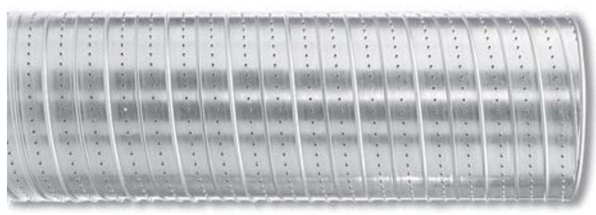
Ventiduct nozzle ducts VSR

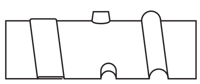


Description

Ventiduct is an air distribution system consisting of spiral-seamed circular ducts that is equipped with a large number of small nozzles inserted into the duct wall. They are supplied in five sizes from ø200 mm to ø500 mm and with various nozzle patterns, which should be chosen according to the task in hand.
Maximum standard length is 3,000 mm. The ducts have a raised protective cover to prevent the nozzles becoming deformed during transport. Ventiduct ducts can be supplied in hot-galvanised or powder-coated versions. The system should be primarily used for the supply of cooled air.

- Large cooling effect
- Large dynamic range
- Large induction rate
- Short throw
- Discrete diffuser design
- Easy to install

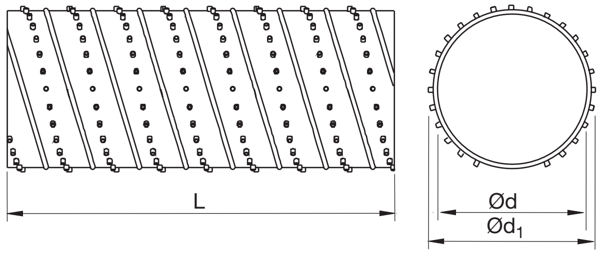
Cross-section of nozzle duct



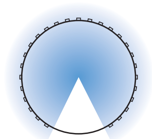
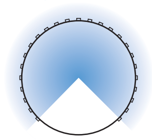
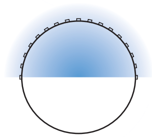
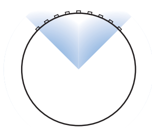
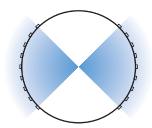
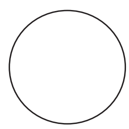
Order code

Product	**VSR**	**aaa**	**bbb**	**cccc**	**d/e**
Type	✓				
Ød		✓			
Nozzle pattern			✓		
Length/no. of parts				✓	
Finish 0 Galvanised 1 Powder coated					✓

Dimensions



Ød mm	Ød1 mm	L mm	Weight kg
200	212	3000	4,5
250	262	3000	5,4
315	327	3000	6,9
400	412	3000	8,6
500	512	3000	10,9

Nozzle pattern		Code
300°		300
270°		270
180°		180
90°		090
2 × 90°		290
Blind piece without nozzles spiral-seamed long-seamed		 000 001

The blind piece is a specially made spiral-seamed pipe that resembles ventiduct in design, as it has no actual nozzles.

Available in the same length as ordinary nozzle ducts.

Alternatively long-seamed pipes can be used, which creates an attractive contrasting effect.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

