	14	7	5
400	3	2	8	18	18	8	5	4
500	3	2	6	11	10	7	5	5
630	1	2	4	11	9	5	4	4

Table 9

INSTALLATION

In order to maintain the system's measurement accuracy, it is important to install units with spacing as shown in fig. 10 and 11. For installation of Leo, a service clearance in accordance with fig. 12 is recommended.

For supply air: When branching it is recommended min. 5xDia. between branch and Leo. Leo can be mounted directly into bend, without affecting the measurement accuracy.

For extract air: For installation with silencer it is recommended min. 5xDia distance between silencer and Leo, if it is used muffler center baffle or other constriction of the cross section. By the use of silencer with free passage, the silencer can be mounted directly to the Leo.

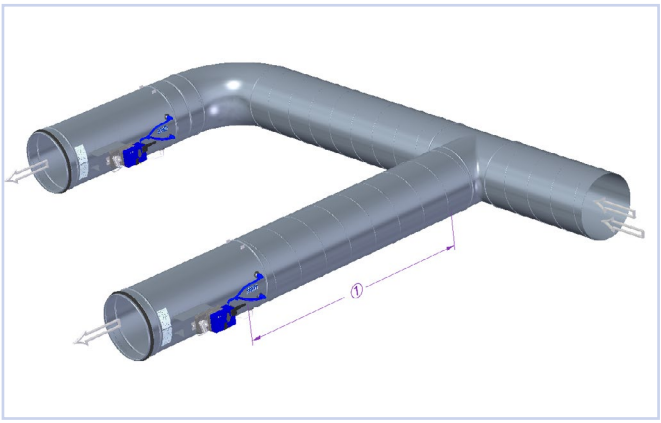


Fig. 10: Installation supply air ① Recommended min. 5 x Dia.

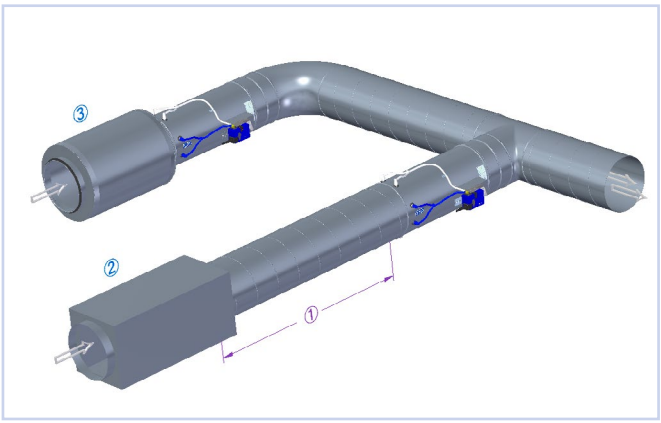


Fig. 11: Installation extract air ① Recommended min. 5 x Dia. ② Silencer with construction. ③ Silencer without construction.

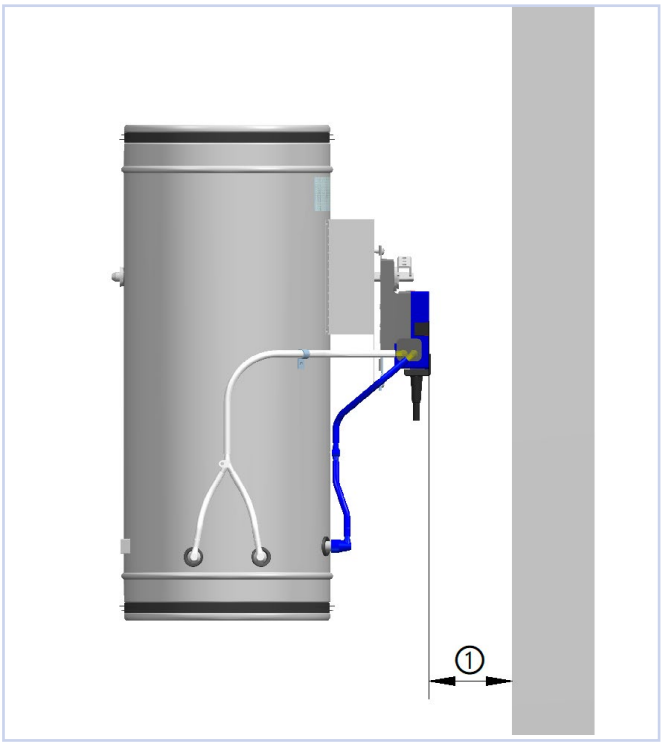


Fig. 12: Installation ① Service clearance min. 100 mm

COMMISSIONING

For commissioning and service, the PC software Belimo PC-Tool or Siemens ACS941 is used. With this service tools, the controller units can be set to the desired minimum and maximum air flow rate, 0-10 V or 2-10 V control signal and open-loop. Functional tests, which can be in presented graphic format, for documentation of the controller's operation can be carried out. Service tools that does not require PC, Belimo ZTH-VAV and Siemens AST20, is also available. For further information, please see www.belimo.eu and www.siemens.com or contact a member of our sales team.

MAINTENANCE

No specific maintenance requirements

ENVIRONMENT

Enquiries regarding product declaration can be directed to our sales team, or information can be found at our website: www.trox.no

ACCESSORIES

For accessories, see product group Automatics.

Leo is developed and manufactured by:

The company reserves the right to make amendments without prior notice.