

## Air diffusion systems

### Linear swirl diffusers WKA

#### General

The swirl diffusers type WKA are linear swirl diffusers for side wall or ceiling applications. They are intended for supplying air in ventilation or air conditioning applications.

Their particular properties are:

- Handling of high thermal loads and air change rates
- Draught free room air movement with low mounting heights
- Very even temperature differences in the occupied zone

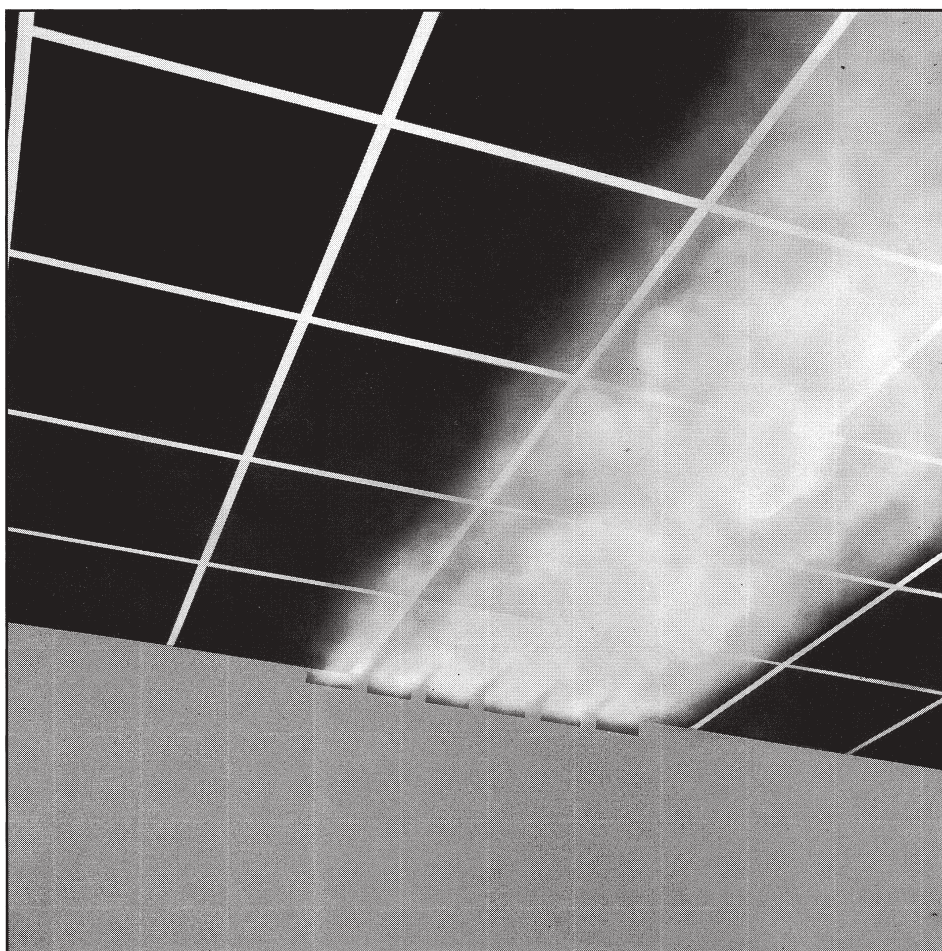
#### Function

The linear swirl diffusers introduce the supply air into the room in the form of one or two swirling horizontal jets along the ceiling. The high induction of the swirling jets creates a rapid reduction of the velocity at the diffuser and the supply to room air temperature difference, this creates an even air temperature level and low room air velocities.

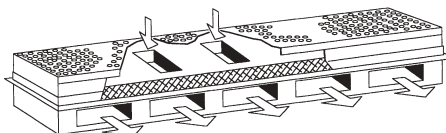
#### Types and sizes available

The linear swirl diffusers can be supplied either for connecting directly into a duct or complete with connection plenum box. There are two sizes available having the following air supply openings.

155 x 45 mm  
80 x 30 mm

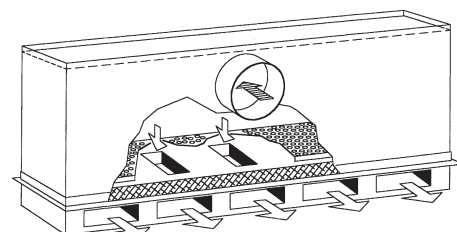


#### Types



Linear swirl diffuser for direct duct connection

Linear swirl diffuser with connection plenum box



**Linear swirl diffusers  
WKA**

<b>Contents:</b>	<b>Page</b>
General, Function, Types and sizes	1
Typical applications	2
Construction and function	3
Dimensions	4/5
Duct entry and installations	6
Room depths and maximum throw	7
Technical data	8/9
Setting	10
Selection example	11
Tender text	12



**Store : Christ Jewellers, Hamburg**



**Meeting room : Law Court, Dresden**



**Lounge : Honda, Hanau**



**Hotel bar : Town hall, Ransbach-Baumbach**

The company reserves the right of design change without notice.

