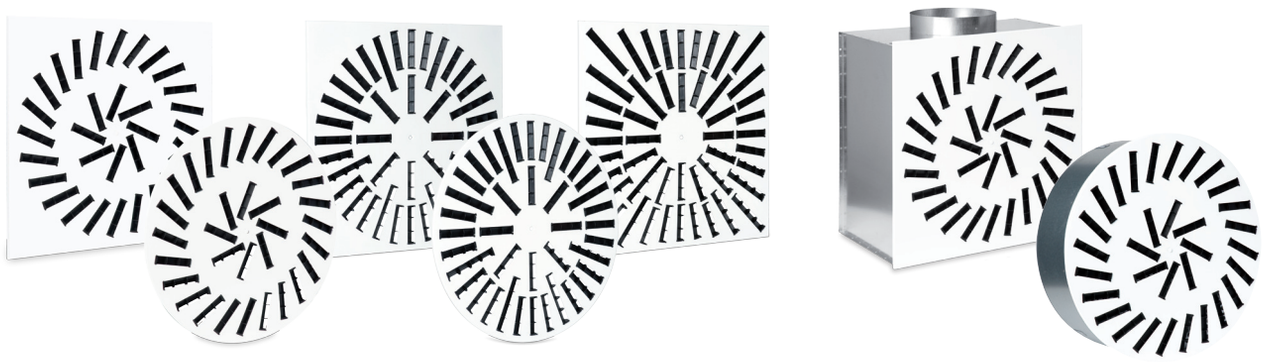
VVKR

Swirl ceiling diffuser with adjustable deflectors



Ordering codes

VVKR-□□□□□□□

Type	A B C	
Round front plate Square front plate	R S	
Dimensions	300 - 825	
Number of deflectors	8 - 92	
Deflectors	Black White without blades (extract air)	B W R
Material / surface finish	AISI304 AISI316 RALxxx	

Ordering Code example:

VVKR - A - S - 300 × 8 - W - RAL9010

Swirl diffuser with adjustable deflectors, type-A square diffuser face size 300×300 mm with 8 deflectors. Deflectors are painted white (W).

NOTE:
Combinations of diffuser types, dimensions and number of deflectors need to be based on Fig. 6 (page 3).

Description

VVKR is a swirl ceiling diffuser with manually adjustable air guiding deflectors. It enables us to adjust the airflow pattern to individual requirements of the room at any time. Ideal to use in shopping halls, receptions, or offices. The diffuser is suited for both cool and hot air application, and can be used for extracting air with or without deflectors. The maximum recommended installation height is 4 meters. Supply air temperature can vary from -10K to +10K based on the room air temperature. The diffuser can be used for large air volume exchanges at high temperature differences ΔT. The front plate is installed to a plenum box with top or side entry.

Information about accessories for VVKR is available on page 14.

- PB-VVK - Plenum box
- PB-VVKU - Universal plenum box

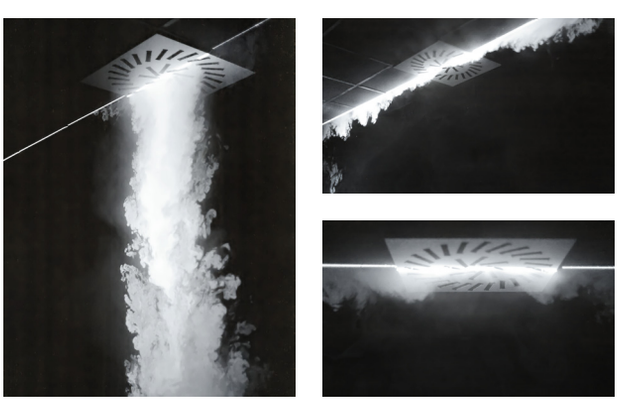


Fig. 1: Air flow visualisation at different deflector configurations (figure left: vertical flow, figure right: horizontal flow)

Design

Material used

The diffuser can be supplied with a round or square front plate manufactured from galvanized steel. The surface is powder painted white RAL9010 as standard, or another RAL code can be specified. It is also possible to manufacture a stainless steel AISI304 or AISI316 version, without surface finish.
The deflectors are made from plastic, available in black or white colour. In the middle of the diffuser there is a pre-punched hole for front plate screw fixing. A screw with a white decorative cap for its installation is provided together with a self-adhesive seal, which must be adhered at the installation site.

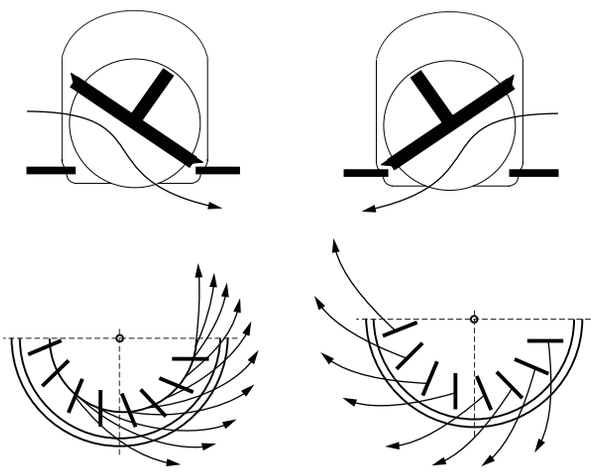


figure left: inner swirl, figure right: outer swirl

Fig. 2: Beveled deflectors configuration

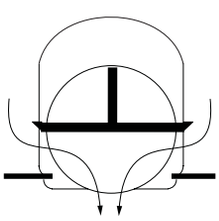


Fig. 3: Vertical airflow

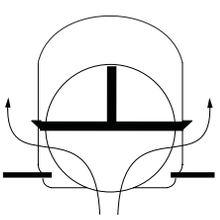
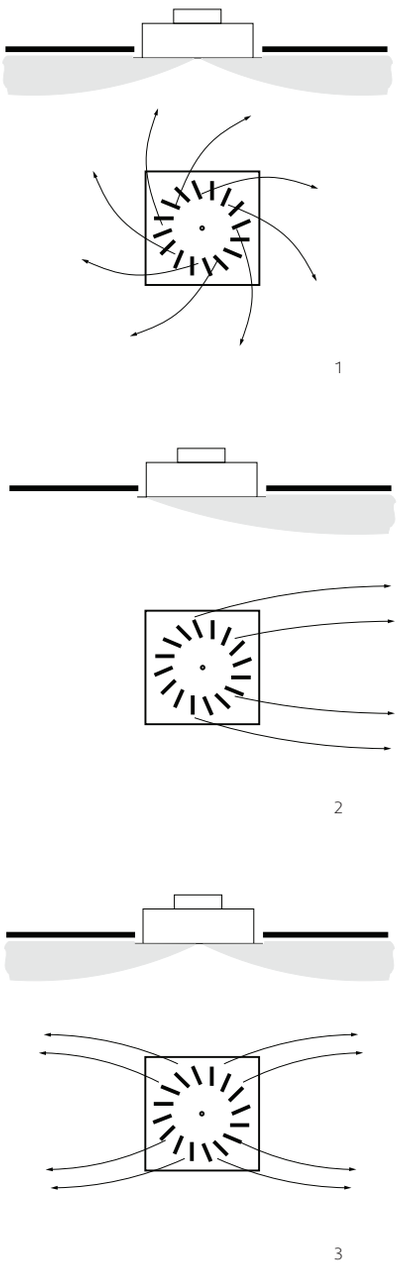


Fig. 4: Extract airflow with deflectors



1. All deflectors are set to an external helix
2. Half of the deflectors are always configured to the internal, or external helix, respectively
3. Deflectors of opposite quadrants are set to the internal, or external helix, respectively

