

Air diffusion systems

Multi-outlet diffuser
WSA

Application

The multi-outlet diffuser type WSA is a supply air diffuser for wall installation. Standard sizes cover a range of 150 to 800 m³/h airflow. Multi-outlet diffusers can be used for cooling and heating up to temperature differences of 8 K. Depending on the thermal loads and volume flow rate, the mounting height ranges between 2.2 and 4 m.

In case of cooling, the WSA diffuser must be mounted more than 0.3 m below a closed ceiling. The horizontal introduction of the supply air for cooling functions only if the Coanda effect is used.

Function

The WSA diffuser supplies the air into the room by a combination of 2 to 4 swirl diffusers with a nominal diameter of DN 100 or DN 125 and a perforated plate. The multi-jets with the perforated plate combine to give quick mixing of the supply and room air resulting in draft-free air movement.

Sizes

Multi-outlet diffusers are manufactured in six different sizes. The diffusion faces have a height of 125 or 160 mm and a width of 425, 625 and 825 mm. Depending on the size, 2 to 4 swirl diffusers with a nominal size of DN 100 or DN 125 are built in.

Suitable size is selected depending on air flow and the permissible vertical or horizontal penetrations.

The ranges of application for diffuser type WSA diffuser are given in figure 1.

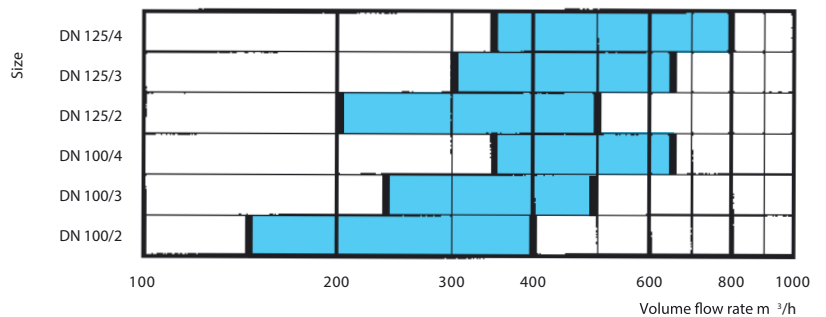


Fig. 1: Recommended ranges of application for diffuser type WSA

Multi-outlet diffuser

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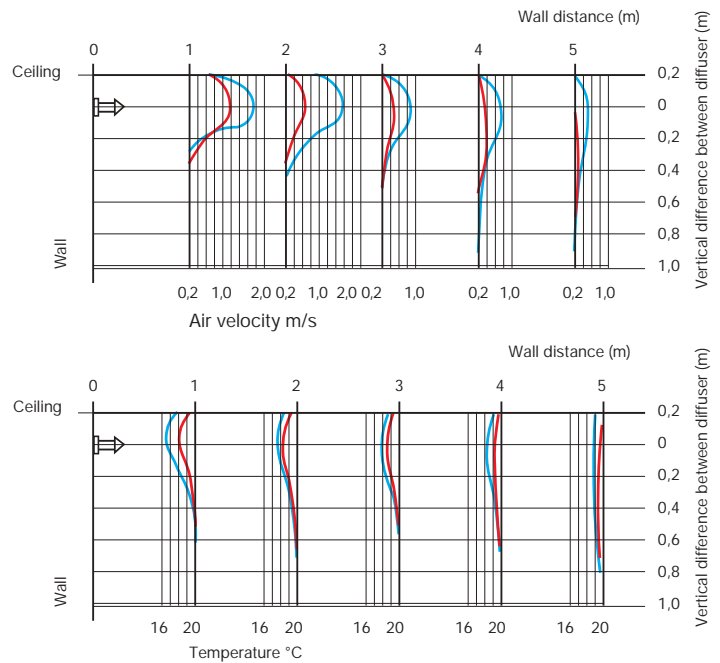
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Multi-outlet diffuser as supply air diffuser for the installation into a wall

Multi-outlet diffusers enable a quick reduction of temperature and velocity. Fig. 2 shows the comparison between a multi-outlet diffuser and a double deflection grille. The temperature and velocity profiles of a multi-outlet diffuser (red) and a grille (blue) are shown for a horizontal penetration depth of 5 m and a vertical of 1.0 m. Compared to the grille, the multi-outlet diffuser rapidly reduces the face velocity and temperature difference between supply and room air in half the time.