Dispersal patterns

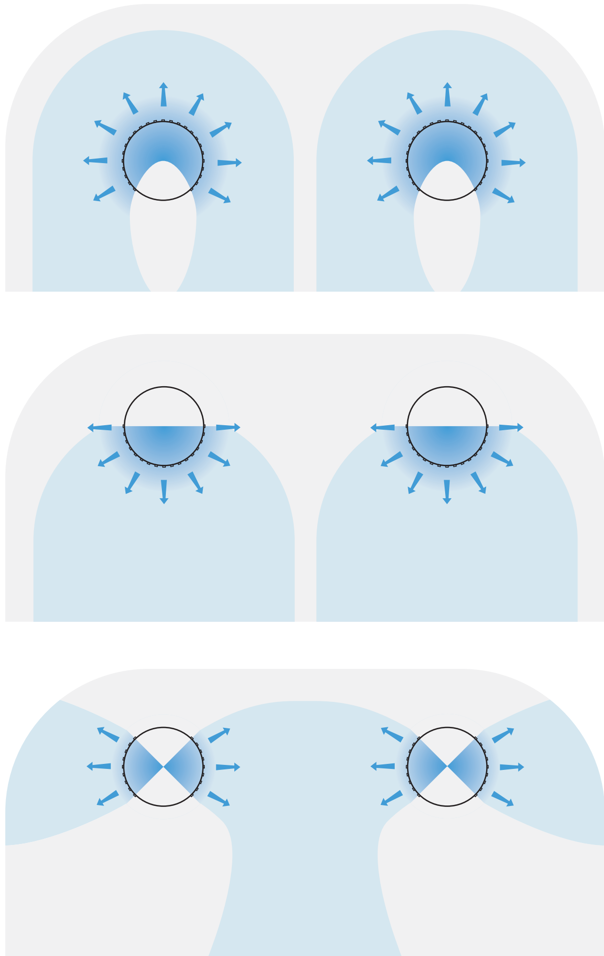
With Ventiduct nozzle ducts, various flow conditions can be achieved in the room. The downward supply of air always creates the greatest air speeds in the occupied zone and is therefore used mostly in industrial ventilation. The choice between air being supplied horizontally or upwards depends on the required form of flow.

Upward supply air
When cooled air is supplied upwards, the cool air mixes with the warmer room air close to the blowing ducts. The blown air typically covers a vertical area of 2-4 metres below the ducts. At greater distances between the blowing ducts, the blown air flows behind in a displacement flow further out in the room.
Depending on the required volume flow, a nozzle pattern of between 90° and 300° is used.

Downward supply air
When air is supplied downwards, the air speeds in the occupied zone are increased by the thermal forces (by cooling) and by the dynamic forces (blowing speed). This can result in quite high air speeds in the occupied zone, which is not acceptable for traditional comfort ventilation. However, blowing can be recommended if a stable downward flow of air is required, and if increased air speeds in the occupied zone are acceptable. This could, for example, be desirable for industrial assignments. A nozzle pattern between 90° and 300° is used, depending on the volume flow required.

Horizontal supply air
When air is supplied horizontally, air jets are formed, creating a mixed flow in the room. Depending on the various parameters, maximum air speeds occur in the occupied zone due to the thermal load, air jet speeds or a combination of both. When low blowing speeds are being used (low volume flow or large ducts/nozzle patterns) the form of the flow approximates a form of low impulse blowing, as with blowing upwards. Horizontal blowing can be used in locations where there is a deliberate demand for a flow of air throughout the premises in accordance with the mixing principle, and therefore where an upward supply is not being used.

Dispersal patterns



Recommended working areas for Ventiduct
The values stated are for guidance only and should be used with care, as incoming volume flow, cooling temperature, duct design and air pattern all have a great deal of influence on the resulting speed in the occupied zone. For more detailed calculations, Lindab will be happy to carry out a computer calculation based on an actual installation.

Air pattern	Up	Down	Horizon-tal
Installation height [m] *	2,5–5,0	3,0–8,0	2,5–5,0
Min. distance from ceiling [m] **	0,2	0,1–0,2	0,1
Δt (t_1 - t_r) [K]	-1..–10	-1..–6	-1..–8

* Distance from floor to lower edge of duct

** Distance from upper edge of duct to ceiling must be maintained to avoid dirtying the ceiling

Technical data

Max. volume flow per metre pipe (m³/h)

	Nozzle pattern			
Dim	**90°**	**180°/2×90°**	**270°**	**300°**
200	45	95	140	155
250	60	115	175	195
315	75	150	220	245
400	95	190	280	315
500	115	235	350	390

Max. total duct length (m)

	Nozzle pattern			
Dim	**90°**	**180°/2×90°**	**270°**	**300°**
200	14	7	5	4
250	17	8	6	5
315	21	11	7	6
400	27	14	9	8
500	34	17	11	10

Sound effect level L_w (dB) = $L_{WA} + K_{ok}$

Dim	125	250	500	1K	2K	4K	8K
200	-7	0	1	-6	-15	-21	-27
250	-5	1	-1	-5	-11	-18	-22
315	1	2	-2	-4	-11	-16	-19
400	-1	-1	-3	-4	-9	-14	-17
500	4	0	-3	-4	-9	-16	-14