Fig. 5: Different ways of deflectors configuration and airflow direction

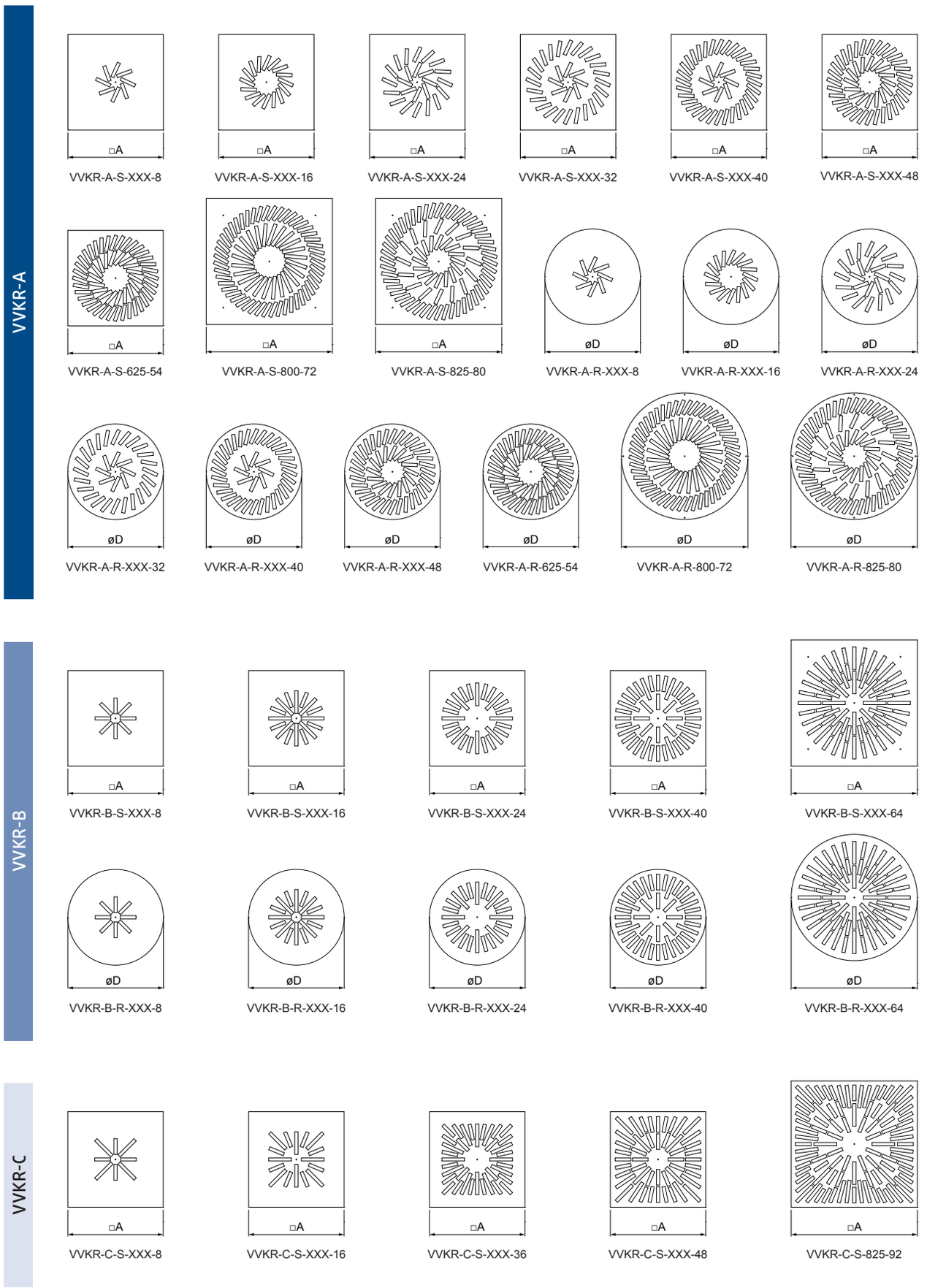


Fig. 6: Diffuser types and shapes

NOTE: The front plate sizes (XXX) for different diffuser types and number of nozzles are available in Tab. 4 on page 4.

Dimensions

Size	□A	øD
	(mm)	
300	296	298
400	396	398
500	496	498
600	596	598
625	621	623
800	796	798
825	821	823

Tab. 1: Diffuser dimensions

Size	Number of deflectors									
	8	16	24	32	40	48	54	64	72	80
300	0,5									
400	0,9	0,9								
500	1,4	1,4	1,3							
600	2,7	2,0	1,9	1,9	2,3	1,8				
625	2,8	2,2	2,1	2,1	2,5	2,6	2,5			
800								4,2	4,3	
825								4,4		4,6

Tab. 2: Weight for round diffusers (kg)

Size	Number of deflectors											
	8	16	24	32	36	40	48	54	64	72	80	92
300	0,7											
400	1,2	1,1										
500	1,9	1,8	1,7		1,6							
600	2,6	2,6	2,5	2,5	2,4	2,5	2,4					
625	2,8	2,8	2,8	2,7	2,6	2,7	2,6	2,6				
800									4,5	4,5		4,1
825									4,7		4,8	4,4

Tab. 3: Weight for square diffusers (kg)

Type	Size × Number of deflectors	Free area	
		With deflectors	Without deflectors
		(m^2)	
A	300×8, 400×8, 500×8, 600×8, 625×8	0,00814	0,01714
	400×16, 500×16, 600×16, 625×16	0,01628	0,03427
	500×24, 600×24, 625×24	0,02443	0,05141
	600×32, 625×32	0,03257	0,06854
	600×40, 625×40	0,04071	0,08568
	600×48, 625×48	0,04885	0,10282
	625×54	0,05496	0,11567
	825×80	0,08142	0,17136
	800×72	0,08575	0,17706
B	300×8, 400×8, 500×8, 600×8, 625×8	0,00814	0,01714
	400×16, 500×16, 600×16, 625×16	0,02044	0,04188
	500×24, 600×24, 625×24	0,02858	0,05902
	600×40, 625×40	0,04487	0,09329
	800×64, 825×64	0,07761	0,15992
C	300×8, 400×8, 500×8, 600×8, 625×8	0,01022	0,02094
	400×16, 500×16, 600×16, 625×16	0,02044	0,04188
	500×36, 600×36, 625×36	0,04288	0,08853
	600×48, 625×48	0,05717	0,11804
	825×92	0,11235	0,23131

Tab. 4: Free area

Diffuser size	Number of deflectors																										
	8					16				24			32		36			40		48		54	64		72	80	92
	Plenum box size																										
	300	400	500	600	625	400	500	600	625	500	600	625	600	625	500	600	625	600	625	600	625	625	800	825	800	825	825
300	•																										
400	•	•				•																					
500	•	•	•			•	•			•					•												
600	•	•	•	•		•	•	•		•	•		•		•	•		•		•							
625	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•					
800																							•	•	•		
825																							•	•		•	•

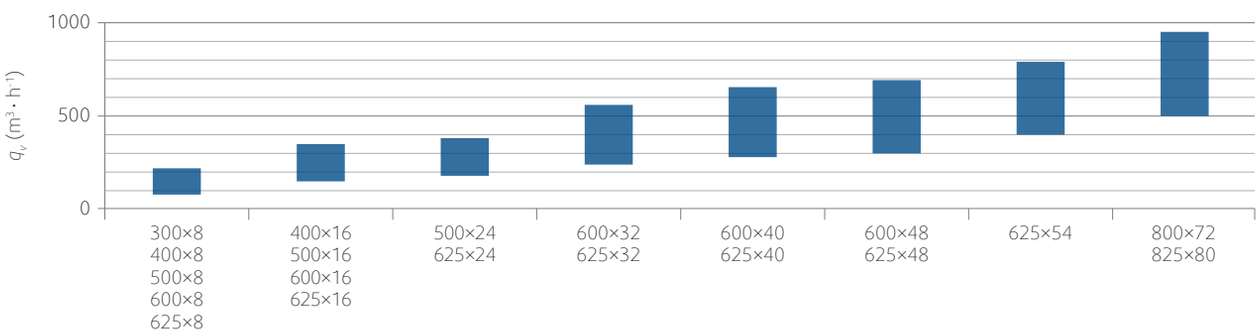
Tab. 5: Overview of possible plenum box and diffuser combinations

NOTES:
For square diffusers VVKR-A or VVKR-B it is possible to use both round and square plenum boxes.
For round diffusers it is only possible to use round plenum boxes.
For diffusers VVKR-C it is only possible to use square plenum boxes.

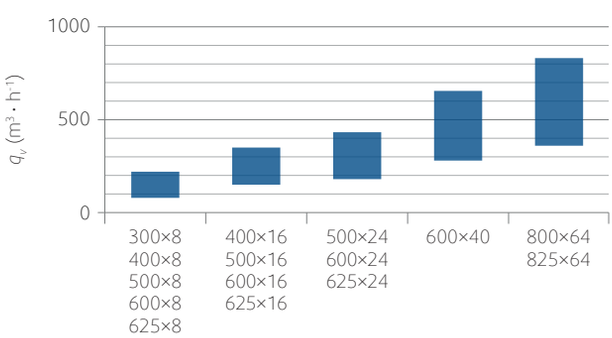
Legend

•	- Recommended plenum box size for diffuser with number of deflectors

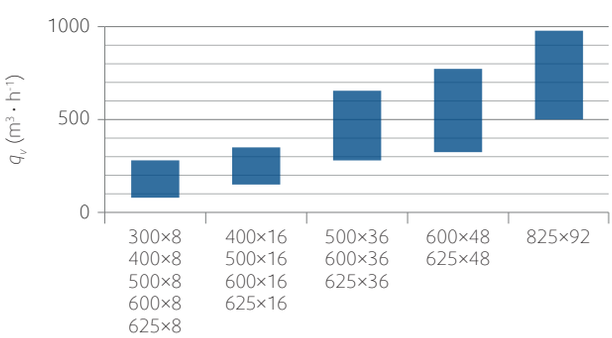
Quick selection



Tab. 6: Quick selection table for VVKR-A for air supply via a plenum box with horizontal connection



Tab. 7: Quick selection table for VVKR-B for air supply via a plenum box with horizontal connection



Tab. 8: Quick selection table for VVKR-C for air supply via a plenum box with horizontal connection

