

# Displacement Flow Diffusers

- Type QLW-AZ
- for supply and extract air



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## Description

The combination displacement flow diffuser type QLW-AZ for supply and extract air has been designed for horizontal installation into walls and formed plaster board bulkheads. In contrast to the well-known principle of mixed air flow, these diffusers guarantee low turbulence air supply. The discharge velocity is very low. While in mixed flow the objective is to get as much induction as possible (by mixing room air with the supply jet), displacement air flow aims to achieve the lowest induction possible.

These combination diffusers discharge the supply air in the lower section. Extract air is taken out through the top section of the diffuser.

In cases where increased cross-talk attenuation is required, the diffusers can be equipped with a rear cross-talk attenuator module.



Type QLW-AZ



Type QLW-AZ-ZT (with cross-talk sound attenuator)



# Construction · Dimensions · Materials

## Construction

The type QLW-AZ displacement flow diffusers consist of a diffuser face made from round hole perforated sheet steel, plenum box and the optional extra cross-talk sound attenuator. The diffuser face can be removed from the front. Air connections are made via rear mounted spigots for supply and extract air.

The diffusers are also available with an optional spigot lip seal and volume flow rate control. Flow is controlled via a damper in the spigot which has two cables accessible from the front (green cable = close damper / white cable = open damper). After the flow rate has been set the cables can be pushed back into the plenum box through the diffuser face.

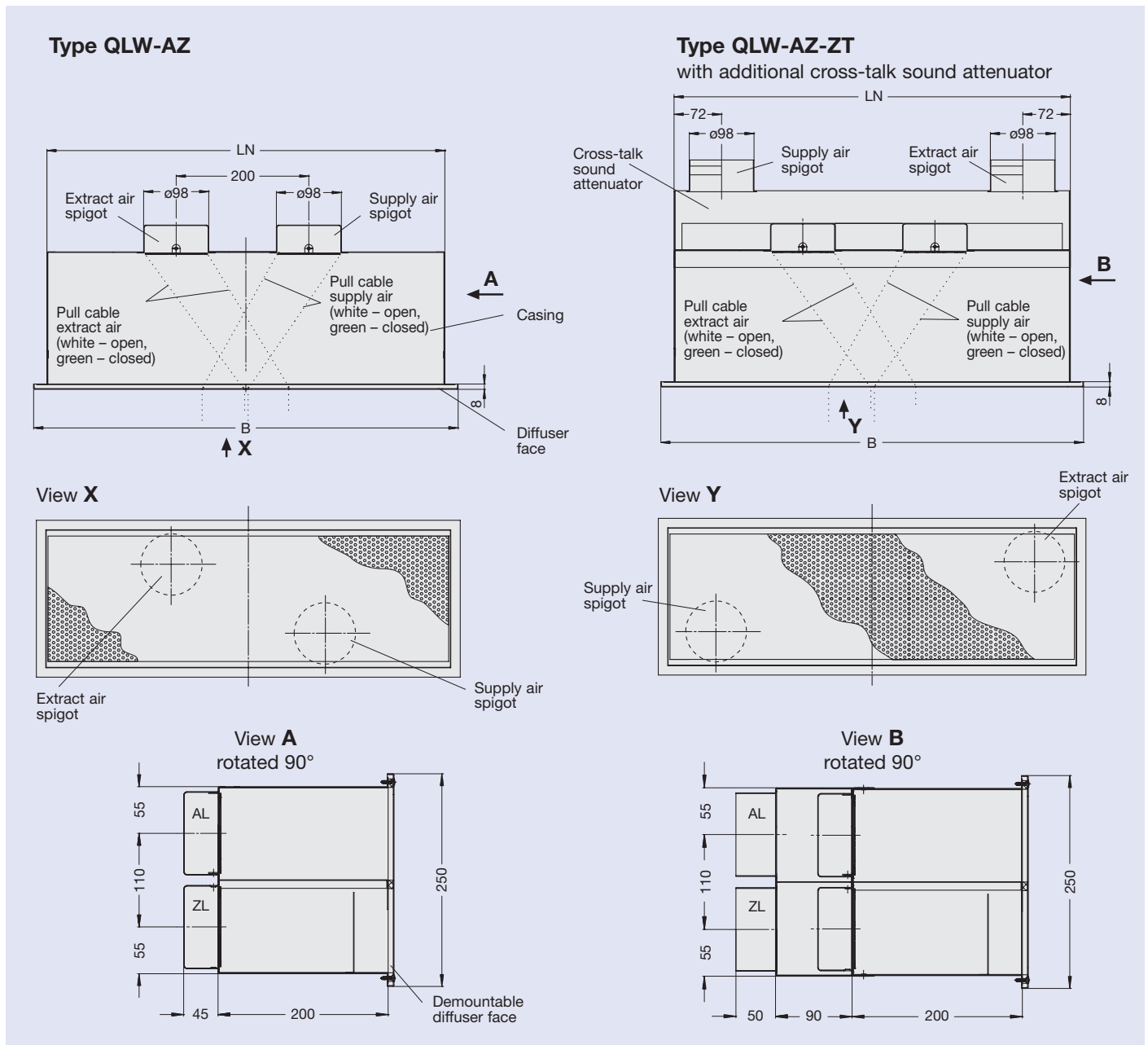
Other face constructions can be provided, in addition to the standard perforated configuration, provided they have a similar free area. A concealed fixing of the diffuser face is also possible. Please feel free to discuss this with us – we'll work together to find the optimum solution for your particular project.