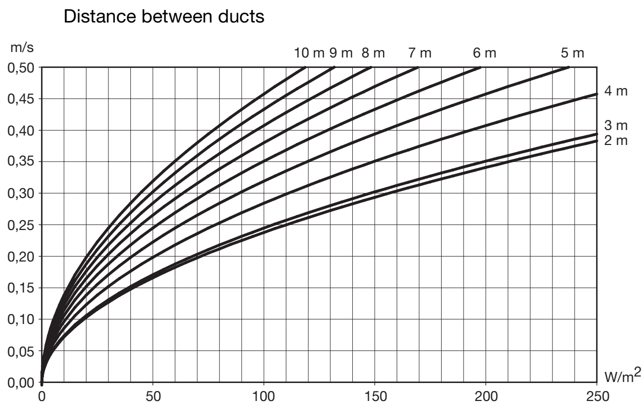
Technical data

Speed in the occupied zone

The speed in the occupied zone is a result of air jet speeds and thermal air movements in the room. An exact calculation of the resulting speed in the living zone can be performed using a computer program (contact the sales department in Farum or Viby).

For upward supply the maximum speeds in the occupied zone are dependent on the temperature difference t_i-t_r. The best results are achieved by using maximum supply per metre pipe according to the table on the left.
Depending on the thermal load (W/m²) and the pipe length, the maximum speed in the occupied zone is indicated as a rough estimate in the diagram below.

Diagram only applies to upward dispersal pattern with maximum volume flow per metre pipe:
(distance to ceiling > 4 × Ø d).

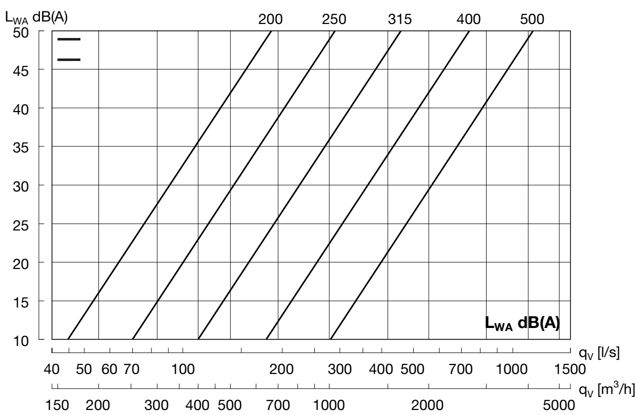


Please contact Lindab's sales department for further information.

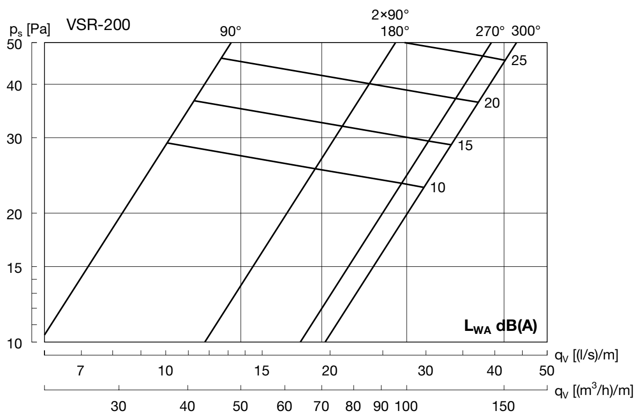
Pressure and sound

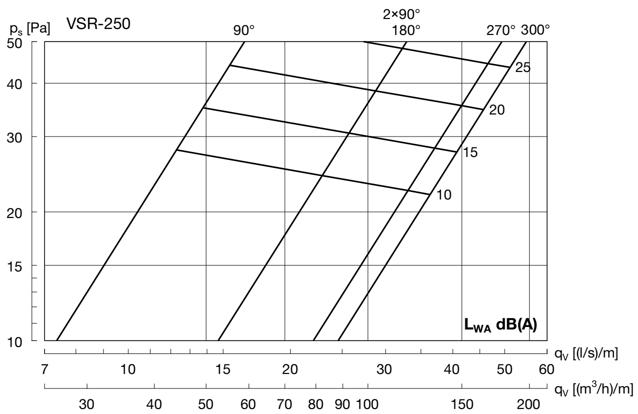
For calculation of the resulting sound power level from a ventiduct, add the sound power level from the nozzles ($L_{WA\ nozzles}$) and the sound power level from the flow noise in the ventiduct ($L_{WA\ pipe}$) logarithmically.

