VAV

VAV

VAV units

VAV

LKPV, IBM, Aarhus.

Optimized usage

Ventilation makes up considerable part of energy costs in the daily usage of the building. At the same time authorities have several requirements concerning how much energy is to be spent on ventilation. In pretty much all types of systems, it consequently makes good sense to use some sort of VAV, making it possible to reduce the air volume depending on the need in each individual room. The reduction of air volume in connection with transport of the air, in addition to the energy needed to cool/heat the outer air, will reduce costs.

Besides saving money on the energy, it also makes it possible to maintain a desired temperature in the individual room at varying loads. Through documented research and testing, it has turned out that there is a specific connection between the operative temperature in the room and the people's productivity. If the temperature in the room is not right, the productivity will fall, which in many instances will mean an economical loss to the individual users of the construction.

With these parameters taken into consideration, there is no doubt that VAV, despite the more expensive one-off investment, will pay for itself in the long run.

Complete programme

Lindab's series of VAV products include several types of supply air diffusers with motorized dampers, in order to reduce the air volume from 100% to 0 %. At the same time a constant air throw is ensured, in order to maintain the Coanda effect and avoid the risk of the air dropping in the occupied zone. Likewise, air flow regulators are available to regulate zones, in addition to motorized dampers for pressure regulation in the distribution ducts. Furthermore room regulator REGULA Combi and pressure regulator PR are available as well.

VRU / FRU

VAV

General information on VAV

VAV is short for "Variable Air Volume". VAV is a demand-controlled ventilation, to be used when the loads in a building vary. In rooms with changing numbers of people, a more satisfactory air quality can be ensured by regulating the air flow in relation to CO_2 concentration, which is a good indicator of air quality. It is however often the heat load, such as people, computers and sun, that is dimensioning the ventilation need in a room. These heat loads will almost always vary throughout the day and the night. By maintaining a constant supply air temperature, lower than the room temperature and instead regulate the air flow in ratio to the desired room temperature, the demand-controlled ventilation will cancel out the heat load.

The variations in airflow are brought about by a duct-damper or by motorized supply air diffusers with a damper function.
VAV-units can be produced for both with displacement ventilation and mixed ventilation.

Description of regulation types

In VAV-units, it is a pre-requisite that the fans can be speed-controlled.
Furthermore the VAV-unit must be divided into zones, typically one zone for each distribution air duct. These zones can be identified from two different principles. The airflow regulation or pressure regulation.

Airflow regulation

With airflow regulation, it is the airflow / air volume in the distribution air duct which is measured and regulated. The airflow is set to be able to vary between a pre-programmed minimum and maximum airflow. An electronic signal from a sensor (temperature, CO_2, movement) or BMS regulates the airflow within the set minimum and maximum airflow limits.

In airflow regulation, the right airflow will be achieved even when the pressure conditions in the air duct are changing, since the airflow regulator is independent of the pressure (and only requires a minimum pre-pressure).

This type of regulation is usually used for zone-regulation in connection with diffusers without dampers in mixed- or displacement systems. If mixed ventilation units without dampers are used, and the temperature difference is high. (ΔT = -8 to 10 K) between supply air and room air, the attention should turn to the risk of cold-drops from the supply air diffusers.

Since the airflow should be measured, there is a minimum limit on the airflow regulator. The minimum airflow must not be set lower than the measurement limit for the velocity of approx. 0.7 m/s. Airflow regulation can be used in the distribution air duct both for supply air and exhaust, either with a parallel signal from a sensor or BMS or with a Master/Slave function. If for example an over- or under pressure in a room is desired, with respect to the surroundings, a Master/Slave function is advisable.

Pressure regulation

Normally it is the distribution air duct on the supply air side which is regulated for pressure. A pressure regulation entails that a constant static pressure is maintained in the air duct. The static pressure is measured by a probe mounted inside the air duct. The probe is connected by a pipe to an electronic unit (pressure regulator) which registers the static pressure in the air duct with a membrane sensor unit.

For units with motorized supply air diffusers there should be a pressure regulation in the distribution air duct, since the diffusers are set and calibrated for a certain airflow variation at a given pressure. Furthermore the pressure regulation ensures that the correct pressure loss over the diffusers is reached, and consequently unwanted diffuser noise is avoided at a minimum airflow.

If instead, un-motorized diffusers are used, and airflow variations are made from motorized dampers in the air duct, a pressure regulation in the distribution air duct will ensure stable pressure conditions in the zone, and therefore good conditions for controlling these air duct dampers.

No matter the unit type however, the pressure loss in the zones distribution air duct has to be taken into consideration, in order to obtain a similar if not identical pressure at all branches to the connection ducts. As a general rule, the pressure loss in the distribution air duct from the first branch to the last branch should not exceed approx. 40 % of the static pressure.

In principle it is possible to obtain an airflow variation from 0-100% using air pressure regulation. The variation is solely dependent on which dampers or VAV-units are being used.

Pressure regulation of a distribution air duct using the supply air diffuser can be combined with an airflow regulation of the exhaust air. Using the Master/Slave principle and measuring the airflow /air volume, in the supply air, the signal for the measured airflow can be used as a signal to the airflow regulator on the exhaust air. That way it is definite that the same volume of air will be removed from a VAV-zone as the volume supplied.

A more simple, but less precise method to secure the same volume of air in and out of the VAV-zone, is to use a mechanical slave-control of the exhaust-damper, which takes the same position as the supply air-damper. Regulation of the exhaust-damper happens by a simple electronic adjustment, when the turning angle has been determined.

VAV

Choice of regulation type

In smaller zones, with a clear pressure conditions (not too long supply air ducts) both in supply air and exhaust air, a VAV-system with a pressure regulation of the distribution air ducts is preferable. If motorized VAV-diffusers are required, a pressure regulation of the zone is necessary.

For units with widely varying pressure conditions, we instead recommend an airflow regulation of each zone.

In zones with longer distribution air ducts, eg. big office spaces, where not much variety happens in the thermal loads, airflow regulation will be preferable.

Airflow regulation

+ full control over airflow
+ measuring of actual airflow
+ signal to BMS about airflow
+ no airflow variations at pressure variations in the air duct system
- minimum airflow limited to 0,7 m/s
- demands special equipment to change settings (compact model)

Pressure regulation

+ very low minimum airflow
+ can be set without the help of tools
+ levels pressure variations from the system in the VAV-zone
+ ensures a low noise level for diffuser and dampers
+ possibility of combination with CAV
- no airflow control
- small pressure loss in distribution air duct is important

Choice of diffuser

Mixed ventilation

1) Motorized supply air diffusers

Advantages:
Built-in damper function, and no extra dampers necessary. Constant air throw despite varying airflow, resulting in good mix even at minimum airflow. Also suitable for supply air at cooling temperature.

Limitations:
Owing to sound generation in the diffuser, the duct pressure must be maintained at a constant (relatively low) level.

2) Non-motorized supply air diffusers

Advantages:
Simple diffusers without moveable parts.
Low sound level particularly at reduced air flow.

Existing systems can be changed to VAV without change of diffuser.
No electrical installations needed for diffusers.
More diffusers can be controlled by one motor damper.
Shut-off is possible with duct damper or airflow regulator.

Limitations:
Minimum airflow should not be chosen less than 50% for perforated or unperforated diffusers, and 40% for swirl diffusers, if cooling supply air is used at a temperature difference of (ΔT = -8 to -10 K) between supply air and room air.

Displacement ventilation

All displacement units are suitable for VAV-systems. The units should be dimensioned for the maximum airflow, where the biggest near-zones and the highest sound levels arise. When the airflow is reduced, so is the near-zone and the sound level. Consequently there is no lower limit to the size of minimum airflow, which is why an airflow variation from 0-100% is possible.

Possible consequences should be evaluated in each case.

VAV

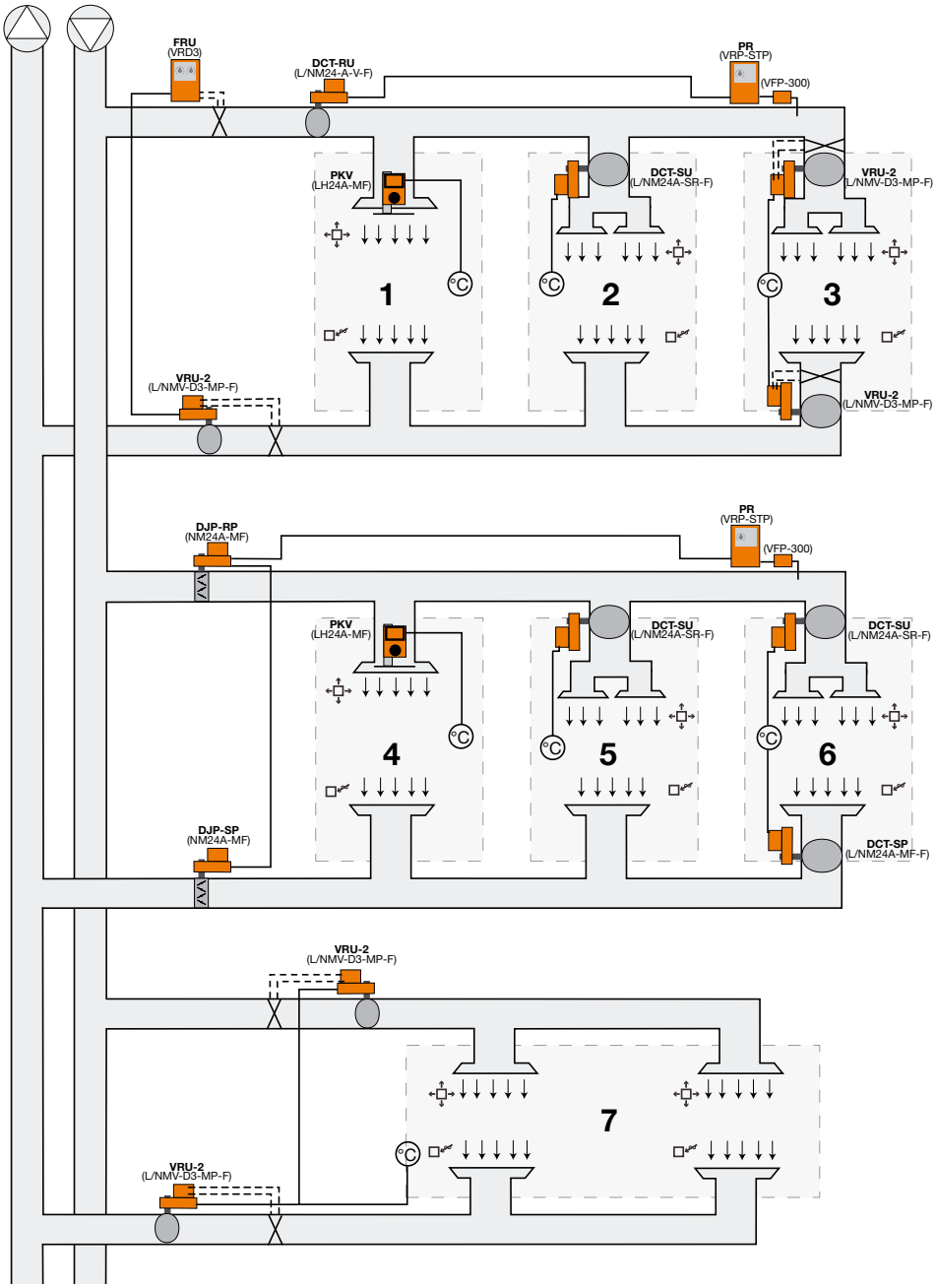
Component qualities

SUPPLY AIR		Airflow control	Pressure control	
		VRU	VAV-unit	Damper
Measurement of airflow - airflow signal to CTS		yes	no	no
Linear functions		yes	no	no
Reliability of airflow		yes	dependent on pressure variation	dependent on pressure variation
Limitation of airflow	max:	yes (standard up to 7 m/s)	pressure dependent	pressure dependent
	min:	yes (standard of 0,7 m/s)	approx. 20% of max. (standard)	damper angle
Shut-off possible		yes	no	yes
Constant airthrow (only mixed ventilation)		no	yes	no
Balancing		not necessary (diffusers are controlled)	by setting of static pressure or damper-position	by setting of static pressure or damper-position

EXHAUST AIR	Airflow control	Mechanical slave control
	VRU	Dampers
Requirements for supply air	VRU/FRU	motor for slave control
Measurement airflow (exhaust) - air flow signal to CTS	yes	no
Reliability of airflow	yes	highly pressure dependent, therefore inaccurate
Control of over pressure, under pressure or pressure balance in room	yes	no
Balancing	not necessary (diffuser controls)	by setting of static pressure or damper-position

VAV

System descriptions



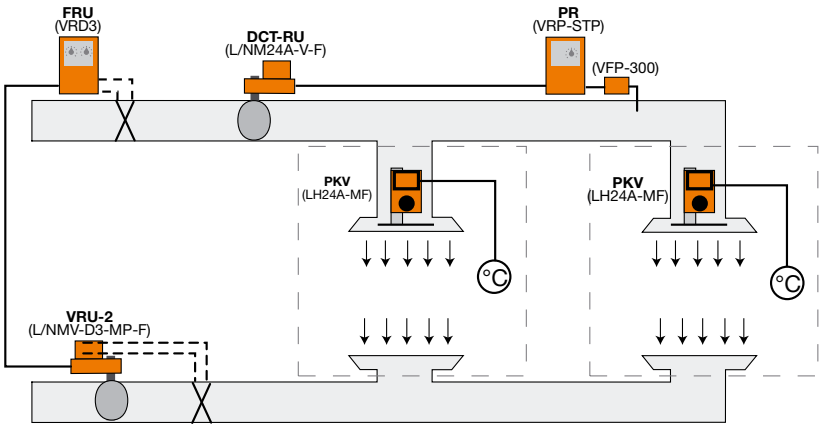
Explanations of units

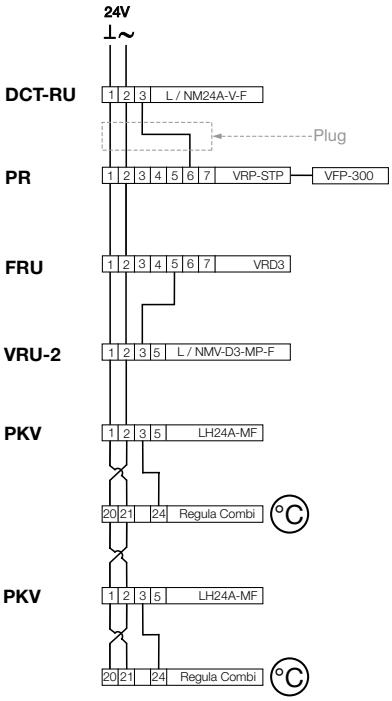
PR: Pressure regulation incl. pressure sensor	DCT-RU: Regulator controlled motorized damper
FRU: Measuring device	DCT-SU: Modulating motorized damper
VRU-2: Airflow regulator (compact model)	DCT-SP: Modulating motorized damper, to be programmed
PKV-TM: Motorized VAV-unit	DJP-RP: Regulator controlled motorized damper, to be programmed
°C: Regula Combi	DJP-SP: Modulating motorized damper, to be programmed

VAV

System 1

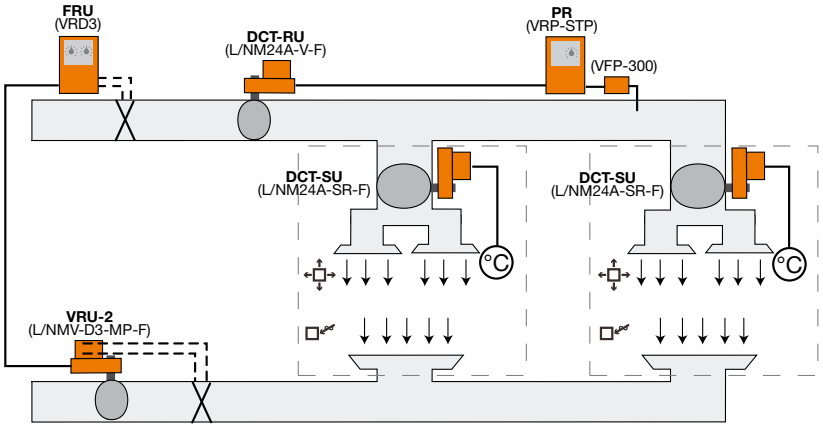
The supply air in the zone is pressure regulated. For details, see section “Pressure regulation”, page 526, under “Description of regulation types”.
The supply air to the rooms is carried through motorized VAV-units controlled by Regula Combi.
Exhaust in the zone is regulated with an airflow regulator, connected by a Master/Slave connection to a measuring device in the supply air, which measures the airflow. That way the same airflow is ensured going in or out of the zone, or a percentage difference if desired.

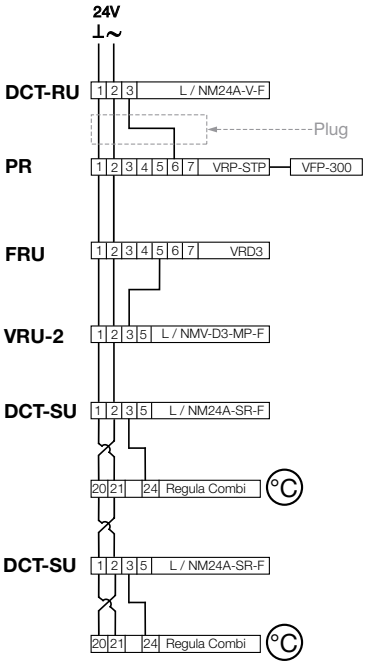




System 2

The supply air in the zone is pressure regulated. For details, see section “Pressure regulation”, page 526 under “Description of regulation types”.
The supply air to the rooms is carried through non-motorized diffusers. The air flow variation is obtained by Regula Combi controlling the damper in the distribution ducts, so that more diffusers can be controlled by a single motorized damper.
The exhaust air in the zone is regulated by an air flow regulator connected to a Master/Slave connection to a measuring device in the supply air duct, which measures the air flow. That way the same airflow is ensured going in or out of the zone, or a percentage difference if desired.

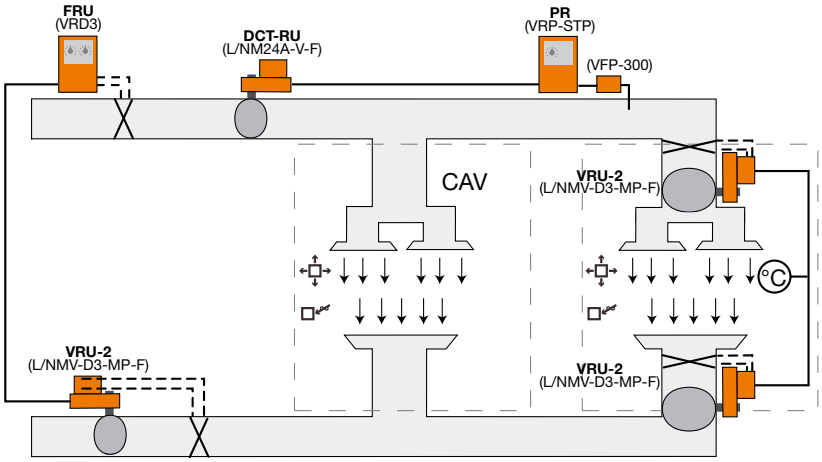


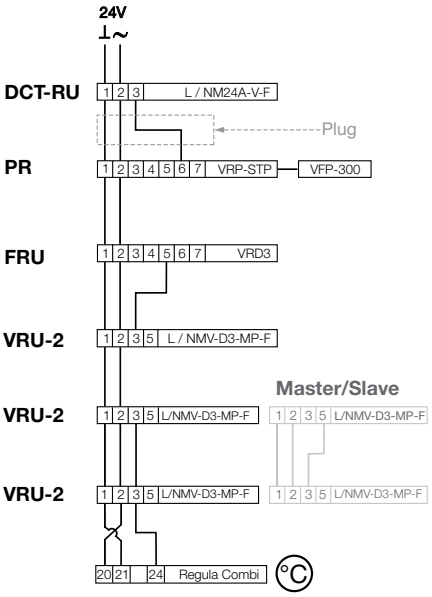


VAV

System 3

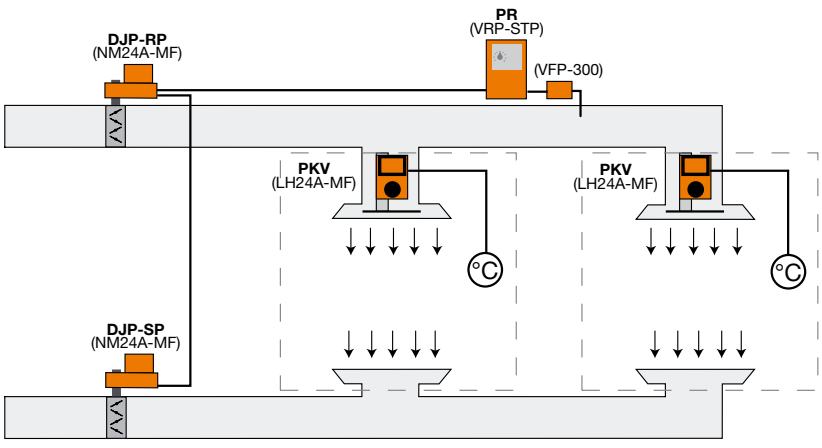
The supply air in the zone is pressure regulated. For details, see section “Pressure regulation”, page 526 under “Description of regulation types”.
Supply air to the rooms is carried by non-motorized diffusers. In the right-hand room the air flow variation is obtained by the Regula Combi controlling the airflow regulators in the distribution duct for both supply air and exhaust. In the left-hand room there is a constant air flow (CAV), which is possible due to the supply air duct being pressure regulated. Possible pressure changes caused by the air flow regulators in the right room will be regulated in the supply air duct.
Exhaust air in the zone is regulated by an airflow regulator, connected to a Master/Slave connection to a measuring device in the supply air, measuring the airflow. That way the same airflow is ensured going in or out of the zone, or a percentage difference if desired.

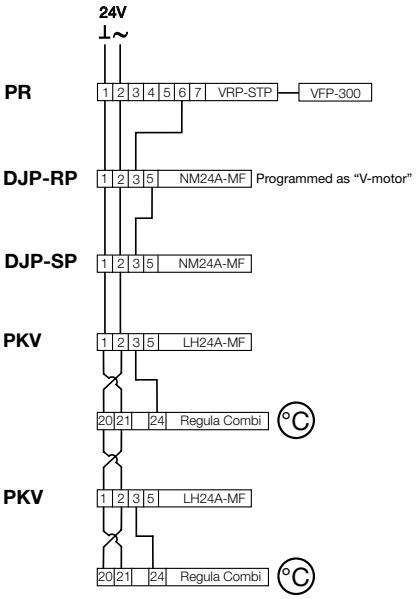




System 4

The supply air in the zone is pressure regulated. For details, see section “Pressure regulation”, page 526 under “Description of regulation types”.
The pressure regulation damper is supplied with a motor to be programmed, whose signal gives information about the damper position.
The supply air to the rooms is carried through motorized VAV-units, controlled by Regula Combi.
The exhaust in the zone is controlled by a damper by “mechanical slave control” which means that the exhaust damper takes the same position as the supply air damper. Regulation of the exhaust air flow happens by simple electronic control, when the turning angle has been set.

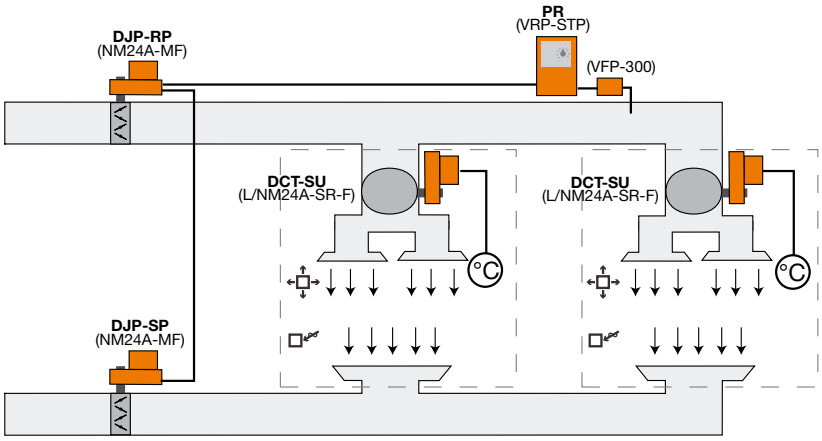


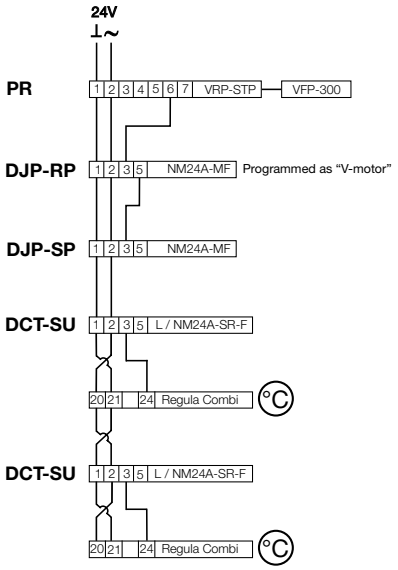


VAV

System 5

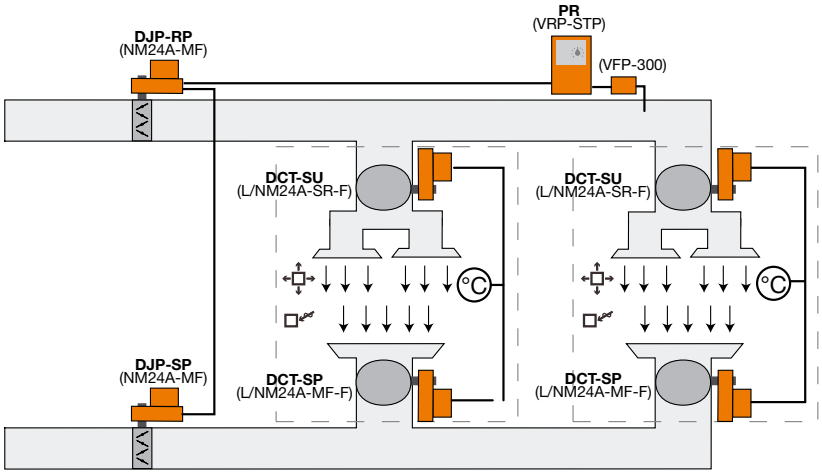
Supply air in the zone is pressure regulated. For details, see section “Pressure regulation”, page 526 under “Description of regulation types”.
The pressure regulation damper is supplied with a motor to be programmed, and whose signal gives information about the damper position.
Supply air to the rooms is carried through non-motorized diffusers. The airflow variation is obtained by the Regula Combi controlling the damper in the distribution ducts, so that more diffusers can be controlled by a single motorized damper. The exhaust in the zone is controlled by a “mechanical slave control”, which means that the exhaust damper takes the same position as the supply air damper. Regulation of the exhaust airflow happens by simple electronic control, when the turning angle has been set.

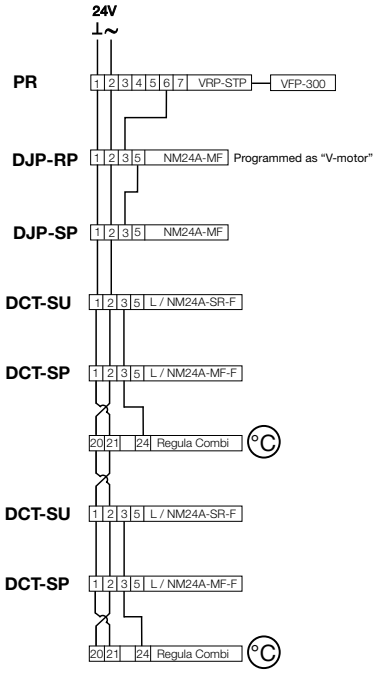




System 6

The supply air in the zone is pressure regulated. For details, see section “Pressure regulation”, page 526 under “Description of regulation types”.
The pressure regulation damper is supplied with a motor to be programmed, whose signal gives information about the damper position.
Supply air to the rooms is carried by non-motorized diffusers. The airflow variation is obtained by the Regula Combi controlling the damper in the distribution ducts, so that more diffusers can be controlled by a single motorized damper. Parallel to this the Regula Combi controls dampers in the exhaust, to be regulated with a simple electronic control, when the turning angle has been set.
The exhaust air in the zone is controlled by a damper by “mechanical slave control”, which means the exhaust damper takes the same position as the supply air damper. Regulation of the exhaust airflow happens by a simple electronic control when the turning angle has been set.

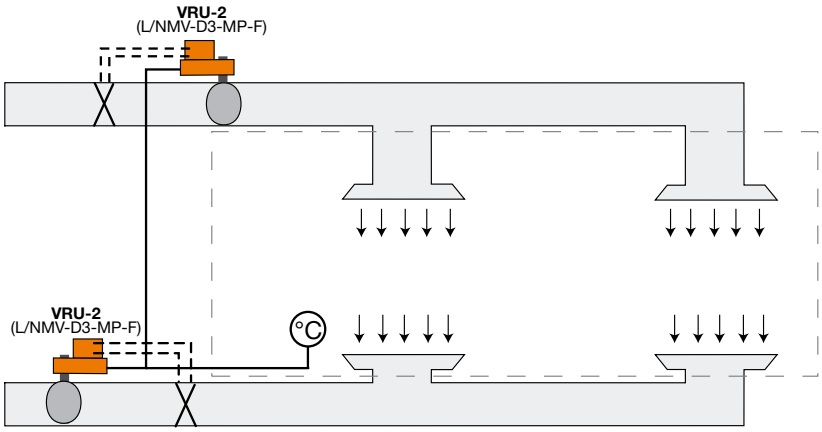


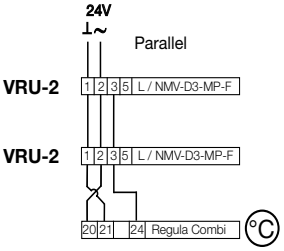


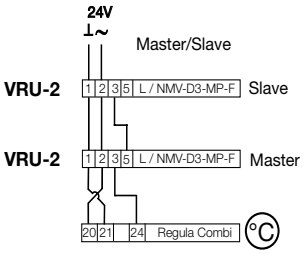
VAV

System 7

Both supply air and exhaust air in the zone are airflow regulated. For details see section “Airflow regulation”, page 526 under “Description of regulation types”. Diffusers for supply air and exhaust air are normal diffusers. The temperature in the zone is maintained by the signal from Regula Combi which is used as a parallel signal to the airflow regulators in supply and exhaust air.
Using this connection, the same airflow can be ensured in and out of the zone or with a constant difference between supply and exhaust air. If instead a percentage difference is wanted, a Master/Slave connection must be used.