Technical parameters

Terminology

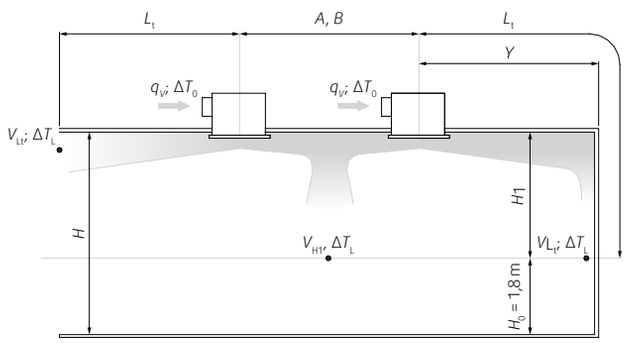


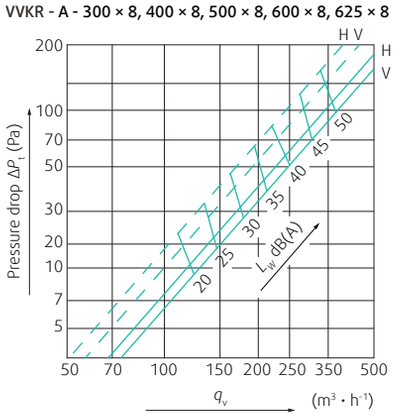
Fig. 7: Airflow inside the room

Legend

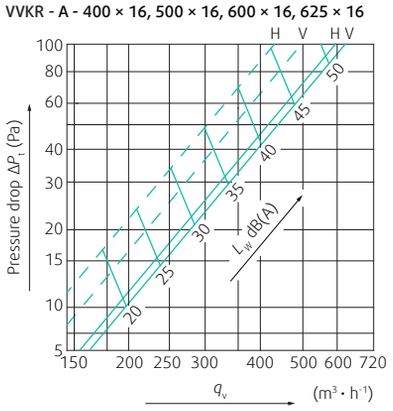
q_v	(m³/h)	- Air flow volume per 1 diffuser
Y	(m)	- Horizontal distance to the wall
H	(m)	- Room height
H_1	(m)	- Distance from the ceiling to the occupied zone
H_0	(m)	- Occupied zone
L_t	(m)	- Throw distance: by the wall - $L_t = H_1 + Y$ between diffusers - $L_t = H_1 + A/2$
V_{Lt}, V_{H1}	(m/s)	- Air velocity at throw distance L_t
ΔT_0	(K)	- Temperate difference between the supply and room air
ΔT_L	(K)	- Difference between the airflow core and room air temperature
Δp_t	(Pa)	- Pressure drop
L_W	dB(A)	- Sound power level
A, B	(m)	- Distance between diffusers by length and by width of the room (A = distance between columns, B = distance between rows)

Pressure drop & sound power level of the supply air

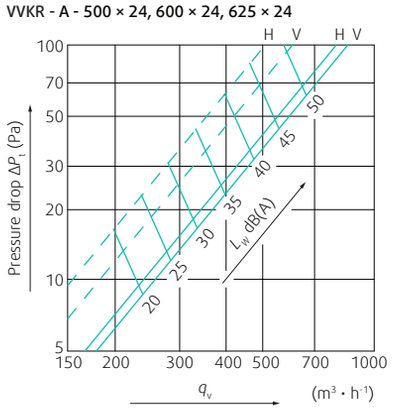
VVKR - A - 300 × 8, 400 × 8, 500 × 8, 600 × 8, 625 × 8



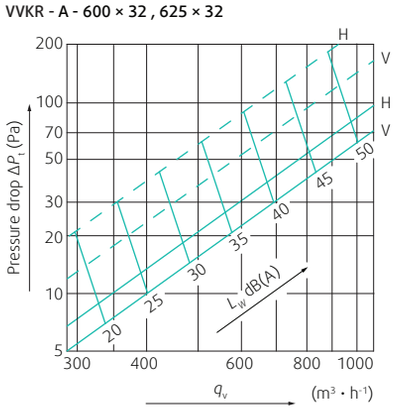
VVKR - A - 400 × 16, 500 × 16, 600 × 16, 625 × 16



VVKR - A - 500 × 24, 600 × 24, 625 × 24

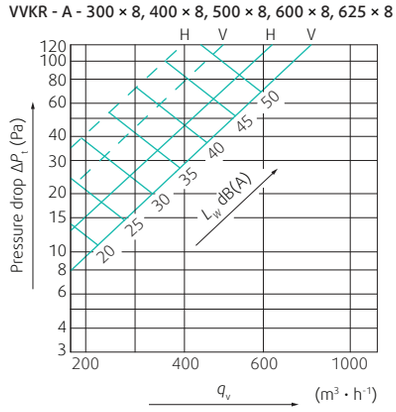


VVKR - A - 600 × 32 , 625 × 32

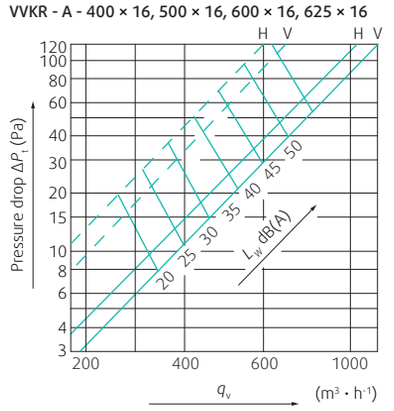


Pressure drop & sound power level of the extract air

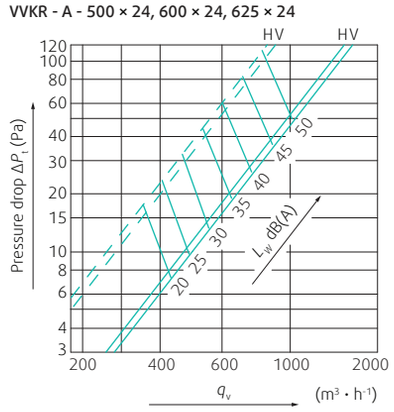
VVKR - A - 300 × 8, 400 × 8, 500 × 8, 600 × 8, 625 × 8



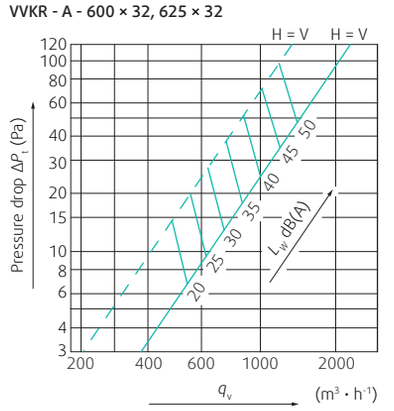
VVKR - A - 400 × 16, 500 × 16, 600 × 16, 625 × 16



VVKR - A - 500 × 24, 600 × 24, 625 × 24

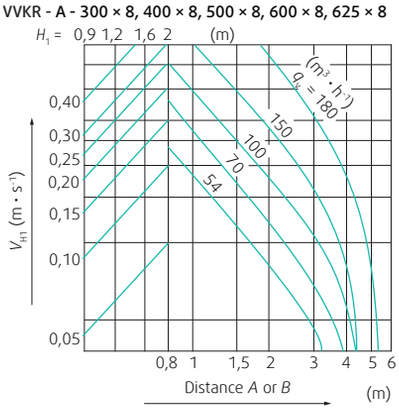


VVKR - A - 600 × 32, 625 × 32

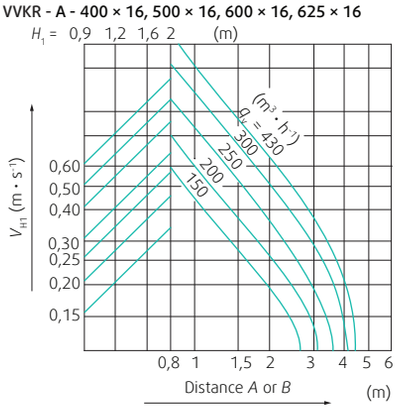


Air flow velocity in the occupied zone

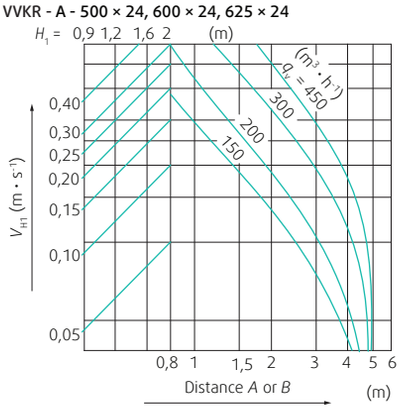
VVKR - A - 300 × 8, 400 × 8, 500 × 8, 600 × 8, 625 × 8



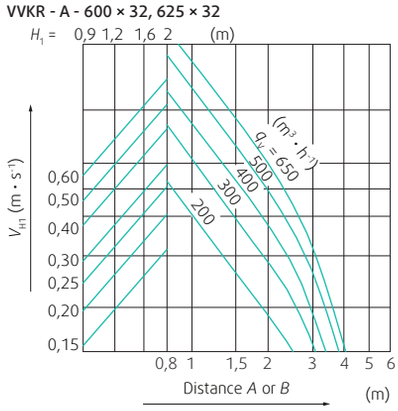
VVKR - A - 400 × 16, 500 × 16, 600 × 16, 625 × 16