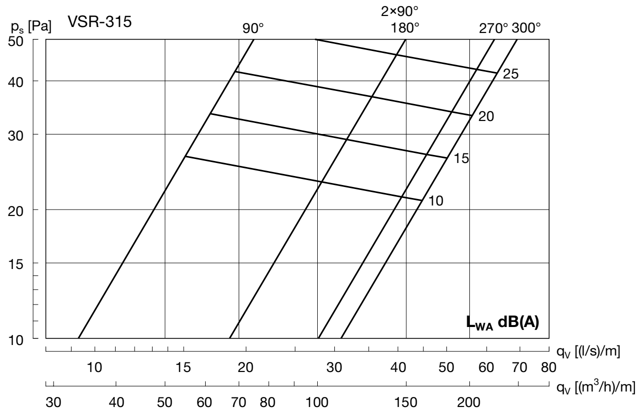
Flow noise in duct

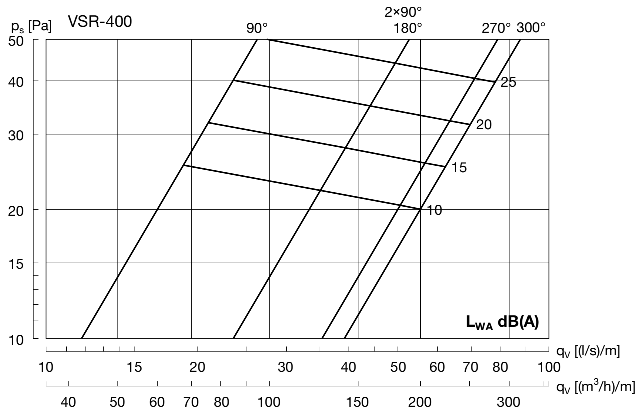


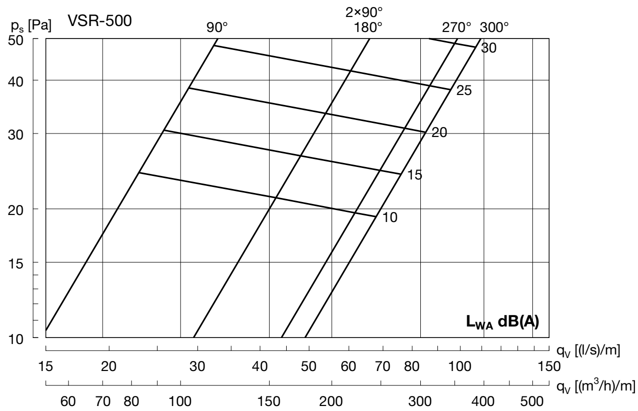
Sound effect level from nozzles









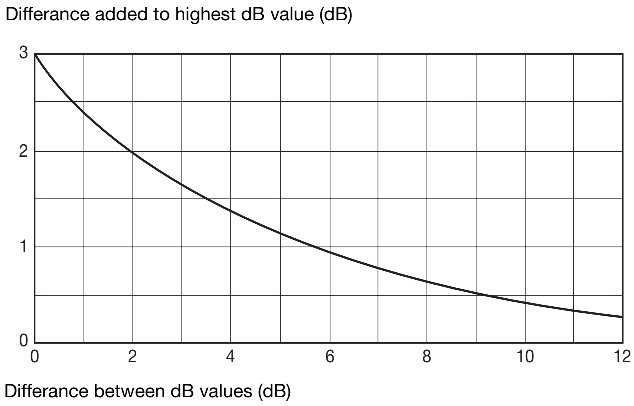


The sound levels from the nozzles apply for duct length 1 m

Correction for other duct lengths:

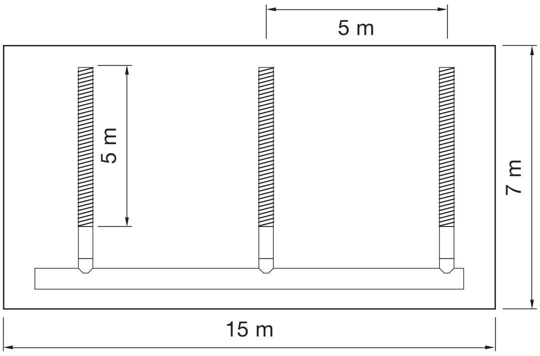
Length m	1,0	1,5	2,0	2,5	3,0	4,0	5,0	6,0
Corrections	0	2	3	4	5	6	7	8