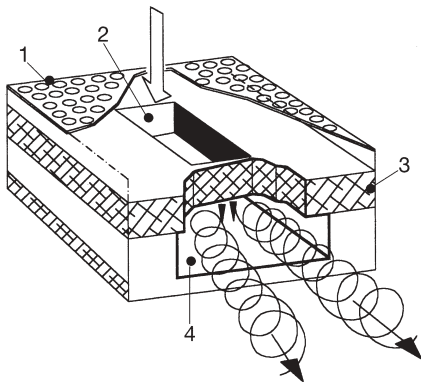


**Linear swirl diffusers  
WKA**

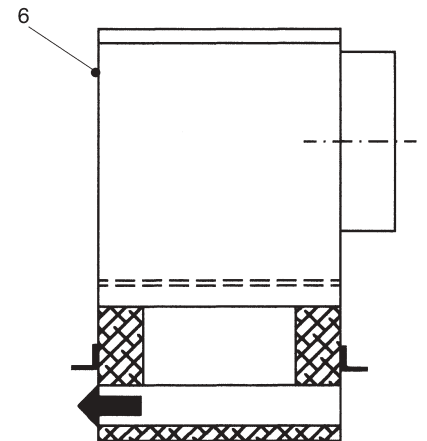
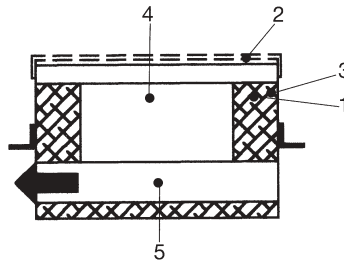
**Construction  
Function**

**Construction and function**

**Functioning principle**



**Construction**



Direct duct connection type

Connecting plenum box type

The supply air enters the length of the linear swirl diffuser over an equalising perforated plate (1) either directly from the ductwork or through a plenum box. The air inlet openings (2) in the upper part of the housing (3) create small stable air jets which blow vertically onto the base (4) of the housing. The impact causes the air to rotate and collide with the two sidewalls, the resultant rotating pattern then projects into the room through either one or both sides of the diffuser.

The linear swirl diffuser WKA is constructed from zinc plated steel and consists of a housing (1), the air entry side of the housing is covered with a perforated equalisation plate (2).

After the equalisation plate the upper part of the housing (3) is lined with 40 mm thick strong insulating material which in turn forms between 5 and 7 air inlet openings (4) to the air outlet chamber (5), the base of the outlet chamber is lined with an acoustic lining to form the outlet openings to one or both sides of the diffuser.

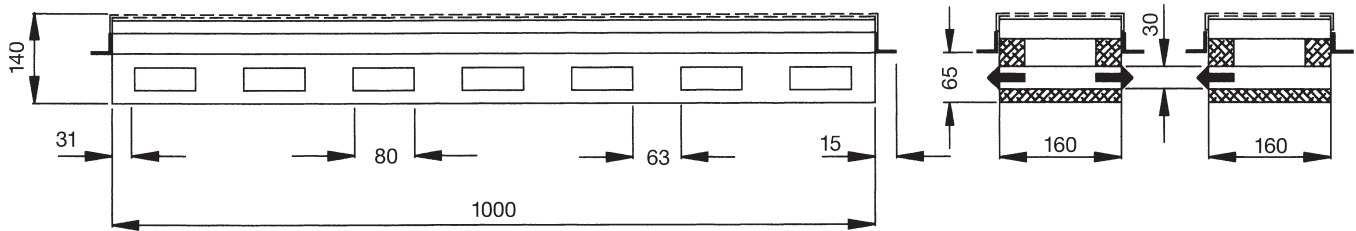
The housing can either be directly connected to ductwork (Direct duct connection type) or connected to a plenum box (6), (Connecting plenum box type).