VVKR - A - 500 × 24, 600 × 24, 625 × 24

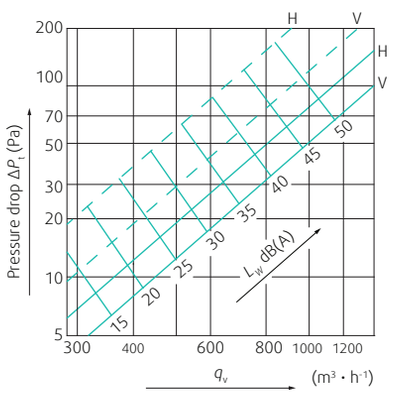


VVKR - A - 600 × 32, 625 × 32

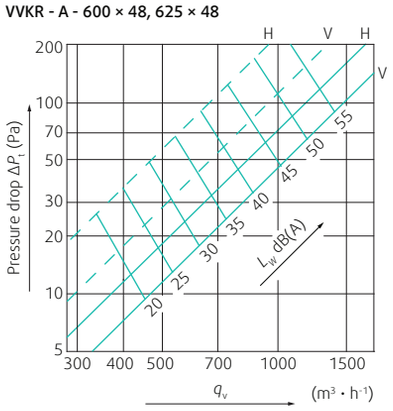


Pressure drop & sound power level of the supply air

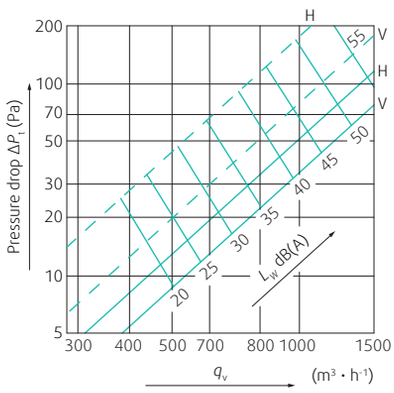
VVKR - A - 600 × 40



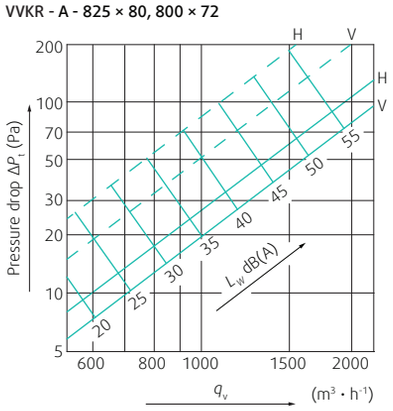
VVKR - A - 600 × 48, 625 × 48



VVKR - A - 625 × 54

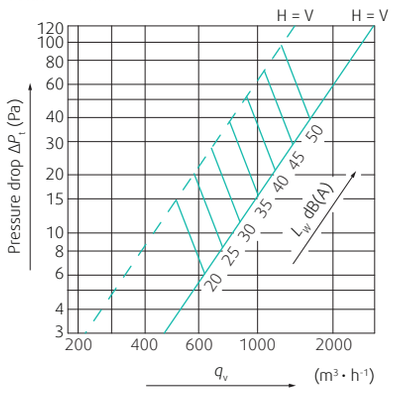


VVKR - A - 825 × 80, 800 × 72

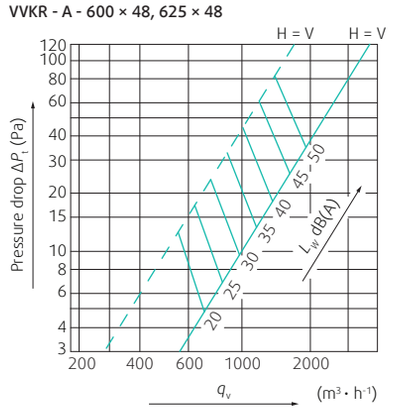


Pressure drop & sound power level of the extract air

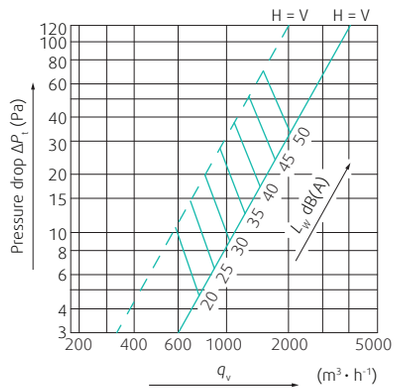
VVKR - A - 600 × 40



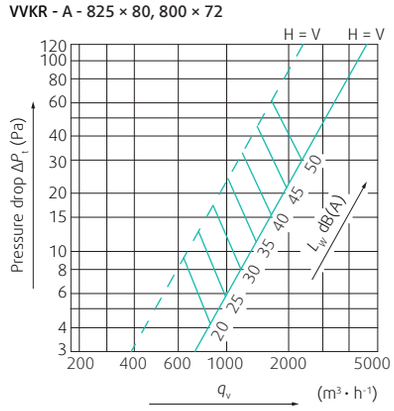
VVKR - A - 600 × 48, 625 × 48



VVKR - A - 625 × 54

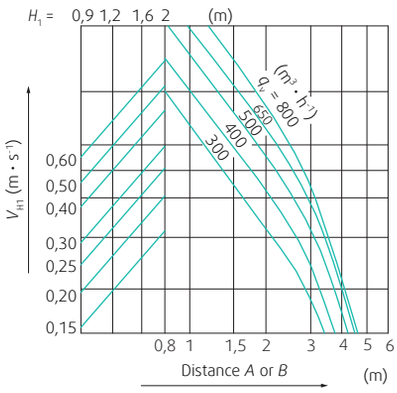


VVKR - A - 825 × 80, 800 × 72

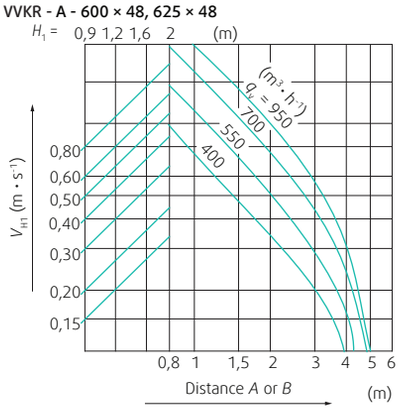


Air flow velocity in the occupied zone

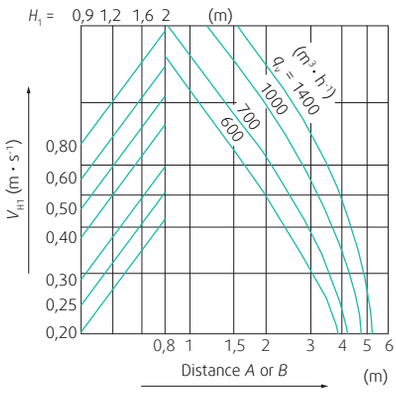
VVKR - A - 600 × 40



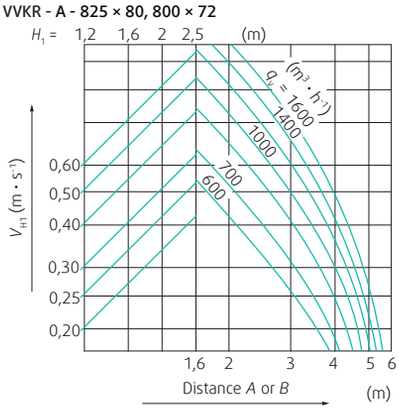
VVKR - A - 600 × 48, 625 × 48



VVKR - A - 625 × 54

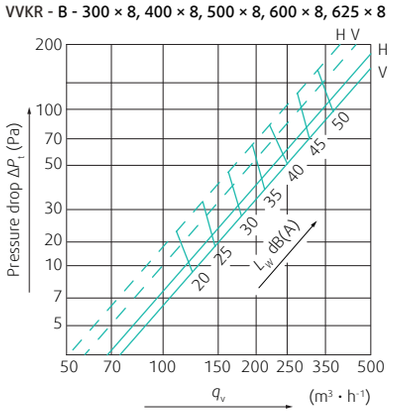


VVKR - A - 825 × 80, 800 × 72

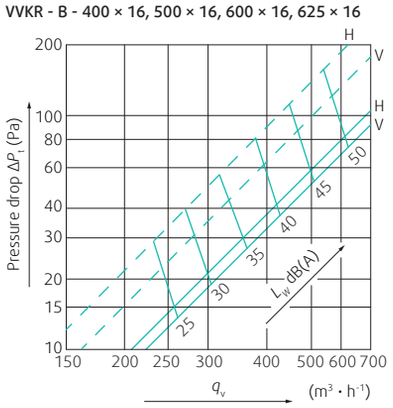


Pressure drop & sound power level of the supply air

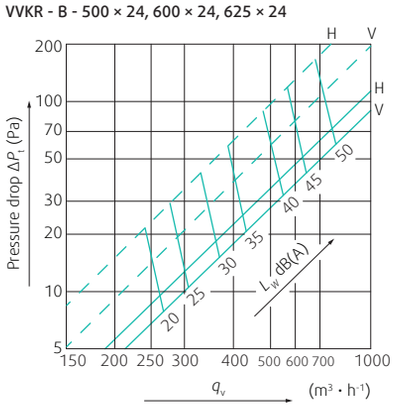
VVKR - B - 300 × 8, 400 × 8, 500 × 8, 600 × 8, 625 × 8