## Materials

Diffuser face, plenum box, spigots and cross-talk sound attenuator are made of galvanised sheet steel. The inner lining of the cross-talk sound attenuator is mineral wool with glass fibre cover on the exposed face, lip seal made of rubber.

The surface of the diffuser face is pre-treated and powder-coated white RAL 9010 (gloss level 50 %), optionally powder-coated to RAL 9006 (gloss level 30 %), or any other RAL colour (gloss level 70 %).

Dimensions in mm			
L <sub>N</sub>	B	Perforated area (mm)	A <sub>tot</sub> (m <sup>2</sup> )
600	640	593 x 200	0.12
750	790	745 x 200	0.15
900	940	891 x 200	0.18
1050	1090	1044 x 200	0.21
1200	1240	1189 x 200	0.24



# Installation · Assembly

## Installation · Assembly

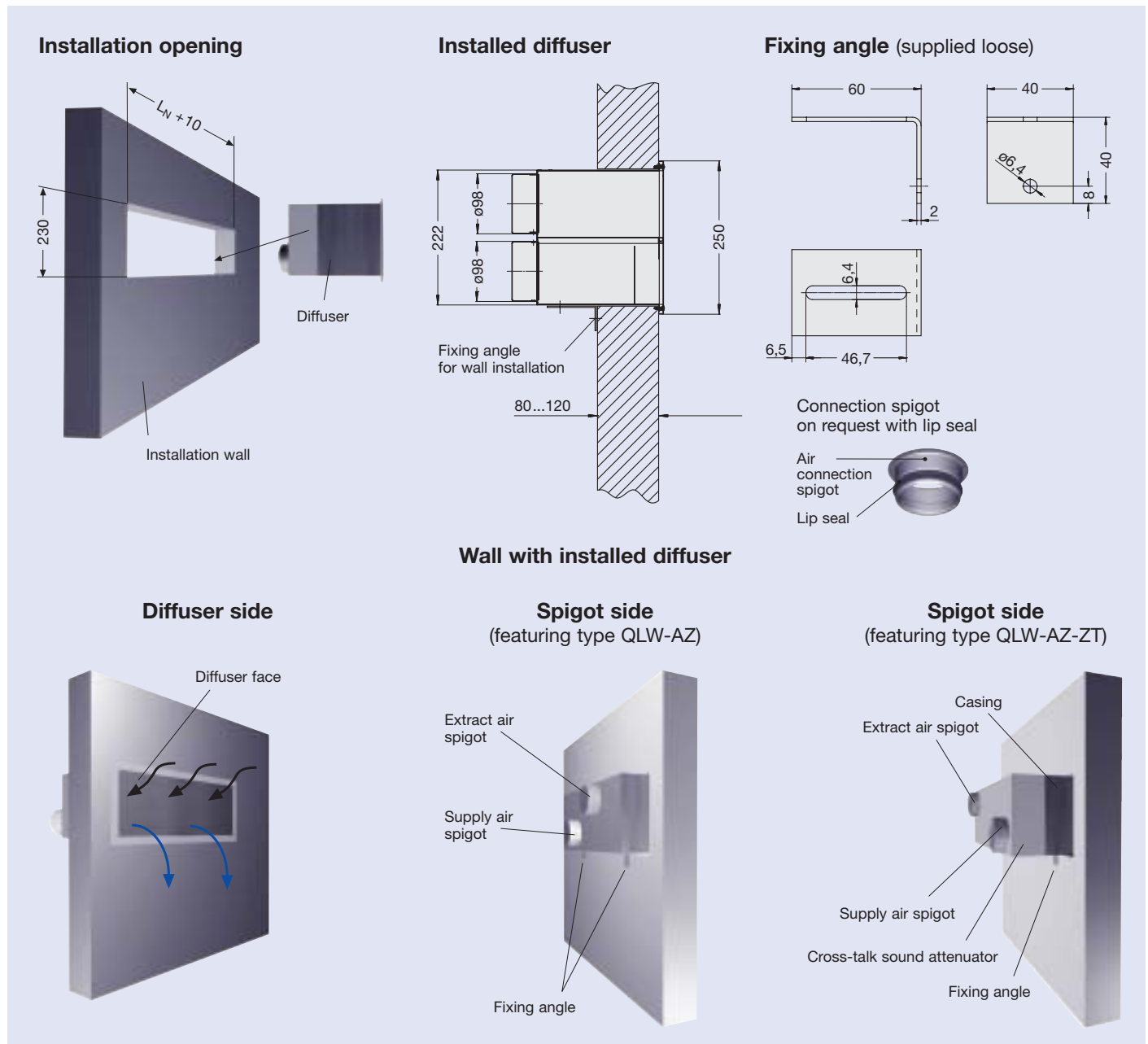
Two optional loose fixing angles have been included for installation of the displacement flow diffusers. Mount them on the underside of the plenum box, where they will fix the plenum to the spigot side of the wall.