VAV diffuser

PKV

Description

PKV is a square PKA type diffuser with integrated motor for supply air of variable air volume (VAV). The integrated motorized damper ensures a constant throw so the Coanda effect always is maintained. The damper setting can be controlled by a room regulator, BMS or other 2-10 V control signal.

- Can vary the volume flow between 0-100 %
- Min. flow preset from factory *)
- Max. flow to be set in MBB box based on k-value
- Settings can be changed with ZTH-GEN or Belimo PC-tool
- VAV zone pressure must be controlled
- The diffuser must be installed together with a MBB-S type plenum box
- For exhaust PKA can be used

*) Min. setting and k-value are made from a pre-defined, available constant pressure in the air duct immediately before the diffuser. The diffuser is typically used at a constant pressure of 30-50 Pa.

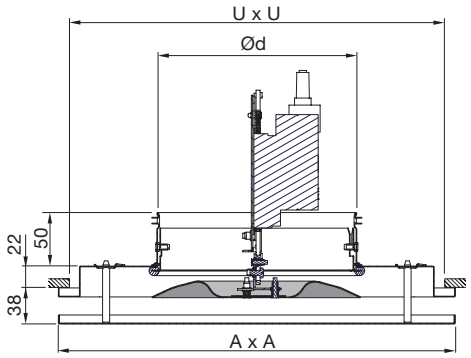
Order code

Product	**PKV**	**aaa**	**bb**	**cc**	**dd**
Type					
PKV					
Dimension					
Ø160-315					
Flow settings					
Min. airflow					
Max. airflow					
Pressure					

Example: PKV-200- 15 l/s - 60 l/s - 40 Pa

When ordering, MBB plenum type must be specified.

Dimensions



PKV Ød mm	A mm	U * mm	Weight (kg) (with Motor)
160	295	260	3,3
200	395	360	4,3
250	495	460	5,7
315	595	560	7,2

* U x U = Ceiling grid opening

Maintenance

The face plate and damper insert can be removed to enable cleaning of internal parts or to gain access to the duct or box. The visible parts of the diffuser can be wiped with a damp cloth.

Materials and finish

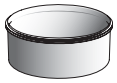
Diffuser:	Galvanised steel
Diffuser finish:	Powder-coated
Standard colour:	RAL 9010, gloss 30
Motor:	Manufact. Belimo type LH24A-MF

Other colours are available. Please contact Lindab's sales department for further information.

VAV diffuser PKV

Accessories

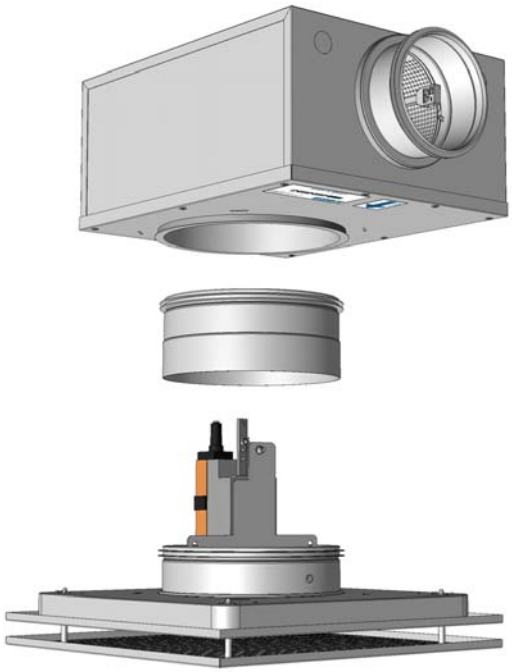
MBZ - Extension piece



Order code MBZ

Product	MBZ	aaa
Type		
MBZ		
Dimension		
Ø160-315		

Example: MBZ-200



When PKV is used with small MBB plenums:

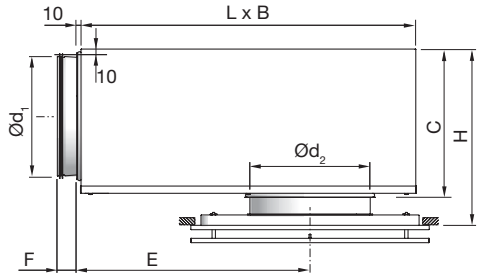
For the following MBB sizes, the MBZ extension piece must be used to ensure full movement of motor-rack.

Size: MBB-100-160-S
MBB-125-160-S
MBB-125-200-S

For other PKV accessories, see the section on Formo ceiling diffusers, PKA accessories.

MBB - Plenum box

PKV+MBB-S



PKV + MBB							
duct	PKV	B	C	E	F	H*	L
Ød1 mm	Ød2 mm	mm	mm	mm	mm	mm	mm
100	160	260	159	216	50	180-220	310
125	160	310	184	262	50	205-245	376
125	200	310	184	262	50	205-245	376
160	160	380	220	323	50	239-279	459
160	200	380	220	323	50	239-279	459
160	250	380	220	323	50	239-279	459
200	200	460	259	396	70	280-320	565
200	250	460	259	396	70	280-320	565
200	315	460	259	396	70	280-320	565
250	250	540	309	486	70	330-370	698
250	315	540	309	486	70	330-370	698
315	315	540	373	646	70	395-435	858

* Using accessory MBZ the H dimension will increase:
$Ød_2$ = 160 - 200 mm => H + 40 mm
$Ød_2$ = 250 - 315 mm => H + 60 mm

Order code

Product	MBB	aaa	bbb	S
Type				
MBB				
Duct connection $Ød_1$				
Ø100-315				
Diffuser dimension $Ød_2$				
Ø160-315				
Function				
S = Supply air				

Example: MBB-160-200-S

VAV diffuser

PKV

Technical data

Diagrams on this page apply to PKV supply. For exhaust air and supplementary technical exhaust data, see the section on Formo ceiling diffusers.

Capacity

Max. volume flow q_v [l/s], [m^3/h], total pressure drop Δp_t [Pa], throw l_{02} [m] and sound effect level L_{WA} [dB(A)] can be seen in the diagrams.

Quick selection, supply air

Quick selection 30 dB(A)

PKV + MBB		30 dB(A)					
		30 Pa		35 Pa		40 Pa	
duct	PKV	q_v		q_v		q_v	
$Ød_1$	$Ød_2$	l/s	m^3/h	l/s	m^3/h	l/s	m^3/h
100	160	28	100	28	100	29	104
125	160	37	133	37	133	37	133
125	200	45	162	48	172	49	176
160	160	42	151	42	151	42	151
160	200	64	230	62	223	62	223
160	250	73	262	73	262	73	262
200	200	67	241	66	237	65	234
200	250	85	306	84	302	83	298
200	315	99	356	100	360	99	356
250	250	91	327	91	327	91	327
250	315	112	403	112	403	112	403
315	315	115	414	112	403	110	396

Quick selection 35 dB(A)

PKV + MBB		35 dB(A)					
		30 Pa		35 Pa		40 Pa	
duct	PKV	q_v		q_v		q_v	
$Ød_1$	$Ød_2$	l/s	m^3/h	l/s	m^3/h	l/s	m^3/h
100	160	28	100	30	108	32	115
125	160	39	140	42	151	43	154
125	200	45	162	49	176	52	187
160	160	48	172	49	176	49	176
160	200	64	230	70	252	75	270
160	250	73	262	79	284	84	302
200	200	75	270	78	280	78	280
200	250	95	342	97	349	98	352
200	315	108	388	115	414	116	417
250	250	104	374	104	374	105	378
250	315	126	453	128	460	129	464
315	315	139	500	137	493	135	486

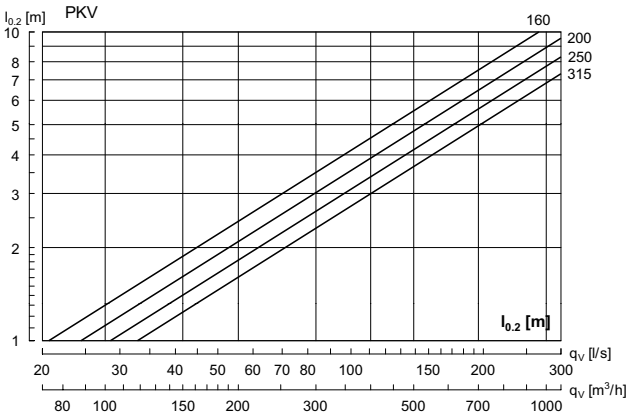
Sound attenuation

Sound attenuation of the diffuser ΔL from duct to room, including end reflection, see table below.

PKV + MBB		Centre frequency Hz							
duct	PKV								
$Ød_1$	$Ød_2$	63	125	250	500	1K	2K	4K	8K
100	160	12	13	8	19	13	16	17	19
125	160	12	13	8	19	13	16	17	19
125	200	16	11	5	16	13	15	15	17
160	160	17	17	11	19	18	17	20	20
160	200	14	14	7	21	15	16	18	19
160	250	15	15	5	17	13	15	16	18
200	200	15	10	6	16	17	15	19	18
200	250	12	9	5	14	17	15	17	17
200	315	12	7	4	11	15	14	16	15
250	250	14	8	8	14	16	17	17	18
250	315	12	6	6	15	15	15	16	17
315	315	7	9	8	14	17	16	17	21

Throw

The throw is specified at a terminal velocity of 0.2 m/s.



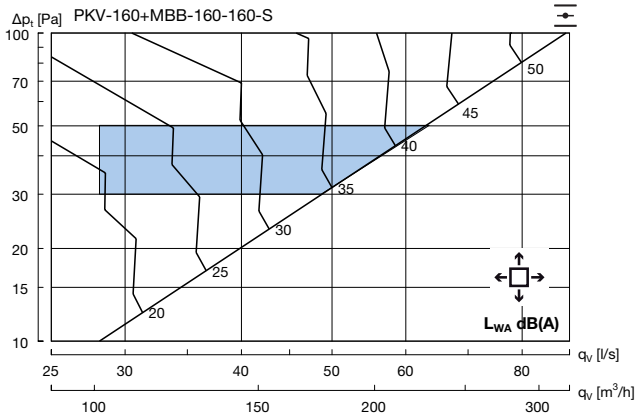
VAV diffuser

PKV

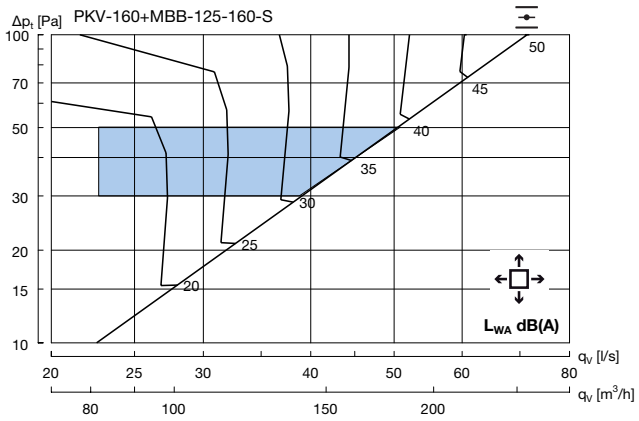
Technical data

Setting range for max. volume flow.

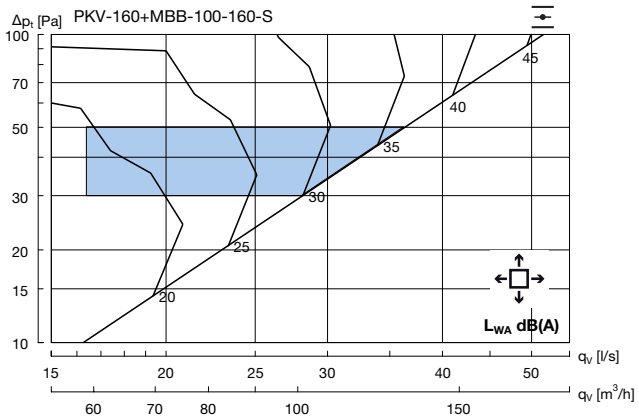
PKV-160 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	7	9	-1	-5	-4	-11	-23	-32

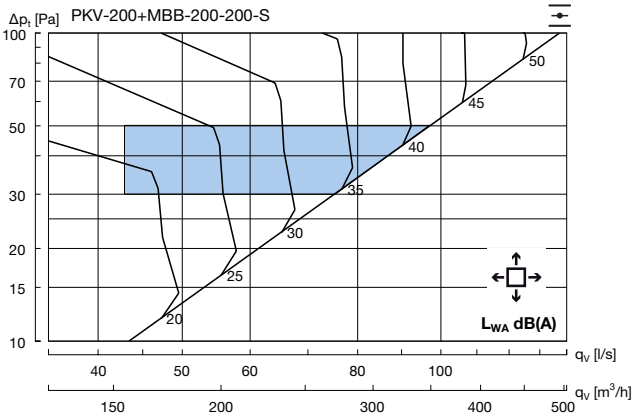


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	5	-1	-4	-3	-11	-22	-30

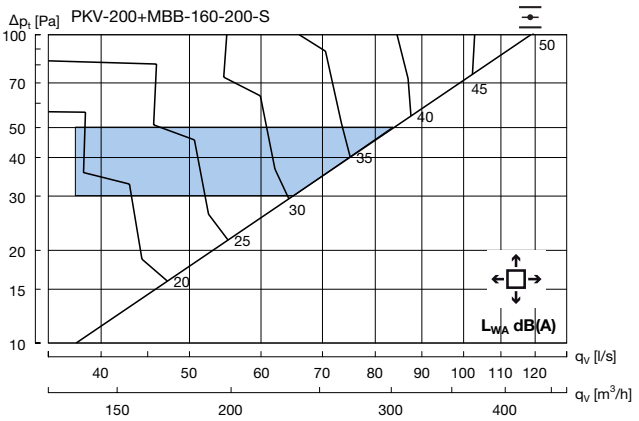


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	6	4	0	-5	-4	-8	-20	-25

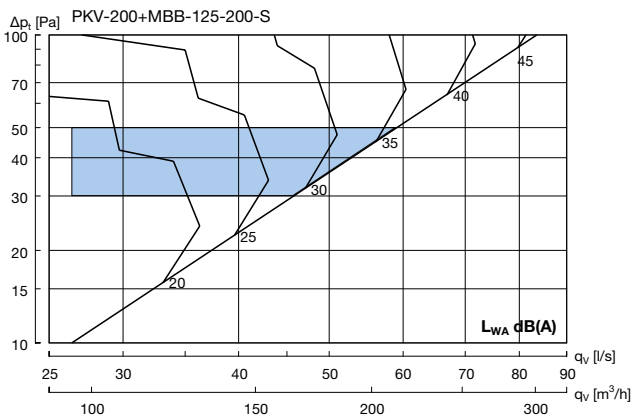
PKV-200 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	12	9	0	-4	-4	-12	-22	-32



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	8	0	-5	-4	-11	-20	-26



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	11	7	0	-4	-4	-11	-17	-23

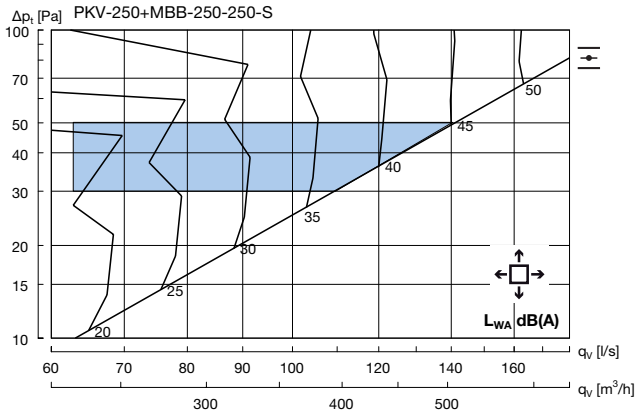
VAV diffuser

PKV

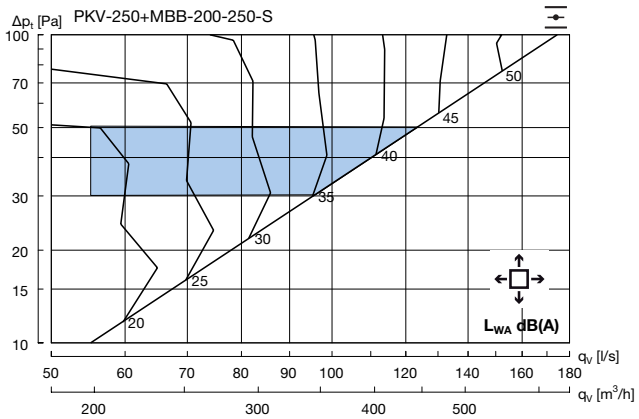
Technical data

Setting range for max. volume flow.

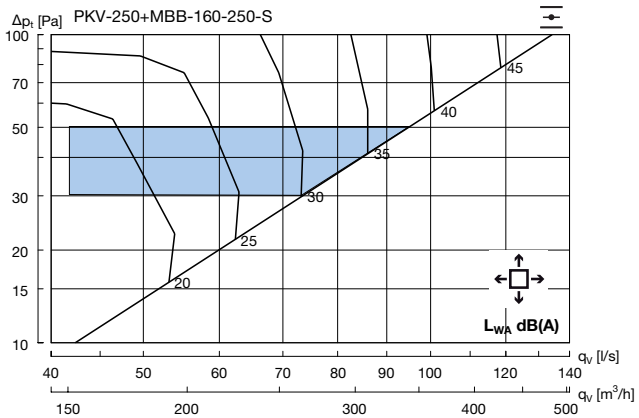
PKV-250 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	6	-2	-3	-4	-11	-23	-31

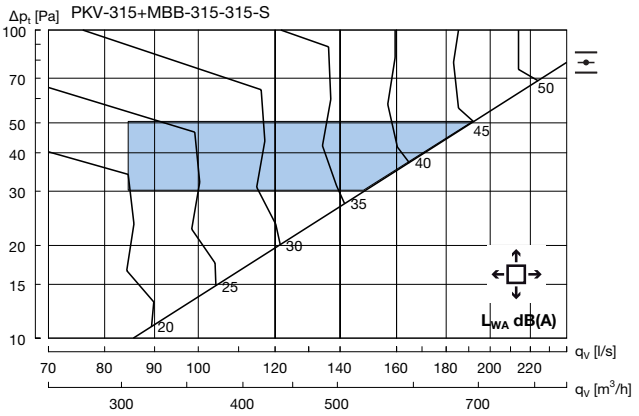


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	11	8	-2	-3	-4	-11	-22	-29

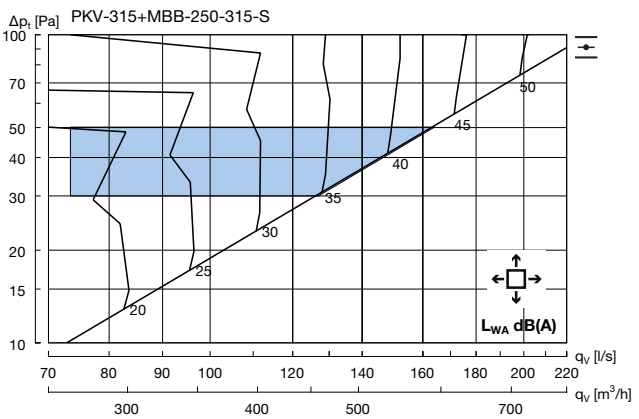


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	9	7	-1	-4	-4	-11	-18	-22

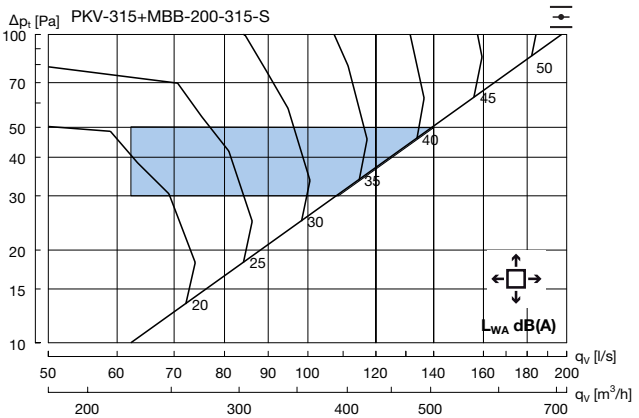
PKV-315 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	4	-2	-2	-4	-11	-23	-32



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	13	7	-2	-2	-4	-12	-22	-30



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	12	9	-2	-4	-5	-10	-18	-26

VAV diffuser

PCV

Description

PCV is a circular PCA type diffuser with integrated motor for supply air of variable air volume (VAV). The integrated motorized damper ensures a constant throw so the Coanda effect always is maintained. The damper setting can be controlled by a room regulator, BMS or other 2-10 V control signal.

- Can vary the volume flow between 0-100 %
- Min. flow preset from factory *)
- Max. flow to be set in MBB box based on k-value
- Settings can be changed with ZTH-GEN or Belimo PC-tool
- VAV zone pressure must be controlled
- The diffuser must be installed together with a MBB-S type plenum box
- For exhaust PCA can be used

*) Min. setting and k-value are made from a pre-defined, available constant pressure in the air duct immediately before the diffuser. The diffuser is typically used at a constant pressure of 30-50 Pa.

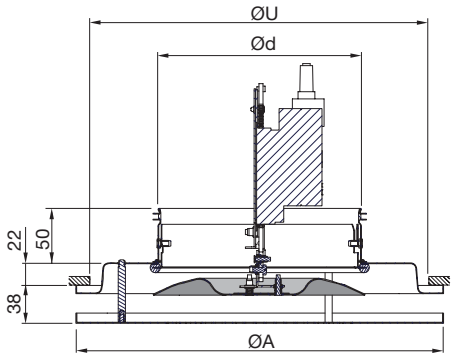
Order code

Product	**PCV**	**aaa**	**bb**	**cc**	**dd**
Type					
PCV					
Dimension					
Ø160-315					
Flow settings					
Min. airflow					
Max. airflow					
Pressure					

Example: PCV-200 - 15 l/s - 60 l/s - 40 Pa

When ordering, MBB plenum type must be specified.

Dimensions



PCV Ød mm	ØA mm	ØU * mm	Weight (kg) (with Motor)
160	300	260	3.0
200	360	320	3.8
250	460	420	4.9
315	540	500	6.1

* ØU = Ceiling grid opening.

Maintenance

The face plate and damper insert can be removed to enable cleaning of internal parts or to gain access to the duct or box. The visible parts of the diffuser can be wiped with a damp cloth.

Materials and finish

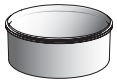
Diffuser:	Galvanised steel
Diffuser finish:	Powder-coated
Standard colour:	RAL 9010, gloss 30
Motor:	Manufact. Belimo type LH24A-MF

Other colours are available. Please contact Lindab's sales department for further information.

VAV diffuser PCV

Accessories

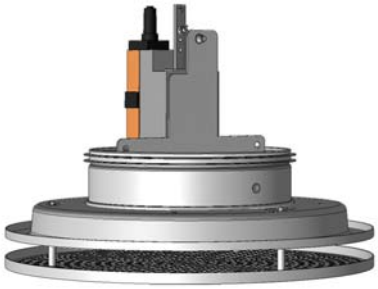
MBZ - Extension piece



Order code MBZ

Product	MBZ	aaa
Type		
MBZ		
Dimension		
Ø160-315		

Example: MBZ-200



When PCV is used with small MBB plenums:

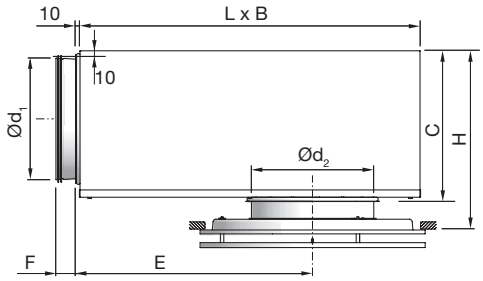
For the following MBB sizes, the MBZ extension piece must be used to ensure full movement of motor-rack.

Size: MBB-100-160-S
MBB-125-160-S
MBB-125-200-S

For other PCV accessories, see the section on Formo ceiling diffusers, PCA accessories.

MBB - Plenum box

PCV+MBB-S



PCV + MBB							
duct	PCV	B	C	E	F	H*	L
$Ød_1$ mm	$Ød_2$ mm	mm	mm	mm	mm	mm	mm
100	160	260	159	216	50	180-220	310
125	160	310	184	262	50	205-245	376
125	200	310	184	262	50	205-245	376
160	160	380	220	323	50	239-279	459
160	200	380	220	323	50	239-279	459
160	250	380	220	323	50	239-279	459
200	200	460	259	396	70	280-320	565
200	250	460	259	396	70	280-320	565
200	315	460	259	396	70	280-320	565
250	250	540	309	486	70	330-370	698
250	315	540	309	486	70	330-370	698
315	315	540	373	646	70	395-435	858

* Using accessory MBZ, the H-dimension will increase:
$Ød_2$ = 160 - 200 mm => H + 40 mm
$Ød_2$ = 250 - 315 mm => H + 60 mm

Order code

Product	MBB	aaa	bbb	S
Type				
MBB				
Duct connection $Ød_1$				
Ø100-315				
Diffuser dimension $Ød_2$				
Ø160-315				
Function				
S = Supply air				

Example: MBB-160-200-S

VAV diffuser

PCV

Technical data

Diagrams on this page apply to PCV supply. For exhaust air and supplementary technical exhaust data, see the section on Formo ceiling diffusers.

Capacity

Max. volume flow q_v [l/s], [m^3/h], total pressure drop Δp_t [Pa], throw l_{02} [m] and sound effect level L_{WA} [dB(A)] can be seen in the diagrams.

Quick selection, supply air

Quick selection 30 dB(A)

PCV + MBB		30 dB(A)					
		30 Pa		35 Pa		40 Pa	
duct	PCV	q_v		q_v		q_v	
$Ød_1$	$Ød_2$	l/s	m^3/h	l/s	m^3/h	l/s	m^3/h
100	160	28	100	28	100	29	104
125	160	37	133	37	133	37	133
125	200	45	162	48	172	49	176
160	160	42	151	42	151	42	151
160	200	64	230	62	223	62	223
160	250	73	262	73	262	73	262
200	200	67	241	66	237	65	234
200	250	85	306	84	302	83	298
200	315	99	356	100	360	99	356
250	250	91	327	91	327	91	327
250	315	112	403	112	403	112	403
315	315	115	414	112	403	110	396

Quick selection 35 dB(A)

PCV + MBB		35 dB(A)					
		30 Pa		35 Pa		40 Pa	
duct	PCV	q_v		q_v		q_v	
$Ød_1$	$Ød_2$	l/s	m^3/h	l/s	m^3/h	l/s	m^3/h
100	160	28	100	30	108	32	115
125	160	39	140	42	151	43	154
125	200	45	162	49	176	52	187
160	160	48	172	49	176	49	176
160	200	64	230	70	252	75	270
160	250	73	262	79	284	84	302
200	200	75	270	78	280	78	280
200	250	95	342	97	349	98	352
200	315	108	388	115	414	116	417
250	250	104	374	104	374	105	378
250	315	126	453	128	460	129	464
315	315	139	500	137	493	135	486

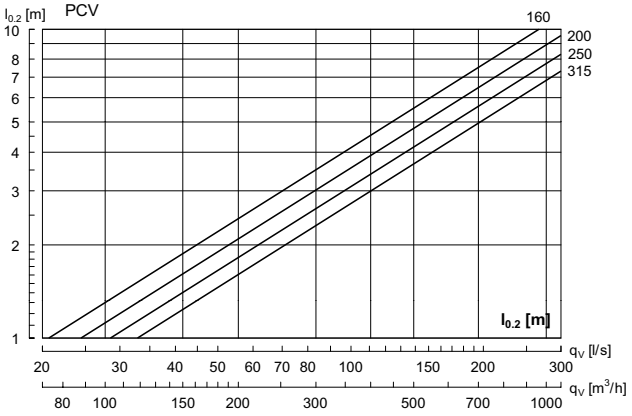
Sound attenuation

Sound attenuation of the diffuser ΔL from duct to room, including end reflection, see table below.

PCV + MBB		Centre frequency Hz							
duct	PCV								
$Ød_1$	$Ød_2$	63	125	250	500	1K	2K	4K	8K
100	160	21	16	5	15	17	18	16	19
125	160	12	13	8	19	13	16	17	19
125	200	16	11	5	16	13	15	15	17
160	160	17	17	11	19	18	17	20	20
160	200	14	14	7	21	15	16	18	19
160	250	15	15	5	17	13	15	16	18
200	200	15	10	6	16	17	15	19	18
200	250	12	9	5	14	17	15	17	17
200	315	12	7	4	11	15	14	16	15
250	250	14	8	8	14	16	17	17	18
250	315	12	6	6	15	15	15	16	17
315	315	7	9	8	14	17	16	17	21

Throw

The throw is specified at a terminal velocity of 0.2 m/s.



