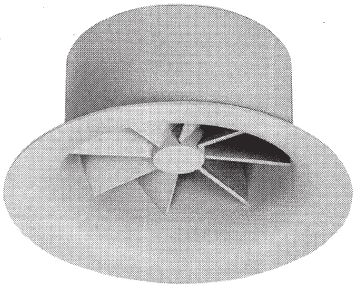


Air diffusion systems

Standard swirl diffusers Type SD

General

The SD range of fixed air pattern diffusers is designed for applications requiring high induction rates and relatively high air change rates. They are applicable for both heating and cooling applications.

The main features of the standard range are

- Treatment of high cooling loads due to the high induction rate.
- Draught free room air movement at low mounting heights.
- Efficient air temperature equalisation in the occupied zone.
- Non reliance on the COANDA effect for the air pattern and therefore the performance is not changed if mounted without a ceiling or above an open cell ceiling.
- The front face of the diffuser does not have unsightly cones projecting below the surface.
- The upper surfaces are minimum in area and mainly vertical they therefore do not present traps for dust and other contaminants.
- The overall dimensions are at a minimum and all sizes can be contained within a 600 x 600 mm ceiling tile.

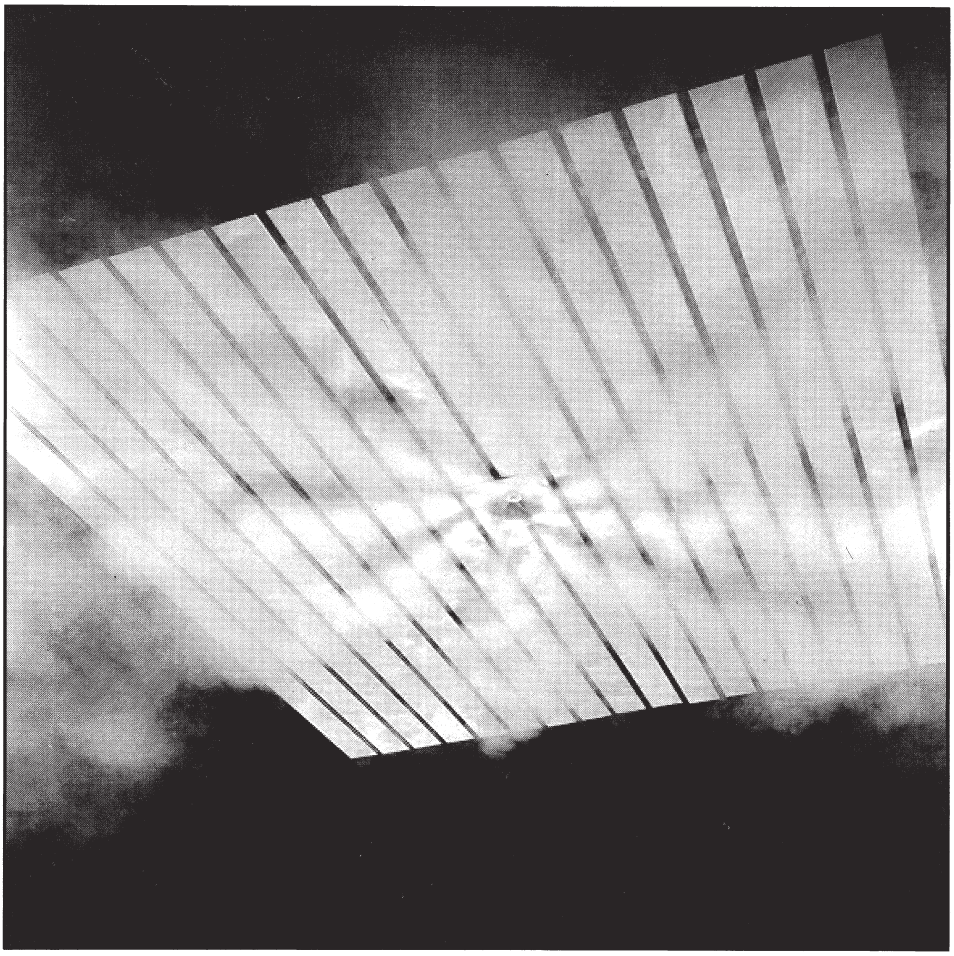
The SD diffusers are suitable for cooling applications up to 12 K and heating up to 6 K in accordance with DIN 1946 part 2.

FUNCTION

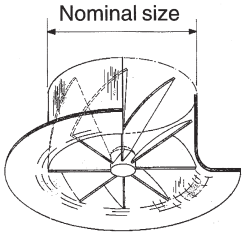
The characteristics are achieved by virtue of the eight unique air deflection blades which create a high rate of secondary air induction whilst at the same time maintaining a symmetrical horizontally rotating air pattern.