**Linear swirl diffusers  
WKA**

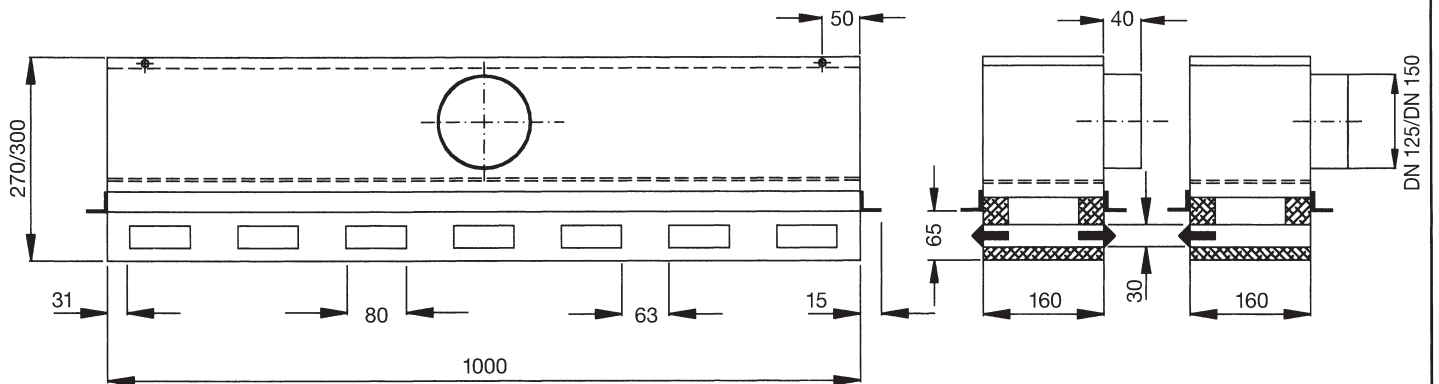
**Dimensions**

**Dimensions**

Size 80/30



**Direct duct connection type WKA 80/30**



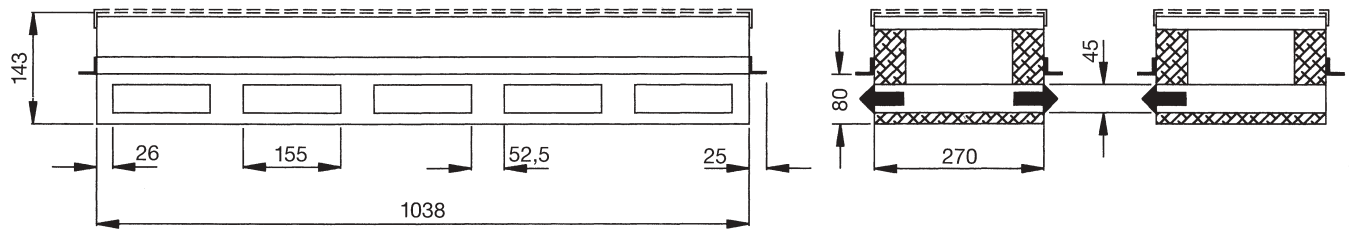
**Connecting plenum box type WKA 80/30-AK**