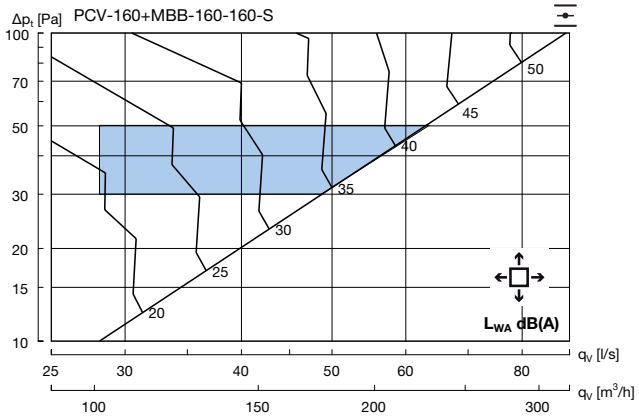
VAV diffuser

PCV

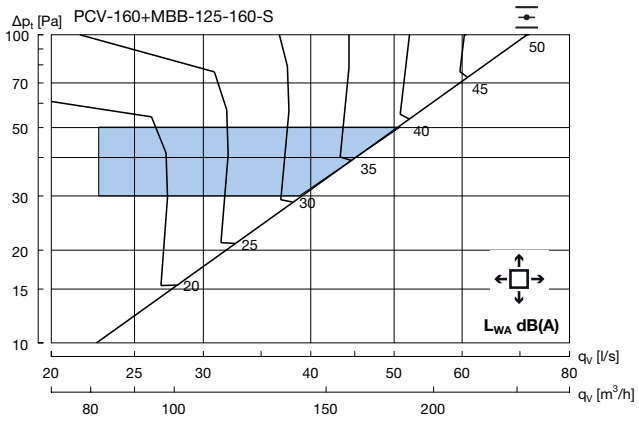
Technical data

Setting range for max. volume flow.

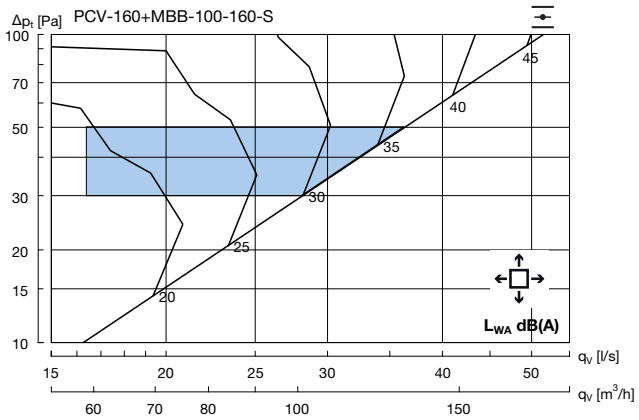
PCV-160 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	7	9	-1	-5	-4	-11	-23	-32

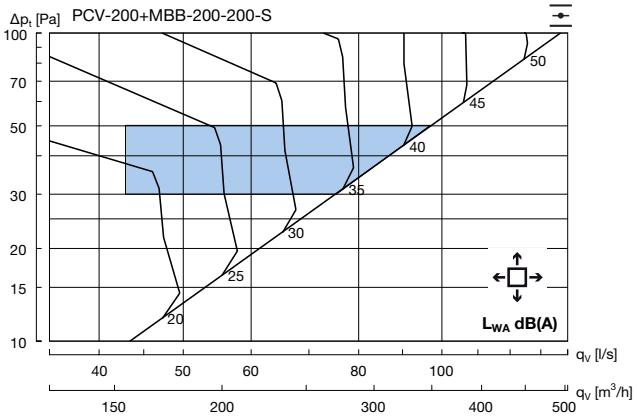


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	5	-1	-4	-3	-11	-22	-30

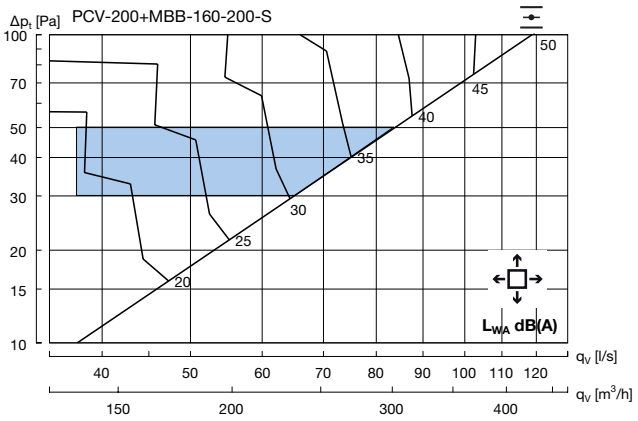


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	6	4	0	-5	-4	-8	-20	-25

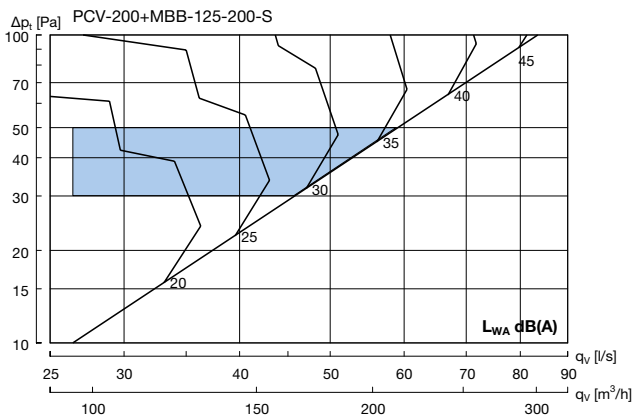
PCV-200 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	12	9	0	-4	-4	-12	-22	-32



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	8	0	-5	-4	-11	-20	-26



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	11	7	0	-4	-4	-11	-17	-23

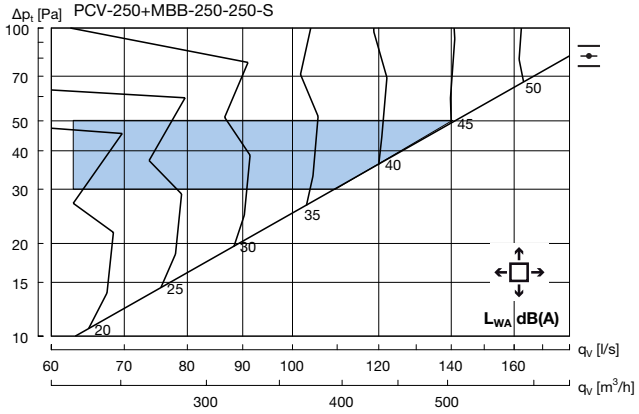
VAV diffuser

PCV

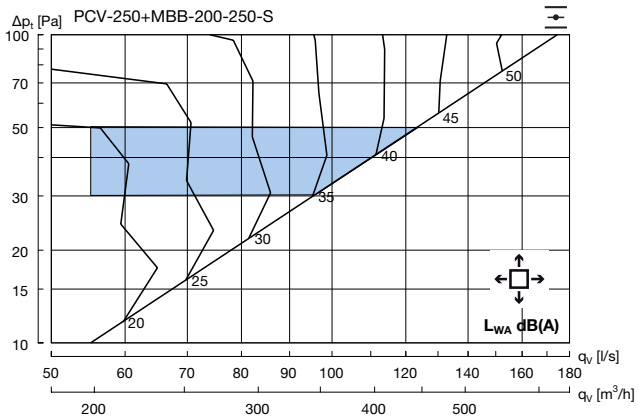
Technical data

Setting range for max. volume flow.

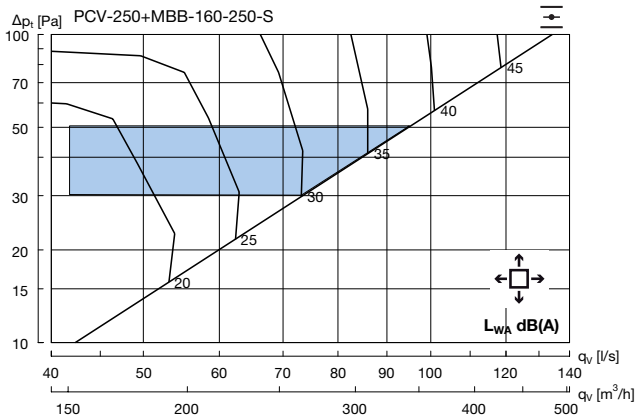
PCV-250 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	6	-2	-3	-4	-11	-23	-31

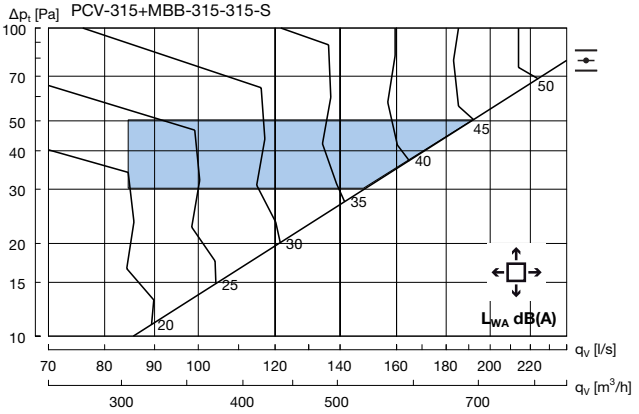


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	11	8	-2	-3	-4	-11	-22	-29

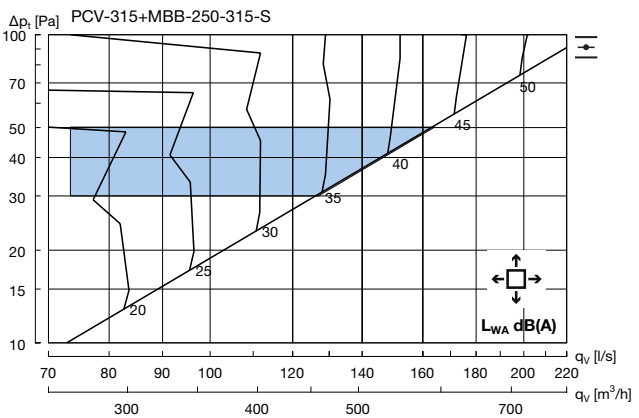


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	9	7	-1	-4	-4	-11	-18	-22

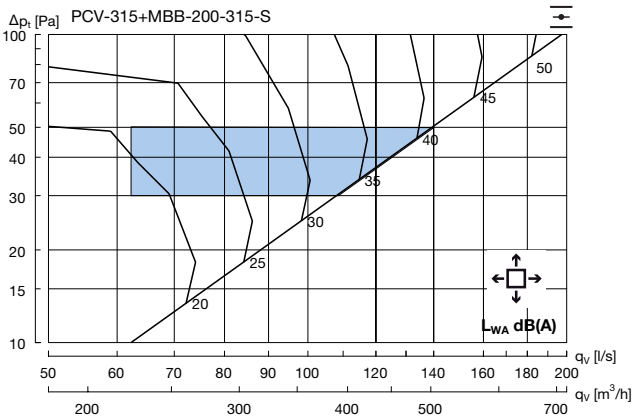
PCV-315 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	4	-2	-2	-4	-11	-23	-32



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	13	7	-2	-2	-4	-12	-22	-30



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	12	9	-2	-4	-5	-10	-18	-26

VAV diffuser

LKV

Description

LKV is a square LKA type diffuser with integrated motor for supply air of variable air volume (VAV). The integrated motorized damper ensures a constant throw so the Coanda effect always is maintained. The damper setting can be controlled by a room regulator, BMS or other 2-10 V control signal.

- Can vary the volume flow between 0-100 %
- Min. flow preset from factory *)
- Max. flow to be set in MBB box based on k-value
- Settings can be changed with ZTH-GEN or Belimo PC-tool
- VAV zone pressure must be controlled
- The diffuser must be installed together with a MBB-S type plenum box
- For exhaust LKA can be used

*) Min. setting and k-value are made from a pre-defined, available constant pressure in the air duct immediately before the diffuser. The diffuser is typically used at a constant pressure of 30-50 Pa.

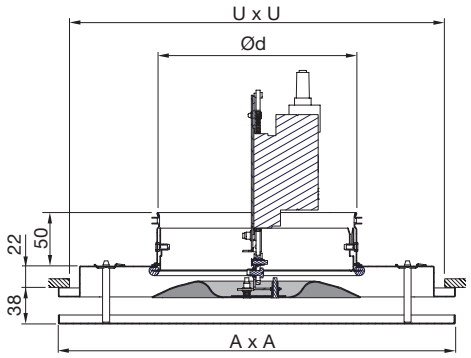
Order code

Product	**LKV**	**aaa**	**bb**	**cc**	**dd**
Type					
LKV					
Dimension					
Ø160-315					
Flow settings					
Min. airflow					
Max. airflow					
Pressure					

Example: LKV-200 -15 l/s - 60 l/s - 40 Pa

When ordering, MBB plenum type must be specified.

Dimensions



LKV Ød mm	A mm	U * mm	Weight (kg) (with Motor)
160	295	260	3,3
200	395	360	4,3
250	495	460	5,7
315	595	560	7,2

* U x U = Ceiling grid opening.

Maintenance

The face plate and damper insert can be removed to enable cleaning of internal parts or to gain access to the duct or box. The visible parts of the diffuser can be wiped with a damp cloth.

Materials and finish

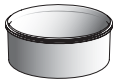
Diffuser:	Galvanised steel
Diffuser finish:	Powder-coated
Standard colour:	RAL 9010, gloss 30
Motor:	Manufact. Belimo type LH24A-MF

Other colours are available. Please contact Lindab's sales department for further information.

VAV diffuser LKV

Accessories

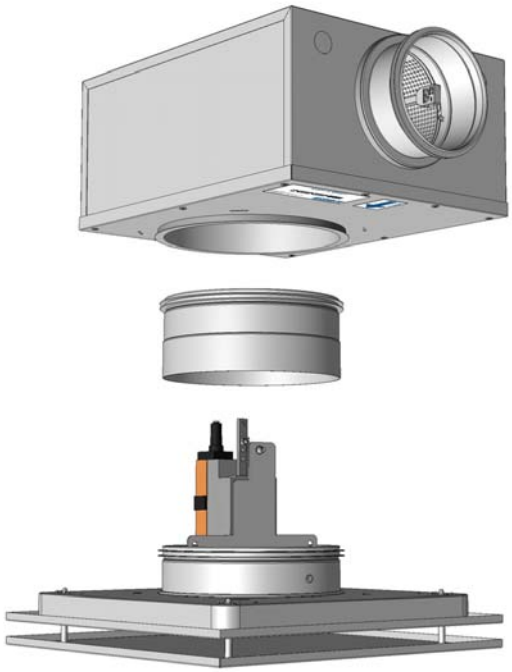
MBZ - Extension piece



Order code MBZ

Product	MBZ	aaa
Type		
MBZ		
Dimension		
Ø160-315		

Example: MBZ-200



When LKV is used with small MBB plenums:

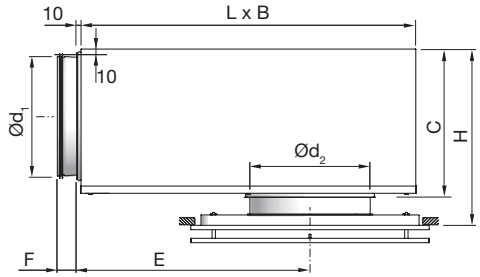
For the following MBB sizes, the MBZ extension piece must be used to ensure full movement of motor-rack.

Size: MBB-100-160-S
MBB-125-160-S
MBB-125-200-S

For other LKV accessories, see the section on Formo ceiling diffusers, LKA accessories.

MBB - Plenum box

LKV+MBB-S



LKV + MBB duct Ød1 mm	LKV Ød2 mm	B mm	C mm	E mm	F mm	H* mm	L mm
100	160	260	159	216	50	180-220	310
125	160	310	184	262	50	205-245	376
125	200	310	184	262	50	205-245	376
160	160	380	220	323	50	239-279	459
160	200	380	220	323	50	239-279	459
160	250	380	220	323	50	239-279	459
200	200	460	259	396	70	280-320	565
200	250	460	259	396	70	280-320	565
200	315	460	259	396	70	280-320	565
250	250	540	309	486	70	330-370	698
250	315	540	309	486	70	330-370	698
315	315	540	373	646	70	395-435	858

* Using accessory MBZ, the H-dimension will increase:
$Ød_2$ = 160 - 200 mm => H + 40 mm
$Ød_2$ = 250 - 315 mm => H + 60 mm

Order code

Product	MBB	aaa	bbb	S
Type				
MBB				
Duct connection $Ød_1$				
Ø100-315				
Diffuser dimension $Ød_2$				
Ø160-315				
Function				
S = Supply air				

Example: MBB-160-200-S

VAV diffuser

LKV

Technical data

Diagrams on this page apply to LKV supply. For exhaust air and supplementary technical exhaust data, see the section on Formo ceiling diffusers.

Capacity

Max. volume flow q_v [l/s], [m^3/h], total pressure drop Δp_t [Pa], throw l_{02} [m] and sound effect level L_{WA} [dB(A)] can be seen in the diagrams.

Quick selection, supply air

Quick selection 30 dB(A)

LKV + MBB		30 dB(A)					
		30 Pa		35 Pa		40 Pa	
duct	LKV	q_v		q_v		q_v	
$Ød_1$	$Ød_2$	l/s	m^3/h	l/s	m^3/h	l/s	m^3/h
100	160	27	97	29	104	30	108
125	160	37	133	39	140	40	144
125	200	46	165	49	176	51	183
160	160	42	151	42	151	42	151
160	200	63	226	62	223	61	219
160	250	74	266	77	277	77	277
200	200	65	234	65	234	65	234
200	250	84	302	84	302	84	302
200	315	104	374	101	363	102	367
250	250	90	324	90	324	90	324
250	315	110	396	111	399	112	403
315	315	115	414	115	414	114	410

Quick selection 35 dB(A)

LKV + MBB		35 dB(A)					
		30 Pa		35 Pa		40 Pa	
duct	LKV	q_v		q_v		q_v	
$Ød_1$	$Ød_2$	l/s	m^3/h	l/s	m^3/h	l/s	m^3/h
100	160	27	97	29	104	31	111
125	160	37	133	40	144	43	154
125	200	46	165	49	176	53	190
160	160	49	176	50	180	50	180
160	200	63	226	68	244	73	262
160	250	74	266	80	288	85	306
200	200	74	266	76	273	77	277
200	250	93	334	101	363	100	360
200	315	106	381	115	414	121	435
250	250	105	378	106	381	106	381
250	315	122	439	127	457	129	464
315	315	135	486	135	486	136	489

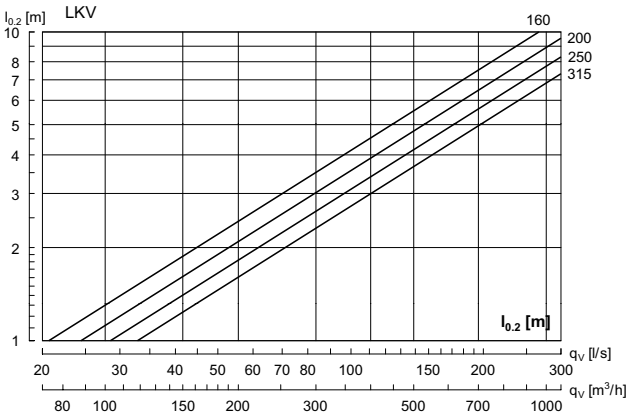
Sound attenuation

Sound attenuation of the diffuser ΔL from duct to room, including end reflection, see table below.

LKV + MBB		Centre frequency Hz							
duct	LKV								
$Ød_1$	$Ød_2$	63	125	250	500	1K	2K	4K	8K
100	160	21	17	5	12	19	20	18	21
125	160	13	13	9	18	18	18	18	20
125	200	14	12	7	15	16	18	17	19
160	160	18	17	11	16	21	19	20	21
160	200	15	14	9	20	21	20	20	20
160	250	16	16	7	17	13	18	19	20
200	200	14	11	8	15	21	18	20	18
200	250	13	10	8	16	20	17	19	17
200	315	15	9	6	14	17	17	18	17
250	250	16	9	9	17	20	19	19	19
250	315	15	8	9	16	18	16	18	18
315	315	8	10	10	16	20	19	18	23

Throw

The throw is specified at a terminal velocity of 0.2 m/s.



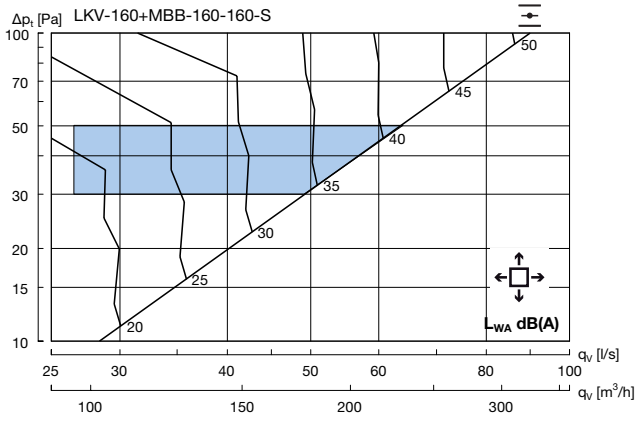
VAV diffuser

LKV

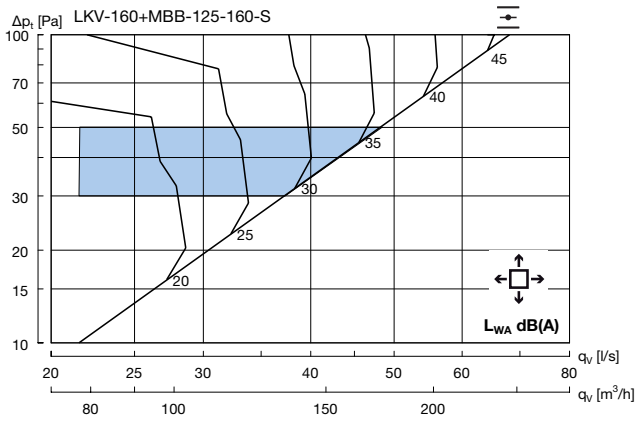
Technical data

Setting range for max. volume flow.

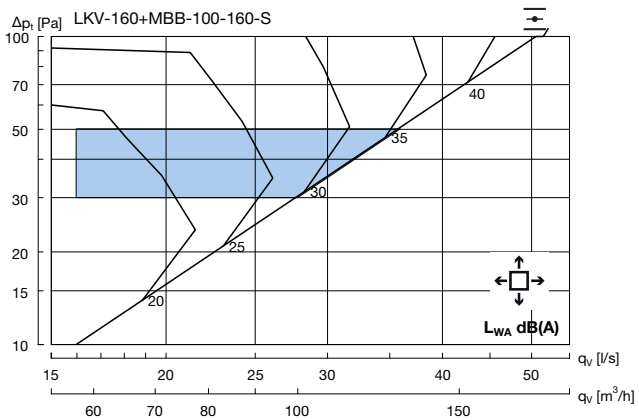
LKV-160 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	12	9	-1	-2	-5	-14	-22	-32

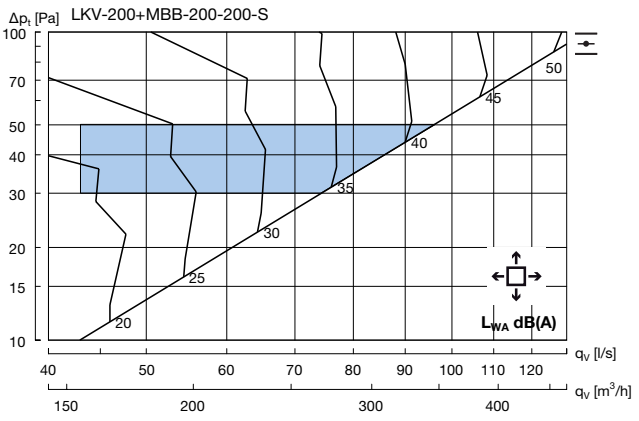


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	6	-1	-1	-5	-12	-21	-29

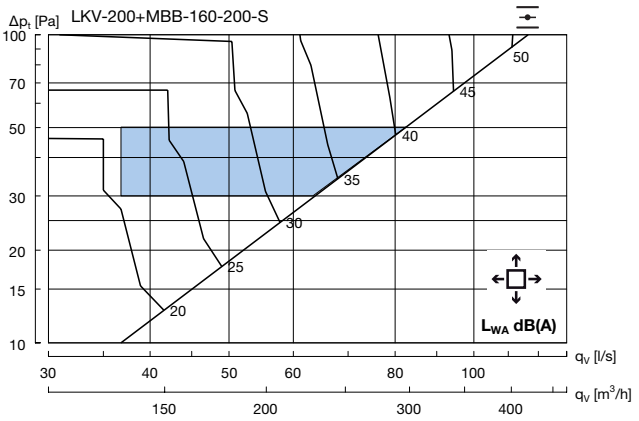


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	6	6	0	-1	-6	-10	-19	-26

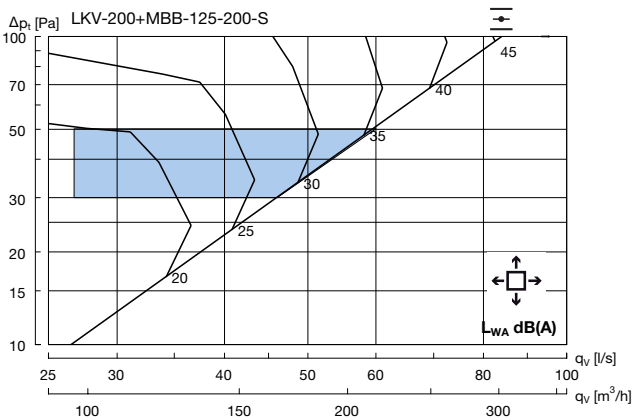
LKV-200 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	8	-1	-1	-5	-15	-24	-32



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	11	9	-1	-2	-5	-15	-20	-26



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	9	8	0	-2	-5	-13	-16	-22

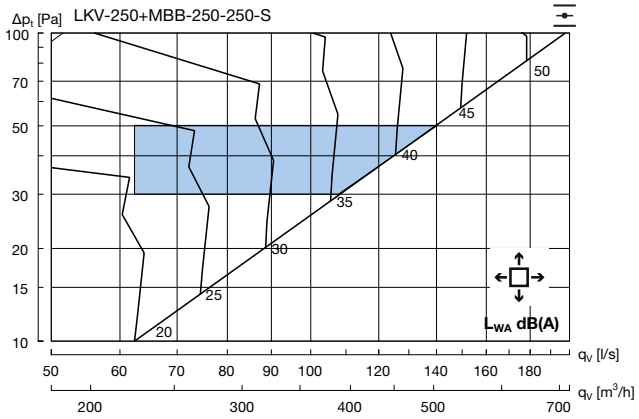
VAV diffuser

LKV

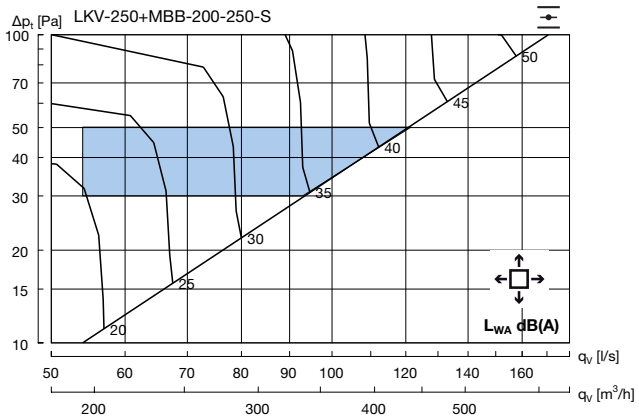
Technical data

Setting range for max. volume flow.

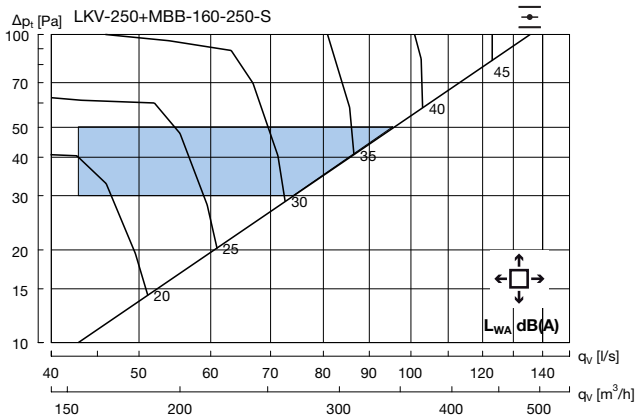
LKV-250 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	12	6	-3	-2	-4	-17	-24	-30

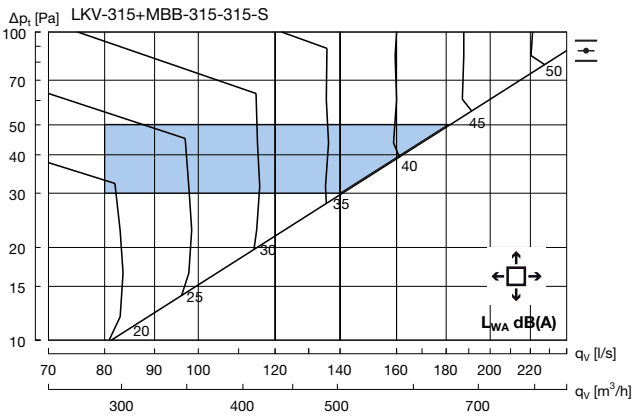


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	11	7	-2	-2	-4	-16	-21	-27

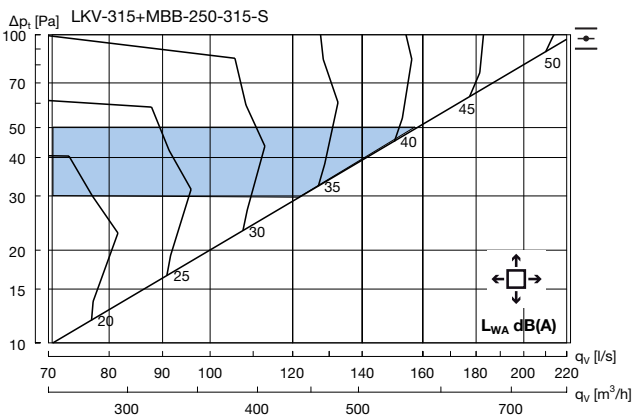


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	8	-1	-3	-4	-13	-17	-20

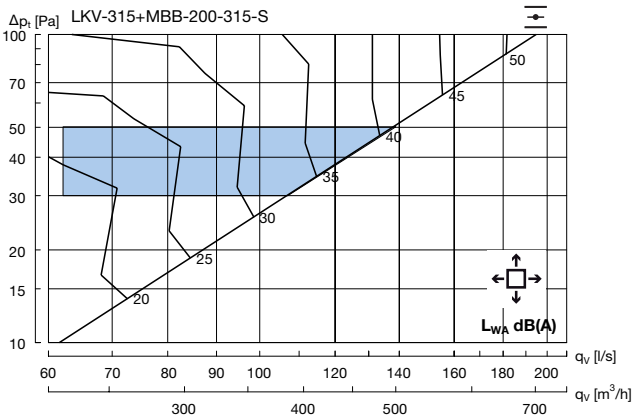
LKV-315 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	12	4	-2	0	-5	-18	-25	-33



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	12	6	-3	-1	-5	-18	-23	-27



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	12	8	-2	-2	-5	-14	-20	-25

VAV diffuser

LCV

Description

LCV is a circular LCA type diffuser with integrated motor for supply air of variable air volume (VAV). The integrated motorized damper ensures a constant throw so the Coanda effect always is maintained. The damper setting can be controlled by a room regulator, BMS or other 2-10 V control signal.