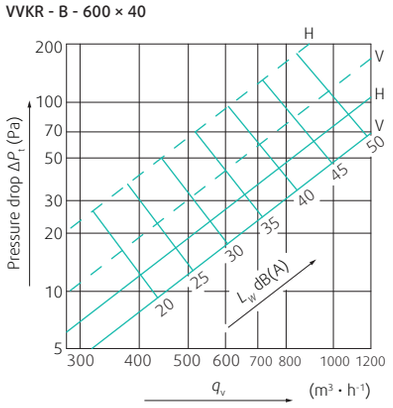
VVKR - B - 400 × 16, 500 × 16, 600 × 16, 625 × 16



VVKR - B - 500 × 24, 600 × 24, 625 × 24

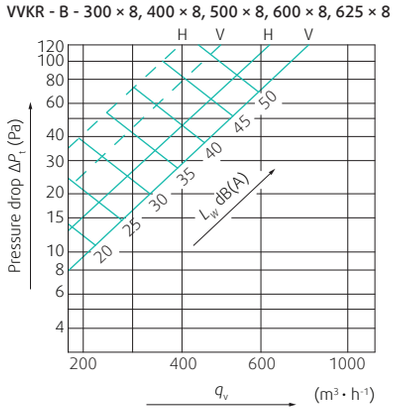


VVKR - B - 600 × 40

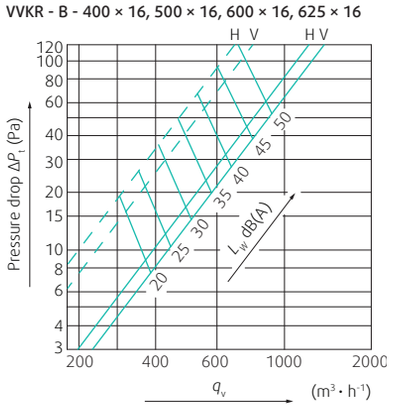


Pressure drop & sound power level of the extract air

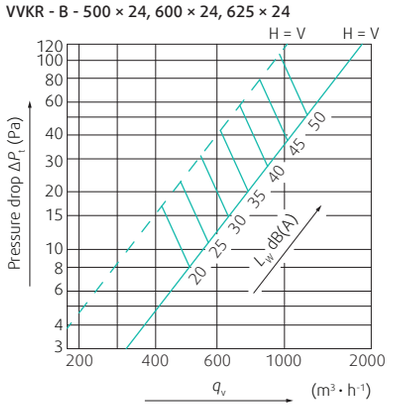
VVKR - B - 300 × 8, 400 × 8, 500 × 8, 600 × 8, 625 × 8



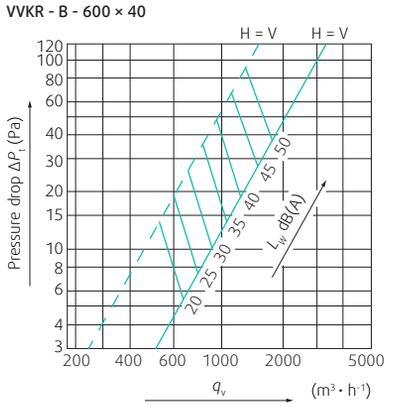
VVKR - B - 400 × 16, 500 × 16, 600 × 16, 625 × 16



VVKR - B - 500 × 24, 600 × 24, 625 × 24

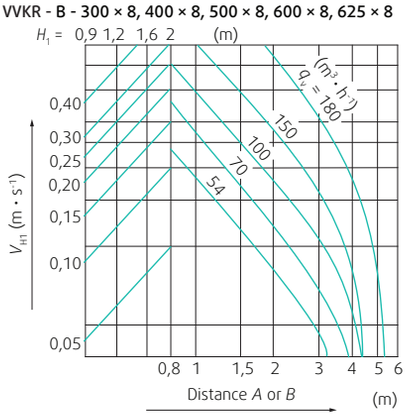


VVKR - B - 600 × 40

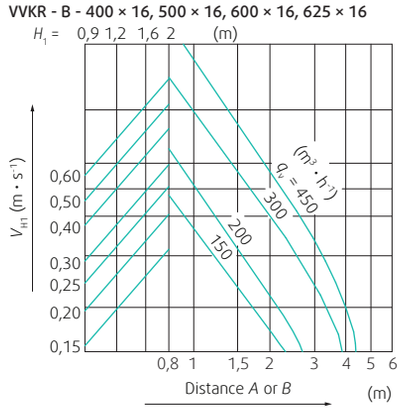


Air flow velocity in the occupied zone

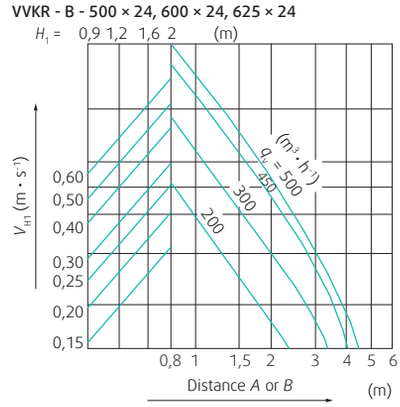
VVKR - B - 300 × 8, 400 × 8, 500 × 8, 600 × 8, 625 × 8



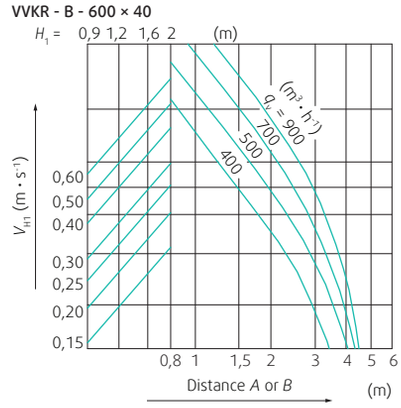
VVKR - B - 400 × 16, 500 × 16, 600 × 16, 625 × 16



VVKR - B - 500 × 24, 600 × 24, 625 × 24

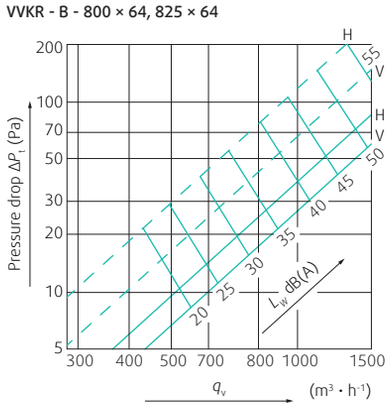


VVKR - B - 600 × 40

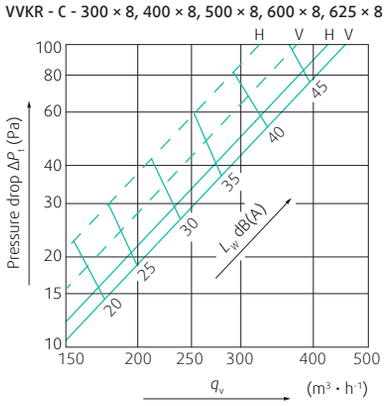


Pressure drop & sound power level of the supply air

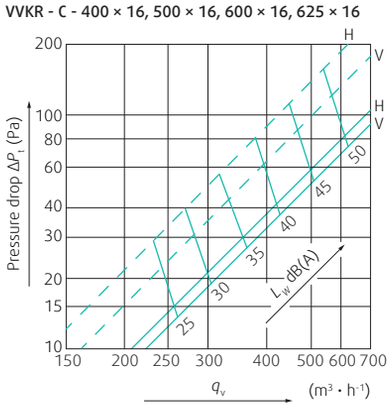
VVKR - B - 800 × 64, 825 × 64



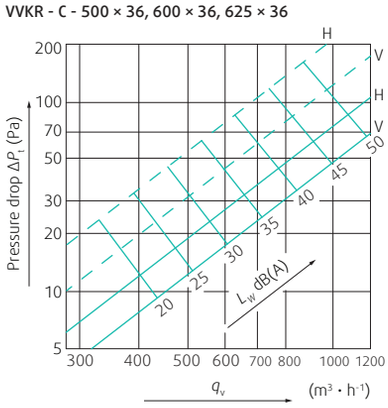
VVKR - C - 300 × 8, 400 × 8, 500 × 8, 600 × 8, 625 × 8