**Linear swirl diffusers  
WKA**

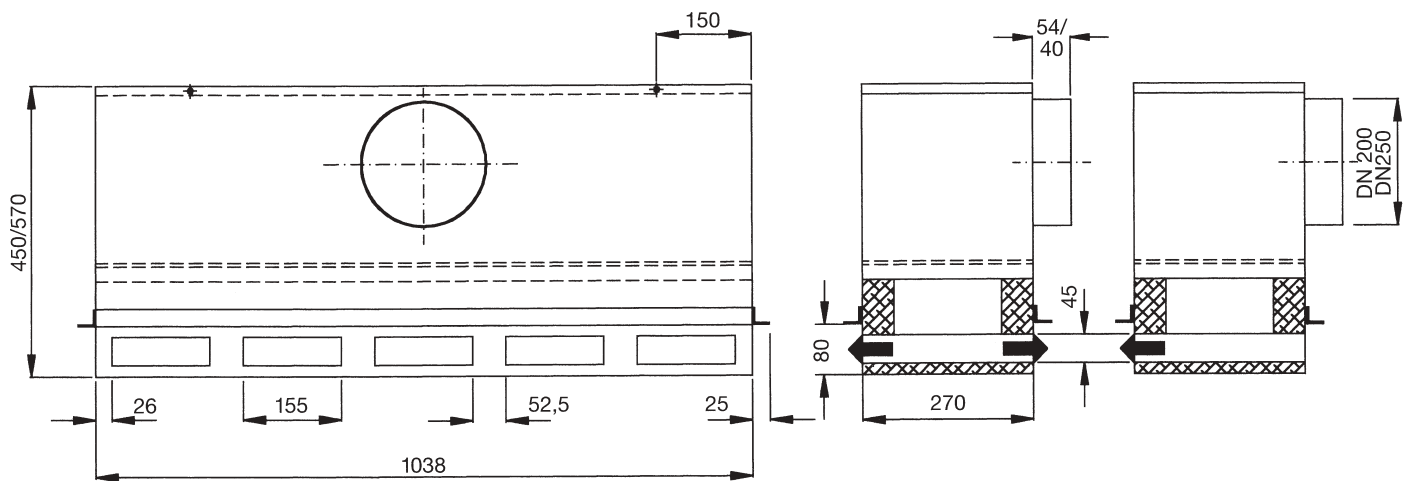
**Dimensions**

**Dimensions**

Size 155/45



**Direct duct connection type WKA 155/45**



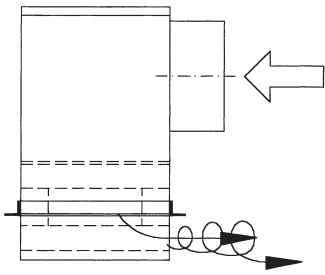
**Connecting plenum box type WKA 155/45-AK**

**Linear swirl diffusers  
WKA**

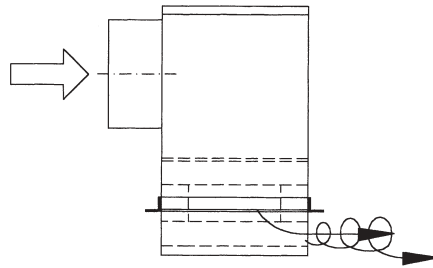
**Duct entry  
WKA-AK**

**Installations**

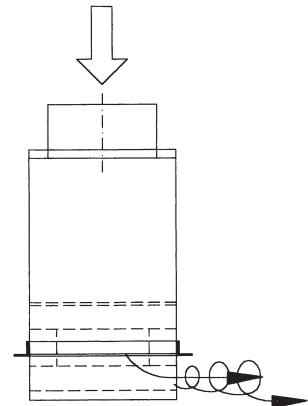
**Duct entry  
WKA-AK**



Front duct entry

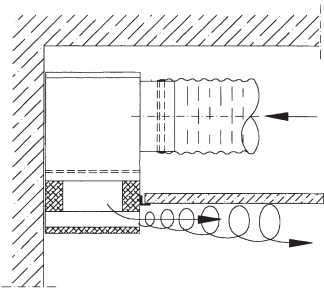


Rear duct entry

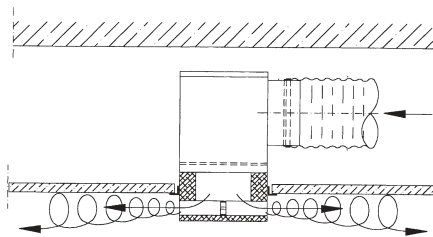


Top duct entry

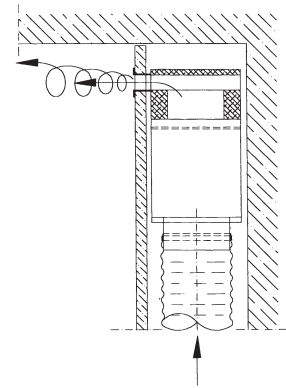
**Installation  
Connecting plenum box type**