- Can vary the volume flow between 0-100 %
- Min. flow preset from factory *)
- Max. flow to be set in MBB box based on k-value
- Settings can be changed with ZTH-GEN or Belimo PC-tool
- VAV zone pressure must be controlled
- The diffuser must be installed together with a MBB-S type plenum box
- For exhaust LCA can be used

*) Min. setting and k-value are made from a pre-defined, available constant pressure in the air duct immediately before the diffuser. The diffuser is typically used at a constant pressure of 30-50 Pa.

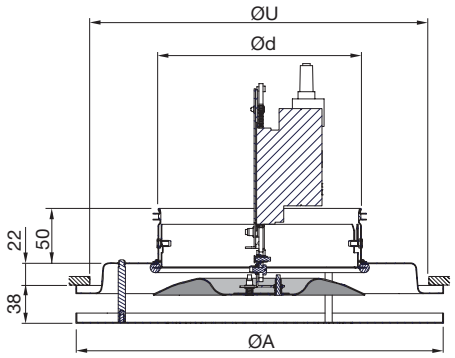
Order code

Product	**LCV**	**aaa**	**bb**	**cc**	**dd**
Type					
LCV					
Dimension					
Ø160-315					
Flow settings					
Min. airflow					
Max. airflow					
Pressure					

Example: LCV-200- 15 l/s - 60 l/s - 40 Pa

When ordering, MBB plenum type must be specified.

Dimensions



LCV Ød mm	ØA mm	ØU * mm	Weight (kg) (with Motor)
160	300	260	1.50
200	360	320	2.30
250	460	420	3.40
315	540	500	4.60

* ØU = Ceiling grid opening.

Maintenance

The face plate and damper insert can be removed to enable cleaning of internal parts or to gain access to the duct or box. The visible parts of the diffuser can be wiped with a damp cloth

Materials and finish

Diffuser:	Galvanised steel
Diffuser finish:	Powder-coated
Standard colour:	RAL 9010, gloss 30
Motor:	Manufact. Belimo type LH24A-MF

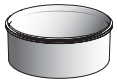
Other colours are available. Please contact Lindab's sales department for further information.

VAV diffuser

LCV

Accessories

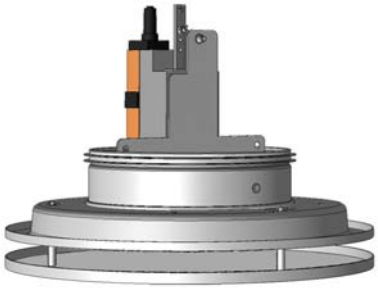
MBZ - Extension piece



Order code MBZ

Product	MBZ	aaa
Type		
MBZ		
Dimension		
Ø160-315		

Example: MBZ-200



When LCV is used with small MBB plenums:

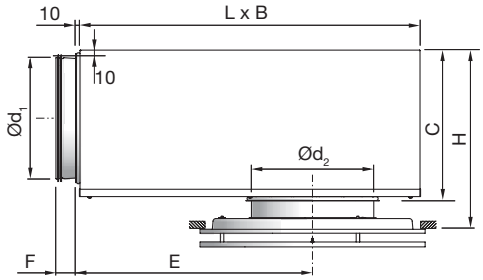
For the following MBB sizes, the MBZ extension piece must be used to ensure full movement of motor-rack.

Size: MBB-100-160-S
MBB-125-160-S
MBB-125-200-S

For other LCV accessories, see the section on Formo ceiling diffusers, LCA accessories.

MBB - Plenum box

LCV+MBB-S



LCV + MBB duct Ød1 mm	LCV Ød2 mm	B mm	C mm	E mm	F mm	H* mm	L mm
100	160	260	159	216	50	180-220	310
125	160	310	184	262	50	205-245	376
125	200	310	184	262	50	205-245	376
160	160	380	220	323	50	239-279	459
160	200	380	220	323	50	239-279	459
160	250	380	220	323	50	239-279	459
200	200	460	259	396	70	280-320	565
200	250	460	259	396	70	280-320	565
200	315	460	259	396	70	280-320	565
250	250	540	309	486	70	330-370	698
250	315	540	309	486	70	330-370	698
315	315	540	373	646	70	395-435	858

* Using accessory MBZ, the H-dimension will increase:
$Ød_2$ = 160 - 200 mm => H + 40 mm
$Ød_2$ = 250 - 315 mm => H + 60 mm

Order code

Product	MBB	aaa	bbb	S
Type				
MBB				
Duct connection $Ød_1$				
Ø100-315				
Diffuser dimension $Ød_2$				
Ø160-315				
Function				
S = Supply air				

Example: MBB-160-200-S

VAV diffuser

LCV

Technical data

Diagrams on this page apply to LCV supply. For exhaust air and supplementary technical exhaust data, see the section on Formo ceiling diffusers.

Capacity

Max. volume flow q_v [l/s], [m^3/h], total pressure drop Δp_t [Pa], throw l_{02} [m] and sound effect level L_{WA} [dB(A)] can be seen in the diagrams.

Quick selection, supply air

Quick selection 30 dB(A)

LCV + MBB		30 dB(A)					
		30 Pa		35 Pa		40 Pa	
duct	LCV	q_v		q_v		q_v	
$Ød_1$	$Ød_2$	l/s	m^3/h	l/s	m^3/h	l/s	m^3/h
100	160	27	97	29	104	30	108
125	160	37	133	39	140	40	144
125	200	46	165	49	176	51	183
160	160	42	151	42	151	42	151
160	200	63	226	62	223	61	219
160	250	74	302	77	277	77	277
200	200	65	234	65	234	65	234
200	250	84	302	84	302	84	302
200	315	106	381	101	363	102	367
250	250	90	324	90	324	90	324
250	315	110	396	111	399	112	403
315	315	115	414	115	414	114	410

Quick selection 35 dB(A)

LCV + MBB		35 dB(A)					
		30 Pa		35 Pa		40 Pa	
duct	LCV	q_v		q_v		q_v	
$Ød_1$	$Ød_2$	l/s	m^3/h	l/s	m^3/h	l/s	m^3/h
100	160	27	97	29	104	31	111
125	160	37	133	40	144	43	154
125	200	46	165	49	176	53	190
160	160	49	176	50	180	50	180
160	200	63	226	68	244	73	262
160	250	74	266	80	288	85	306
200	200	74	266	76	273	77	277
200	250	93	334	101	363	100	360
200	315	106	381	115	414	121	435
250	250	105	378	106	381	106	381
250	315	122	439	127	457	129	464
315	315	135	486	135	486	136	489

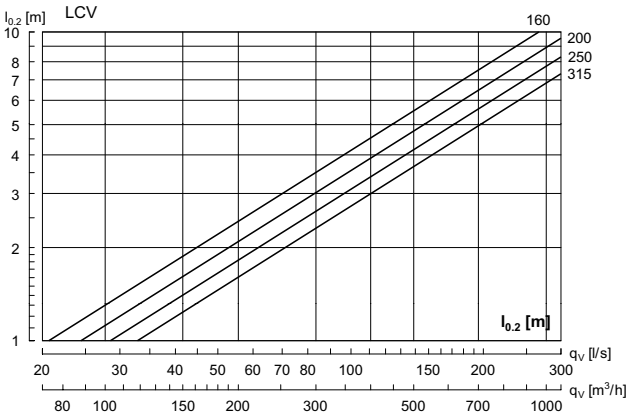
Sound attenuation

Sound attenuation of the diffuser ΔL from duct to room, including end reflection, see table below.

LCV + MBB		Centre frequency Hz							
duct	LCV								
$Ød_1$	$Ød_2$	63	125	250	500	1K	2K	4K	8K
100	160	21	17	5	12	19	20	18	21
125	160	13	13	9	18	18	18	18	20
125	200	14	12	7	15	16	18	17	19
160	160	18	17	11	16	21	19	20	21
160	200	15	14	9	20	21	20	20	20
160	250	16	16	7	17	13	18	19	20
200	200	14	11	8	15	21	18	20	18
200	250	13	10	8	16	20	17	19	17
200	315	15	9	6	14	17	17	18	17
250	250	16	9	9	17	20	19	19	19
250	315	15	8	9	16	18	16	18	18
315	315	8	10	10	16	20	19	18	23

Throw

The throw is specified at a terminal velocity of 0.2 m/s.



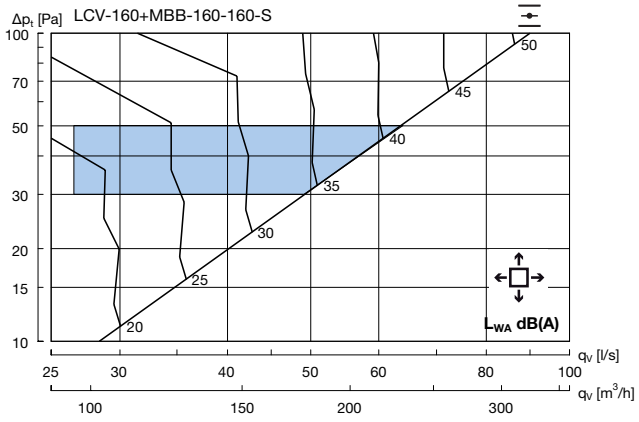
VAV diffuser

LCV

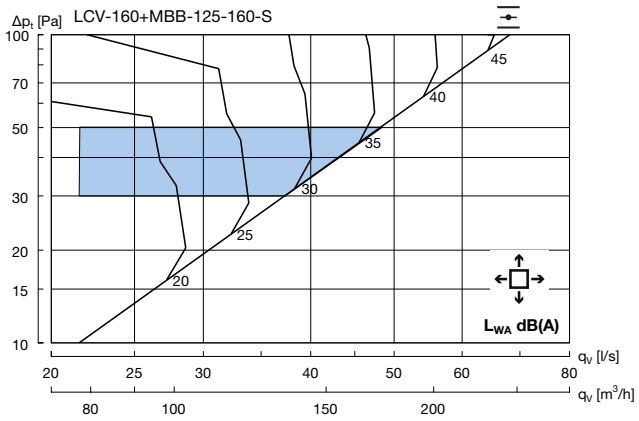
Technical data

Setting range for max. volume flow.

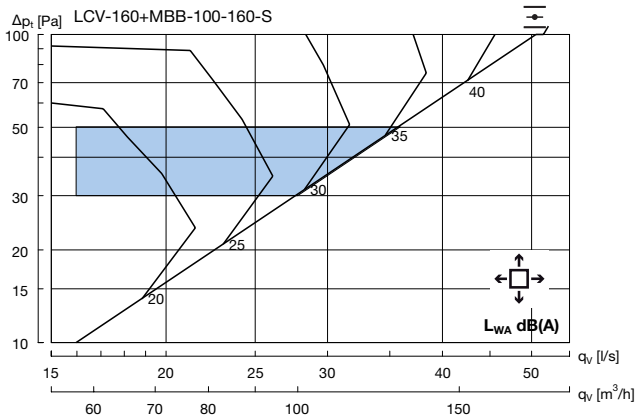
LCV-160 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	12	9	-1	-2	-5	-14	-22	-32

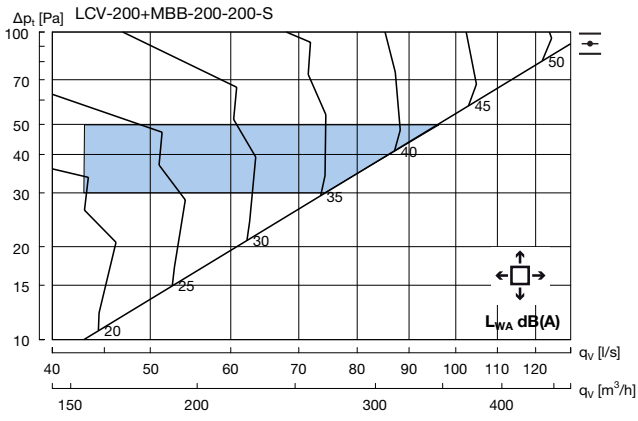


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	6	-1	-1	-5	-12	-21	-29

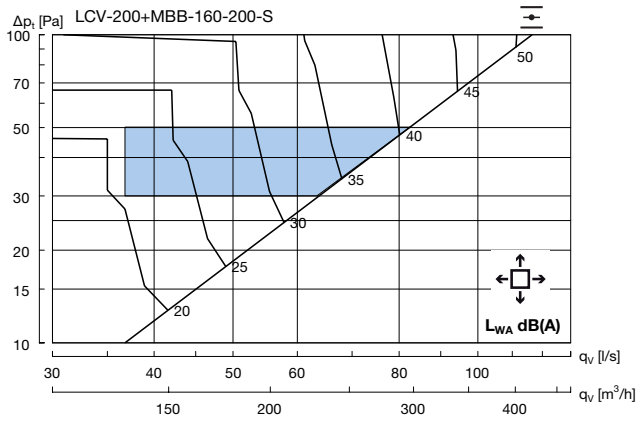


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	6	6	0	-1	-6	-10	-19	-26

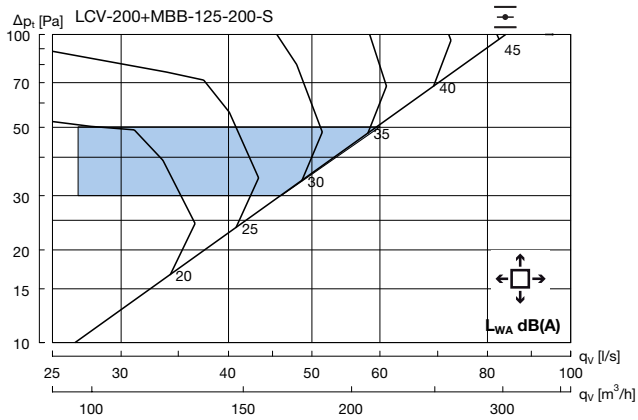
LCV-200 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	8	-1	-1	-5	-15	-24	-32



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	11	9	-1	-2	-5	-15	-20	-26



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	9	8	0	-2	-5	-13	-16	-22

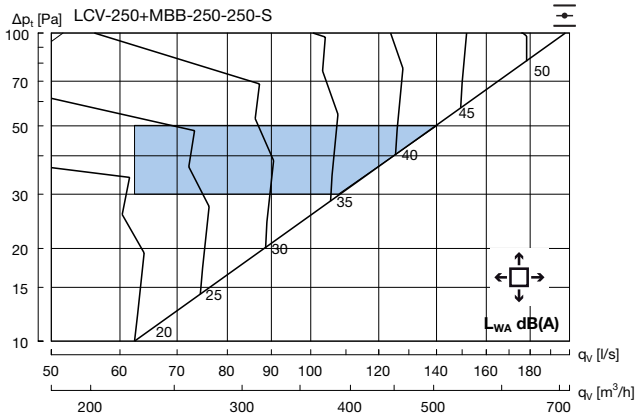
VAV diffuser

LCV

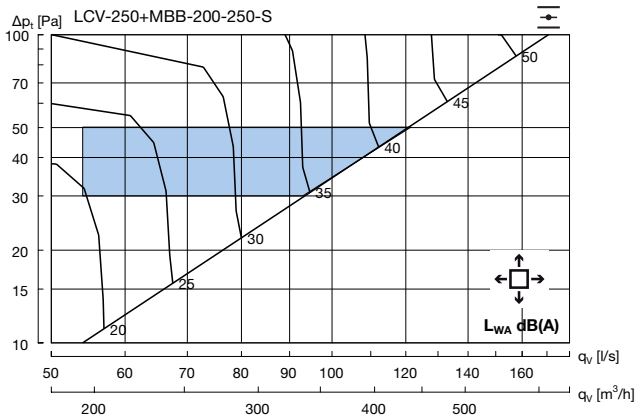
Technical data

Setting range for max. volume flow.

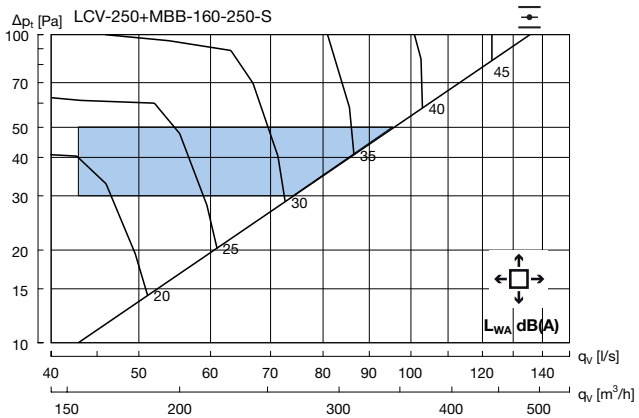
LCV-250 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	12	6	-3	-2	-4	-17	-24	-30

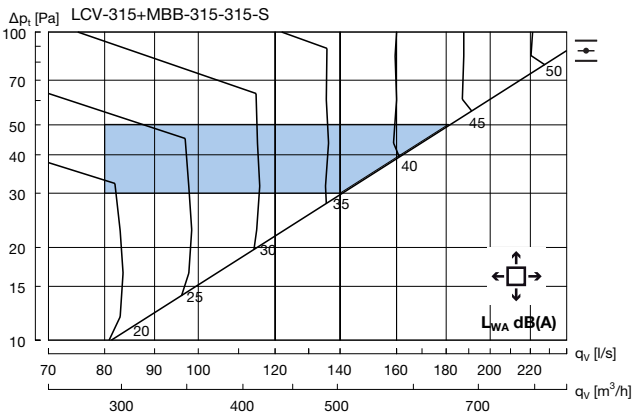


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	11	7	-2	-2	-4	-16	-21	-27

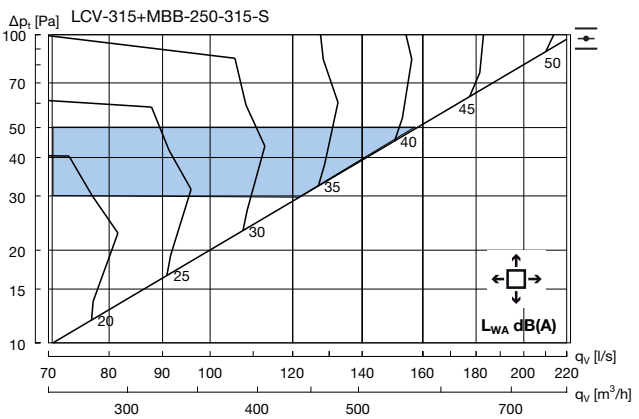


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	8	-1	-3	-4	-13	-17	-20

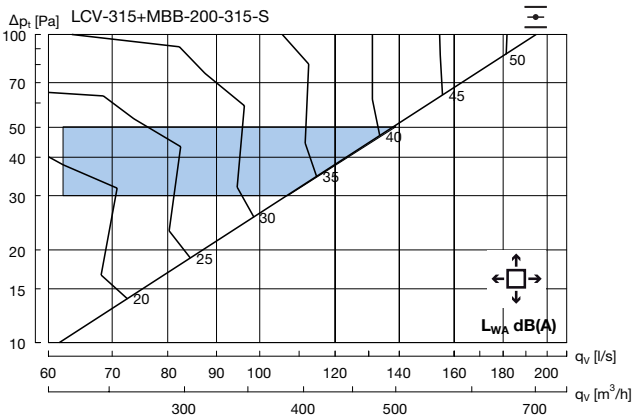
LCV-315 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	12	4	-2	0	-5	-18	-25	-33



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	12	6	-3	-1	-5	-18	-23	-27



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	12	8	-2	-2	-5	-14	-20	-25

VAV diffuser

LKPV

Description

LKPV is an unperforated flush-mounted LKP type diffuser with integrated motor for supply air of variable air volume (VAV). The integrated motorized damper ensures a constant throw so the Coanda effect always is maintained. The damper setting can be controlled by a room regulator, BMS or other 2-10 V control signal.

- Can vary the volume flow between 0-100 %
- Min. flow preset from factory *)
- Max. flow to be set in MBB box based on k-value
- Settings can be changed with ZTH-GEN or Belimo PC-tool
- VAV zone pressure must be controlled
- The diffuser must be installed together with a MBB-S type plenum box
- For exhaust LKP can be used

*) Min. settings and k-value are made from a pre-defined, available constant pressure in the air duct immediately before the diffuser. The diffuser is typically used at a constant pressure of 30-50 Pa.

Order code

Product	LKPV	aaa	bbb	cc	dd	ee

Type
LKPV

Dimension
Ø160-315

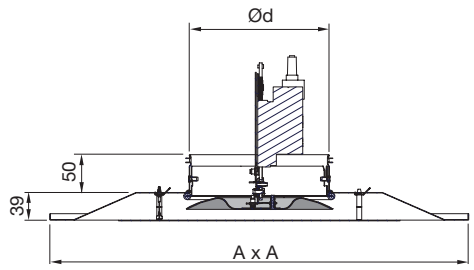
Flow settings
Min. airflow
Max. airflow
Pressure

Ceiling system
1 - 14

Example: LKPV-200- 15 l/s - 60 l/s - 40 Pa -1

When ordering, MBB plenum type must be specified.

Dimensions



LKPV Ød mm	A * mm	Weight (kg) (with Motor)
160	595	6,8
200	595	6,8
250	595	6,8
315	595	6,8

* Ceiling system 1, other ceiling systems, see Integra chapter page 122 - 123.
No moduleplate, upper part adapted to ceiling systems.

Maintenance

The face plate and damper insert can be removed to enable cleaning of internal parts or to gain access to the duct or box. The visible parts of the diffuser can be wiped with a damp cloth.

Materials and finish

Diffuser:	Galvanised steel
Diffuser finish:	Powder-coated
Standard colour:	RAL 9010, gloss 30
Motor:	Manufact. Belimo type LH24A-MF

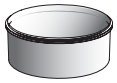
Other colours are available. Please contact Lindab's sales department for further information.

VAV diffuser

LKPV

Accessories

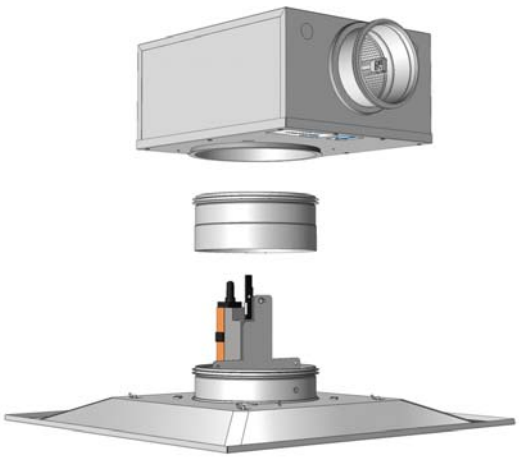
MBZ - Extension piece



Order code MBZ

Product	**MBZ**	**aaa**
Type		
MBZ		
Dimension		
Ø160-315		

Example: MBZ-200



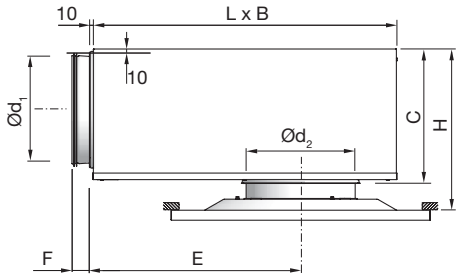
When LKPV is used with small MBB plenums:

For the following MBB sizes, the MBZ extension piece must be used to ensure full movement of motor-rack.

Size: MBB-100-160-S
MBB-125-160-S
MBB-125-200-S

MBB - Plenum box

LKPV+MBB-S



LKPV + MBB							
duct	LKPV	B	C	E	F	H*	L
$Ød_1$ mm	$Ød_2$ mm	mm	mm	mm	mm	mm	mm
100	160	260	159	216	50	198-238	310
125	160	310	184	262	50	223-263	376
125	200	310	184	262	50	223-263	376
160	160	380	220	323	50	257-297	459
160	200	380	220	323	50	257-297	459
160	250	380	220	323	50	257-297	459
200	200	460	259	396	70	298-338	565
200	250	460	259	396	70	298-338	565
200	315	460	259	396	70	298-338	565
250	250	540	309	486	70	348-388	698
250	315	540	309	486	70	348-388	698
315	315	540	373	646	70	413-453	858

* Using accessory MBZ the H dimension will increase:
$Ød_2$ = 160 - 200 mm => H + 40 mm
$Ød_2$ = 250 - 315 mm => H + 60 mm

Order code

Product	**MBB**	**aaa**	**bbb**	**S**
Type				
MBB				
Duct connection $Ød_1$				
Ø100-315				
Diffuser dimension $Ød_2$				
Ø160-315				
Function				
S = Supply air				

Example: MBB-160-200-S

VAV diffuser

LKPV

Technical data

Diagrams on this page apply to LKPV supply. For exhaust air and supplementary technical exhaust data, see the section on Integra ceiling diffusers.

Capacity

Max. volume flow q_v [l/s], [m^3/h], total pressure drop Δp_t [Pa], throw l_{02} [m] and sound effect level L_{WA} [dB(A)] can be seen in the diagrams.

Quick selection, supply air

Quick selection 30 dB(A)

LKPV + MBB		30 dB(A)					
		30 Pa		35 Pa		40 Pa	
duct	LKPV	q_v		q_v		q_v	
$Ød_1$	$Ød_2$	l/s	m^3/h	l/s	m^3/h	l/s	m^3/h
100	160	26	93	28	100	29	104
125	160	31	111	31	111	31	111
125	200	40	144	41	147	41	147
160	160	31	111	31	111	31	111
160	200	46	165	45	162	45	162
160	250	56	201	53	190	52	187
200	200	46	165	45	162	45	162
200	250	63	226	63	226	63	226
200	315	74	266	74	266	74	266
250	250	64	230	63	226	62	223
250	315	77	277	75	270	73	262
315	315	80	288	80	288	79	284

Quick selection 35 dB(A)

LKPV + MBB		35 dB(A)					
		30 Pa		35 Pa		40 Pa	
duct	LKPV	q_v		q_v		q_v	
$Ød_1$	$Ød_2$	l/s	m^3/h	l/s	m^3/h	l/s	m^3/h
100	160	26	93	28	100	30	108
125	160	32	115	35	126	36	129
125	200	40	144	43	154	46	165
160	160	37	133	37	133	37	133
160	200	50	180	54	194	54	194
160	250	58	208	63	226	68	244
200	200	54	194	54	194	54	194
200	250	67	241	72	259	75	270
200	315	81	291	88	316	88	316
250	250	71	255	76	273	76	273
250	315	87	313	93	334	91	327
315	315	91	327	94	338	94	338

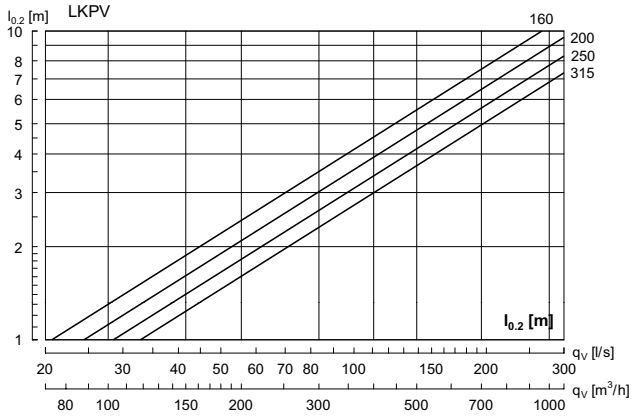
Sound attenuation

Sound attenuation of the diffuser ΔL from duct to room, including end reflection, see table below.

LKPV + MBB		Centre frequency Hz							
duct	LKPV								
$Ød_1$	$Ød_2$	63	125	250	500	1K	2K	4K	8K
100	160	18	13	9	20	16	24	22	24
125	160	18	13	9	20	16	24	22	24
125	200	20	15	8	18	14	19	20	23
160	160	18	13	9	20	16	24	22	24
160	200	18	13	9	16	20	17	20	22
160	250	18	13	7	15	20	15	18	21
200	200	19	15	11	18	18	17	20	21
200	250	18	14	9	17	15	15	19	21
200	315	16	12	6	16	14	14	18	19
250	250	15	11	8	17	15	19	22	22
250	315	10	7	7	15	8	14	17	21
315	315	10	7	7	15	8	14	17	21

Throw

The throw is specified at a terminal velocity of 0.2 m/s.