Push the diffuser and its plenum box into the wall from the front side. Then fix the angle brackets by inserting the screws provided into the slotted holes in the brackets. Nutserts have been provided for this purpose on the underside of the plenum box (for wall attachment versions only). Finally, fix the angle brackets securely to the wall.

The diffuser face can be removed by undoing the screws in the border. The face plate can be refitted at a later date after wall surface finishes (paint/wallpaper) have been completed thus avoiding any damage to the diffuser face.

When subsequently adding a cross-talk sound attenuator, push the sound attenuator into the rear of the plenum box so that the attenuator's pressed case guides slot into the corresponding plenum case guides.

Using the holes in the attenuator case match drill into the plenum box. Then use self-tapping screws or blind rivets to fix the cross-talk sound attenuator into place.



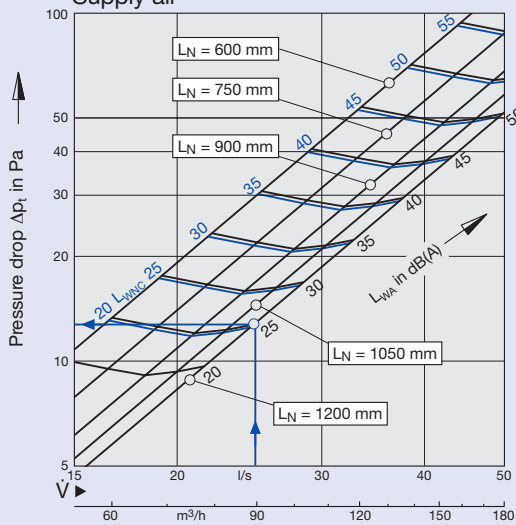
## Nomenclature

- $\dot{V}$  in l/s or m<sup>3</sup>/h: Volume flow rate per diffuser
- $\Delta p_t$  in Pa: Total pressure drop
- $L_{WA}$  in dB(A): A-weighted sound power level
- $L_{WNC}$  : NC rating of the sound power level spectrum
- $D_t$  in dB: Insertion loss re flow regenerated noise DIN EN ISO 7235-2004
- $R'$  in dB: Construction sound reduction index
- $R_{WR}$  in dB: Weighted sound reduction index
- $L_{pA}$  in dB(A): A-weighted sound pressure level in the room
- $\bar{v}_{tot}$  in m/s: Discharge velocity related to  $A_{tot}$
- $A_{tot}$  in m<sup>2</sup>: Total outlet area
- $\Delta t_z$  in K: Temperature difference between supply and room air