Installed in false ceiling void at wall surface

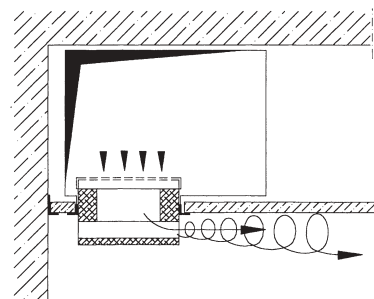


Installed in false ceiling void at room centre



Installed in false wall void

**Direct duct connection**

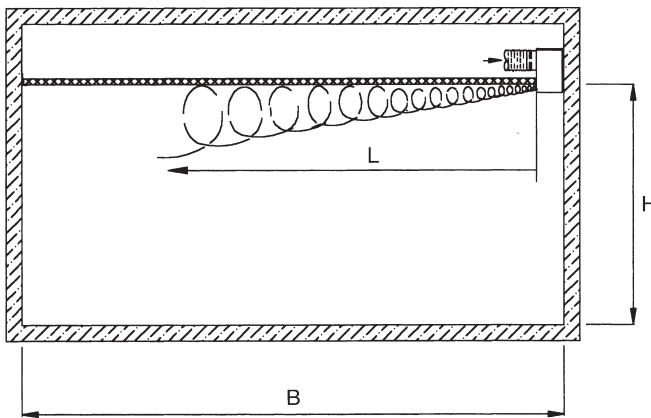


**Linear swirl diffusers  
WKA**

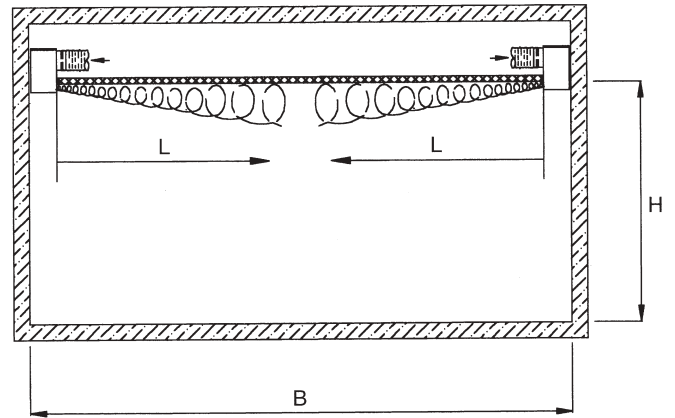
**Room depths  
Maximum throw**

**Room depths and maximum throw**

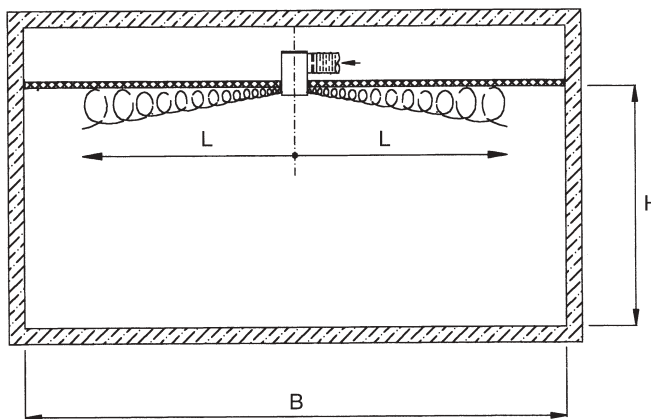
The following diagrams illustrate the maximum throw  $L_h$  for given room depths  $W$  at different installations (see also Figs. 2 & 3 on page 8). The minimum and maximum throws given are the valid limits for draught free room conditions.



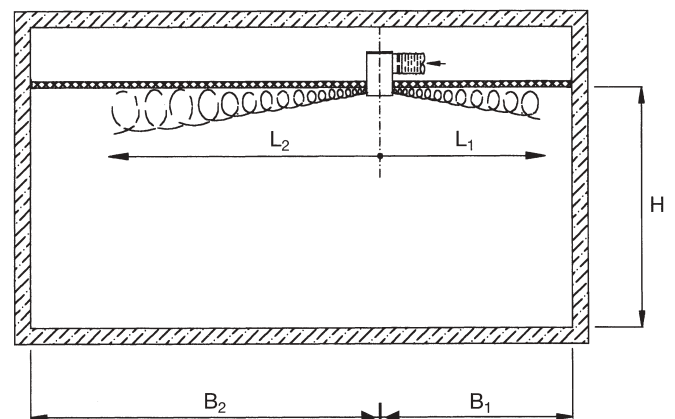
Diffuser situated at side wall, one way blow  
 $L_h = B$  ( $L_{hmin} = 0,7 \cdot B$ ,  $L_{hmax} = B + H - 1,7$ )



Diffuser situated at opposite side walls, one way blow  
 $L_h = B \cdot 0,35$  ( $L_{hmin} = 0,3 \cdot B$ ,  $L_{hmax} = B \cdot 0,3 + H - 1,7$ )



Diffuser situated at centre of ceiling, two way blow  
 $L_h = B \cdot 0,5$  ( $L_{hmin} = 0,35 \cdot B$ ,  $L_{hmax} = B \cdot 0,5 + H - 1,7$ )



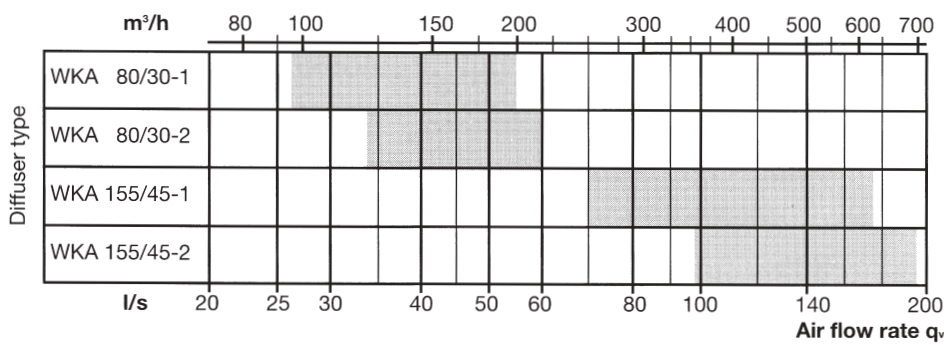
Diffuser situated off centre of ceiling, two way blow  
 $L_{h1} = B_1$   $L_{h2} = B_2$   
 $(L_{h1min} = 0,7 \cdot B_1$   $L_{h1max} = L_{h1} + H - 1,7)$

**Linear swirl diffusers  
WKA**

**Technical data**

**Air flow rate operating range**  
**Temp. diff. operating range**  
**Throw as function of air flow rate**

**Air flow rate operating range**



The air flow rates given are for fully open diffusers (without setting blade). The minimum air flow rates are the minimum for stable air flow and the maximum air flow rates are based on a noise level of 40 NR.