Fig. 2: Comparison grill/multi-outlet diffuser

Reduction of temperature difference and face velocity with an airflow rate of 300 m³/h and a temperature difference of 6 K for cooling (Grille type 625x125 mm, horizontal bar; multi-outlet diffuser type WSA DN 100/3/625x125).



Lecture hall: Marienkrankenhaus in Hamburg, Germany

Restaurant: Hotel Schützen in Stansstadt, Switzerland

Multi-outlet diffuser WSA

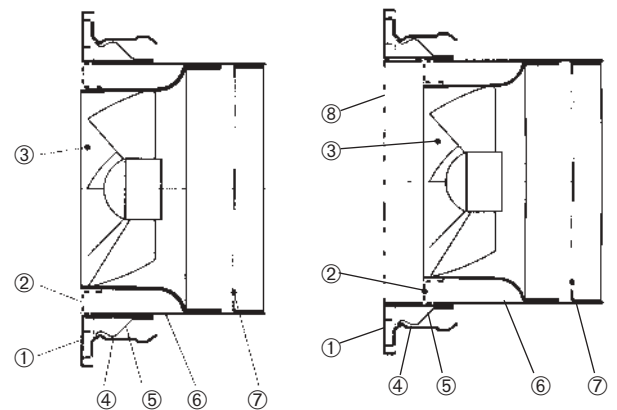
Construction and dimensions

Construction

A frame ① manufactured from extruded aluminium surrounds the diffusion face ② consisting of 2 to 4 swirl diffusers ③ and the perforated area of displacement. The housing has a balancing perforated plate ⑦ to enable an uniform air flow and the required pressure loss.

For the installation, the mounting frame ④ manufactured from galvanized steel is inserted into the opening. The clamps ⑤ at the grille frame of the multi-outlet diffuser secure the diffuser in the mounting frame.

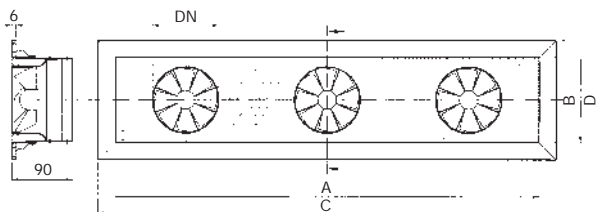
For decorative purposes, the multi-outlet diffuser can also be supplied with a perforated front plate ⑧.



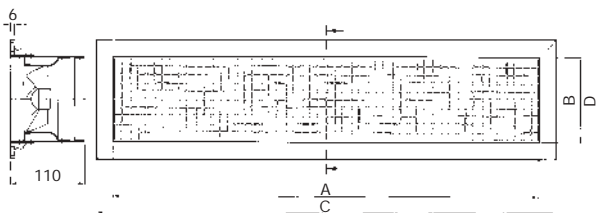
- 1. Grille frame
- 2. Area of displacement
- 3. Swirl diffuser
- 4. Mounting frame

- 5. Clamping spring
- 6. Housing
- 7. Balancing plate
- 8. Perforated front plate

Dimensions



WSA standard design



WSA with grille plate

Type	DN	n*)	A	B	C	D
100/2/425x125	100	2	425	125	475	175
100/3/625x125	100	3	625	125	675	175
100/4/825x125	100	4	825	125	875	175
125/2/425x160	125	2	425	160	475	210
125/3/625x160	125	3	625	160	675	210
125/4/825x160	125	4	825	160	875	210