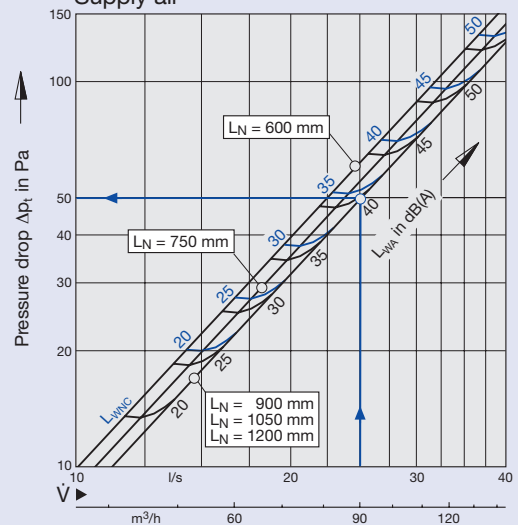
### Correction factors damper setting

Type		$\Delta p_t$		$L_{WA}$ (dB)	
		45°	closed	45°	closed
with cross-talk sound attenuator	Supply air	x 1.0	x 1.4	+ 1	+ 3
	Extract air	x 1.2	x 1.7	+ 3	+ 4
without cross-talk sound attenuator	Supply air	x 1.5	x 3.5	+ 4	+ 5
	Extract air	x 2.5	x 7.2	+ 6	+ 10

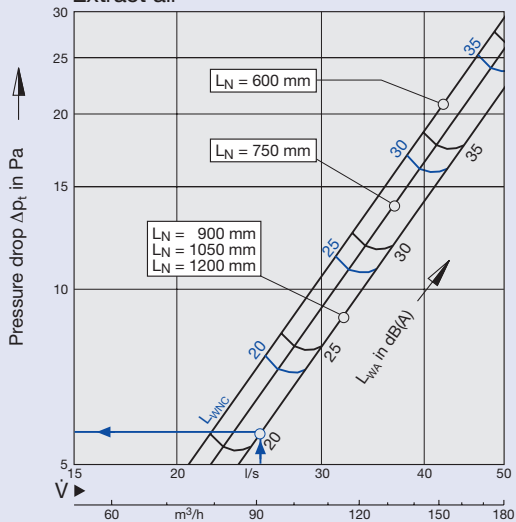
### 1 Sound power and pressure drop without cross-talk sound attenuation Supply air



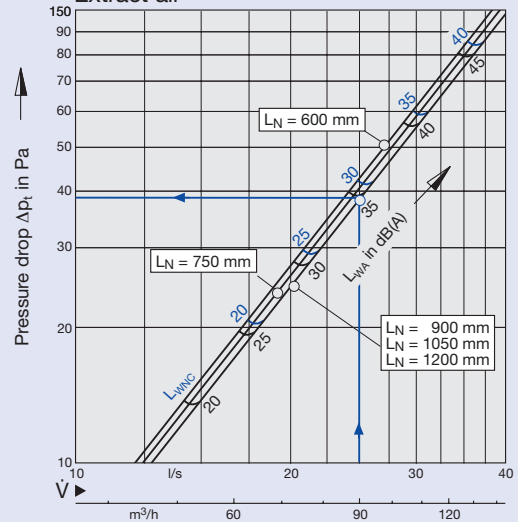
### 3 Sound power and pressure drop with cross-talk sound attenuation Supply air