To reduce the minimum air flow rate, setting elements can be used. (see Page 10).

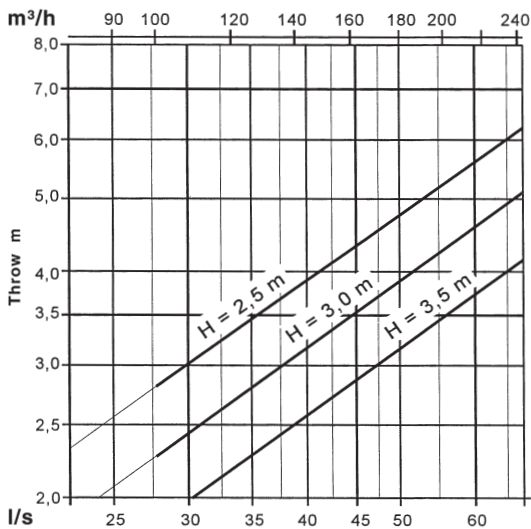
**Fig. 1 Air flow rate operating ranges for sizes WKA 80/30 and WKA 155/45 diffusers with one and two-way blow**

**Temperature operating range**

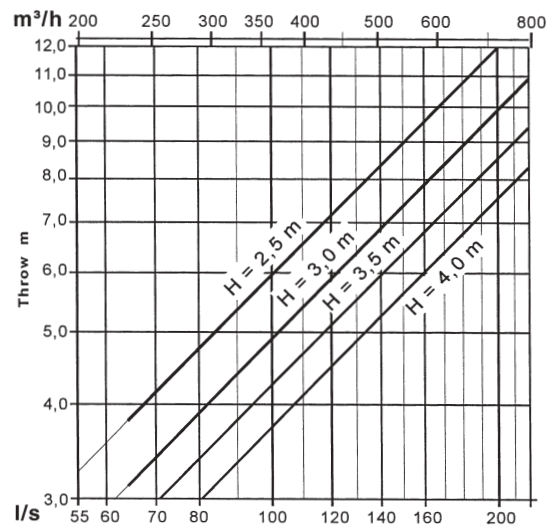
Supply-room air temperature difference- Cooling:  $\Delta t \leq 10K$   
 Heating:  $\Delta t \leq 6K$  (with 100% extract at ceiling)  
 $\Delta t \leq 8K$  (with 30% extract air at floor level)

**Throw as function of air flow rate**

The following graphs give the throw as a function of the air flow rate and the mounting height H (the air flow rate is for one-way blow only)



**Fig. 2 WKA 80/30- Throw as function of air-flow rate and mounting height H**



**Fig. 3 WKA 155/45- Throw as function of air-flow rate and mounting height H**



**Linear swirl diffusers  
WKA**

**Technical data**

**Noise level  
Pressure loss**

**Noise level and pressure loss**

The following graphs, Figs. 4 to 7 are valid for fully open diffusers (without setting elements)

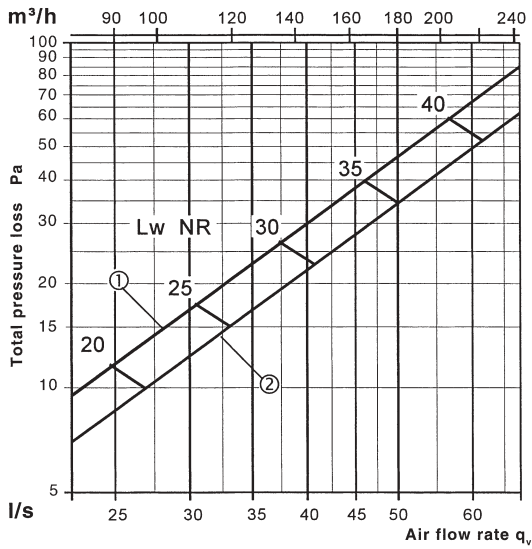


Fig. 4 - WKA 80/30, one way blow  
① = Plenum with 125ø spigot  
② = Plenum with 160ø spigot & diffuser without plenum