*Number of swirl diffusers

Connection methods

Multi-outlet diffusers are available for the connection with

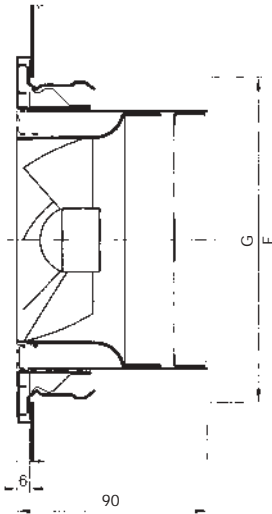
- ducts
- boxes

Multi-outlet diffuser WSA

Connection methods

Connection with ducts

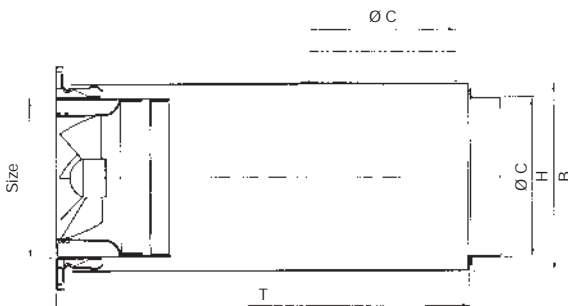
The unassembled mounting frame is fastened to the duct opening. Clamping springs hold the multi-outlet diffuser within the mounting frame. The dimensions F and G of the duct opening to be as shown on the table to the right.



Size	Opening	
	F	G
100/2/425x125	445	150
100/3/625x125	645	150
100/4/825x125	845	150
125/2/425x160	445	185
125/3/625x160	645	185
125/4/825x160	845	185

Connection with boxes

The multi-outlet diffuser is mounted in the same manner as for ducts by means of clamping springs into the mounting frame.



Size WSA	B**	Dimensions (mm)		
		Ø C	H**	T**
100/2/425x125	441	2 x DN 125	147	325
100/3/625x125	641	3 x DN 125	147	325
		2 x DN 160	147	360*
100/4/825x125	841	3 x DN 125	147	325
		2 x DN 160	147	360*
125/2/425x160	441	2 x DN 125	182	325
125/3/625x160	641	2 x DN 160	182	360
125/4/825x160	841	3 x DN 160	182	360

* Only for vertical connection

** Outside dimensions

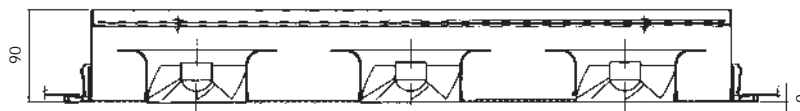
Multi-outlet diffuser WSA

Accessories

Accessories

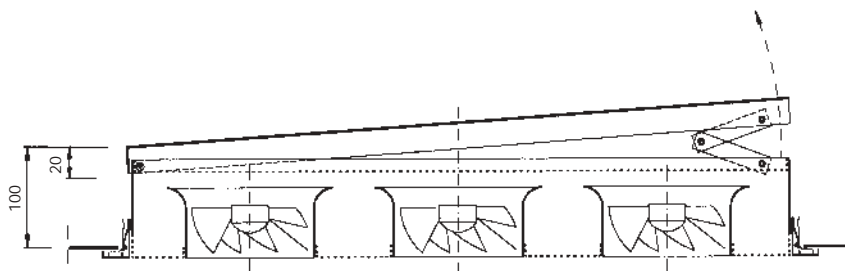
Flow control

All diffuser sizes can be supplied with a flow control for the adjustment of the airflow. It can be adjusted from the front face of the diffuser. Flow control can be fitted for duct mounted diffusers as well as for diffusers with plenums.

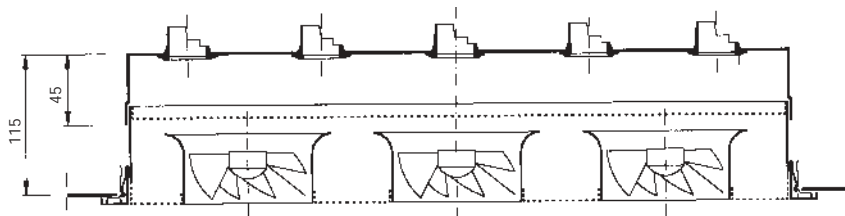


Deflector

Two types of deflectors are available to control the flow through diffusers connected directly to ducting.



Deflector design »adjustable«



Deflector design »not adjustable«

Multi-outlet diffuser WSA

Selection of diffuser size

Determination of diffuser size

For draft-free room conditions, the selection of a suitable diffuser size is important. This depends on the airflow and thermal loading. Therefore, each type of diffuser has a horizontal and vertical penetration depth relative to the airflow and thermal loading. The horizontal penetration depth is defined as the distance between the diffuser and the point in the room, at which the horizontal air velocity has reduced to a value of 0.2 m/s. The vertical penetration depth is defined as the distance between the mounting height of the diffuser and the highest point in the room, at which the vertical air velocity has also reduced to 0.2 m/s.