### 2 Sound power and pressure drop without cross-talk sound attenuation Extract air



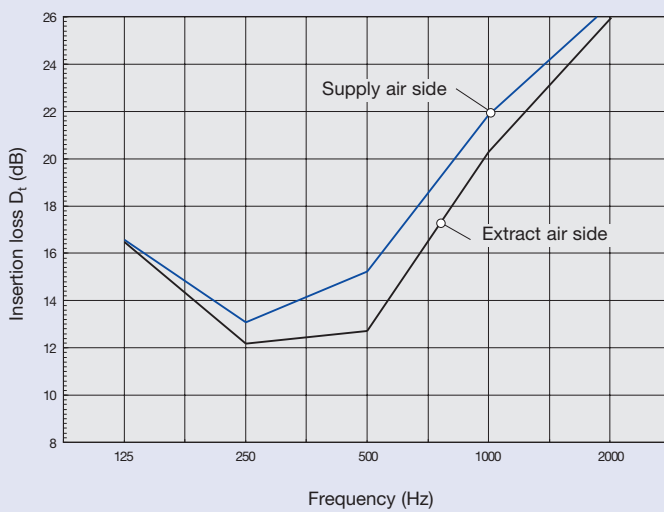
### 4 Sound power and pressure drop with cross-talk sound attenuation Extract air



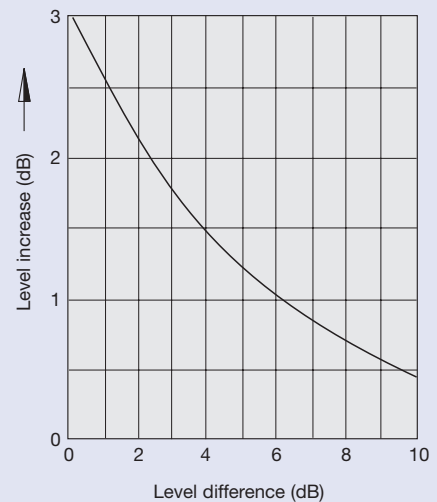
## Quick Selection

$L_N$ (mm)	Supply air volume flow rate $\dot{V}$					
	at $\bar{v}_{tot} = 0,1$ m/s		QLW-AZ $L_{WA} = 40$ dB(A)		QLW-AZ-ZT $L_{WA} = 40$ dB(A)	
	m <sup>3</sup> /h	l/s	m <sup>3</sup> /h	l/s	m <sup>3</sup> /h	l/s
600	45	13	90	25	80	22
750	57	16	100	28	85	24
900	69	19	110	31	90	25
1050	81	23	120	33	90	25
1200	93	26	130	36	90	25

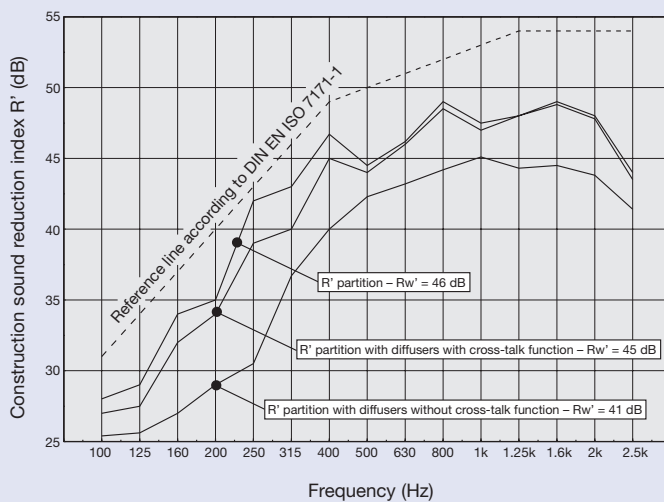
### 5 Insertion loss with cross-talk sound attenuator



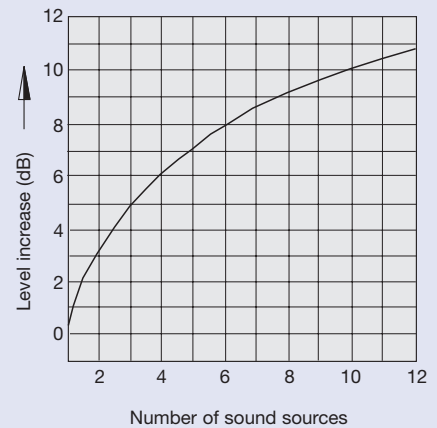
### 7 Summation of sound levels of two different sound sources



### 6 Influence of the displacement flow diffuser on the partition sound reduction index



### 8 Summation of sound levels of more than one sources of the same amplitude



## Example

An office space which is three modules wide with a maximum occupancy of three people is to be ventilated using one QLW-AZ diffuser per modular width. The requirement is for a mean indoor air quality of RAL 3 acc. to EN 13779. To achieve this, fresh air has to be supplied at a rate of 29 m<sup>3</sup>/h (8 l/s) per person.