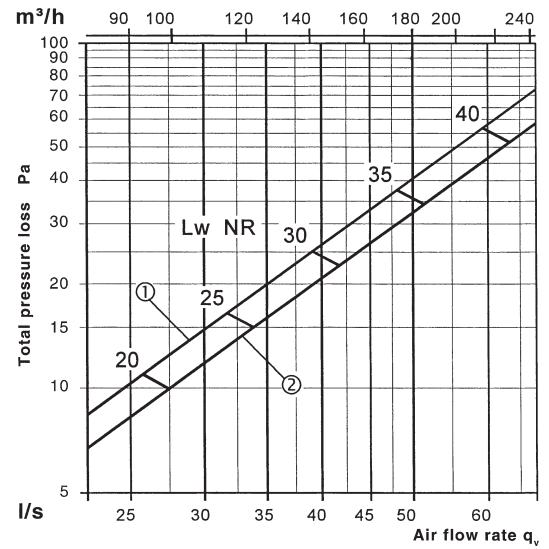


Fig. 5 - WKA 80/30, two way blow  
① = Plenum with 125ø spigot  
② = Plenum with 160ø spigot & diffuser without plenum

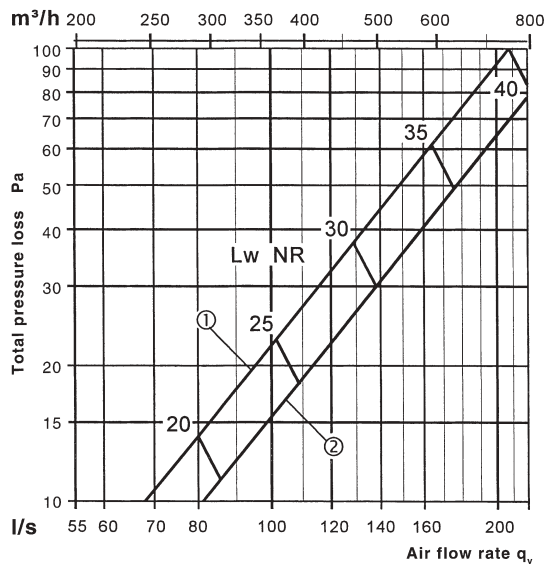


Fig. 6 - WKA 155/45, one way blow  
① = Plenum with 200ø spigot  
② = Plenum with 250ø spigot & diffuser without plenum

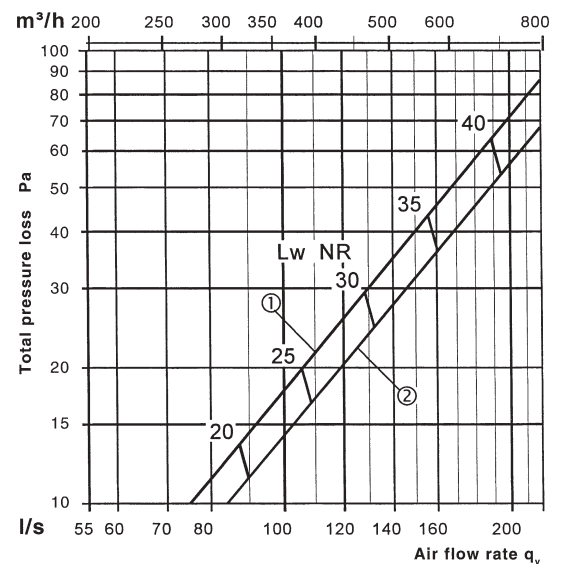


Fig. 7 - WKA 155/45, two way blow  
① = Plenum with 200ø spigot  
② = Plenum with 250ø spigot & diffuser without plenum

## Linear swirl diffusers WKA

## Setting elements

### Setting elements

Setting elements are elements formed from sheet steel fitted with a surrounding gasket, they are fitted into each of the outlet openings in the outlet chamber. By sliding the elements horizontally within the outlet chamber the air inlet opening is opened or closed, the less the dimension 'x' in Fig. 8. the less the opening is.

The setting elements are adjusted by means of a removable threaded rod.

#### Function

The closing of one or more inlet openings increases the air velocity at the entrance to the outlet chamber, this results in:

- Increase in the pressure loss
- Increase in the intensity of the swirling air stream
- Increase in the noise level

With the two-way blow diffusers, off-setting of the setting element will result in proportioning the air flow to each of the respective openings thereby changing the respective throw at each side of the diffuser. The proportional change is directly related to the ratio of 'x<sub>1</sub>' to 'x<sub>2</sub>' as shown in Fig. 9.