Fig. 3 to 8 give information on the horizontal and vertical penetration depths of the multi-outlet diffusers related to the air flow per diffuser and thermal loading between 0 and 8 K for cooling.

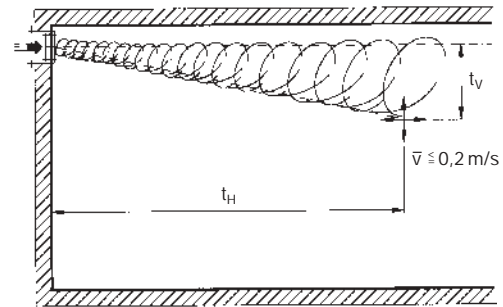
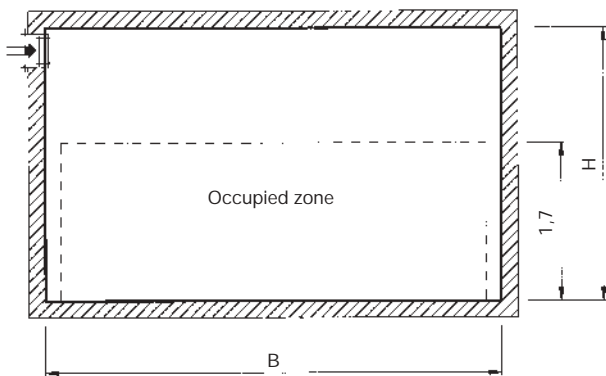


Fig. 3: Horizontal and vertical penetration depths of multi-outlet diffusers

Minimum and maximum horizontal penetration depth



To achieve a good room air movement the following rule applies to $t_{H \min}$ and $t_{H \max}$:

$$t_{H \min} = B \times 0,8$$

$$t_{H \max} = B + H - 1$$

Multi-outlet diffuser WSA

Technical data

Horizontal and vertical
penetration depths for
WSA 100/2 to 100/4

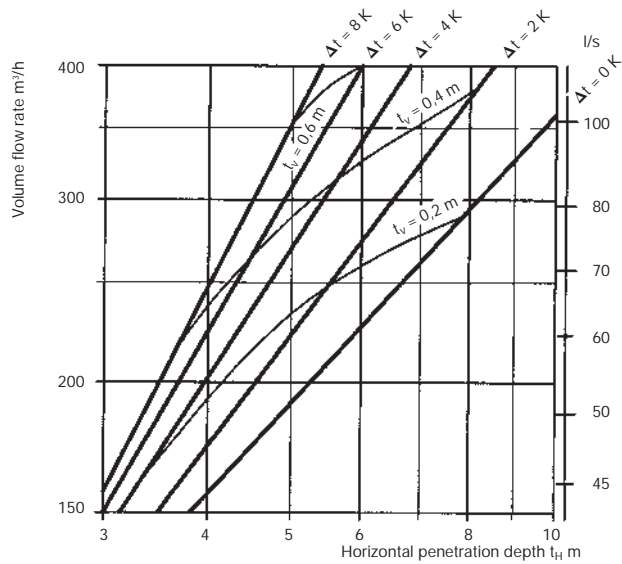


Fig. 4: Penetration depths WSA
100/2/425 x 125 for
cooling ≤ 8 K up to isotherm

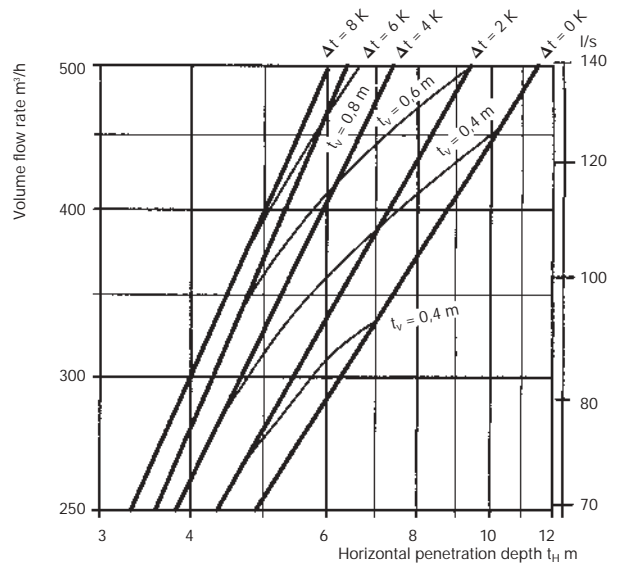


Fig. 5: Penetration depths WSA
100/3/625 x 125 for
cooling ≤ 8 K up to isotherm

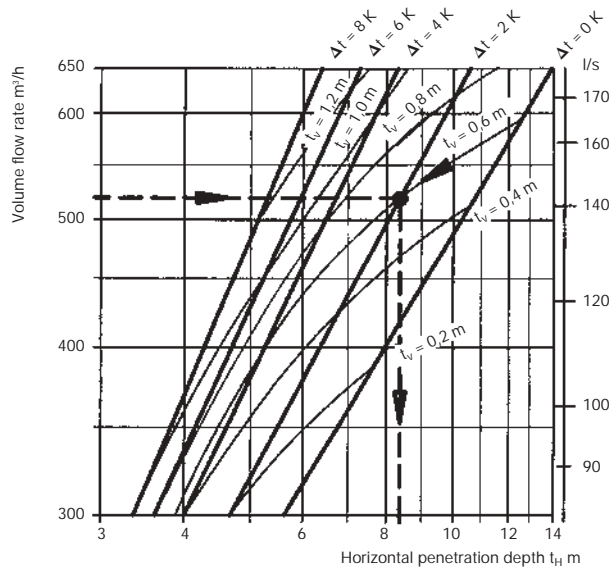


Fig. 6: Throw and drop of:
WSA 100/4/825 x 125 for
cooling mode from isothermal to 8 K

Example:

WSA: 100/4/825 x 125

$V = 515 \text{ m}^3/\text{h}$

$t_H = 8.1 \text{ m}$

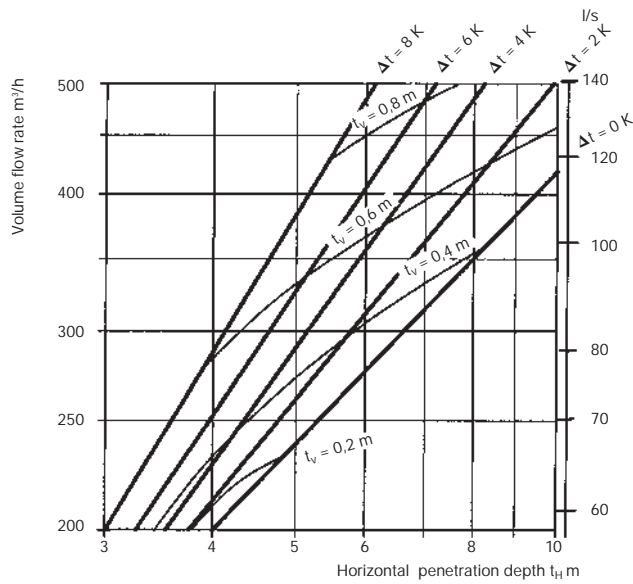
$t_v = 0.6 \text{ m}$

$\Delta t = 2 \text{ K}$

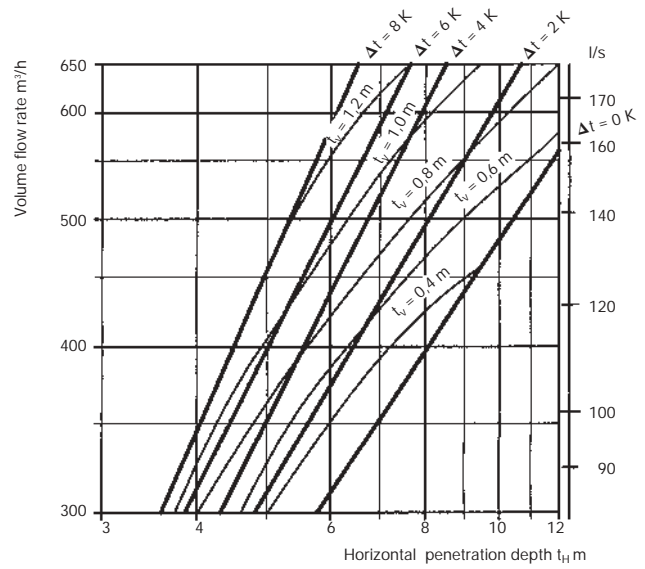
Multi-outlet diffuser WSA

Technical data

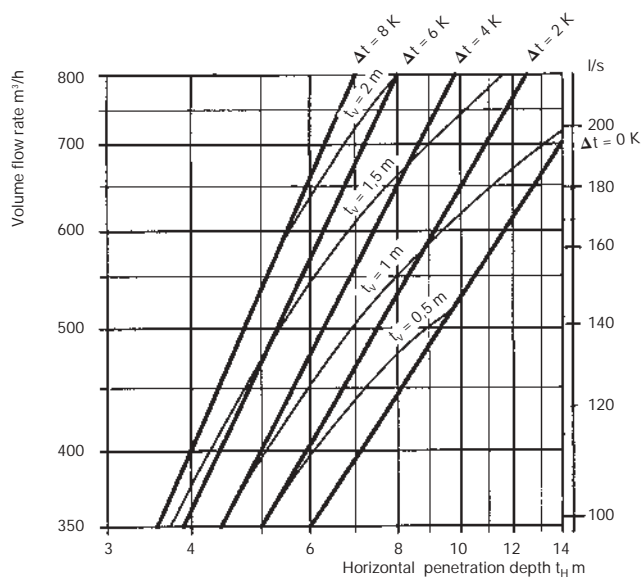
Horizontal und vertical
penetration depths for
WSA 125/2 to 125/4



**Fig. 7: Penetration depths WSA
125/2/425 x 160 for
cooling ≤ 8 K up to isotherm**



**Fig. 8: Penetration depths WSA
125/3/625 x 160 for
cooling ≤ 8 K up to isotherm**



**Fig. 9: Penetration depths WSA
125/4/825 x 160 for
cooling ≤ 8 K up to isotherm**

Multi-outlet diffuser WSA

Technical data

Pressure loss and noise level

Pressure loss and noise level

Figures 10 and 11 show the total pressure loss and noise level for multi-outlet diffusers. These values apply to the standard construction. With perforated front plate, the noise level increases by 1–2 dB (A); the pressure loss remains the same.

Fig. 10

Pressure loss and noise level for multi-outlet diffusers

- DN 100/2/425 x 125
- DN 100/3/625 x 125
- DN 100/4/825 x 125

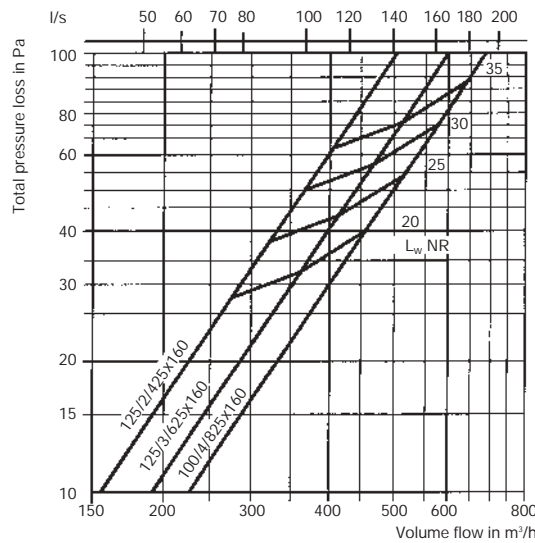
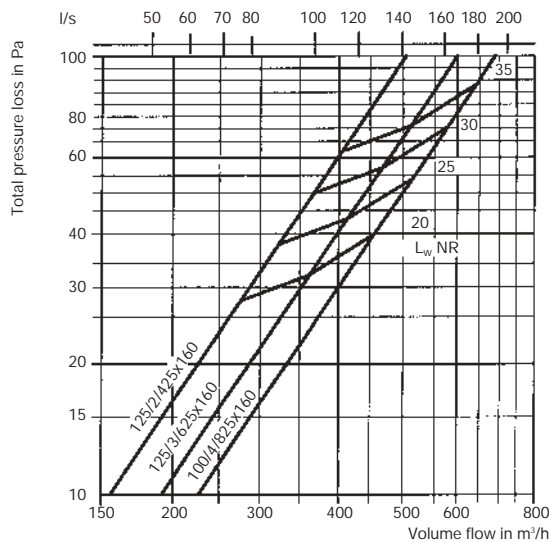