Addition of sound levels from nozzles and duct:



Technical data

Calculation example



Required information:

Pressure loss: p_t [pa]
Resulting sound level in the premises: L_p [dB(A)]
Max. speed in the occupied zone: v_{occ} [m/s]

Calculation based on catalogue values:

VSR-250, 270°	
Ceiling height	5,0 m
Installation height upper edge duct	4,5 m
Volume of the room:	525 m^3
Hard room	(T_s ~ 1,9 s)
Volume flow	2400 m^3/h (667 l/s)

The following can be determined from the diagrams on the previous page:

Pressure loss:	40 Pa
Sound effect: $L_{WA\ pipe}$:	41 dB(A)
Sound effect: $L_{WA\ nozzle}$:	22 dB(A)

Duct length of 5 m = > correction of + 7

Sound effect nozzles corrected: $L_{WA\ nozzles}$ = 22 + 7 = 29 dB(A)

Addition of sound levels from nozzles and duct:

Difference: 12 dB -> No addition
Three identical sound sources: + 4,8
(see figure 25 in the Theory section)
Sound effect L_{WA} for three pipes: 41+ 5= 46 dB(A)

Resulting sound level:
The sound formula from *page 46 in the Theory section* is used

The absorption area of the room is determined by

$A = 0,16\ (V/T_s) = 0,16\ (525/1,9) = 44\ m^2$ Sabine

Based on *Figures 27 and 28 in the Theory section*,
room attenuation D is determined:

Figure 27: $\sqrt{n}/\sqrt{Q}$ = 1,7 for direction factor Q = 1 and n = 3

1.5 m above the floor is distance to pipe r = 4.5-0.25-1.5 = 2.75 m

Figure 28: $r\sqrt{(n/Q)}$ = 4.7 and A = 44 => D = 10 dB

Resulting sound pressure in the room:

$L_p = L_{WA}$ (for three pipes) – D = 46–10 = 36 dB(A)

Φ = 3,2 kW => ΔT = 3200/(667·1,2) = -4 K

3200 W/(15 m x 5 m)

=> 43 W/m^2 in the actively ventilated area

Speed in the occupied zone according to the diagram:

43 W/m^2 and 5 m distance => v_{occ} = 0.21 m/s

Dimensiononig of Ventiduct

Projekt :

Produktionslokale

Rum

Længde	m	7	A_{total} m^2	105,0
Bredde	m	15	V m^3	525
Højde	m	5	Fri afstand	
Opholdszone	m o. floor	1,8	ok rør/loft	
Montagehøjde (ok) rør	m	4,5	ok	0,50
Efterklangstid Ts	s	1,9	Rumdæmpning	
Absorptionskoefficient	α_m	0,10	hårdt	

		A	B	C
Dimension		Ø D 250	Ø D 250	Ø D 250
Mønster		270i	270i	270i
Spredning		opad	opad	opad
Volumenstrøm (total)	m3/h	2400	2400	2400
Undertemperatur	K	2	4	6
Antal rør	stk.	3	3	3
Længde pr. rør	m	5	5	5
Afstand mellem rør eller B/n	m	5	5	5

		A	B	C
Aktiv rumareal	m^2	75	75	75
(areal)		ok	ok	ok
(bredde)		ok	ok	ok
(længde)		ok	ok	ok
Maks. flow pr. m Ventiduct	m3/(hm)	175	175	175
Aktuelt flow pr. m rør	m3/(hm)	160	160	160
Kontrol maks. flow pr. m		ok	ok	ok
Total rørlængde	m	15,0	15,0	15,0
Kontrol maks. r˝rlængde		ok	ok	ok
Afstand gulv / uk rør	m	4,25	4,25	4,25
Termiske parametre				
Køling total	W	1632	3264	4896
Q/A_{total}	W/m^2	16	31	47
Luftskifte	1/h	4,6	4,6	4,6
Flow pr A_{aktiv}	m3/(hm2)	32	32	32
Q/L	W/m	109	218	326
Q/A_{aktiv}	W/m^2	22	44	65
Lyd				
Flow pr. rør	m3/h	800	800	800
Maks. kanalhastighed	m/s	4,5	4,5	4,5
dyser	dB(A)	30	30	30
kanal	dB(A)	41	41	41
Lydeffekt pr. rør	dB(A)	42	42	42