To achieve a dampering effect with a two-way blow diffuser and subsequent increase in pressure loss and swirl intensity, two setting elements must be used.

#### Uses

- Equalisation of the air flow at each individual opening.
- Increase of throw by closing openings
- Increase of the swirl effect and induction when the air flow rate drops below the minimum such as in extreme heating and cooling situations

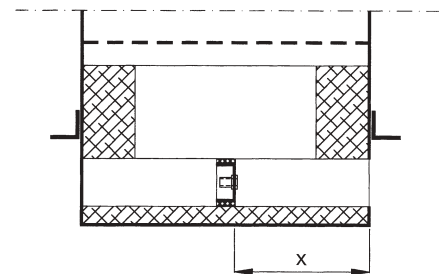


Fig. 8: One way blow linear swirl diffuser WKA-1 with setting element

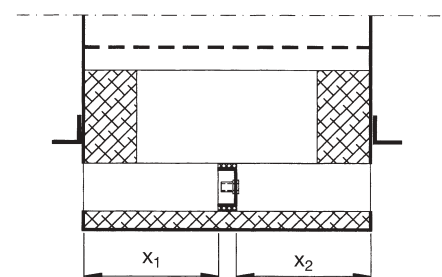


Fig. 9: Two-way blow linear swirl diffuser WKA- with setting element for proportioning the air flow

## Linear swirl diffusers WKA

## Selection example

### Selection example

#### Given

Room dimensions	:	8 m long 6 m wide 3 m high
Air flow rate	:	416 l/s (1500 m <sup>3</sup> /h)
Temp. diff.- cooling	:	6 K
Maximum noise level	:	33 NR

The supply duct is along the length of the room and under the ceiling. the desired diffuser is a WKA 155/45 one-way blow complete with plenum box.

#### Method

(in this example the values of l/s and m<sup>3</sup>/h have been rounded off)

For a one-way blow diffuser positioned at a side wall the throw is considered to be the same as the room width (see page 7), therefore  $L = W = 6$  m

From Fig. 3 with a throw of 6 m and a room height of 3 m, the flow rate is 117 l/s (420 m<sup>3</sup>/h).

This indicates a requirement of 3,6 diffusers.

For practical purposes 4 diffusers must be used but with one diffuser having 40% of the openings closed, that is 2 openings of the 5 closed completely by means of the setting elements.

From Fig. 6, for a one-way blow WKA-1 155/45 diffuser with plenum box handling 117 l/s (420 m<sup>3</sup>/h) the pressure loss with a 200ø inlet spigot is 25 Pa and the noise level 30 NR.

The diffuser with 2 closed outlet openings handling 65 l/s (240 m<sup>3</sup>/h) will have a lower inlet velocity and lower pressure loss, therefore the resultant noise level and pressure loss will be lower than for the fully open diffusers.

#### Required:

- Number of diffusers
- Air flow rate per diffuser
- Total pressure loss
- Noise level

### Conclusion

Linear swirl diffusers WKA-1-AK 155/45 will be required 3 of which will be fully open handling 117 l/s (420 m<sup>3</sup>/h) and one of which will need to have 2 of the outlet openings closed by means of the setting elements and handle 65 l/s (240 m<sup>3</sup>/h).

Pressure loss = 25 Pa

Noise level = 30 NR

# Tender text

Position	Description	No. of units	Unit price	Extended price
	<p><b>Linear swirl diffusers</b> for ceiling or side-wall air supply requiring even air diffusion and the minimum possible temperature gradient in the occupied zone.</p> <p>The diffuser consists of a rectangular formed housing with 5 rectangular openings constructed from zinc plated 1203 steel, with a perforated equalisation plate leading to an upper chamber and a separate outlet chamber.</p> <p>Setting elements are included for regulating the air flow.</p> <p><b>Sizes</b></p> <p><input type="checkbox"/> 80/30    L = 1000 mm</p> <p><input type="checkbox"/> 155/45    L = 1030 mm</p> <p><b>Specific information</b></p> <p><input type="checkbox"/> Direct duct connection</p> <p><input type="checkbox"/> Plenum box, inlet spigot ..... Ø</p> <p><input type="checkbox"/> one-way blow</p> <p><input type="checkbox"/> one-way blow</p> <p><b>Finish</b> (visible surfaces)</p> <p><input type="checkbox"/> Primed</p> <p><input type="checkbox"/> Enamelled matt black</p> <p>Air flow rate ..... l/s or m<sup>3</sup>/h</p> <p>Max. noise level ..... NR or dB(A)</p> <p>Max. pressure loss ..... Pa</p> <p>Manufacturer:        <b>STRULIK</b></p> <p>Type:                    <b>WKA</b></p>			