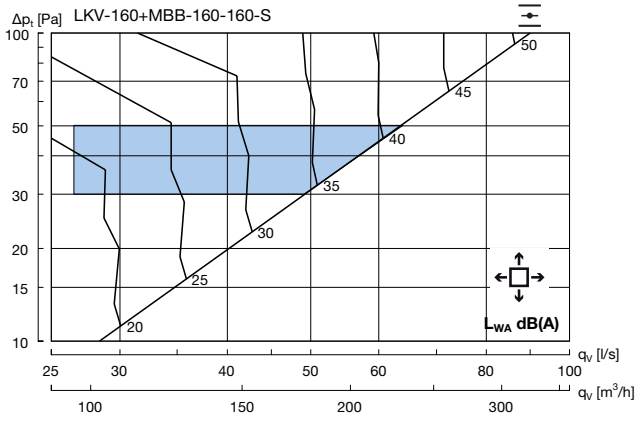
VAV diffuser

LKPV

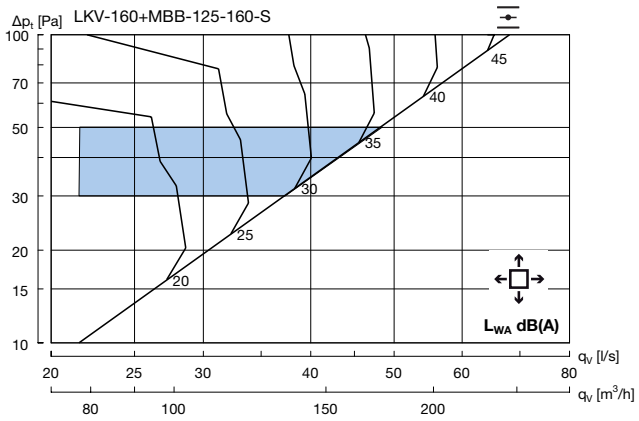
Technical data

Setting range for max. volume flow.

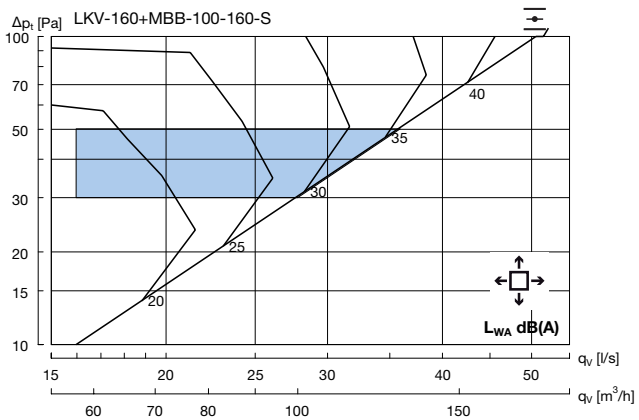
LKPV-160 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	8	0	-5	-4	-11	-26	-34

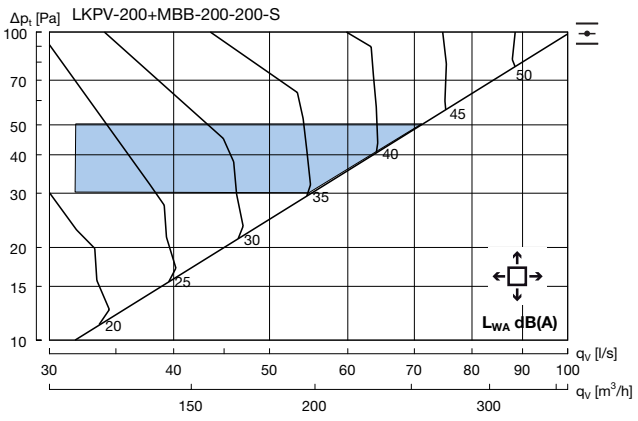


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	8	5	-1	-5	-3	-11	-23	-29

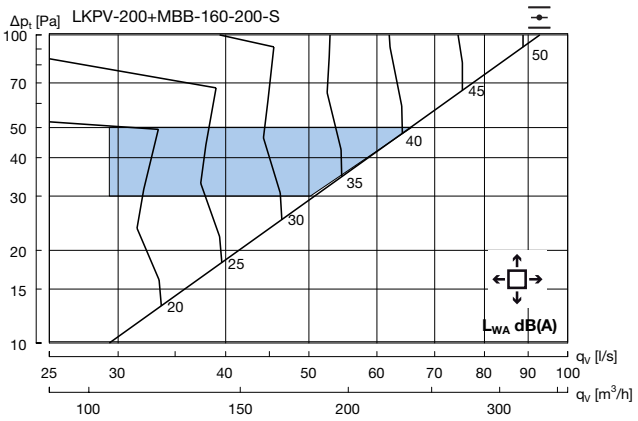


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	9	4	-2	-2	-5	-9	-19	-26

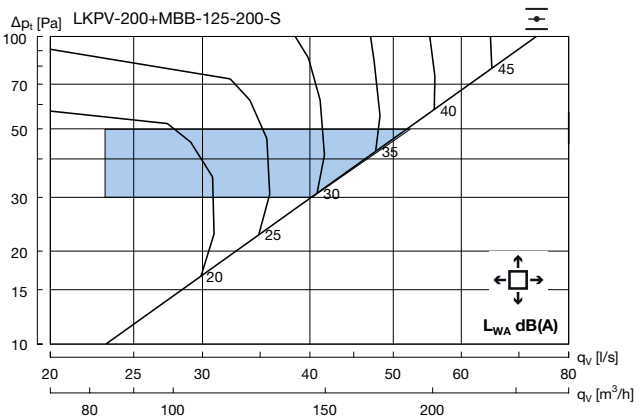
LKPV-200 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	9	5	-2	-4	-2	-16	-24	-29



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	7	8	-1	-4	-3	-16	-24	-28



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	9	5	-2	-5	-2	-15	-20	-26

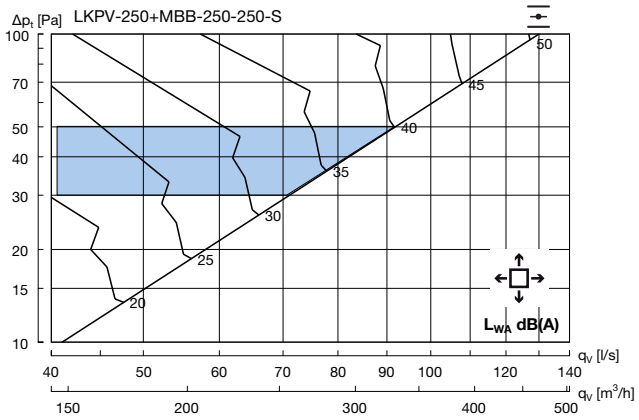
VAV diffuser

LKPV

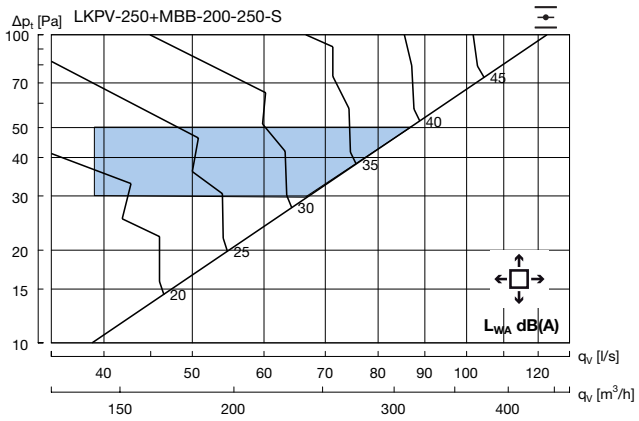
Technical data

Setting range for max. volume flow.

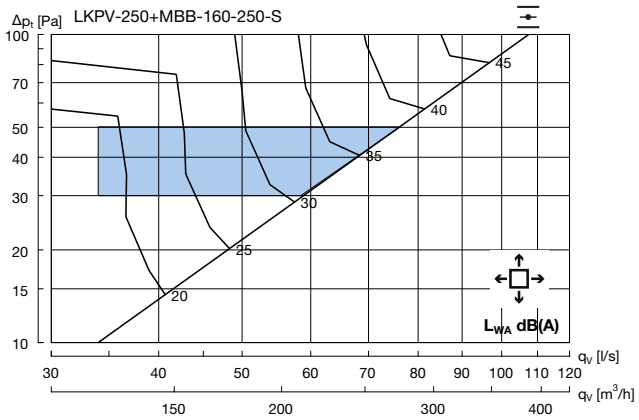
LKPV-250 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	12	7	-1	-2	-4	-18	-33	-47

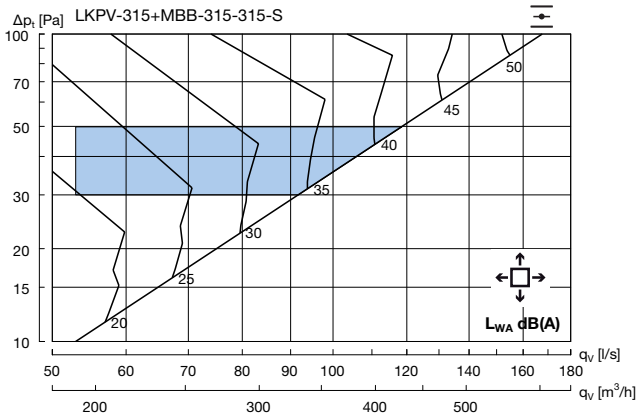


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	7	8	-1	-4	-3	-15	-24	-31

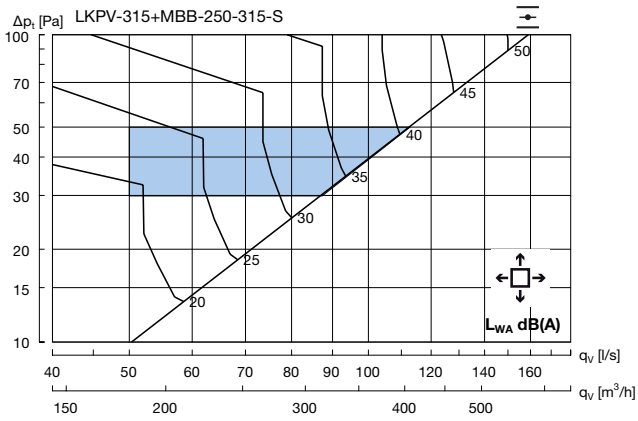


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	9	6	-3	-5	-2	-15	-23	-29

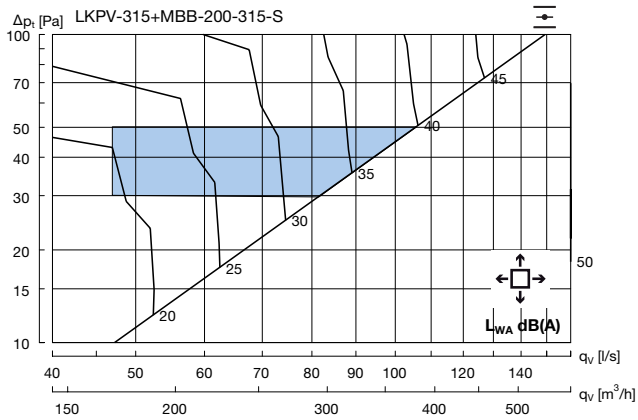
LKPV-315 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	11	8	1	-3	-4	-14	-25	-34



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	11	8	1	-3	-5	-14	-25	-31



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	8	1	-4	-4	-13	-23	-32

VAV diffuser

LCPV

Description

LCPV is an unperforated flush-mounted LCP type diffuser with integrated motor for supply air of variable air volume (VAV). The integrated motorized damper ensures a constant throw so the Coanda effect always is maintained. The damper setting can be controlled by a room regulator, BMS or other 2-10 V control signal.

- Can vary the volume flow between 0-100 %
- Min. flow preset from factory *)
- Max. flow to be set in MBB box based on k-value
- Settings can be changed with ZTH-GEN or Belimo PC-tool
- VAV zone pressure must be controlled
- The diffuser must be installed together with a MBB-S type plenum box
- For exhaust LCP can be used

*) Min. settings and k-value are made from a pre-defined, available constant pressure in the air duct immediately before the diffuser. The diffuser is typically used at a constant pressure of 30-50 Pa.

Order code

Product	LCPV	aaa	bbb	cc	dd	ee

Type
LCPV

Dimension
Ø160-315

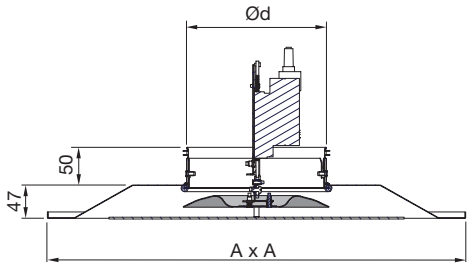
Flow settings
Min. airflow
Max. airflow
Pressure

Ceiling system
1 - 14

Example: LCPV-200- 15 l/s - 60 l/s - 40 Pa -1

When ordering, MBB plenum type must be specified.

Dimensions



LCPV Ød mm	A * mm	Weight (kg) (with Motor)
160	595	6,8
200	595	6,8
250	595	6,8
315	595	6,8

* Ceiling system 1, other ceiling systems, see Integra chapter page 122 - 123.
No moduleplate, upper part adapted to ceiling systems.

Maintenance

The face plate and damper insert can be removed to enable cleaning of internal parts or to gain access to the duct or box. The visible parts of the diffuser can be wiped with a damp cloth.

Materials and finish

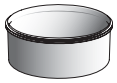
Upper part:	Galvanised steel
Face plate:	Aluminium
Face plate finish:	Powder-coated
Standard colour:	RAL 9010, gloss 30
Motor:	Manufact. Belimo type LH24A-MF

Other colours are available. Please contact Lindab's sales department for further information.

VAV diffuser LCPV

Accessories

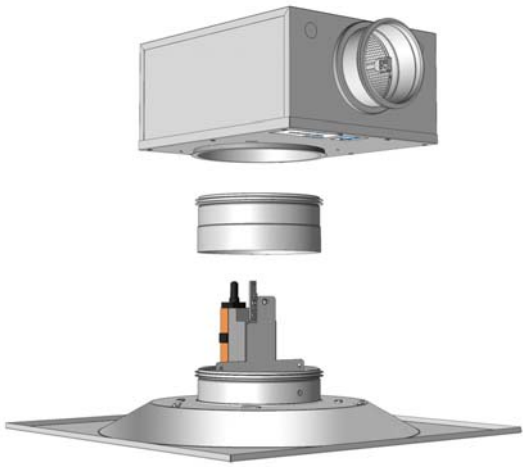
MBZ - Extension piece



Order code MBZ

Product	**MBZ**	**aaa**
Type		
MBZ		
Dimension		
Ø160-315		

Example: MBZ-200



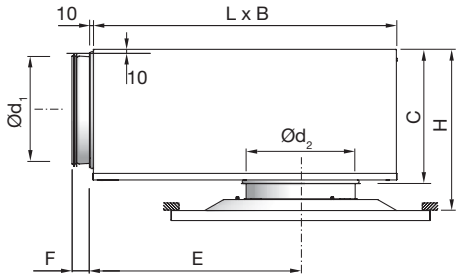
When LCPV is used with small MBB plenums:

For the following MBB sizes, the MBZ extension piece must be used to ensure full movement of motor-rack.

Size: MBB-100-160-S
MBB-125-160-S
MBB-125-200-S

MBB - Plenum box

LCPV+MBB-S



LCPV + MBB							
duct	LCPV	B	C	E	F	H*	L
$Ød_1$ mm	$Ød_2$ mm	mm	mm	mm	mm	mm	mm
100	160	260	159	216	50	206-246	310
125	160	310	184	262	50	231-271	376
125	200	310	184	262	50	231-271	376
160	160	380	220	323	50	265-305	459
160	200	380	220	323	50	265-305	459
160	250	380	220	323	50	265-305	459
200	200	460	259	396	70	306-346	565
200	250	460	259	396	70	306-346	565
200	315	460	259	396	70	306-346	565
250	250	540	309	486	70	356-396	698
250	315	540	309	486	70	356-396	698
315	315	540	373	646	70	421-461	858

* Using accessory MBZ the H dimension will increase:
$Ød_2$ = 160 - 200 mm => H + 40 mm
$Ød_2$ = 250 - 315 mm => H + 60 mm

Order code

Product	**MBB**	**aaa**	**bbb**	**S**
Type				
MBB				
Duct connection $Ød_1$				
Ø100-315				
Diffuser dimension $Ød_2$				
Ø160-315				
Function				
S = Supply air				

Example: MBB-160-200-S

VAV diffuser

LCPV

Technical data

Diagrams on this page apply to LCPV supply. For exhaust air and supplementary technical exhaust data, see the section on Integra ceiling diffusers.

Capacity

Max. volume flow q_v [l/s], [m^3/h], total pressure drop Δp_t [Pa], throw l_{02} [m] and sound effect level L_{WA} [dB(A)] can be seen in the diagrams.

Quick selection, supply air

Quick selection 30 dB(A)

LCPV + MBB		35 dB(A)					
		30 Pa		35 Pa		40 Pa	
duct	LCPV	q_v		q_v		q_v	
$Ød_1$	$Ød_2$	l/s	m^3/h	l/s	m^3/h	l/s	m^3/h
100	160	26	93	28	100	29	104
125	160	36	129	36	129	36	129
125	200	42	151	44	158	45	162
160	160	39	140	39	140	39	140
160	200	53	190	55	198	54	194
160	250	64	230	69	248	69	248
200	200	53	190	53	190	52	187
200	250	75	270	74	266	74	266
200	315	91	327	91	327	90	324
250	250	79	284	80	288	80	288
250	315	99	356	97	349	96	345
315	315	105	378	106	381	106	381

Quick selection 35 dB(A)

LCPV + MBB		35 dB(A)					
		30 Pa		35 Pa		40 Pa	
duct	LCPV	q_v		q_v		q_v	
$Ød_1$	$Ød_2$	l/s	m^3/h	l/s	m^3/h	l/s	m^3/h
100	160	26	93	28	100	30	108
125	160	36	129	39	140	41	147
125	200	42	151	46	165	49	176
160	160	42	151	46	165	46	165
160	200	53	190	57	205	61	219
160	250	64	230	69	248	74	266
200	200	64	230	64	230	64	230
200	250	78	280	84	302	89	320
200	315	91	327	98	352	105	378
250	250	84	302	91	327	93	334
250	315	99	356	107	385	115	414
315	315	109	392	118	424	124	446

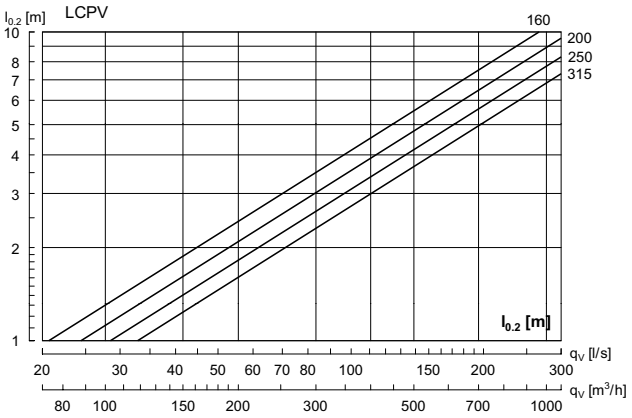
Sound attenuation

Sound attenuation of the diffuser ΔL from duct to room, including end reflection, see table below.

LCPV + MBB		Centre frequency Hz							
duct	LCPV								
$Ød_1$	$Ød_2$	63	125	250	500	1K	2K	4K	8K
100	160	17	16	6	10	18	18	18	21
125	160	15	14	10	17	16	17	18	21
125	200	13	12	7	13	13	16	17	18
160	160	17	15	12	21	19	19	21	21
160	200	17	16	10	20	17	17	19	20
160	250	16	14	7	17	15	16	19	20
200	200	13	11	10	17	18	15	19	18
200	250	14	11	8	15	19	15	18	17
200	315	14	9	7	13	18	14	17	17
250	250	15	10	9	17	18	18	19	19
250	315	15	8	9	16	18	16	18	18
315	315	8	10	10	17	18	17	18	24

Throw

The throw is specified at a terminal velocity of 0.2 m/s.



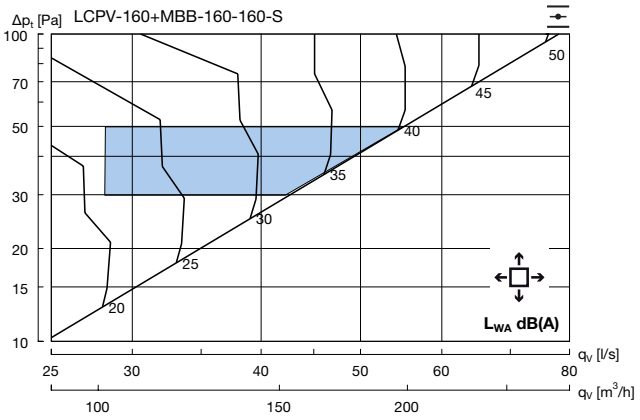
VAV diffuser

LCPV

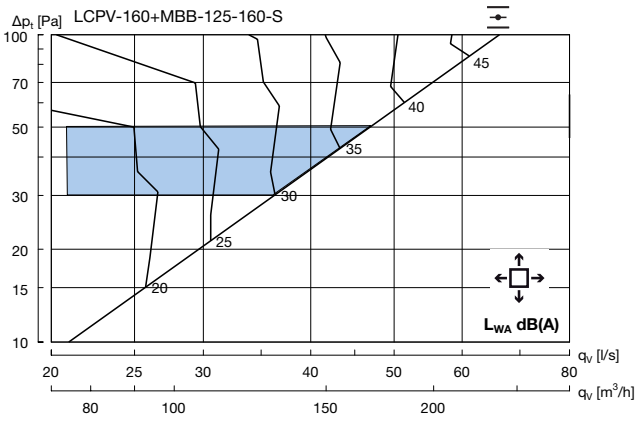
Technical data

Setting range for max. volume flow.

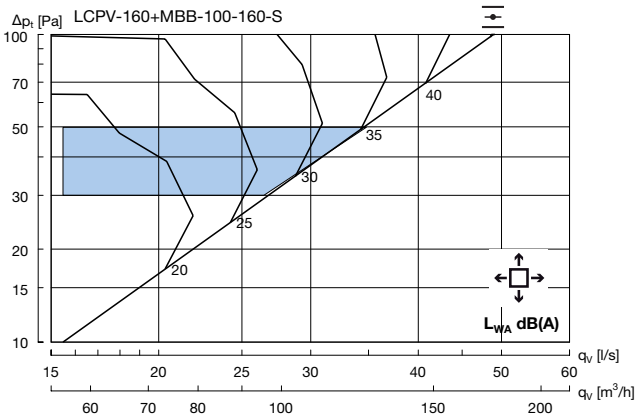
LCPV-160 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	11	10	1	-4	-5	-13	-22	-28

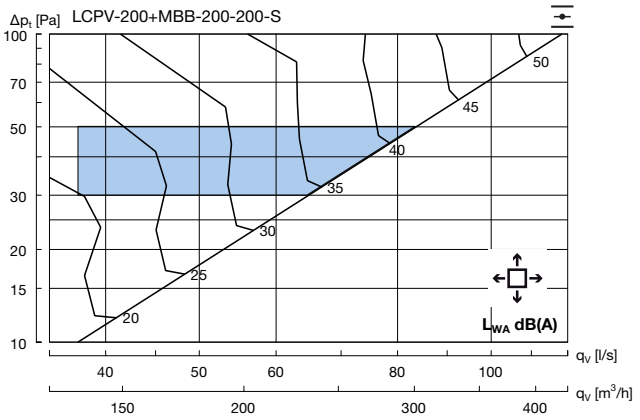


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	7	6	0	-3	-4	-12	-23	-30

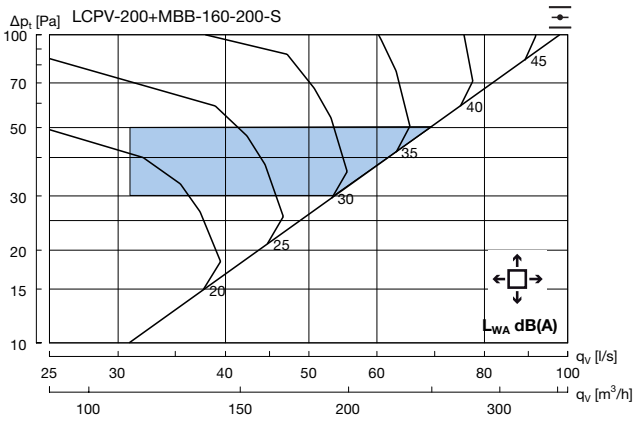


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	7	5	-1	-1	-5	-11	-20	-26

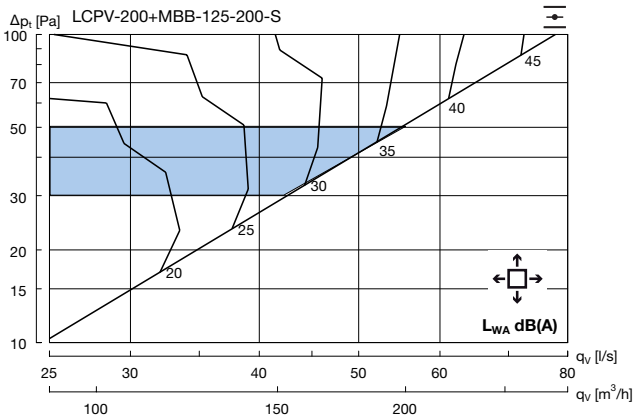
LCPV-200 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	8	6	-2	-4	-2	-16	-26	-31



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	13	10	0	-4	-5	-14	-22	-29



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	9	6	-2	-4	-3	-13	-18	-24

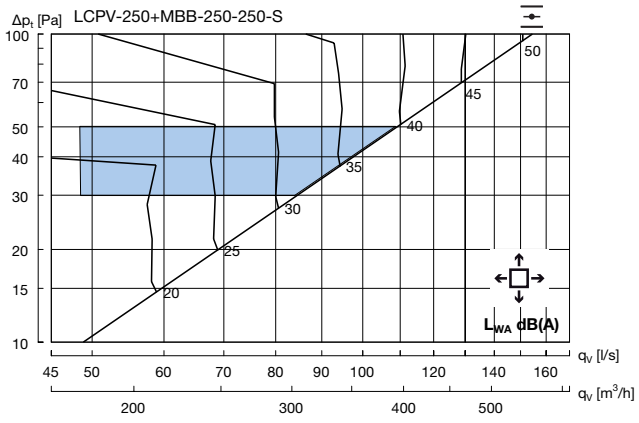
VAV diffuser

LCPV

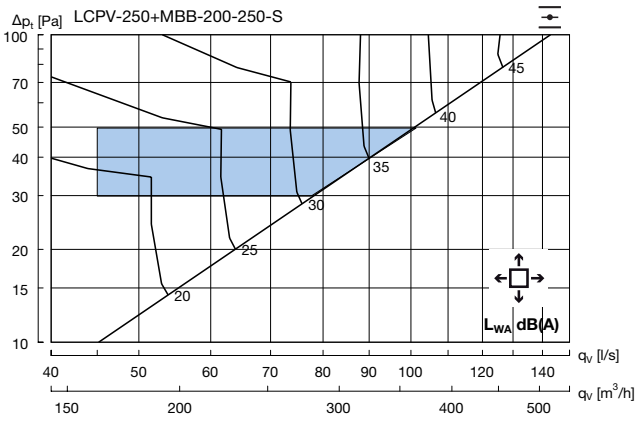
Technical data

Setting range for max. volume flow.