VVKR - C - 400 × 16, 500 × 16, 600 × 16, 625 × 16

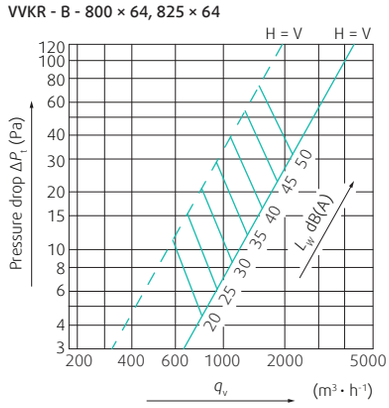


VVKR - C - 500 × 36, 600 × 36, 625 × 36

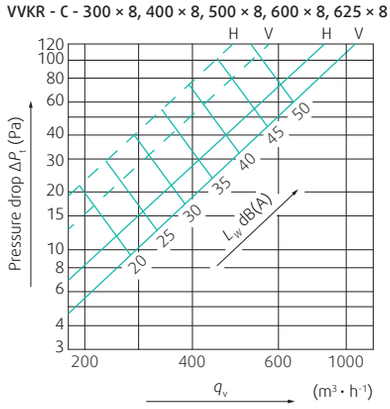


Pressure drop & sound power level of the extract air

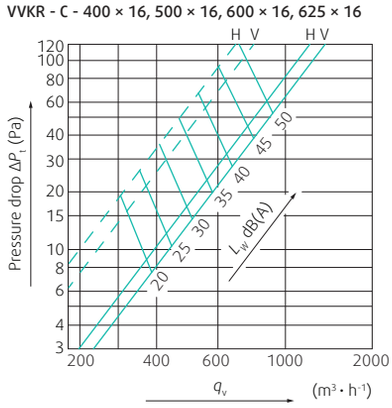
VVKR - B - 800 × 64, 825 × 64



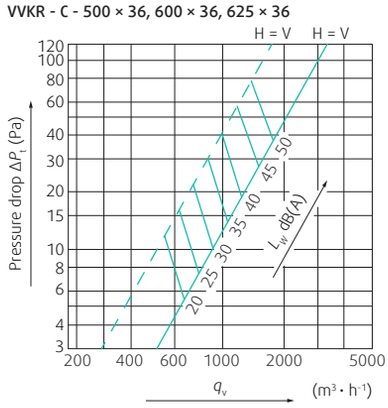
VVKR - C - 300 × 8, 400 × 8, 500 × 8, 600 × 8, 625 × 8



VVKR - C - 400 × 16, 500 × 16, 600 × 16, 625 × 16

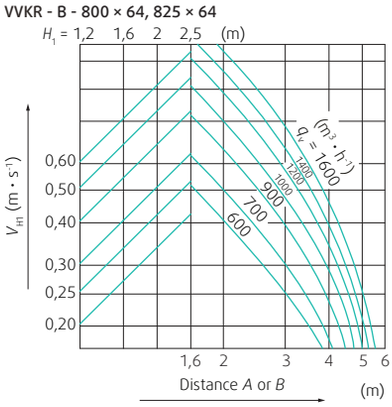


VVKR - C - 500 × 36, 600 × 36, 625 × 36

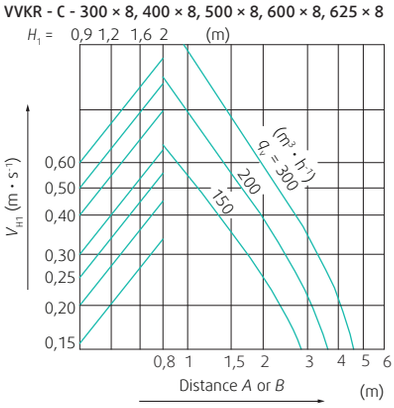


Air flow velocity in the occupied zone

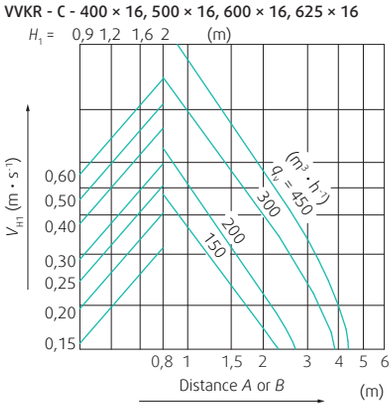
VVKR - B - 800 × 64, 825 × 64



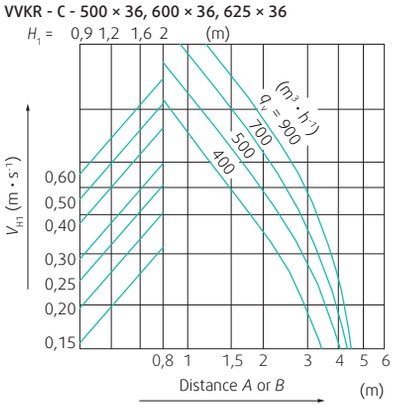
VVKR - C - 300 × 8, 400 × 8, 500 × 8, 600 × 8, 625 × 8



VVKR - C - 400 × 16, 500 × 16, 600 × 16, 625 × 16

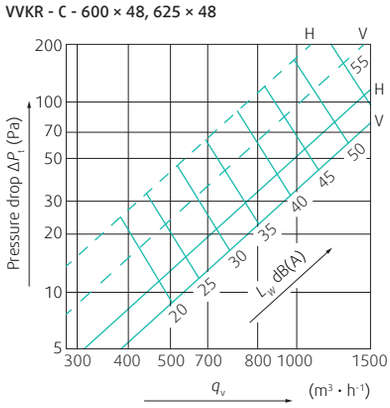


VVKR - C - 500 × 36, 600 × 36, 625 × 36

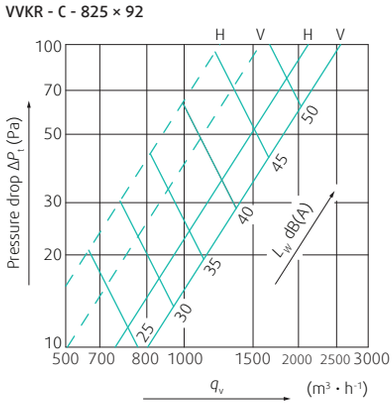


Pressure drop & sound power level of the supply air

VVKR - C - 600 × 48, 625 × 48

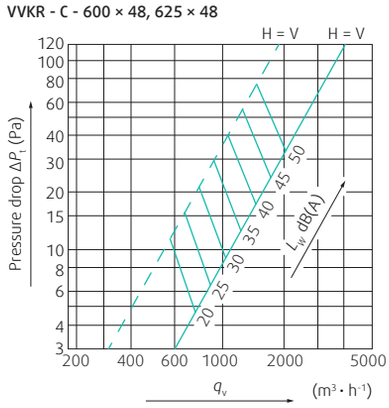


VVKR - C - 825 × 92

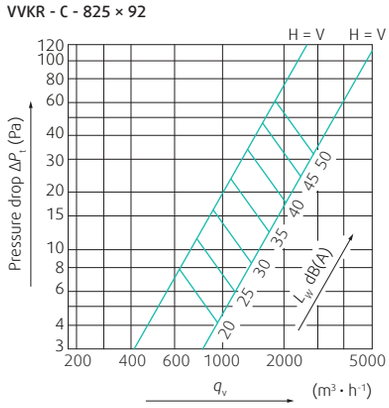


Pressure drop & sound power level of the extract air

VVKR - C - 600 × 48, 625 × 48

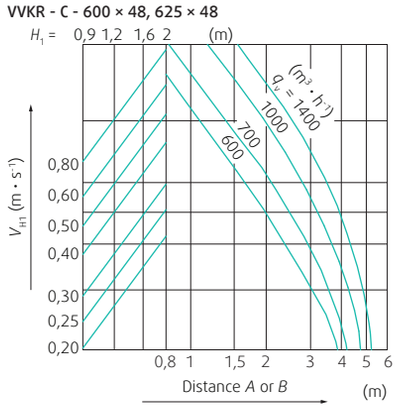


VVKR - C - 825 × 92

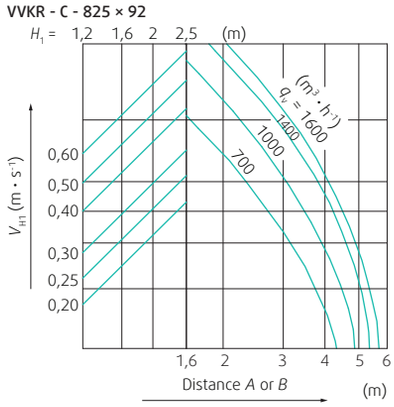


Air flow velocity in the occupied zone

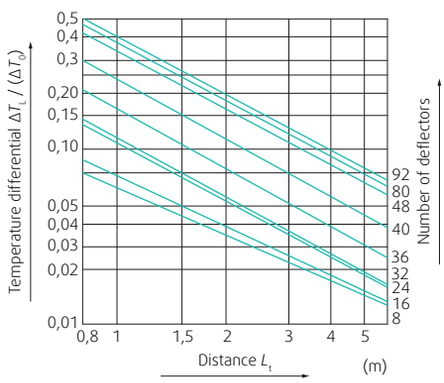
VVKR - C - 600 × 48, 625 × 48



VVKR - C - 825 × 92



Temperature differential



NOTES:

1. When installing under a continuous ceiling, the values VH1 and ΔTL / ΔT0 need to be multiplied by the coefficient 0,7
2. The diagrams for the air flow throw and velocity are only applicable for installation where A = B

Legend

H	- Horizontal (side) connection
V	- Vertical (top) connection
———	- Control damper opened
- - - - - -	- Control damper 45°

Swirl Diffuser VVKR Calculation and Design Example

Given parameters:

Room dimensions:
Width: 18,0 m
Length: 24,0 m
Height: 3,65 m
Air exchange in the room: i = 12 times
Room temperature: T = 24 °C
Temperature differential between the room air temperature and the supply air temperature ΔT_0 = -8 K
Average air flow velocity between two diffusers at distance H_1, v_{H1} < 0,2 m·s^{-1}
Requested sound power level L_{WA} < 30 dB(A)

Requested parameters:

1. Q_V - supply air flow volume into the room
2. q_V - supply air flow volume into one VVKR
3. VVKR type

Solution:

1. We determine the supply air volume for the room 24 m long, 18 m wide and 3.65 m high with a plasterboard ceiling. Q_V = 24 × 18 × 3,65 × 1 = 24 m × 18 m × 3,65 m × 12 = 18922 m^3 · h^{-1}
2. Architect's definition for this particular case is that the minimim distance from a vertical wall is 3 m (Y = 3 m). Then the remaining area for VVKR distribution is 12 × 18 m. If the axial distance between end diffusers at a transverse direction is 12 m and the distance between rows is B = 3 m, then the number of rows is 5 and if the axial distance between end diffusers at a longitudinal direction is 18 m and the distance between columns is A = 3 m, then the number of columns is 7.
   We calculate the supply air flow volume into one VVKR
   q_V = Q_V / number of rows (B) × number of columns (A) = 18922 / (5 × 7) = 540 m^3 · h^{-1}
3. Based on Tab. 6 we determine a preliminary size design for q_V = 540 m^3 · h^{-1}, which is VVKR-A-S-600×40

Calculation of the amount of pressure drop, sound power level and effective velocity for a swirl diffuser

Given parameters:

VVKR-A-S-600×40

Air supply into box	- horizontally
Measurable air flow volume	q_V = 540 m^3 · h^{-1}
Free area at dimensions 600 × 40 (from Tab. 4)	A_V = 0,0409 m^2

Requested parameters:

1. L_{WA}
2. Δp_t

Solution:

Based on page 13 (Diagram 1) for an open damper in VVKR-A-S-600×40, where q_V = 540 m^3 · h^{-1} we get:

1. diffuser pressure drop:	Δp_t = **22 Pa**
2. sound power level:	L_{WA} = **29 dB(A)**

Calculation of v_{H1} and ΔT_L for a swirl diffuser at basic deflector configuration

Flow length between the occupied zone and the ceiling — $H_1 = H - H_0$ (Obr. 7)
$H_1 = 3{,}65 - 1{,}8 = 1{,}85$ m

Distance between two anemostats — $A = B = 3$ m

Diagram 2 for VVKR-A-600×40 with a horizontal connection, at $q_v = 540$ m³ · h⁻¹, A = 3 m and distance $H_1 = 1{,}85$ m shows:
1. $v_{H1} = 0{,}18$ m · s⁻¹

Diagram 3 shows the temperature differential $\Delta T_L / \Delta T_0$ for VVKR-A-S-600×40,
at distance $L_t = A/2 + H_1 = 1{,}5 + 1{,}85 = 3{,}35$ m is:
2. $\Delta T_L / \Delta T_0 = 0{,}06$

$\Delta T_L = \Delta T_0 \times 0{,}06 = -8 \times 0{,}06 = -0{,}48$ K

NOTE: In the calculation, it is important to use a lower L_t amount, i.e. the worst case scenario (by a wall or between two diffusers).

Conclusion:
The requests in the example will be fulfilled by anemostat
VVKR - A - S - 600 × 40 in the amount of 35 pieces

with the PB - VVK - S - 600 - S - H plenum box in the amount of 35 pieces, distributed according to the example solution

VVKR - A - 600 × 40

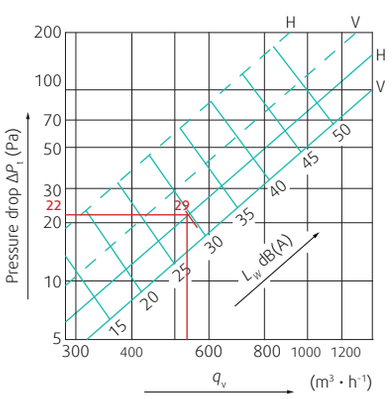


Diagram 1: Supply air pressure drop and sound power level, VVKR - A - 600 × 40

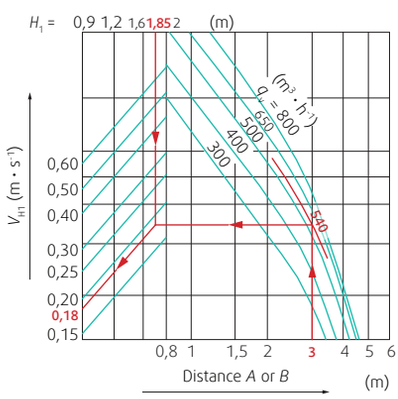


Diagram 2: Air flow throw and air flow velocity, VVKR - A - 600 × 40

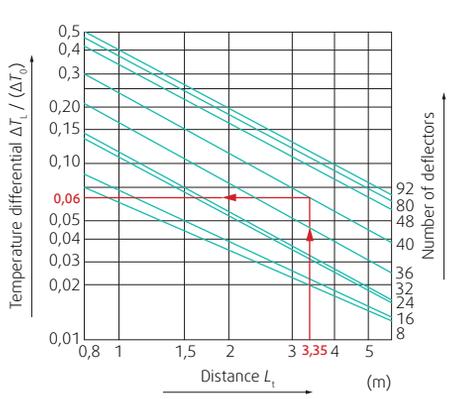
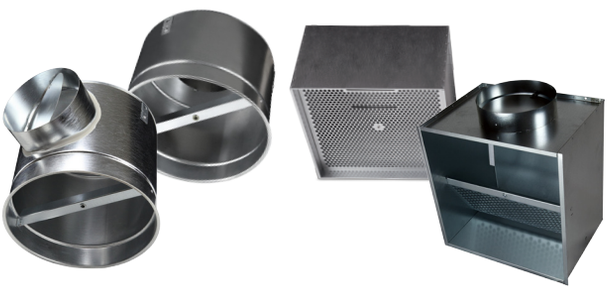


Diagram 3: Temperature differential

Accessories

PB-VVK

Plenum box



The PB-VVK is produced in 2 types of shapes round (PB-VVK-R) or square (PB-VVK-S), with a horizontal or a vertical connection and with internal or external insulation. The plenum box is made of galvanized sheet as a standard.

There are 2 types of connection:

- D1: a simple spigot without a seal, with a damper
- D2: a pressed spigot with a seal including the Zeus damper (damper information available on page 15)

Ordering codes

PB-VVK- □□□□□□□

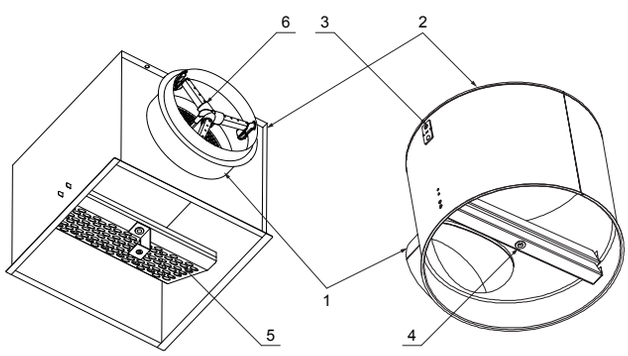
Plenum box face round	R
Plenum box face square	S
Dimensions	300 - 825
Supply with mesh screen	S
Extract without mesh screen	E
Horizontal connection (from the side)	H
Vertical connection (from the top)	V
Untight spigot with a damper [1]	D1
Pressed tight spigot with the Zeus damper [1]	D2
With internal insulation, 14 mm [2]	I2
With external insulation [2]	J

Ordering codes example:

PB-VVK - S - 300 - S - H - I2

Square plenum box with nominal dimension 300, supply with mesh screen, horizontal connection (from the side), spigot type D1, internal insulation.

1. If the spigot type is not entered in the ordering code, type "D1" will be supplied by default. It is not possible to order the Zeus damper for the product PB-VVK-R with horizontal connection. Plenum boxes with a vertical spigot D2 are supplied without a mesh screen.
2. In case the insulation type is not entered in the ordering code, the product PB-VVK will be supplied without insulation.