Resultat

Maks. hastighed	**m/s**	**0,15**	**0,21**	**0,25**
Resulterende lydtrykniveau	**dB(A)**	**36**	**36**	**36**
Totaltrykfald	**Pa**	**53**	**53**	**53**

Bemærkninger

Indblæsning af 2400 m3/h i lokale på 15 x 7 m (LH = 5,0m)
Termisk belastning 3,2 KW
"Hårdt" rum (efterklangstid: Ts 1,9 sek.)

(Printout from the program)

Lindab is able to offer complete calculations for an actual installation using our internal dimensioning program (see printout above from the program). Based on the specification of a large number of variables, detailed information can be obtained on maximum speeds in the occupied zone, pressure loss and resulting sound levels in the premises for the overall installation. Variables that it is not possible to include in calculations based on the catalogue values.

Contact Lindab for further information.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

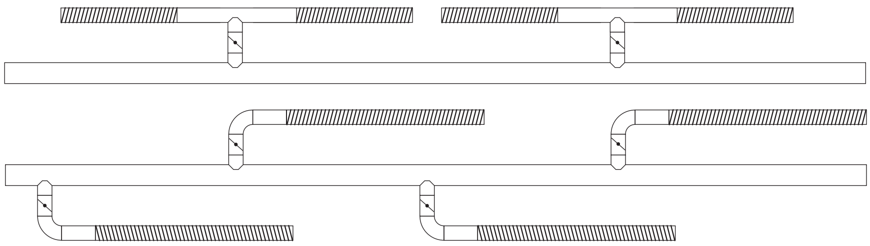
Technical data

Examples of duct design

Ventiduct nozzle ducts can be installed in various ways. In high-ceilinged premises it is generally an advantage to install Ventiduct nozzle ducts as low down as possible (min. height above floor 2.5 m). This provides the greatest efficiency.

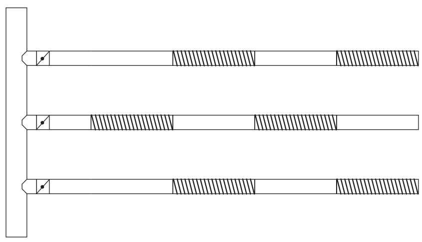
Cactus model

This solution is used for long, narrow rooms.



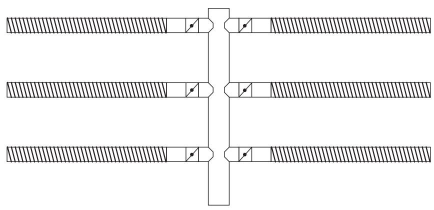
Exchange model

An ideal solution for long, narrow premises. This model provides an even distribution of supplied air.



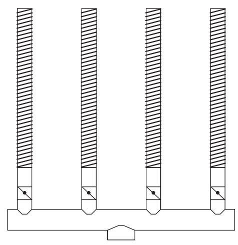
Fishbone model

Ventiduct nozzle ducts stretch out from both sides of the main duct. It is recommended that an adjustment damper be used for accurate regulation of the air volume.



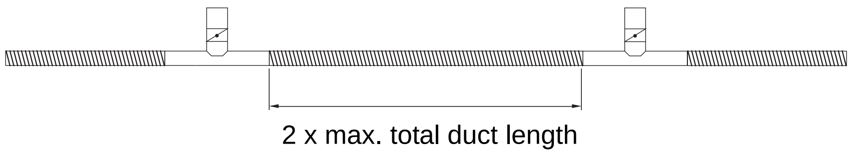
Fork model

Here the Ventiduct nozzle ducts are positioned on one side of a main or branch duct.

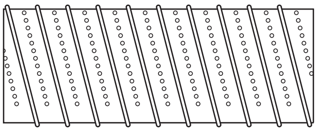


Line model

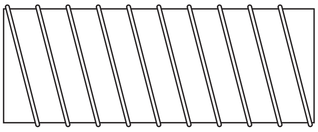
A simple solution that makes duct installation easier and minimises the number of adjustment dampers. The distance between the connection ducts is equivalent to twice Ventiduct's maximum length plus the two blind pieces.