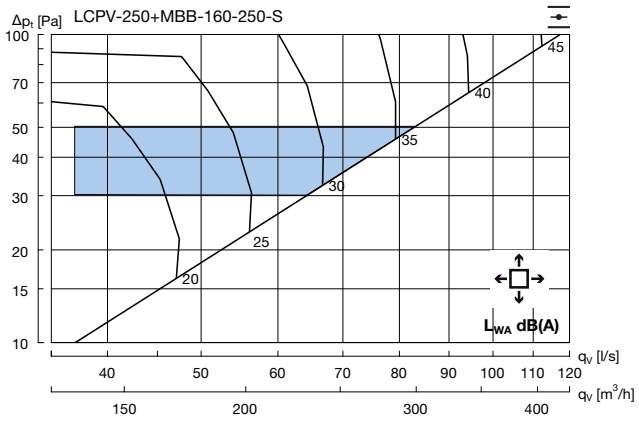
LCPV-250 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	11	7	0	-3	-4	-15	-26	-31

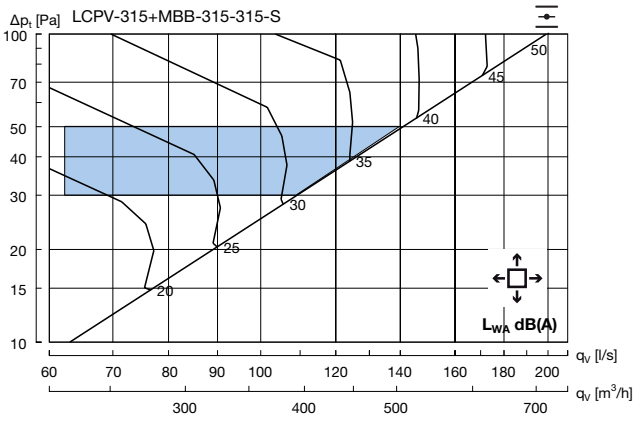


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	11	10	1	-3	-5	-16	-25	-32

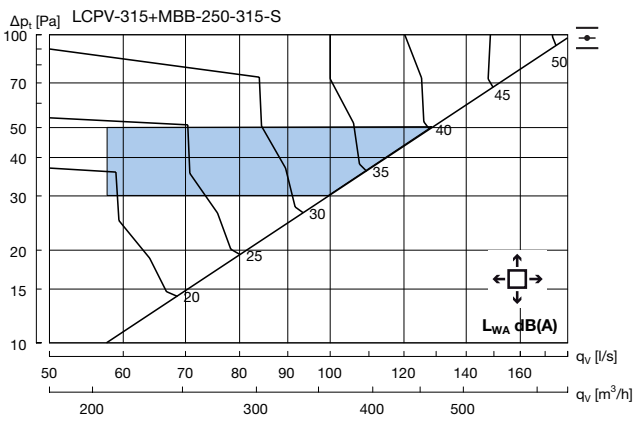


Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	9	0	-4	-4	-13	-18	-22

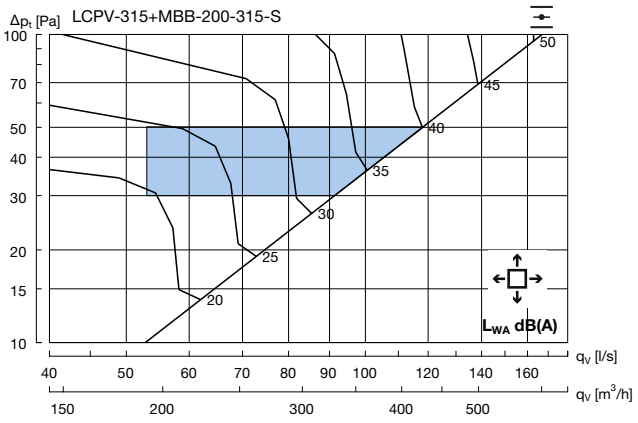
LCPV-315 + MBB - Supply air



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	9	6	1	-1	-5	-14	-25	-32



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	9	1	-2	-5	-13	-24	-32



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	10	9	0	-3	-5	-13	-20	-25

VAV diffuser

PCSV/LCSV

Description

PCSV/LCSV is a circular PCS/LCS type diffuser with integrated motor for supply air of varying volume flow (VAV). The integrated motorized damper ensures a constant throw so the Coanda effect always is maintained. The damper setting can be controlled by a room regulator, BMS or other 2-10 V control signal.

- Can vary the volume flow between 0-100 %
- Pre-set min. and max. volume flow *)
- Settings can be changed with ZTH-GEN and Belimo PC-tool
- VAV zone pressure must be controlled
- For exhaust PCS / LCS can be used

*) Settings are made from a pre-defined, available constant pressure in the air duct immediately before the diffuser. The diffuser is typically used at a constant pressure of 30-50 Pa.

Order code

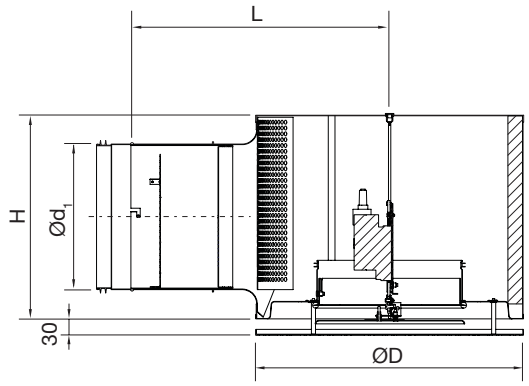
Product	PCSV/LCSV	aaa	bb	cc	dd
Type					
PCSV/LCSV					
Dimension					
Ø160-315					
Flow settings					
Min. airflow					
Max. airflow					
Pressure					

Example: PCSV-200- 15 l/s - 60 l/s - 40 Pa

PCSV/LCSV is supplied as standard with a 2-10 V modulating motor. Can be supplied with another form of control on request.

Dimensions

LCSV / PCSV



PCSV/LCSV Ød mm	ØD mm	Ød$_1$ mm	L mm	H mm	Weight (kg) (with Motor)
160	300	160	372	260	6.1
200	360	200	415	300	8.4
250	460	250	445	350	11.1
315	540	315	445	420	12.9

Maintenance

The face plate and damper insert can be removed to enable cleaning of internal parts or to gain access to the duct or box. The visible parts of the diffuser can be wiped with a damp cloth.

Materials and finish

Material:	Galvanised steel
Standard finish:	Powder-coated
Standard colour:	RAL 9010, gloss 30
Motor:	Manufact. Belimo type LH24A-MF

Other colours are available. Please contact Lindab's sales department for further information.

VAV diffuser PCSV/LCSV

Technical data

Diagrams on this page apply to PCSV / LCSV supply air. For exhaust air and supplementary technical exhaust data, see the section on ceiling diffusers -visible, PCS and LCS.

Capacity

Max. volume flow q_v [l/s], [m^3/h], total pressure drop Δp_t [Pa], throw l_{02} [m] and sound effect level L_{WA} [dB(A)] can be seen in the diagrams.

Quick selection

PCSV/ LCSV Ød$_1$ Size mm	30 Pa			35 Pa			40 Pa		
	q_v l/s	q_v m^3/h	L_{WA} dB(A)	q_v l/s	q_v m^3/h	L_{WA} dB(A)	q_v l/s	q_v m^3/h	L_{WA} dB(A)
160	35	128	28	38	138	31	41	148	33
200	55	199	29	59	215	31	63	230	33
250	91	327	29	98	354	31	105	378	33
315	127	457	32	137	494	34	146	528	36

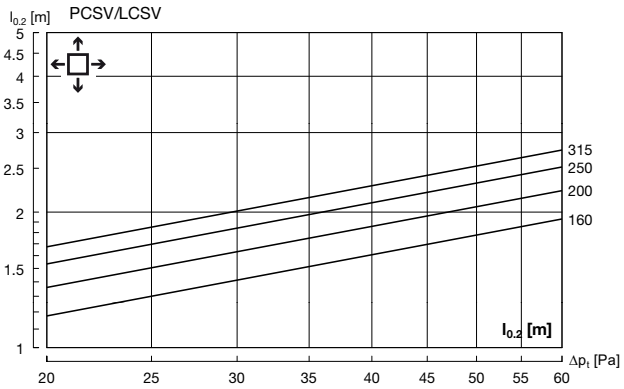
Sound attenuation

Sound attenuation of the diffuser ΔL from duct to room, including end reflection, see table below.

PCSV/LCSV	Centre frequency Hz							
Ød$_1$	63	125	250	500	1K	2K	4K	8K
160	15	11	9	21	15	12	13	16
200	12	8	6	15	15	9	11	14
250	19	15	12	17	12	9	11	14
315	16	13	11	14	12	9	12	13

Throw

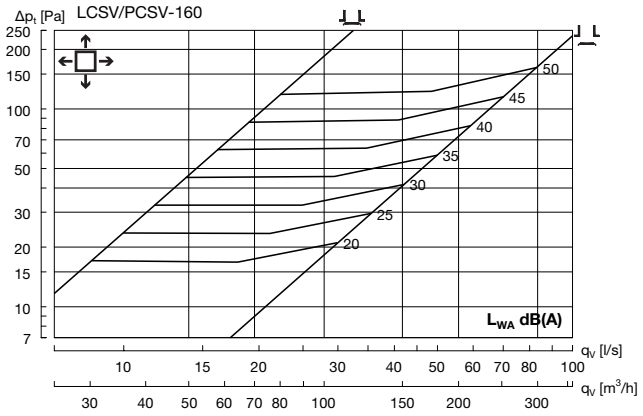
The throw is specified at a terminal velocity of 0.2 m/s as a function of the total pressure drop.



VAV diffuser PCSV/LCSV

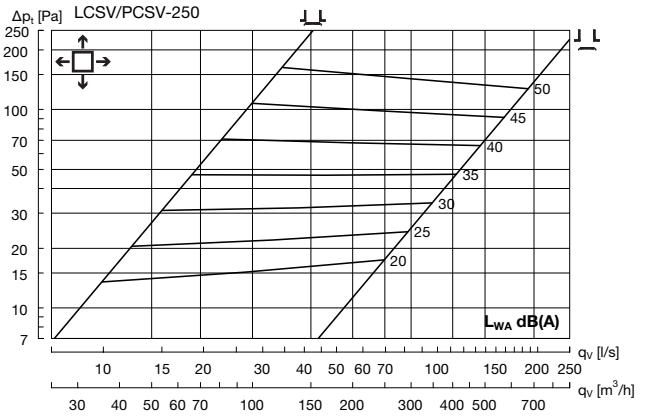
Technical data

LCSV / PCSV-160



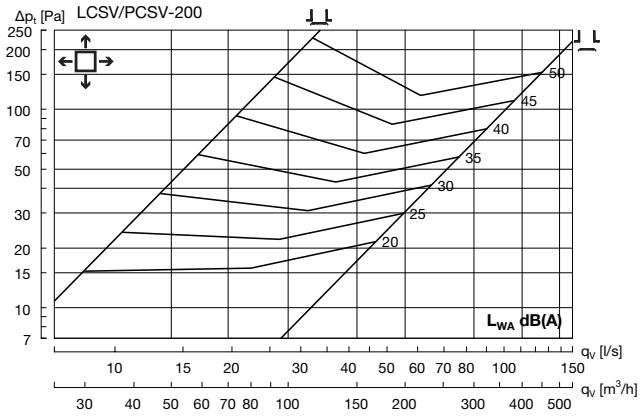
Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	0	4	0	-1	-5	-14	-22	-27

LCSV / PCSV-250



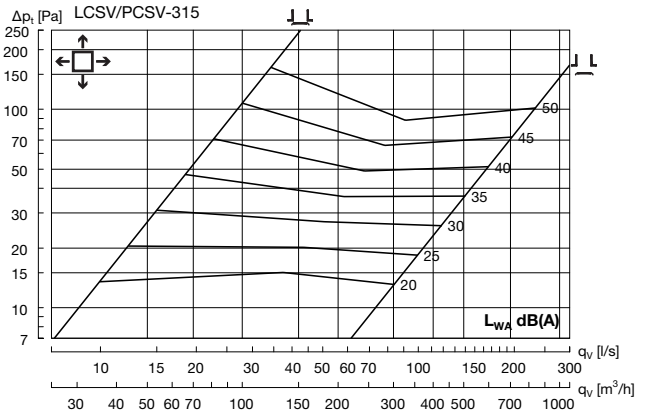
Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	2	0	-4	-2	-2	-15	-22	-37

LCSV / PCSV-200



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	7	3	-1	-1	-4	-13	-23	-28

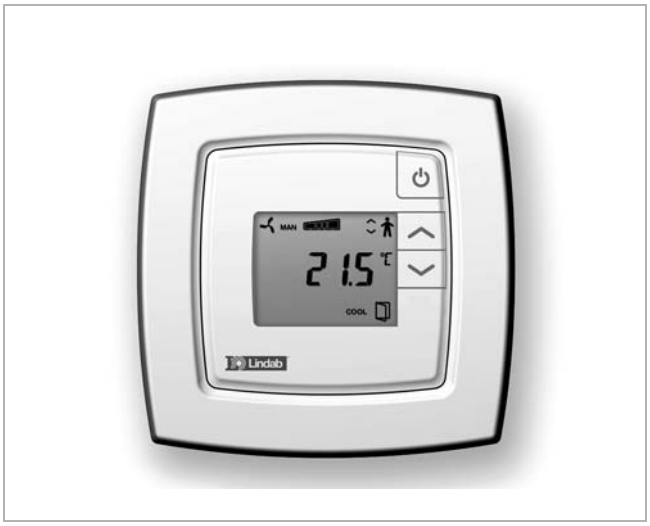
LCSV / PCSV-315



Hz	63	125	250	500	1K	2K	4K	8K
K_{ok}	3	-1	-5	-1	-3	-15	-28	-41

Controller

Regula Combi



Description

Regula Combi is a microprocessor-based controller with 7 predefined programs.

The controller can control both water and air-borne indoor climate systems. One of the programs have been specially designed for air systems with VAV.

PI regulation with either 24 V on/off or 0-10 V control.

Internal temperature sensor and three inputs for controlling the indoor climate, with external sensors for:

- Temperature
- CO_2
- Movement (PIR)

Technical data

The regulation of temperature takes place in sequences with heating and cooling by signals from the universal outputs UO1 (heating) and UO2 (cooling). The universal output UO3 (forced cooling ventilation) will be activated with 100% signal by pressing the Occupancy button (Bypass operating mode).

As default the UO2 signal will also change to 100% when pressing the Occupancy button.

The basic airflow is set to 20% (default), so the cooling sequence will result in signals from 2-10 V. By pressing the Occupancy button for more than 5 seconds operating mode Off will occur, that will change the UO2 signal to 0 V regardless of cooling or heating demands. This match Lindab volume flow regulator functions.

A heating function for UO2 can be activated (by changing parameter 11 to value 5 instead of 4). This will allow UO2 to follow the heating signal UO1 to a free chosen max level (parameter 49) when there is heating demand. This should only be used when having heated air (above room temperature) in the duct e.g. by connecting UO1 to a duct heater. If the heating function on UO2 is activated forced cooling ventilation by pressing the Occupancy button will not lead to 100% signal on UO2.

Operating mode Standby occurs after 30 min (adjustable) if a presence sensor is connected and signal is given, then the neutral zone increases with +/- 2°C (to heating set point 19°C and cooling set point 24°C).

If a CO_2 sensor is connected the universal output signal UO2 will be affected according to the CO2 sequence. The major requirement from the cooling sequence and the CO2 sequence will control the UO2 signal.

Bypass operating mode with UO2 and UO3 = 100% signal will be activated for 45 min (changeable) by pressing the occupancy button once (for less than 5 seconds).

Regula Combi in detail, go to:

www.lindQST.com

-> documentfinder -> Regulation -> Regula Combi

Volume flow regulator VRU

Description

VRU is a circular volume flow regulator for VAV regulation in duct systems and consists of a measuring unit and a damper. VRU is used for volume flow regulation in circular ducts controlled from e.g. a room controller or BMS.
VRU is as standard supplied with MF actuator without communication, but can on request be delivered for Belimo MP, LON or ModBus communication. Further documentation on the actuator can be requested from Lindab.
VRU is equipped with LindabSafe for connection to the duct and is prepared for insulation up to 50 mm.
VRU can be installed in any position without adjustment required. To avoid contamination of the measuring cross, VRU should only be used for clean air.

- Requires minimal initial pressure (<20 Pa at V_{nom})
- Simple adjustment of settings with ZTH or PC tool
- Damper tightness class 3
- Standard delivered with 2-10 V control signal
- Standard delivered with 2-10 V damper position feedback signal *
- Can be supplied with attenuation shield on request
- Can be supplied with actuator for several BUS systems
- Standard MF actuator is used in Pascal systems

Order code - VRU

Product	VRU	bbb	cccc
Type			
VRU			
Dimension			
Ød 100 - 630			
Motor type			
MF, MP, LON, MOD, UNI, SPR, MF-D, MP-D, LON-D, MOD-D			

Example: VRU - 250 - MF

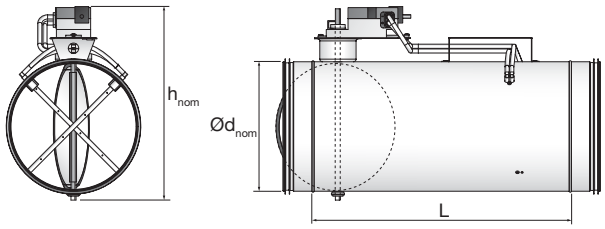
Factory settings

	Standard	On request
Min. airflow	0	Other min. flow
Max. airflow	V_{nom} (7m/s)	Other max. flow
Control signal	2-10 V	0-10 V
Feedback signal	Damper position *	Air flow

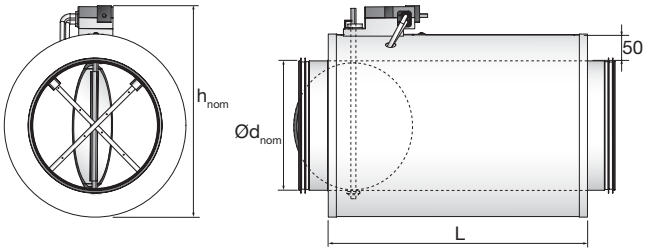
* Valid for MF and MP. UNI and SPR only available with air flow feedback signal.

Dimensions

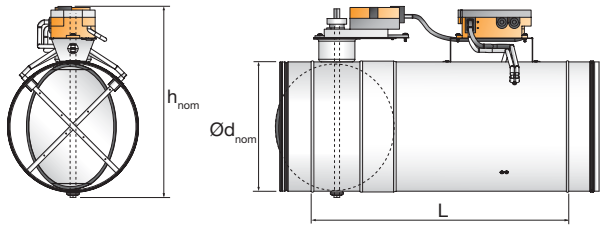
VRU-250 (MF, MP, LON, MOD)



VRU-250 (MF-D, MP-D, LON-D, MOD-D)



VRU-250 (UNI)



Ød$_{nom}$	L	h$_{nom}$		
		MF / MP / LON/ MOD / UNI	MF-D / MP-D / LON-D / MOD-D	SPR
100	400	225	262	241
125	400	250	287	266
160	400	285	322	301
200	400	325	358	341
250	500	375	407	391
315	500	440	471	455
400	510	526	557	560
500	610	626	657	660
630	660	756	787	790

Motor type table

Motor		
Type	**Ød 100 - 315**	**Ød 400 - 630**
MF (Standard)	LMV-D3-MF-F	NMV-D3-MF-F
MP	LMV-D3-MP-F	NMV-D3-MP-F
LON	LMV-D3-LON-F	NMV-D3-LON-F
MOD	LMV-D3-MOD-F	NMV-D3-MOD-F
UNI	VRD3+LM24A-V-F	VRD3+NM24A-V-F
SPR	VRD3+LF24-MFT	VRD3-NF24A-V-F
MF-D *	LMV-D3-MF-F	NMV-D3-MF-F
MP-D *	LMV-D3-MP-F	NMV-D3-MP-F
LON-D *	LMV-D3-LON-F	NMV-D3-LON-F
MOD-D *	LMV-D3-MOD-F	NMV-D3-MOD-F

* VRU with attenuation shield.

Volume flow regulator VRU

Technical data

Settings

V_{nom} indicates the measuring range for the actuator. A standard VRU is calibrated to a V_{nom} of 7 m/s according to the table below.

In special cases the VRU can be set to a higher V_{nom} , e.g. 10 m/s.

For VRU, V_{max} and V_{min} indicate the limits for the actuators working range.

There is linearity between V_{min} to V_{max} and the input signal. V_{max} can be set in the range 20-100% of V_{nom} , V_{min} in the range of 0-100% of V_{nom} ; however, air velocities below 0,7 m/s corresponds to a measuring pressure of less than 1 Pa, which makes the flow regulation less accurate.

Volume flow measurement

The accuracy of volume flow measurement depends on the flow conditions in front of the measuring cross.

It is preferable to have a long straight duct section in front of the measuring point, according to the table below.

If these recommendations are not followed, it will cause an unstable flow measurement and therefore higher inaccuracy in the regulation of the required airflow.

Components	Recommended straight duct before unit
Bend	3 x d
Tee-piece	2 x d
Damper	6 x d

VRU_{nom} flow and measuring limit

Size Ød mm	Measuring limit (0,7 m/s) m³/h	l/s	(Standard) V_{nom} (7m/s) m³/h	l/s	V_{nom} (10m/s) m³/h	l/s
100	20	6	198	55	283	79
125	31	9	309	86	442	123
160	51	14	506	141	723	201
200	79	22	791	220	1130	314
250	124	34	1236	343	1766	491
315	196	54	1963	545	2804	779
400	317	88	3165	879	4522	1256
500	495	138	4946	1374	7065	1963
630	785	218	7851	2181	11216	3116

Volume flow regulator VRU

Technical data

Pressure drop diagram and sound data for dimensioning.
The solid curves indicate the total pressure drop Δp_t over the damper as a function of the volume flow q and the blade angle α.

The broken curves indicate the A-weighted sound effect level L_{WA}, in dB to the duct.

Example:

Dimension:	Ø100
Volume flow:	60 l/s
Pressure drop:	200 Pa

The following can be obtained from the diagram:

Blade angle α:	32°
Sound effect level:	63 dB(A)

Measuring method for sound:
Sound data has been measured by the Swedish National Testing and Research Institute (SP) with reference to ISO 5135 and EN/ISO 3741.

Blade angle:

0° =	open damper.
90° =	closed damper.

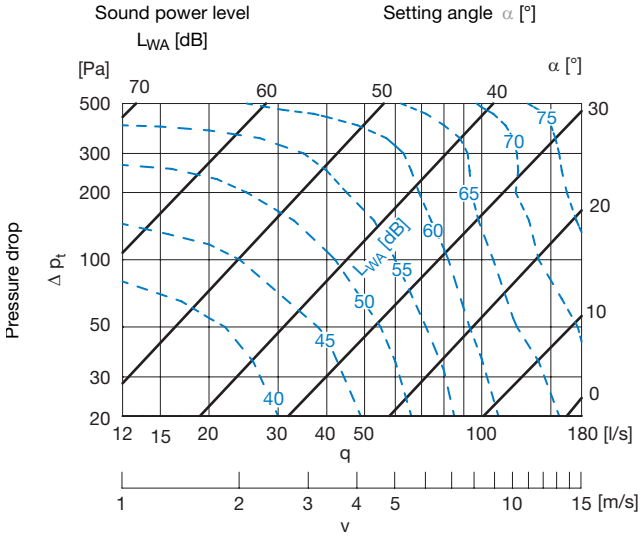
Dimensioning
When dimensioning the dampers inherent noise from the dampers and their regulating properties (damper characteristics) must be taken into consideration.

If excessively large dampers are used, the working area (angle of rotation) at given V_{min} and V_{max} may be so limited that regulation does not function satisfactorily.

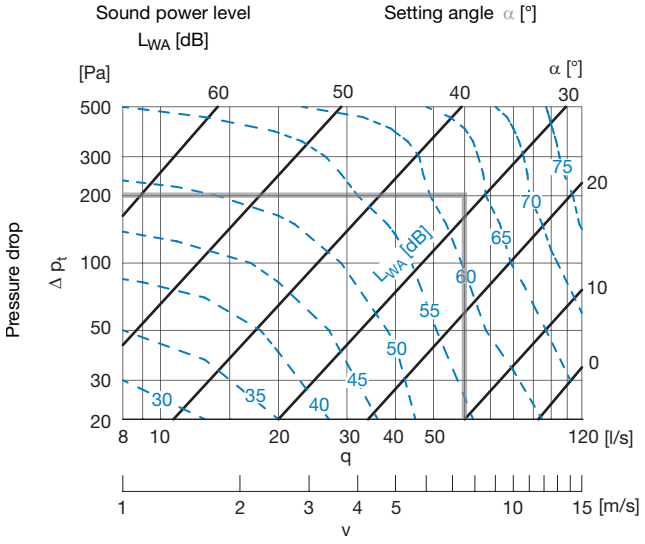
Efforts must be made to use damper dimensions that result in the largest possible working areas (angles of rotation).

Due to regulation accuracy, working areas with damper angles < 15° should be avoided.

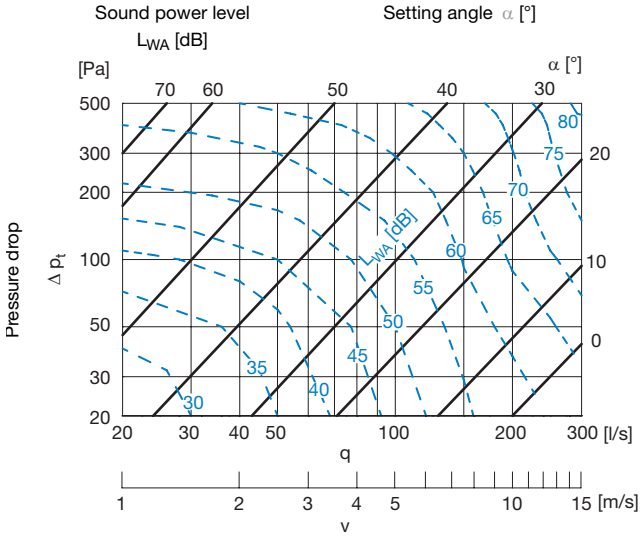
Ød 125



Ød 100



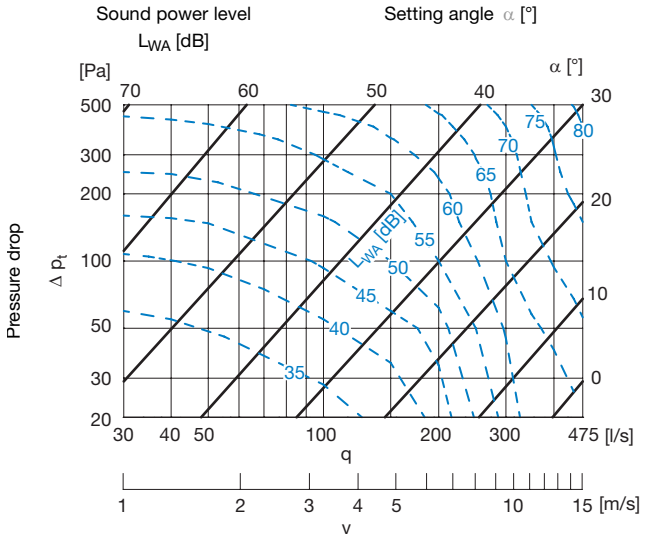
Ød 160



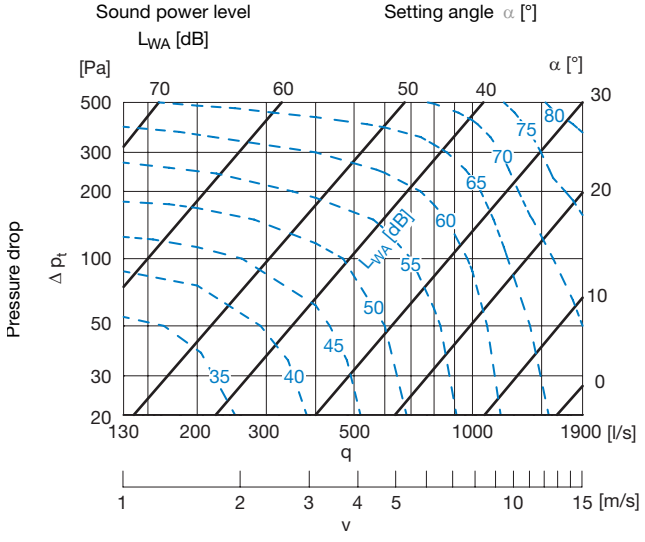
Volume flow regulator VRU

Technical data

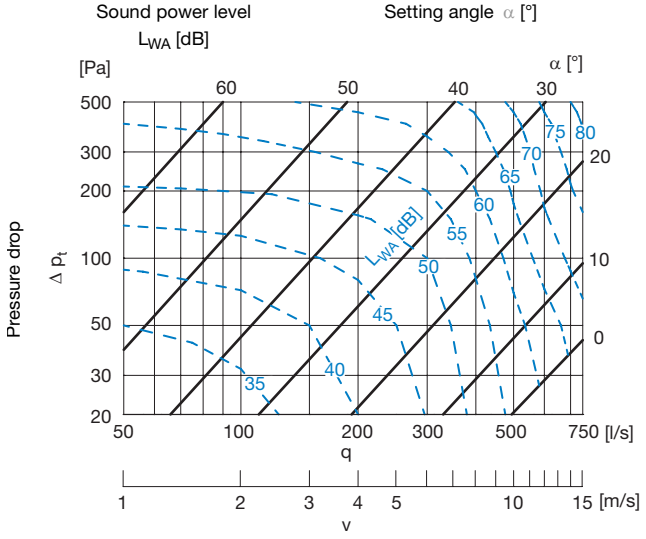
Ød 200



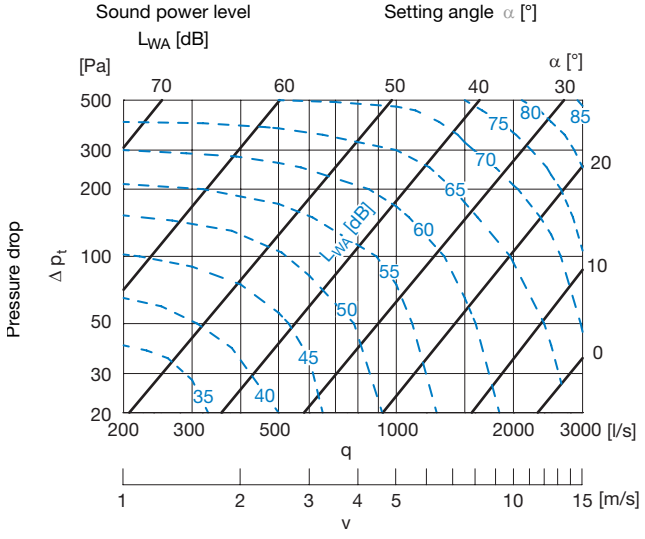
Ød 400



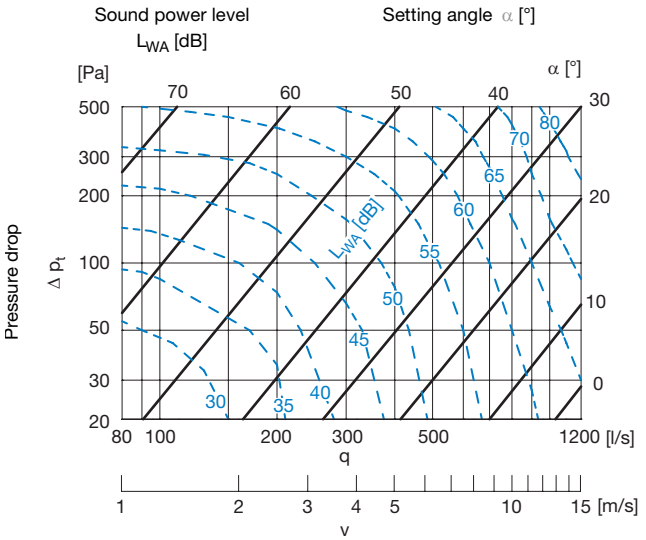
Ød 250



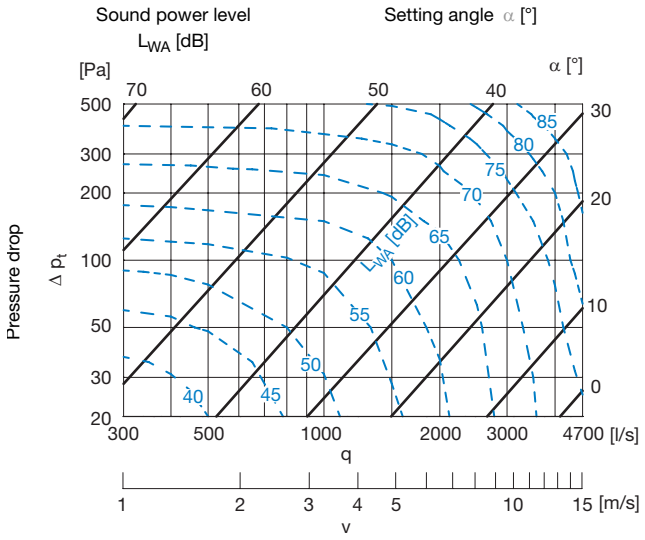
Ød 500



Ød 315



Ød 630



Volume flow regulator VRU

Technical data

Sound data

Below sound effect levels for ducts (flow noise) with reference to ISO 5135 as a function of volume flow and pressure difference. The necessary minimum prepressure is 20 Pa for all sizes, equivalent to the pressure loss over VRU at nominal volume flow and with fully open damper.