Product parts description:

1. Spigot
2. Casing
3. Hanging bracket
4. Bridge with a rivet nut for connection to a diffuser
5. Mesh screen with a rivet nut for connection
6. Damper

Fig. 8: Product PB-VVK

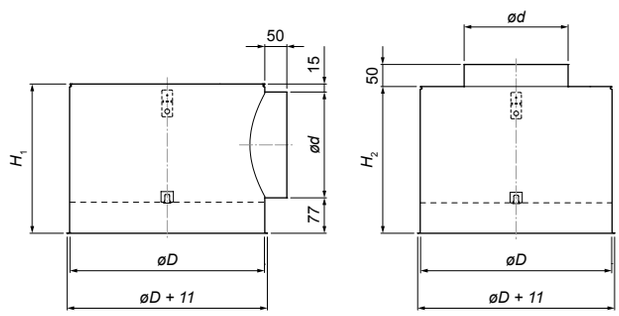


Fig. 9: Main dimensions of the PB-VVK-R

Size	øD	H_1 (horiz.)	H_2 (vert.)	ød	m	
					horiz.	vert.
	(mm)				(kg)	
300-160	275	250	200	158	2,29	1,97
400-200	364	290	200	198	3,34	2,82
500-200	470	290	200	198	4,68	3,91
600-200	575	290	300	198	6,21	6,31
600-250	575	340	300	248	6,68	6,23
625-200	595	290	300	198	6,52	6,92
625-250	595	340	300	248	7,00	6,55
800-315	775	405	300	313	11,35	10,46
825-315	795	405	300	313	11,83	10,88

Tab. 9: Main dimensions of the PB-VVK-R

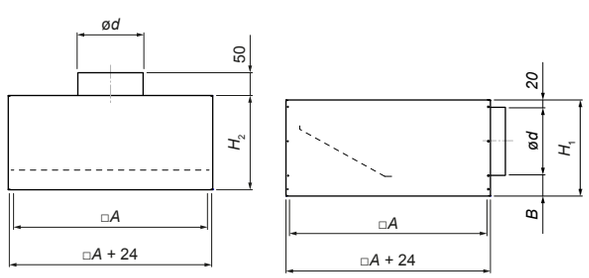
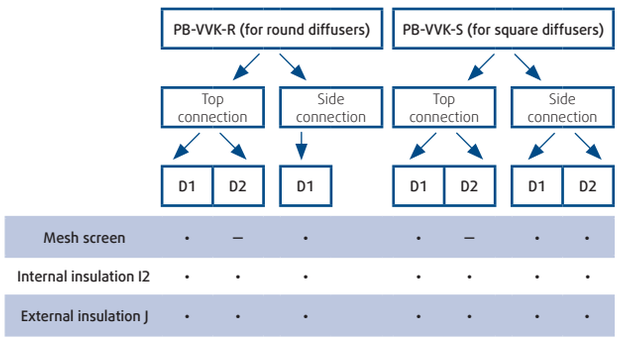


Fig. 10: Main dimensions of PB-VVK-S

Size	A×A	H_1 (horiz.)	H_2 (vert.)	ød	B	m	
						horiz.	vert.
	(mm)					(kg)	
300-160	266×266	240	200	158	62	2,58	2,39
400-160	366×366	240	200	158		3,62	3,43
400-200	366×366	280	200	198		3,98	3,65
500-200	466×466	280	200	198		5,27	4,74
600-200	566×566	280	300	198		6,71	7,19
600-250	566×566	330	300	248		7,42	7,31
625-200	591×591	280	300	198		7,11	7,63
625-250	591×591	330	300	248		7,81	7,73
800-315	766×766	400	300	313	67	13,63	12,03
825-315	791×791	400	300	313		14,22	12,61

Tab. 10: Main dimensions of the PB-VVK-S

Plenum box selection diagram

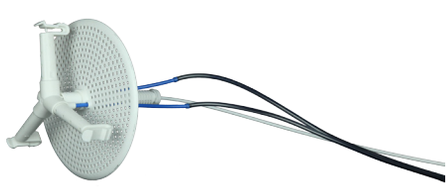


Legend

D1	- Untight socket with a sheet-metal control damper
D2	- Pressed tight socket with a Zeus damper
xxxx	- Defined selection option
•	- Option to add a position to the selection
–	- Not possible to add a position to the selection

The Zeus damper

The Zeus control damper contains impulse tubes for measuring differential pressure using a portable measuring device. It can be adjusted manually using a cable gearing.



NOTE: In case of using PB-VVK-R with horizontal connection it is not possible to use the Zeus damper.

PB-VVKU

Universal plenum box

The PB-VVKU is a universal box which is possible to use for installation on various types of air terminal devices. The PB-VVKU is manufactured from galvanized sheet. Upon customer's request it is possible to apply a powder-paint RAL surface finish. The box is optimized for use with both horizontal and vertical connection. When in storage, the PB-VVKU provides the advantage of stacking, thus saving storage space.

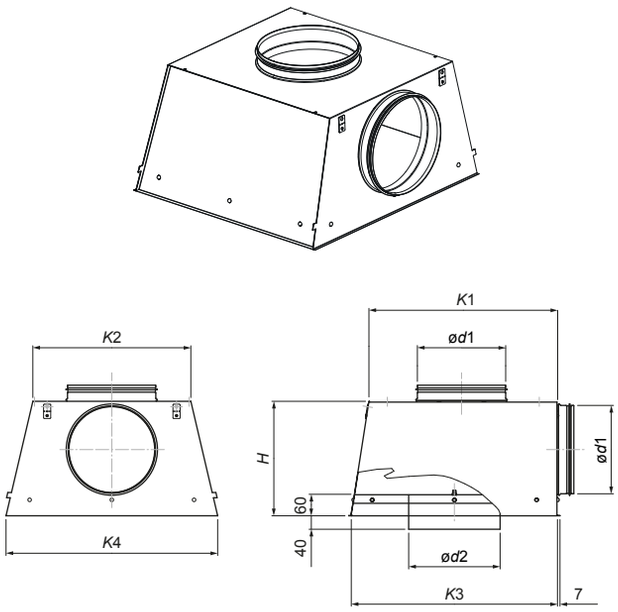
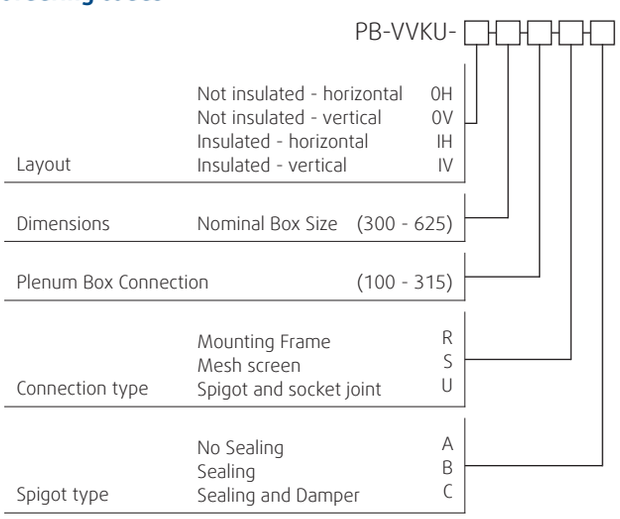


Fig. 11: Main dimensions of the PB-VVKU

Ordering codes



Ordering codes example:

PB-VVKU - 0H - 300 - 100 - S - B

Universal plenum box, not insulated with horizontal supply, nominal size 300, connection dimension 100, mesh screen, sealed socket.

NOTE: When using the PB-VVKU plenum box, it is recommended to read the technical documentation for the product TPI-07.

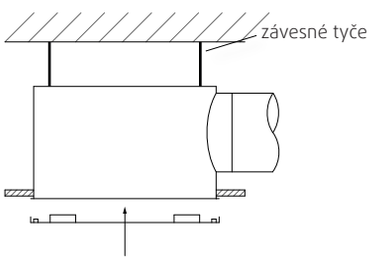
Size	ød1	ød2	K1	K2	K3	K4	H	m
	(mm)							(kg)
300	98	126	250	200	278	292	190	1,95
300	123	161	247	200	278	292	215	2,20
300	158		242	185	278	292	250	2,50
400	158	202	340	279	378	392	240	4,10
400	198	252	334	260	378	392	280	4,50
500	158		438	375	478	492	250	5,90
500	198		432	356	478	492	290	6,10
500	248	317	432	336	478	492	320	6,50
600	198		535	465	578	592	270	6,70
600	248		528	442	578	592	320	7,70
600	313		500	400	578	592	385	8,90
625	198		560	490	603	617	270	8,70
625	248		553	467	603	617	320	9,10
625	313	402	540	440	603	617	385	9,70

Tab. 11: Main dimensions and weight of the PB-VVKU

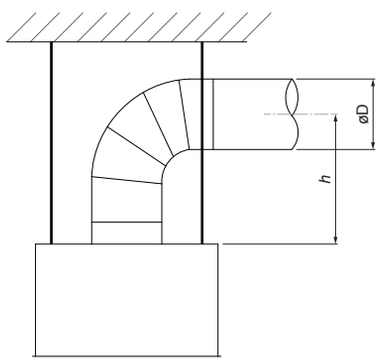
Mounting

The VVKR swirl diffuser is most commonly installed onto a ventilation duct as illustrated on Fig. 12. The mounting consists of installing the plenum box to the ceiling using draw-bars and mounting the diffuser face onto the plenum box using a centric screw which is included in the delivery.

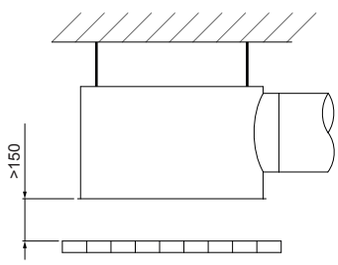
Fig. 12 depicts various methods of installing the VVKR onto the ceiling. When mounted into a suspended grid ceiling the supply air swirl is expected to be partially reduced. It is therefore needed to respect the minimum distance of the diffuser - at least 150 mm from the grid ceiing.



1. Flush mounted for continuous suspended ceiling



2. Free hanging installation onto ceiling
$h_{min} > (3 \sim 5)\ D$



3. Installation between the ceiling and the suspended grid ceiling

Fig. 12: Examples of mounting

Diffusers - Related products

VVKN

Swirl diffusers with fixed deflectors

Information about the product is in the technical documentation TPI-31.

VVT

Swirl diffusers with thermostatic control

Information about the product is in the technical documentation TPI-41.