Components



VSR nozzle duct - Nozzle pattern 90 - 300
Ventiduct nozzle ducts over 3 m are supplied in multiple sections, e.g. one 4 m long duct is supplied in two 2 m lengths.



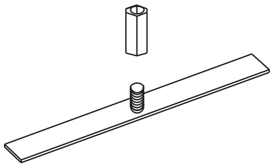
VSR 000
Blind piece without nozzles, spiral-seamed.

VSR 001
Blind piece without nozzles, long-seamed (smooth)

Order code

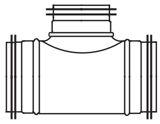
Product	INV	aaa
Type		
Dimension Ød		

Accessories

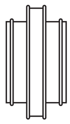


INV
Mounting bracket for Ventiduct

OSB10
Threaded rod

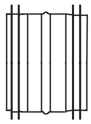


TCPU
T-piece

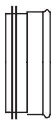


DIRU
Iris damper

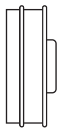
DRU
Balancing damper



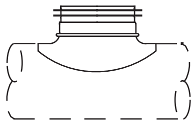
NPU
Spigot



ESU
End cap



ESUH
End cap with handle



PSU
Saddle

All accessories are supplied in the same material as the Ventiducts, and can also be supplied with a powder-coated finish.

Other components
Motorised shut-off and adjustment damper DCT and volume flow regulator VRU incl. accompanying silencer SLU.

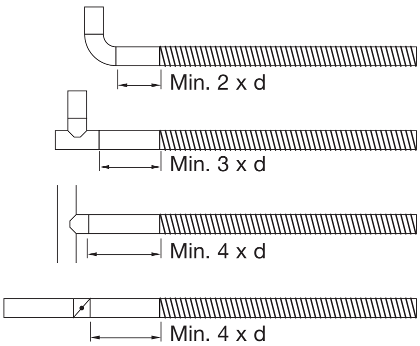
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

Technical data

Building-in distance

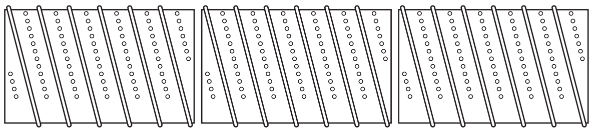
Ventiducts should not be positioned too close to dampers, bends, T-pieces or other elements that may create turbulence and hence noise.
Straight duct sections should be installed between the Ventiducts and potentially disruptive components, as shown in the illustration below. Suitable duct sections are available.



Mounting

Assembly

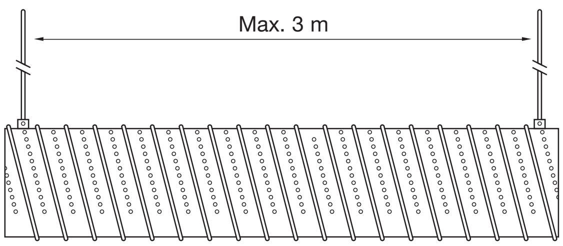
The Ventiducts are individually packed in cardboard boxes at the factory, to minimise the risk of transport damage.
The packaging is numbered to ensure that the ducts are mounted in the correct order, so that the spiral seam is continuous.



Suspension

If it is necessary to be able to dismantle the Ventiducts, e.g. for cleaning, we recommend using Lindab Transfer connections (see Lindab's Duct Systems catalogue)

IMPORTANT: In order to maintain the number sequence, the Ventiducts should be left in their packaging until mounting commences.



Maximum distance between suspension loops is 3 metres.

Balancing

Measuring of the airflow

The easiest way to measure the volume flow is to measure the nozzle pressure in the middle of the Ventiduct (see sketch).
To do this, attach the hose from the manometer to one of the nozzles. The static pressure (P_s) in the duct can then be read.
Once you know the static pressure, you can read the volume flow per m/duct from the "Sound and pressure" diagram for the relevant duct dimension and nozzle pattern.

The total volume flow can thus be calculated by multiplying the relevant diagram value by the total active length of the Ventiduct.