Because the room has a total load of approx. 540 W the volume flow has to be increased to 270 m<sup>3</sup>/h at a  $\Delta t_z$  of -6 K.

That means a volume of 90 m<sup>3</sup>/h (25 l/s) per diffuser has to be supplied to and extracted from the room. As per the table on page 6 this results in a diffuser length of 1200 mm for a  $\bar{v}_{tot}$  of approx. 0.1 m/s.

The design is based on a volume control damper position of 45° to balance air flow to the diffuser.

The selection must comply with the normal sound pressure level in small offices of 30 – 40 dB(A) acc. to EN 13779. The room attenuation is assumed to be 8 dB.

### Sound power and pressure loss without cross-talk sound attenuator:

#### Diagram 1:

$$\Delta p_t \text{ (supply)} = 12 \text{ Pa}$$

$$L_{WA} \text{ (supply)} = 25 \text{ dB(A)}$$

Correction for damper setting of 45°:

$$\Delta p_t \text{ (supply)} = 12 \text{ Pa} \times 1,5 = 18 \text{ Pa}$$

$$L_{WA} \text{ (supply)} = 25 + 4 \text{ dB(A)} = 29 \text{ dB(A)}$$

#### Diagram 2:

$$\Delta p_t \text{ (extract)} = 6 \text{ Pa}$$

$$L_{WA} \text{ (extract)} = 21 \text{ dB(A)}$$

Correction for damper setting of 45°:

$$\Delta p_t \text{ (extract)} = 6 \text{ Pa} \times 2,5 = 15 \text{ Pa}$$

$$L_{WA} \text{ (extract)} = 21 + 6 \text{ dB(A)} = 27 \text{ dB(A)}$$

The difference in the sound power levels of the supply and extract air is 2 dB. For this reason, approx. 2 dB must be added to the greater value in calculating the total levels (see diagram 7), yielding a total sound power level of 31 dB(A).

With a room attenuation of 8 dB and the additional sound level provided by three diffusers (acc. to diagram 8 = 5 dB), this yields a room sound pressure level of 28 dB(A), which is permissible.

As diagram 6 in the example situation shows, the sound reduction index of the wall is significantly weakened by the installation of a diffuser without a cross-talk sound attenuator. To prevent this and minimise cross-talk to neighbouring rooms through the ventilation ducts a cross-talk sound attenuator should be added. Analysis should be carried out to check whether the sound pressure levels in the room can be maintained even when using the diffuser with the added cross-talk sound attenuator, because although the attenuator significantly improves the room-to-room attenuation (see diagram 5), it creates additional air regenerated noise.

### Sound power and pressure loss with cross-talk sound attenuator:

#### Diagram 3:

$$\Delta p_t \text{ (supply)} = 50 \text{ Pa}$$

$$L_{WA} \text{ (supply)} = 40 \text{ dB(A)}$$

Correction for damper setting of 45°:

$$\Delta p_t \text{ (supply)} = 50 \text{ Pa} \times 1 = 50 \text{ Pa}$$

$$L_{WA} \text{ (supply)} = 40 + 1 \text{ dB(A)} = 41 \text{ dB(A)}$$

#### Diagram 4:

$$\Delta p_t \text{ (extract)} = 39 \text{ Pa}$$

$$L_{WA} \text{ (extract)} = 35 \text{ dB(A)}$$

Correction for damper setting of 45°:

$$\Delta p_t \text{ (extract)} = 39 \text{ Pa} \times 1,2 = 47 \text{ Pa}$$

$$L_{WA} \text{ (extract)} = 35 + 3 \text{ dB(A)} = 38 \text{ dB(A)}$$

The difference in the sound power levels of the supply and extract air is 3 dB. For this reason, approximately 2 dB should be added to the greater value in calculating the total levels (see diagram 7), yielding a total sound power level of 43 dB(A).

With a room attenuation of 8 dB and the additional sound level provided by three diffusers (acc. to diagram 8 = 5 dB), this yields a sound pressure level in the room of 40 dB(A), which is 12 dB noisier than without a cross-talk sound attenuator but still within the permissible range.