dim Ød	Pressure drop [Pa]	Velocity app. 1 [m/s]								Velocity app. 3 [m/s]								Velocity app. 6 [m/s]							
		Centre frequency [Hz]								Centre frequency [Hz]								Centre frequency [Hz]							
		63	125	250	500	1k	2k	4k	8k	63	125	250	500	1k	2k	4k	8k	63	125	250	500	1k	2k	4k	8k
100		Flow 8 [l/s] / 29 [m³/h]								Flow 25 [l/s] / 90 [m³/h]								Flow 50 [l/s] / 180 [m³/h]							
	500	60	60	59	52	50	44	44	44	67	64	64	57	54	48	48	48	72	69	69	62	59	52	52	52
	200	53	51	53	43	42	35	32	32	59	58	58	50	48	40	37	37	66	65	64	57	54	45	42	42
	100	51	46	44	38	35	28	21	20	58	55	53	46	41	34	26	24	65	64	62	54	48	40	31	29
	50	48	42	38	33	26	19	16	14	55	53	48	42	35	26	22	18	64	63	60	53	44	33	28	22
	20	43	35	30	23	17	9	7	6	50	49	42	37	28	17	15	14	62	61	57	51	41	27	25	15
125		Flow 12 [l/s] / 43 [m³/h]								Flow 40 [l/s] / 144 [m³/h]								Flow 75 [l/s] / 270 [m³/h]							
	500	66	63	61	55	52	46	47	44	71	68	65	59	56	50	50	47	76	73	70	63	60	53	53	50
	200	59	53	49	44	38	34	33	32	65	62	57	51	46	41	38	38	72	71	65	59	53	47	43	43
	100	58	49	43	40	31	28	22	22	64	59	53	47	39	34	29	27	71	70	63	55	47	40	35	32
	50	57	42	41	31	29	20	17	15	63	54	50	41	36	27	25	20	70	68	60	51	43	34	32	24
	20	56	32	39	29	27	11	15	11	62	48	48	34	34	20	22	15	68	65	56	47	39	29	28	17
160		Flow 20 [l/s] / 72 [m³/h]								Flow 60 [l/s] / 216 [m³/h]								Flow 120 [l/s] / 432 [m³/h]							
	500	62	63	61	56	52	51	50	49	68	67	64	59	55	53	52	51	73	71	68	62	59	55	54	53
	200	52	52	51	44	43	38	37	36	61	58	56	50	48	42	40	40	71	65	62	56	53	47	44	44
	100	47	43	39	37	32	27	27	25	59	54	50	45	40	35	33	31	70	64	60	53	48	42	39	38
	50	42	36	33	28	25	20	17	16	54	50	46	37	33	29	25	25	69	63	58	48	42	37	32	32
	20	37	30	30	26	19	16	11	10	49	46	43	35	27	24	19	18	68	61	55	44	36	32	27	23
200		Flow 30 [l/s] / 108 [m³/h]								Flow 100 [l/s] / 360 [m³/h]								Flow 200 [l/s] / 720 [m³/h]							
	500	65	60	56	52	49	47	44	42	70	64	61	55	52	52	55	55	75	69	65	59	55	55	59	59
	200	55	52	51	43	40	37	38	38	62	57	55	47	44	42	42	42	71	65	61	53	50	48	47	47
	100	46	43	41	34	32	29	29	29	57	52	48	41	39	36	34	34	69	64	58	50	47	44	42	42
	50	40	38	33	30	28	27	23	22	51	45	41	36	32	32	28	28	63	56	51	44	39	39	34	34
	20	34	31	26	25	25	23	18	16	44	37	33	29	27	25	21	19	56	47	43	36	29	27	24	22
250		Flow 50 [l/s] / 180 [m³/h]								Flow 150 [l/s] / 540 [m³/h]								Flow 300 [l/s] / 1080 [m³/h]							
	500	67	65	57	50	47	52	51	50	69	66	59	53	50	54	53	52	71	67	61	56	53	56	55	54
	200	55	54	49	43	42	38	42	42	59	57	52	46	44	41	44	44	63	60	55	49	46	44	46	46
	100	52	48	40	37	34	33	31	28	56	52	45	41	38	36	34	31	62	57	51	46	43	40	38	35
	50	44	41	35	32	29	24	22	20	52	48	40	38	34	30	28	24	61	56	47	45	40	38	33	28
	20	33	35	29	29	25	15	12	10	47	44	37	35	31	25	22	17	59	54	46	42	38	36	30	24
315		Flow 80 [l/s] / 288 [m³/h]								Flow 250 [l/s] / 900 [m³/h]								Flow 500 [l/s] / 1800 [m³/h]							
	500	63	60	53	49	47	46	45	44	68	65	59	53	50	50	53	50	74	71	65	58	55	55	58	55
	200	50	44	42	38	38	33	37	34	60	55	50	45	43	40	43	40	70	65	58	52	49	48	49	46
	100	42	39	33	31	30	25	30	23	54	52	45	41	38	36	36	31	66	64	56	50	47	46	44	39
	50	34	34	30	26	22	21	19	15	49	49	43	38	34	32	30	24	64	63	55	49	45	42	40	32
	20	26	30	27	21	16	15	13	11	44	46	41	35	30	27	25	18	62	61	54	48	43	37	34	24
400		Flow 130 [l/s] / 468 [m³/h]								Flow 400 [l/s] / 1440 [m³/h]								Flow 800 [l/s] / 2880 [m³/h]							
	500	76	71	66	59	55	58	57	56	79	73	67	62	57	60	59	58	82	75	68	65	59	62	61	60
	200	61	58	50	44	43	44	45	41	67	62	56	50	48	48	48	45	74	68	62	56	53	52	52	49
	100	50	45	40	34	36	35	35	29	61	56	49	44	42	39	39	34	72	67	58	53	49	47	46	40
	50	42	37	31	29	28	27	25	20	57	52	44	39	37	35	34	26	71	66	56	50	47	44	44	33
	20	40	34	27	25	24	23	21	11	55	50	40	35	34	32	30	20	70	65	54	47	44	40	38	28
500		Flow 200 [l/s] / 720 [m³/h]								Flow 600 [l/s] / 2160 [m³/h]								Flow 1200 [l/s] / 4320 [m³/h]							
	500	82	76	69	63	62	61	60	59	84	77	70	64	63	62	61	60	85	78	71	65	64	63	62	61
	200	66	60	55	48	45	44	46	43	71	65	59	53	50	50	50	47	77	70	64	58	56	55	54	51
	100	55	50	47	38	38	36	34	31	63	58	53	47	46	44	42	37	72	66	60	55	53	51	49	43
	50	46	40	36	33	32	29	29	25	59	52	47	44	42	38	38	31	71	63	57	54	51	46	46	37
	20	41	33	29	27	26	19	18	20	56	47	42	40	38	32	30	26	70	60	54	52	49	44	40	32
630		Flow 300 [l/s] / 1080 [m³/h]								Flow 900 [l/s] / 3240 [m³/h]								Flow 1800 [l/s] / 6480 [m³/h]							
	500	86	77	71	67	64	61	61	60	88	80	73	69	66	64	63	62	90	83	75	71	68	67	65	64
	200	76	70	63	60	56	53	52	48	78	72	65	62	59	55	55	49	80	74	67	64	60	57	57	50
	100	65	61	52	49	45	43	41	37	71	66	59	54	50	46	45	40	78	71	66	59	56	49	48	44
	50	54	49	45	39	34	36	30	26	66	58	53	48	43	40	39	30	77	68	62	57	51	45	47	36
	20	45	35	38	30	29	29	26	20	61	50	47	43	38	36	33	25	76	65	57	55	46	42	39	30

Flow measuring unit FRU

Description

FRU is a measuring unit with a measuring cross, which is used for measuring volume flow in circular ducts.

FRU is equipped with Belimo VRD3, providing an output signal that is proportional to the volume flow. FRU can be used to monitor the actual airflow or can be used to control a volume flow regulator.

FRU is equipped with Lindab Safe in the front for connection to the duct and a female coupling in the back, and is ready for insulation up to 50 mm.

FRU can be installed in any position without requiring adjustment.
To avoid contamination of the measuring cross, FRU should only be used for clean air.

FRU needs a certain distance of straight duct before the unit and this has to be observed to obtain a stable and accurate airflow regulation.

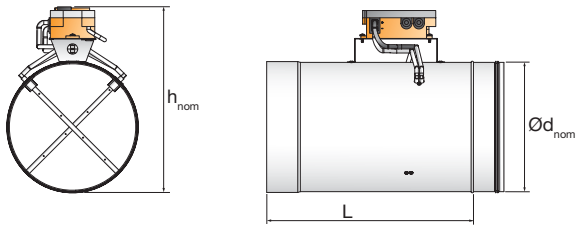
- Requires minimal initial pressure (<20 Pa at V_{nom})
- Output signal indicates actual volume flow

Order code - FRU

Product	**FRU**	**aaa**
Type		
FRU		
Dimension		
Ød 100 - 630		

Example: FRU - 250

Dimensions



$Ød_{nom}$	L	h_{nom}
100	300	202
125	300	227
160	300	262
200	300	302
250	400	352
315	400	417
400	400	504
500	510	604
630	560	734

Technical data

Volume flow measurement
The accuracy of volumeflow measurement depends on the flow conditions in front of the measuring cross. It is preferable to have a long straight duct section in front of the measuring point, according to the table below.

Components	Recommended straight duct before unit
Bend	3 x d
Tee-piece	2 x d
Damper	6 x d

Settings
V_{nom} indicates the measuring range for the actuator. A standard FRU is calibrated to V_{nom} of 7 m/s according to the table below.
In special cases the FRU can be set to a higher V_{nom}, e.g. 10 m/s.
The output signal from VRD3 is linear between 2-10 V which corresponds to a flow between 0 and V_{nom}.
Air flows corresponding to air velocities below 0,7 m/s will result in a 2 V signal. (Zero flow).

FRU nominal flow

Size $Ød_{nom}$	(Standard) V_{nom} (7m/s)	
mm	m^3/h	l/s
100	198	55
125	309	86
160	506	141
200	791	220
250	1236	343
315	1963	545
400	3165	879
500	4946	1374
630	7851	2181

Volume flow regulator VRA/FRA

VRA-0 / FRA

Description

FRA is a measuring unit with a measuring cross, which is used for measuring volume flow in rectangular ducts. FRA is equipped with Belimo VRD3, which provides an output signal that is proportional to the volume flow.

VRA consists of a FRA measuring unit and a DJP type damper put together to form a complete unit. VRA is used for volume flow regulation in rectangular ducts, either for constant volume flow with step control, e.g. controlled by a switch or clock, or for variable volume flow, where the volume flow varies between a defined minimum and maximum limit. The actual volume flow is determined by a control signal from, for example, Regula Combi, BMS or another FRA/VRA. VRA-0 consists of a regulator (Belimo VRD3) with a manual setting and motor. VRA-2 is equipped with a regulator and motor in one unit (Belimo NMV-D3-MP), which is programmable and has MP bus. VRA-3 consists of a regulator (Belimo VRD3) with a manual setting and motor with a spring return. Further documentation on the diffusers can be requested from Lindab.

VRA/FRA is equipped with LS flanges and is supplied ready for insulation up to 50 mm. VRA/FRA can be installed in any position without requiring adjustment. To avoid dirtying the measuring cross and sensor, VRA/FRA should only be used for clean air.

Order code

Product	VRA	a	A x B	cc	dd

Type
VRA

Motor type
0 = Universal
2 = Compact model
3 = With spring return

Dimension
400x200 - 800x300

Flow settings
Min. airflow
Max. airflow

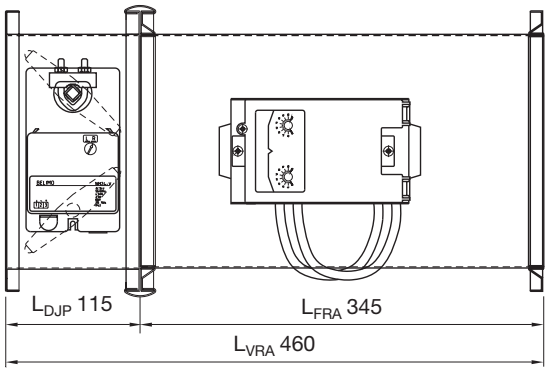
Example: VRA - 2 - 500 x 200 - 55 l/s - 220 l/s

VRA is as standard delivered with 2-10 V control signal. On request it can be delivered with 0-10 V .

Advantages of VRA/FRA

- Requires minimal initial pressure (<20 Pa at V_{nom})
- Has large regulation range
- Simple adjustment of volume flow
- Parallel or slave operation of several terminals
- Shut-off to damper tightness class 3 (VRA only)
- Establishment of over/underpressure or pressure balance in the ventilated zones
- Output signal indicates actual volume flow
- Is compatible with all types of automatic equipment with control voltage 2-10 V or 0-10 V
- VRA-2 can communicate with BMS systems via MP bus

Dimensions



Motor overview

Type	Motor
VRA-0	VRD3 + NM24-V
VRA-2	NMV-D3-MP
VRA-3	VRD3 + NF24A-MF

FRA	VRD3

Standard sizes

400 x 200
500 x 200
600 x 200
600 x 300
800 x 300

Order code - FRA

Product	FRA	A x B

Type
FRA

Dimension
400x200 - 800x300

Example: FRA - 500x200

Other sizes are available on request. Please contact Lindab's sales department for further information.

Volume flow regulator

VRA/FRA
VRU/FRU

Technical data

Sizes and volume flows

VRU/FRU and VRA/FRA are calibrated and set as standard to a nominal volume flow (V_{nom}) of 7 m/s according to the tables below. In special circumstances they can be set to a higher V_{nom}, e.g. 10 m/s. V_{nom} indicates the measuring range for the regulator, and the linear output signal (2-10 V or 0-10 V) is an expression of the volume flow between 0 – V_{nom}.

For VRU/VRA, V_{max} and V_{min} indicate the limits for the regulator's working range. Similarly there is a linear connection between V_{min} - V_{max} and the input signal (2-10 V or 0-10V). V_{max} can be set in the range 20-100% of V_{nom}, V_{min} in the range 0-100% of V_{nom} ; however, air velocities below 0,7 m/s corresponds to a measuring pressure of less than 1 Pa, which makes the flow regulation less accurate.

V_{max}, V_{min} and mode (2-10 V / 0-10 V) for VRU/VRA and mode (2-10 V / 0-10 V) for FRU/FRA can be set using the adjustment tool Belimo ZTH-GEN. For VRU-2 (with L/NMV-D3-MP-F) there are several programming options for using Belimo PC-Tool . See the Belimo documentation for further details.

VRU/VRA works with almost no initial pressure. Pressure loss over VRU/VRA at nominal volume flow and with a fully open damper is less than 20 Pa.

VRU/VRA or FRU+DCT/FRA+DJP

The choice between VRU/VRA or FRU+DCT-Rx / FRA+DJP-Rx depends on the installation features of the duct system. VRU/VRA should be used where it can be positioned so that the flow to the measuring cross ensures a good volume flow measurement. If you wish to position the damper close to a joint or bend, a DCT type duct damper should be used. In that case, volume flow regulator FRU with measuring cross is positioned after the damper with a suitably straight section of duct in front of it.

Volume flow measurement

The accuracy of volume flow measurement depends on the flow conditions in front of the measuring cross. It is preferable to have a long straight duct section in front of the measuring point, according to the table below.

Components	Recommended straight duct section in front of measuring cross
Bend	3 x d
Tee-piece	2 x d
Damper	6 x d

In poor flow conditions the absolute volume flow measurement will be less accurate (i.e. min. and max. volume flow with greater inaccuracy), while the VAV function will not normally change (i.e. any temperature control in the room will still function).

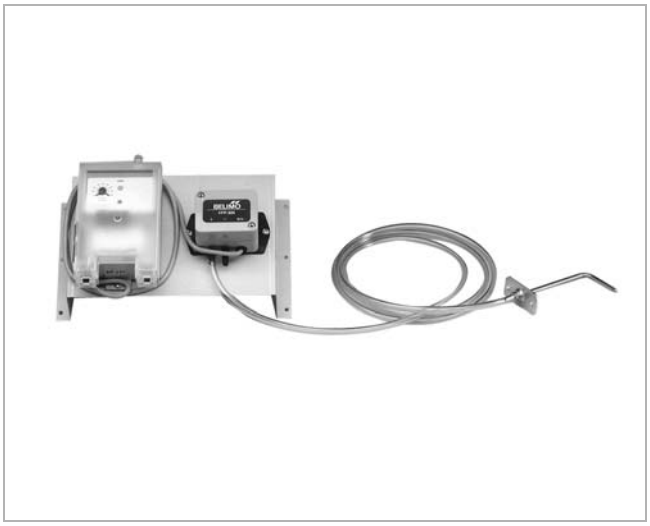
VRU capacity, - max.

Size Ød_1 mm	(Standard) V_{nom} (7m/s)		V_{nom} (10m/s)	
	m³/h	l/s	m³/h	l/s
125	309	86	442	123
160	506	141	723	201
200	791	220	1130	314
250	1236	343	1766	491
315	1963	545	2804	779
400	3165	879	4522	1256
500	4946	1374	7065	1963
630	7851	2181	11216	3116

VRA capacity, - max.

Size A mm	Size B mm	(Standard) V_{nom} (7m/s)		V_{nom} (10m/s)	
		m³/h	l/s	m³/h	l/s
400	200	2016	560	2880	800
500	200	2520	700	3600	1000
600	200	3024	840	4320	1200
600	300	4536	1260	6480	1800
800	300	6048	1680	8640	2400

Pressure regulator PR



Description

Pressure regulator PR consists of a static pressure probe for installation in circular or square ducts, a pressure sensor (Belimo VFP) and a regulator (Belimo VRP-STP).

The regulator has an outlet for measuring static pressure and controls a damper of type DCT-Rx or DJP-Rx and programmable motors.

Pressure regulator PR is used together with an adjustment damper type DCT or DJP to maintain a constant static pressure in distribution ducts to a VAV zone.

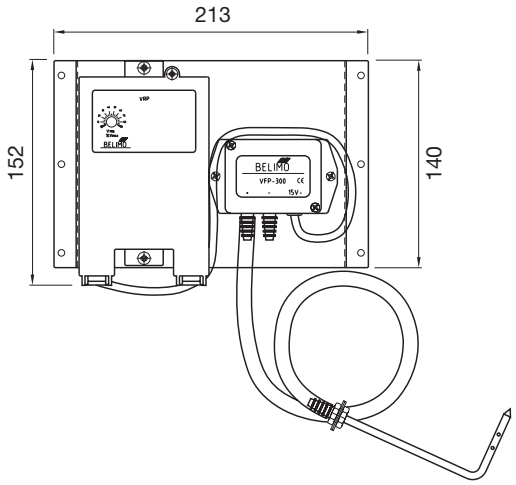
The pressure regulator is supplied with a 2 m long pressure hose for the pressure probe.

PR can be supplied with the following pressure ranges (Pa):

100 - 300 - 600 – 1,000 – 1,500 – 3,000.

- Has large regulation range
- Simple adjustment of set point

Dimensions



Ordering example

Product	**PR**	**aaaa**
Type		
Pressure range		

Damper - circular

DCT

Description

DCT is a circular control and shut-off damper.

The damper can be used for pressure or volume flow regulation with external control options (open, closed, min., max.) depending on the form of control/regulation.

DCT is available with a spring return motor. The damper can be controlled by an FRU (as a VRU) or a PR regulator, by a BMS system or Regula Combi (with modulating signal) or as a slave for another damper (mechanical slave operation with the same damper position).

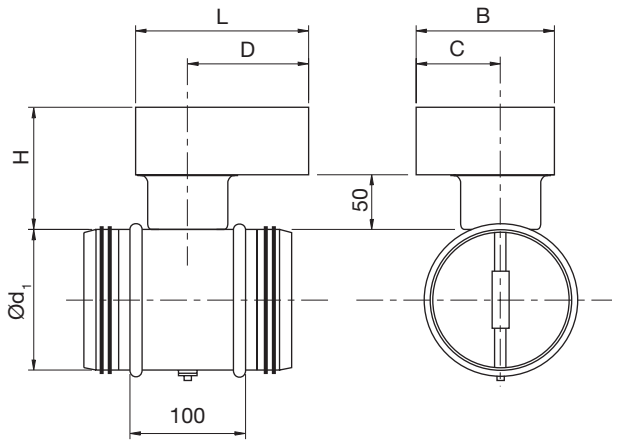
When ordering, it is important to specify the form of control, and whether the damper motor must be programmable. All DCT dampers are supplied with Belimo motors.

Order code - DCT

Product	**DCT**	**a**	**bbb**	**c**	**d**
Type					
DCT					
Motor type					
Standard	0				
Spring return	3				
Dimension					
$Ød_1$ 100 - 630					
Form of control					
R: Regulator-controlled					
S: Parallel signal (modulating)					
Programming					
U: Without programming					
P: Programmable					

Example: DCT - 0 - 315 - R - U

Dimensions



Type	B mm	C mm	D mm	H mm	L mm
DCT-0-RU/SU	80	40	140	112	165
DCT-0-RP/SP	80	40	162	112	187
DCT-3	96	48	204	130,5	236

Motor overview

Type 0	$Ød_1$ 100-315 Motor 0 (Standard)	$Ød_1$ 400-630 Motor 0 (Standard)
DCT-RU	LM24A-V-F	NM24A-V-F
DCT-RP	LM24A-MF-F	NM24A-MF-F
DCT-SU	LM24A-SR-F	NM24A-SR-F
DCT-SP	LM24A-MF-F	NM24A-MF-F

Type 3	$Ød_1$ 100-315 Motor 3 (Spring-return)	$Ød_1$ 400-630 Motor 3 (Spring-return)
DCT-RU	LF24A-MFT	NF24A-MF
DCT-RP	LF24A-MFT	NF24A-MF
DCT-SU	LF24-SR	NF24A-SR
DCT-SP	LF24A-MFT	NNF24-MF

RU Used only with PR (and FRU) and is preset to a VAV input signal: 6 ± V,

RP Has a programmable motor, is used together with PR and is preprogrammed for a VAV input signal: 6 ± V. Has modulating output signal indicating damper position for mechanical control of a slave damper.

SU Has a motor, which is controlled by modulating input signal (2-10V). Also has a modulating output signal indicating damper position.

SP Has a programmble motor, which can be controlled by optional input signal (Standard modulating). Also has a modulating output signal indicating damper position for mechanical control of a slave damper.

Damper - circular

DCT

Technical data

Pressure drop diagram and sound data for dimensioning.
The solid curves indicate the total pressure drop Δp_t over the damper as a function of the volume flow q and the blade angle α.

The broken curves indicate the A-weighted sound effect level L_{WA}, in dB to the duct.

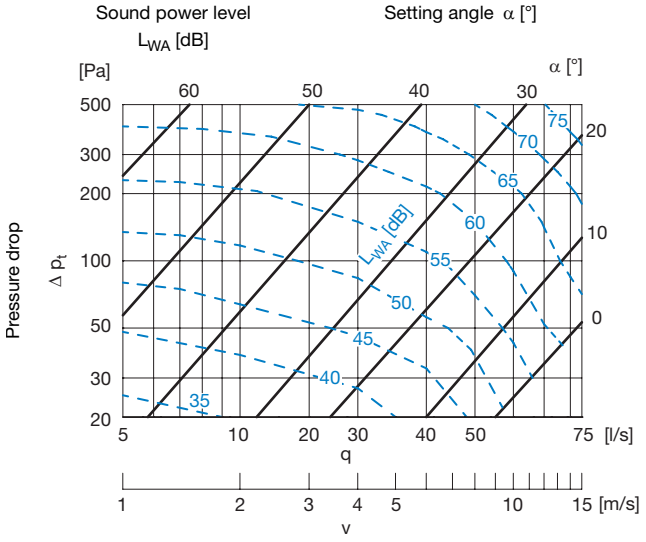
Example:
Dimension: Ø100
Volume flow: 60 l/s
Pressure drop: 200 Pa

The following can be obtained from the diagram:
Blade angle α: 32°
Sound effect level: 63 dB(A)

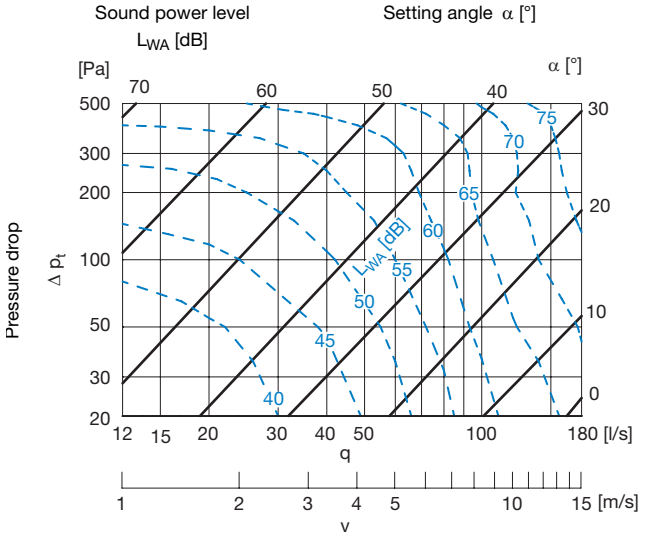
Measuring method for sound:
Sound data has been measured by the Swedish National Testing and Research Institute (SP) with reference to ISO 5135 and EN/ISO 3741.

Blade angle α:
0° = open damper.
90° = closed damper.