Fig. 11

Pressure loss and noise level for multi-outlet diffusers

- DN 100/2/425 x 125
- DN 100/3/625 x 125
- DN 100/4/825 x 125



Noise level per octave

The noise level values are measured from the evaluated noise level and an octave correction factor according to the following formula:

$$L_{wo} = L_{wa} + K_o$$

with

- L_{wo} : Noise level per octave dB
- L_{wa} : Measured noise level dB (A)
- K_o : Octave correction factor dB

Example:

Given: $L_{wa} = 35$ dB (A)
Result: L_{wo} at 1000 Hz
 $L_{w 1000} = 35 - 7 = 28$ dB

Correction table for octave calculation (dB/oct.)

F	63	125	250	500	1000	2000	4000
K_o	-18	-7	-6	-7	-7	-14	-28

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Example

Example

Given:

Room dimensions: Length 8 m
 Width 6 m
 Height 3 m

Volume flow: 1440 m³/h

Temperature difference for cooling + 6 K

Maximum noise level: 40 dB (A)

The air supply duct is arranged alongside the room underneath the ceiling.

Selection:

Type and number of multi-outlet diffusers.

Penetration depth:

Vertical penetration depth:

For a room height of 3 m the maximum vertical penetration depth is

$$3.0 - 1.7 = 1.3 \text{ m}$$

$$t_v = 1.3 \text{ m}$$

Horizontal penetration depth:

$$\text{Maximum: } t_{H \max} = 6 + 1.3 = 7.3 \text{ m}$$

$$\text{Minimum: } t_{H \min} = 6 \times 0.8 = 4.8 \text{ m}$$

With the given volume flow rate of 1140 m³/h, at least 3 to 4 diffuser must be used to achieve a good room air movement.

With 3 diffusers $V = 480 \text{ m}^3/\text{h}$ per diffuser.

With $\Delta t = 6 \text{ K}$ for cooling a diffuser to be chosen must have its operating point in the upper third of the recommended volume flow range.

According to figure 1, this is type 100/3/625x125

Fig. 5 shows for this type with 480 m³/h and $\Delta t = 6 \text{ K}$ for cooling

$$t_H = 6.2 \text{ m}$$

$$t_V = 0.2 \text{ m}$$

According to figure 10, the noise level is 35 dB (A) and the pressure loss 60 Pa.

Result

3 multi-outlet diffusers type 2 (DN 100/3/625x125) are required, each handling 480 m³/h.

Pressure loss: $\Delta p = 60 \text{ Pa}$

Noise level: $L_w = 35 \text{ dB(A)}$

Tender/Order Form

Item	Description	Units Pieces	Unit price	Total
	<p>Multi-outlet diffuser type WSA as supply air diffuser for wall installation and generation of a diffused air movement in a room at a minimum possible temperature gradient. Aluminium outlet element consisting of a frame with perforated plate, a balancing perforated plate installed at the inlet and, depending on the size, two to four integral swirl nozzles.</p> <p>Size:</p> <p> <input type="checkbox"/> 100/2 <input type="checkbox"/> 125/2 <input type="checkbox"/> 100/3 <input type="checkbox"/> 125/3 <input type="checkbox"/> 100/4 <input type="checkbox"/> 125/4 </p> <p>Design of faceplate:</p> <p> <input type="checkbox"/> Standard <input type="checkbox"/> With perforated plate </p> <p>Construction:</p> <p> <input type="checkbox"/> For duct installation (including mounting frame) <input type="checkbox"/> With plenum box, zinc-plated steel 1203, with pcs connections DN </p> <p>Accessories:</p> <p> <input type="checkbox"/> Volume control, adjusted from the front <input type="checkbox"/> Deflector <input type="checkbox"/> Adjustable <input type="checkbox"/> Not Adjustable </p> <p>Surface finish of faceplate:</p> <p> <input type="checkbox"/> Powder coated to RAL 9010 (standard) <input type="checkbox"/> Stove enamelled to RAL </p> <p> Volume flow: m³/h Maximum noise level: dB (A) Maximum pressure loss: Pa </p> <p> Manufacturer: STRULIK Type: WSA </p>			