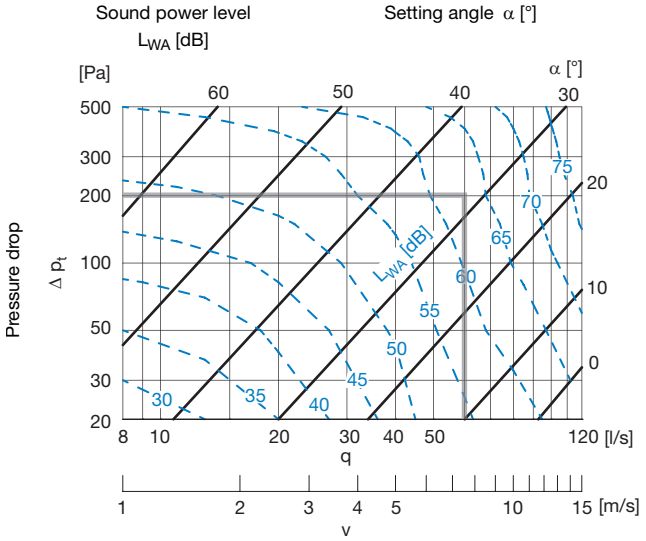
Ø80



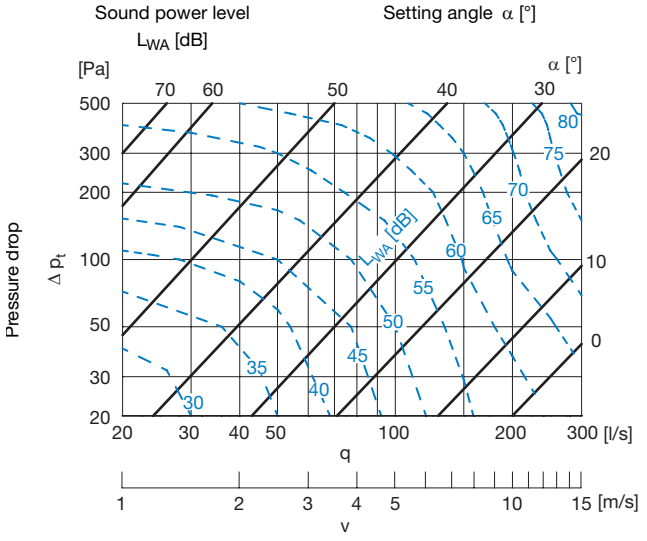
Ø125



Ø100



Ø160

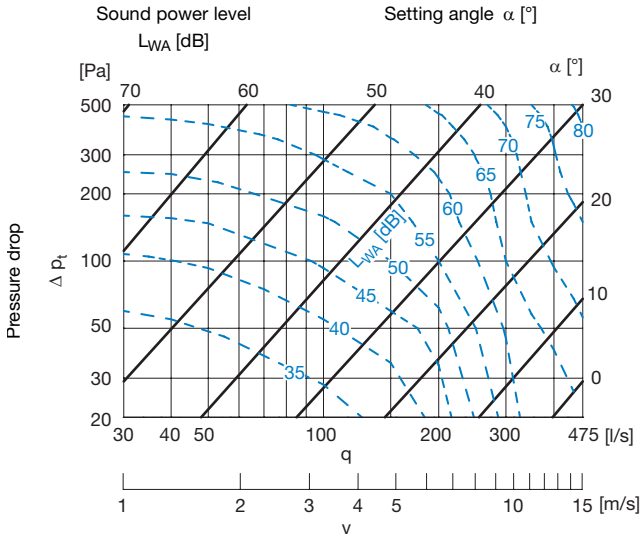


Damper - circular

DCT

Technical data

Ø200



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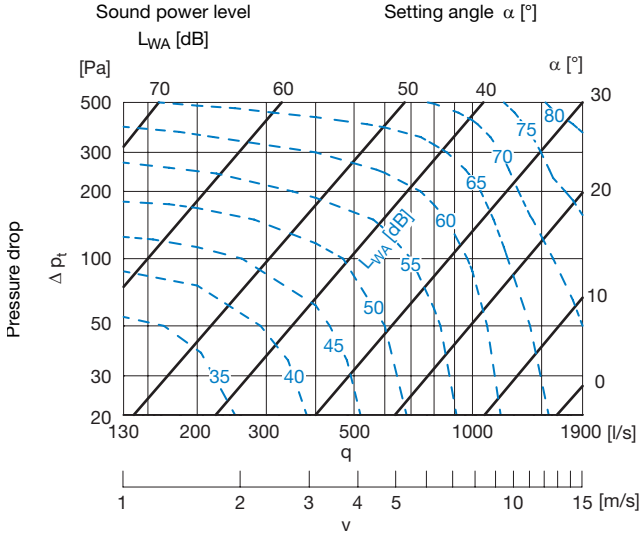

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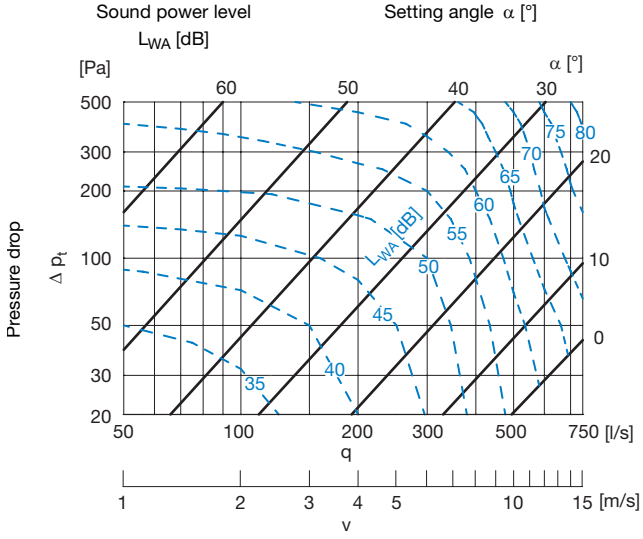

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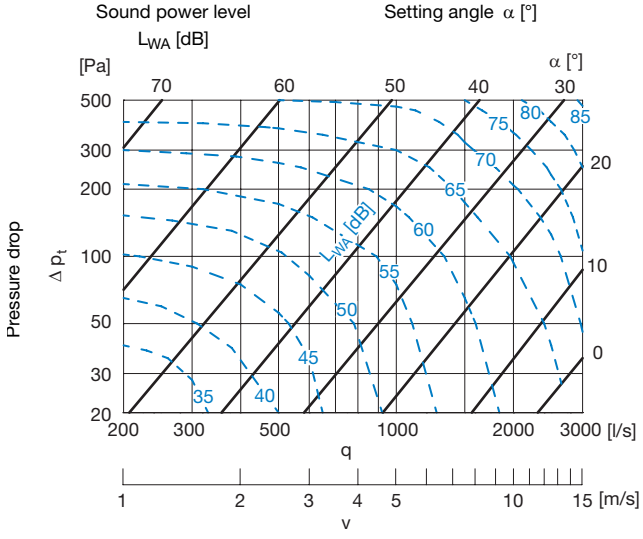

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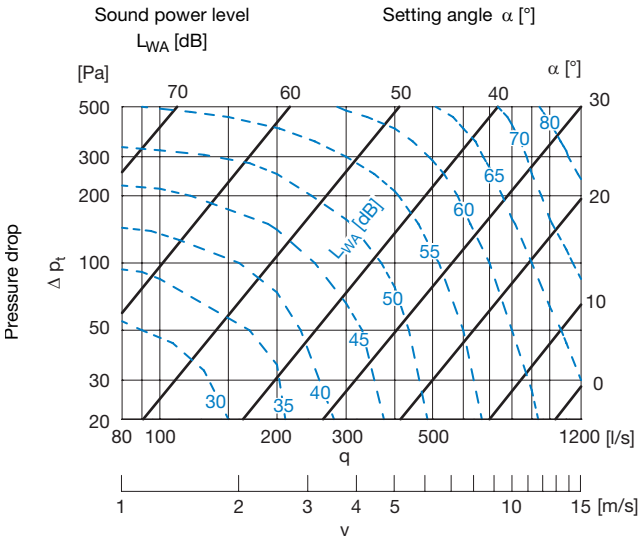
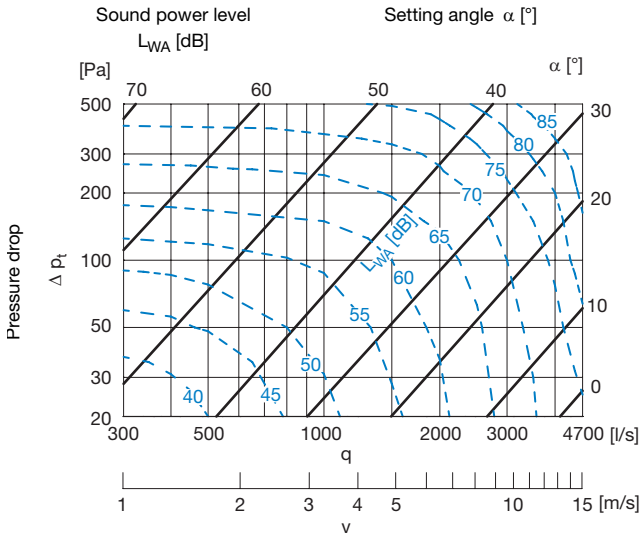


Ø630



Damper - circular

DCT

Technical data

Sound data

The following pages give sound effect levels for ducts (flow noise) with reference to ISO 5135 as a function of volume flow and pressure difference. The necessary minimum pre-pressure difference is 20 Pa for all sizes, equivalent to the pressure loss over VRU at nominal volume flow and with a fully open damper.

Ød	Pressure drop [Pa]	Velocity app. 1 [m/s]								Velocity app. 3 [m/s]								Velocity app. 6 [m/s]							
		Centre frequency [Hz]								Centre frequency [Hz]								Centre frequency [Hz]							
		63	125	250	500	1k	2k	4k	8k	63	125	250	500	1k	2k	4k	8k	63	125	250	500	1k	2k	4k	8k
100		Flow 8 [l/s] / 29 [m³/h]								Flow 25 [l/s] / 90 [m³/h]								Flow 50 [l/s] / 180 [m³/h]							
	500	60	60	59	52	50	44	44	44	67	64	64	57	54	48	48	48	72	69	69	62	59	52	52	52
	200	53	51	53	43	42	35	32	32	59	58	58	50	48	40	37	37	66	65	64	57	54	45	42	42
	100	51	46	44	38	35	28	21	20	58	55	53	46	41	34	26	24	65	64	62	54	48	40	31	29
	50	48	42	38	33	26	19	16	14	55	53	48	42	35	26	22	18	64	63	60	53	44	33	28	22
	20	43	35	30	23	17	9	7	6	50	49	42	37	28	17	15	14	62	61	57	51	41	27	25	15
125		Flow 12 [l/s] / 43 [m³/h]								Flow 40 [l/s] / 144 [m³/h]								Flow 75 [l/s] / 270 [m³/h]							
	500	66	63	61	55	52	46	47	44	71	68	65	59	56	50	50	47	76	73	70	63	60	53	53	50
	200	59	53	49	44	38	34	33	32	65	62	57	51	46	41	38	38	72	71	65	59	53	47	43	43
	100	58	49	43	40	31	28	22	22	64	59	53	47	39	34	29	27	71	70	63	55	47	40	35	32
	50	57	42	41	31	29	20	17	15	63	54	50	41	36	27	25	20	70	68	60	51	43	34	32	24
	20	56	32	39	29	27	11	15	11	62	48	48	34	34	20	22	15	68	65	56	47	39	29	28	17
160		Flow 20 [l/s] / 72 [m³/h]								Flow 60 [l/s] / 216 [m³/h]								Flow 120 [l/s] / 432 [m³/h]							
	500	62	63	61	56	52	51	50	49	68	67	64	59	55	53	52	51	73	71	68	62	59	55	54	53
	200	52	52	51	44	43	38	37	36	61	58	56	50	48	42	40	40	71	65	62	56	53	47	44	44
	100	47	43	39	37	32	27	27	25	59	54	50	45	40	35	33	31	70	64	60	53	48	42	39	38
	50	42	36	33	28	25	20	17	16	54	50	46	37	33	29	25	25	69	63	58	48	42	37	32	32
	20	37	30	30	26	19	16	11	10	49	46	43	35	27	24	19	18	68	61	55	44	36	32	27	23
200		Flow 30 [l/s] / 108 [m³/h]								Flow 100 [l/s] / 360 [m³/h]								Flow 200 [l/s] / 720 [m³/h]							
	500	65	60	56	52	49	47	44	42	70	64	61	55	52	52	55	55	75	69	65	59	55	55	59	59
	200	55	52	51	43	40	37	38	38	62	57	55	47	44	42	42	42	71	65	61	53	50	48	47	47
	100	46	43	41	34	32	29	29	29	57	52	48	41	39	36	34	34	69	64	58	50	47	44	42	42
	50	40	38	33	30	28	27	23	22	51	45	41	36	32	32	28	28	63	56	51	44	39	39	34	34
	20	34	31	26	25	25	23	18	16	44	37	33	29	27	25	21	19	56	47	43	36	29	27	24	22
250		Flow 50 [l/s] / 180 [m³/h]								Flow 150 [l/s] / 540 [m³/h]								Flow 300 [l/s] / 1080 [m³/h]							
	500	67	65	57	50	47	52	51	50	69	66	59	53	50	54	53	52	71	67	61	56	53	56	55	54
	200	55	54	49	43	42	38	42	42	59	57	52	46	44	41	44	44	63	60	55	49	46	44	46	46
	100	52	48	40	37	34	33	31	28	56	52	45	41	38	36	34	31	62	57	51	46	43	40	38	35
	50	44	41	35	32	29	24	22	20	52	48	40	38	34	30	28	24	61	56	47	45	40	38	33	28
	20	33	35	29	29	25	15	12	10	47	44	37	35	31	25	22	17	59	54	46	42	38	36	30	24
315		Flow 80 [l/s] / 288 [m³/h]								Flow 250 [l/s] / 900 [m³/h]								Flow 500 [l/s] / 1800 [m³/h]							
	500	63	60	53	49	47	46	45	44	68	65	59	53	50	50	53	50	74	71	65	58	55	55	58	55
	200	50	44	42	38	38	33	37	34	60	55	50	45	43	40	43	40	70	65	58	52	49	48	49	46
	100	42	39	33	31	30	25	30	23	54	52	45	41	38	36	36	31	66	64	56	50	47	46	44	39
	50	34	34	30	26	22	21	19	15	49	49	43	38	34	32	30	24	64	63	55	49	45	42	40	32
	20	26	30	27	21	16	15	13	11	44	46	41	35	30	27	25	18	62	61	54	48	43	37	34	24
400		Flow 130 [l/s] / 468 [m³/h]								Flow 400 [l/s] / 1440 [m³/h]								Flow 800 [l/s] / 2880 [m³/h]							
	500	76	71	66	59	55	58	57	56	79	73	67	62	57	60	59	58	82	75	68	65	59	62	61	60
	200	61	58	50	44	43	44	45	41	67	62	56	50	48	48	48	45	74	68	62	56	53	52	52	49
	100	50	45	40	34	36	35	35	29	61	56	49	44	42	39	39	34	72	67	58	53	49	47	46	40
	50	42	37	31	29	28	27	25	20	57	52	44	39	37	35	34	26	71	66	56	50	47	44	44	33
	20	40	34	27	25	24	23	21	11	55	50	40	35	34	32	30	20	70	65	54	47	44	40	38	28
500		Flow 200 [l/s] / 720 [m³/h]								Flow 600 [l/s] / 2160 [m³/h]								Flow 1200 [l/s] / 4320 [m³/h]							
	500	82	76	69	63	62	61	60	59	84	77	70	64	63	62	61	60	85	78	71	65	64	63	62	61
	200	66	60	55	48	45	44	46	43	71	65	59	53	50	50	50	47	77	70	64	58	56	55	54	51
	100	55	50	47	38	38	36	34	31	63	58	53	47	46	44	42	37	72	66	60	55	53	51	49	43
	50	46	40	36	33	32	29	29	25	59	52	47	44	42	38	38	31	71	63	57	54	51	46	46	37
	20	41	33	29	27	26	19	18	20	56	47	42	40	38	32	30	26	70	60	54	52	49	44	40	32
630		Flow 300 [l/s] / 1080 [m³/h]								Flow 900 [l/s] / 3240 [m³/h]								Flow 1800 [l/s] / 6480 [m³/h]							
	500	86	77	71	67	64	61	61	60	88	80	73	69	66	64	63	62	90	83	75	71	68	67	65	64
	200	76	70	63	60	56	53	52	48	78	72	65	62	59	55	55	49	80	74	67	64	60	57	57	50
	100	65	61	52	49	45	43	41	37	71	66	59	54	50	46	45	40	78	71	66	59	56	49	48	44
	50	54	49	45	39	34	36	30	26	66	58	53	48	43	40	39	30	77	68	62	57	51	45	47	36
	20	45	35	38	30	29	29	26	20	61	50	47	43	38	36	33	25	76	65	57	55	46	42	39	30

Damper - rectangular DJP

Description

DJP is a rectangular control and shut-off damper.

DJP has opposing aerodynamic damper blades that are rotated via a lever device. The damper is supplied with an LS connection system for rectangular ducts. The damper can be used for pressure or volume flow regulation with external control options (open, closed, min., max.) depending on the form of control/regulation.

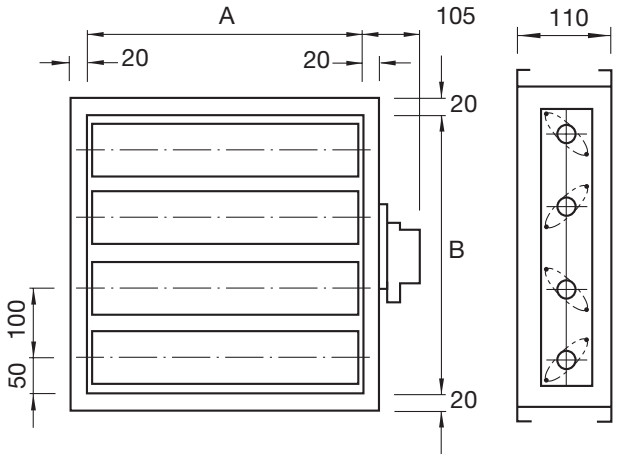
DJP is available with a spring return motor, so the damper can be used as a smoke damper. The damper can be controlled by an FRA (as a VRA) or a PR regulator, directly by a temperature sensor or BMS system (2–10 V modulating) or as a slave for another damper (mechanical slave operation with the same damper position).

When ordering, it is important to specify the form of control, and whether the damper motor must be programmable. All DJP dampers have Belimo motors installed.

Ordering example

Product	**DJP**	**a**	**A x B**	**c**	**d**
Type					
Standard	0				
Spring return	3				
Size					
A (Width)					
B (Height)					
Form of control					
R: Regulator-controlled					
S: Slave or sensor-controlled					
Programming					
U: Without programming					
P: Programmable					

Dimensions



Motor overview

Type	Motor 0	Motor 3
DJP-RU	NM24A-V	NF24A-MF
DJP-RP	NM24A-MF	NF24A-MF
DJP-SU	NM24A-SR	NF24A-SR
DJP-SP	NM24A-MF	NF24A-MF

RU Used only with PR (and FRU) and is preset to a VAV input signal: 6 ± 4 V.

RP Has a programmable motor, is used together with PR and is preprogrammed for a VAV input signal: 6 ± 4 V. Has a modulating output signal indicating damper position for mechanical control of a slave damper.

SU Has a motor, which is controlled by a modulating input signal (2-10 V).
Also has a modulating output signal indicating damper position.

SP Has a programmable motor, which can be controlled by an optional input signal (standard modulating). Also has a modulating output signal indicating damper position for mechanical control of a slave damper.

Damper - rectangular DJP

Technical data

Frequency-related sound effect level

DJP-1m^2		Sound power level [L_{w}] [dB]							
Duct velocity	Pressure difference [Pa]	Centre frequency [Hz]							[L_{WA} (A)] [dB(A)]
		125	250	500	1000	2000	4000	8000	
2m/s	50	62	60	59	53	50	45	42	60
	100	66	64	62	59	57	54	52	65
	200	71	65	63	65	65	61	58	70
	400	81	80	79	81	81	78	76	86
4m/s	50	65	63	62	56	53	48	45	63
	100	69	67	65	62	60	57	54	68
	200	74	68	67	68	68	64	60	73
	400	84	83	82	84	84	81	79	89
6m/s	50	67	65	63	57	54	49	45	64
	100	72	68	67	65	63	58	49	70
	200	75	69	68	70	71	66	63	76
	400	85	84	83	86	85	83	80	91
8m/s	50	68	66	63	59	56	51	48	65
	100	74	73	71	67	65	59	56	73
	200	80	80	79	75	75	70	65	82
	400	87	86	85	87	87	84	81	92

Correction of sound effect level for other damper sizes

Area [m^2]	0,1	0,2	0,4	0,6	0,8	1,0	1,5	2,0
dB correction	-10	-7	-4	-2	-1	0	+2	+3

Damper - rectangular DCT/DJP

Technical data

Dimensioning

When dimensioning the dampers inherent noise from the dampers and their regulating properties (damper characteristics) must be taken into consideration.

If excessively large dampers are used, the working area (angle of rotation) at given V_{min} and V_{max} may be so limited that regulation does not function satisfactorily. Efforts must be made to use damper dimensions that result in the largest possible working areas (angles of rotation).

Due to regulation accuracy, working areas with damper angles > 75° should be avoided. The diagram shows the damper position at given pressure losses and volume flows.

Example

The example shows the working area for a Ø250 mm damper, which works between

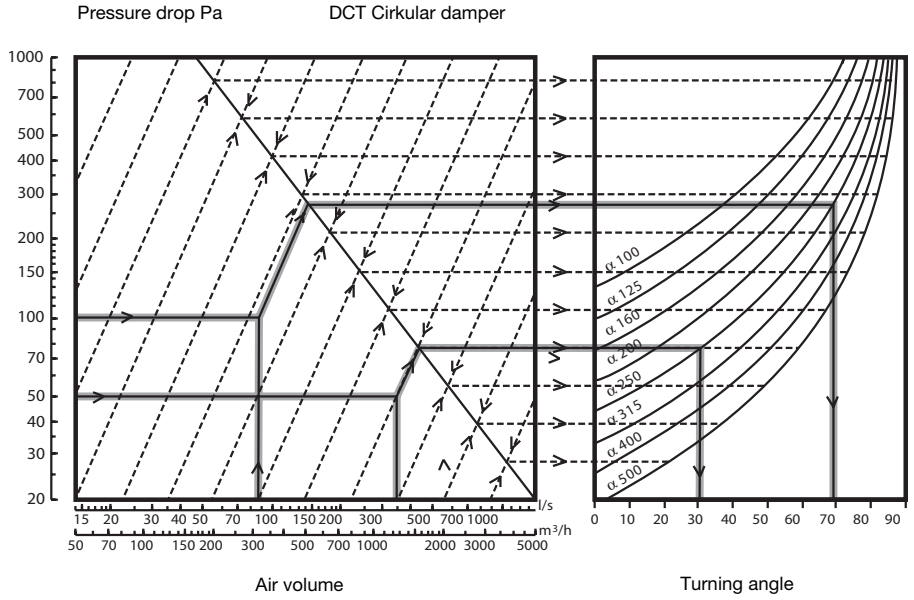
V_{max} =1,236 m³/h; Δp = 50 Pa

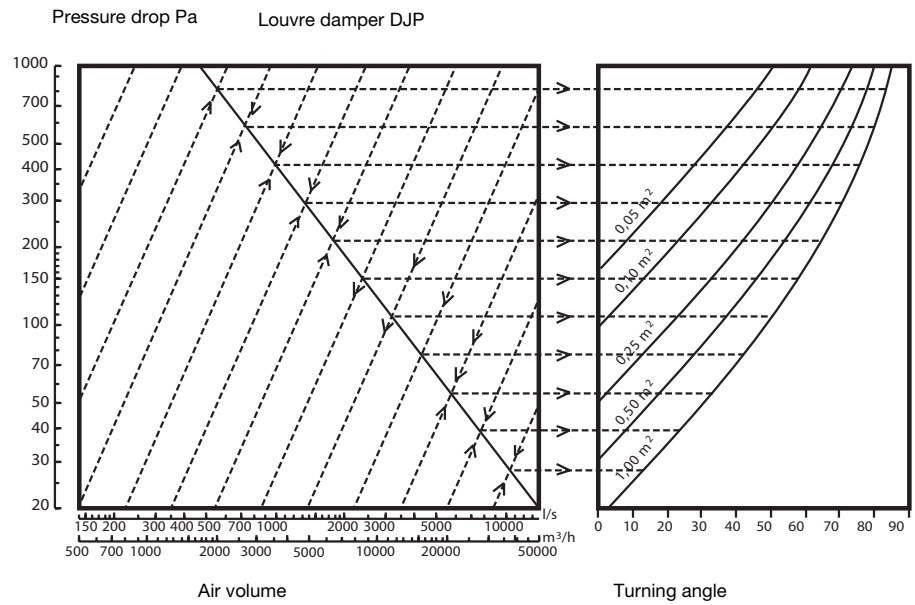
and

V_{min} =309 m³/h ; Δp = 100 Pa.

The diagram shows damper positions 31° and 69°.

Correction of sound effect level for other damper sizes





Insert flow gauge FMI

Description

Insert flow gauge FMI is a calibrated orifice plate that can be installed in circular ducts where it is necessary to measure the volume flow. The pressure over the gauge is taken from the two nipples, and the volume flow is determined using the diagram or the accompanying curve constants.

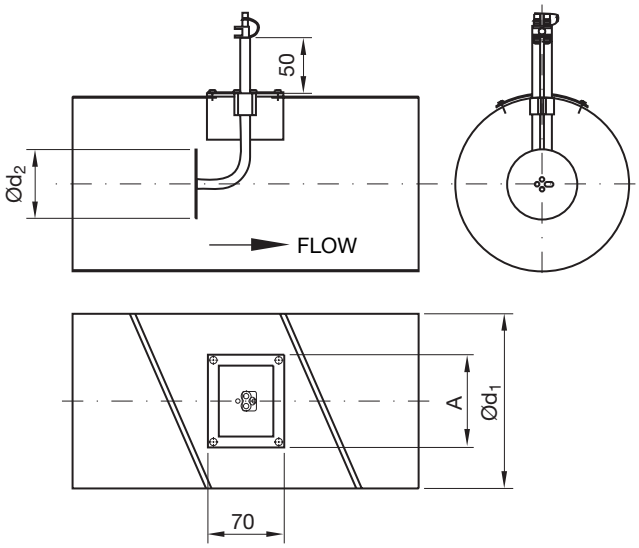
FMI can be installed after duct installation and also in existing systems.

Order code

Product	**FMI**	**aaa**
Type		
FMI		
Dimension Ød$_1$		
80 - 630		

Example: FMI - 250

Dimensions



Ød$_1$ mm	Ød$_2$ mm	A mm
80	35	90
100	43	90
125	53	90
160	63	90
200	83	145
250	103	145
315	116	145
400	151	180
500	191	265
630	241	265

Technical data

The Volumeflow (q) can be calculated from the following formulas:

$$q = k_1\sqrt{\Delta p\ [m^3/h]} \qquad q = k_2\sqrt{\Delta p\ [l/s]}$$

Ød$_1$ mm	K$_1$ [m3/h]	K$_2$ [l/s]
80	11,4	3,18
100	18,7	5,20
125	29,7	8,25
160	51,1	14,20
200	80,3	22,30
250	124,0	34,50
315	211,0	58,50
400	346,0	96,00
500	544,0	151,00
630	875,0	243,00

Materials and finish:

Materials: Galvanised steel and aluminium

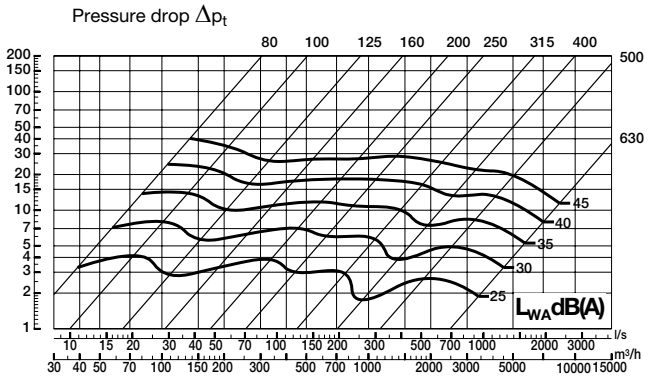
Other colours are available. Please contact Lindab's sales department for further information.

Insert flow gauge FMI

Technical data

Pressure loss – Sound effect

The diagram shows the current pressure loss as a function of the volume flow and A-weighted sound effect level L_{WA} dB(A) at duct. Frequency-related sound effect at duct is shown in the table below.



Measurement accuracy

The length of the straight section of ducting required as a minimum to limit the method error to 5% or 10% respectively is shown in the chart, (d_1 is nom. duct dimension).

Components:	5%	10%
Bend	6 x d_1	0 x d_1
Tee-piece *	5 x d_1	0 x d_1
Damper	6 x d_1	4 x d_1

*) "Tee-Piece" here means a circular joint consisting of a Tee-piece or an attachment.

	Velocity app. 5 m/s							Velocity app. 7,5 m/s							Velocity app. 10 m/s						
dim	Centre frequency [Hz]							Centre frequency [Hz]							Centre frequency [Hz]						
Ød$_1$	125	250	500	1K	2K	4K	8K	125	250	500	1K	2K	4K	8K	125	250	500	1K	2K	4K	8K
	Flow 90 m^3/h (25 l/s)							Flow 135 m^3/h (37,5 l/s)							Flow 180 m^3/h (50 l/s)						
80	45	42	37	28	18	13	12	53	48	44	37	27	21	19	59	53	50	44	36	31	27
	Flow 140 m^3/h (39 l/s)							Flow 210 m^3/h (58 l/s)							Flow 280 m^3/h (78 l/s)						
100	43	40	35	27	19	14	9	53	48	44	36	28	23	18	62	55	51	44	37	33	30
	Flow 220 m^3/h (61 l/s)							Flow 330 m^3/h (92 l/s)							Flow 440 m^3/h (122 l/s)						
125	47	41	34	27	20	15	13	55	50	44	36	30	26	21	62	57	52	45	41	38	31
	Flow 360 m^3/h (100 l/s)							Flow 540 m^3/h (150 l/s)							Flow 720 m^3/h (200 l/s)						
160	46	39	33	27	21	16	13	55	48	42	36	31	26	21	62	56	51	44	40	37	30
	Flow 540 m^3/h (150 l/s)							Flow 810 m^3/h (225 l/s)							Flow 1080 m^3/h (300 l/s)						
200	42	36	31	24	18	20	12	49	46	41	34	29	29	23	55	55	49	44	40	37	35
	Flow 880 m^3/h (244 l/s)							Flow 1320 m^3/h (367 l/s)							Flow 1760 m^3/h (488 l/s)						
250	47	38	31	28	24	22	18	51	46	40	37	34	32	29	57	52	47	45	43	42	42
	Flow 1400 m^3/h (389 l/s)							Flow 2100 m^3/h (583 l/s)							Flow 2800 m^3/h (778 l/s)						
315	42	35	31	28	24	22	15	50	43	39	37	33	32	26	55	50	46	45	42	42	39
	Flow 2200 m^3/h (610 l/s)							Flow 3300 m^3/h (920 l/s)							Flow 4400 m^3/h (1220 l/s)						
400	45	41	34	33	30	26	16	54	48	43	41	39	36	28	61	53	50	48	46	45	42
	Flow 3500 m^3/h (792 l/s)							Flow 5200 m^3/h (1444 l/s)							Flow 7000 m^3/h (1944 l/s)						
500	38	34	31	30	28	25	17	48	44	41	40	38	35	27	58	54	51	50	48	45	37
	Flow 5600 m^3/h (1556 l/s)							Flow 8400 m^3/h (2333 l/s)							Flow 11200 m^3/h (3111 l/s)						
630	38	33	31	31	28	26	22	48	43	41	41	38	36	32	58	53	51	51	48	46	42