With the correct selection low air velocities with draught free conditions are achieved in the occupied zone.

SD diffusers are available in the sizes shown opposite.



Sizes available:



(Nominal diameters)

DN 100	DN 200
DN 125	DN 250
DN 160	DN 315
DN 180	DN 355
	DN 400

Standard swirl diffusers Type SD

Applications

- Business centres
- Department stores
- Offices
- Control rooms
- Laboratories
- Measurement rooms

Content

page

Trading centre: Alfatex, Hagen

Business centre: Schinzel, Lüneburg

Office: Lufthansa cityoffice, Hamburg

Control room: Kraftwerk Saarlouis

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Standard swirl diffuser Type SD

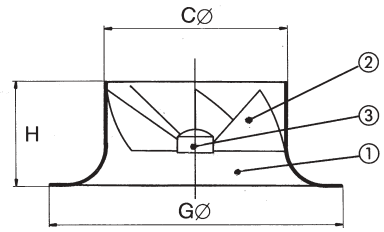
Construction, flanges, dimensions

Construction and dimensions

The SD diffusers are constructed from the following aluminium components:

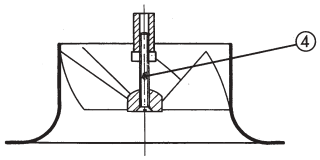
1. Outer cone
2. 8 fixed deflection blades
3. Centre hub

Size 400 has curved deflection blades



Nom. size	Dimensions mm		
	C	G	H
DN 100	98	155	51
DN 125	123	185	63
DN 160	158	240	85
DN 180	178	280	103
DN 200	198	310	110
DN 250	248	380	130
DN 315	313	490	175
DN 355	353	550	205
DN 400	398	625	265

The diffuser will be supplied with a central M6 screw (4) for independently fixing through the hub to a connection cone, plenum box etc.

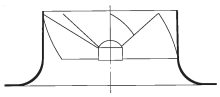


Flange variations

Various flange types are available to meet architectural and construction requirements, the standard variations are shown below but special requirements are available on request.

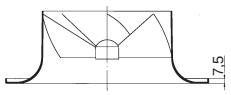
Flange Type SD

Standard circular flat flange
(standard flange for sizes 100–355).



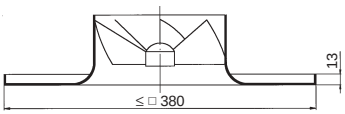
Flange Type SD-B

Standard circular flange with 7,5 mm edge
(normal flange for size 400).



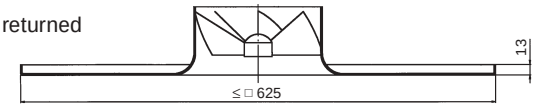
Flange Type SD-SF/K

Square flange form with a 13 mm returned edge. Max. side length 380 mm.



Flange Type SD-SF/G

Square flange form with a 13 mm returned edge. Max. side length 625 mm.



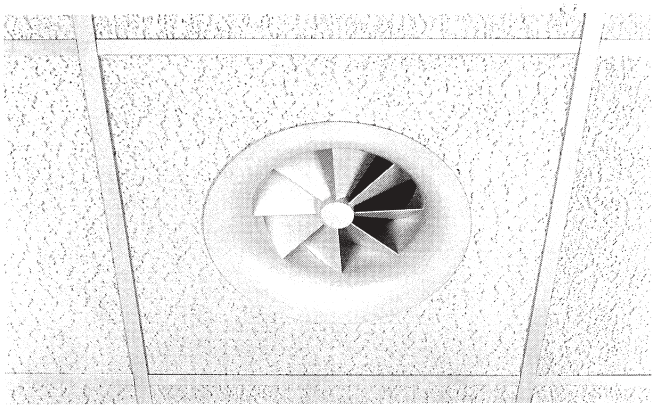
Standard swirl diffuser Type SD

Surface finishes, flange forms

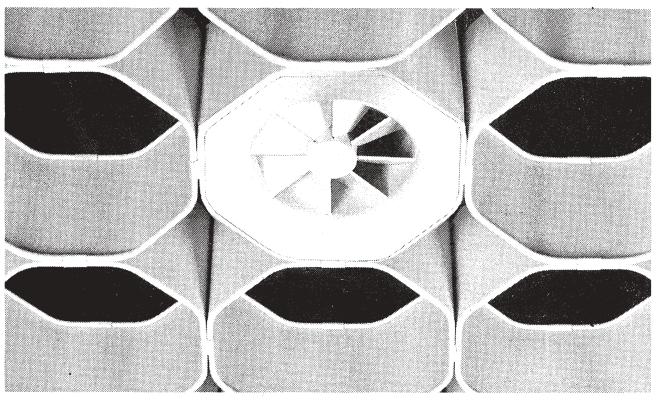
Surface finishes

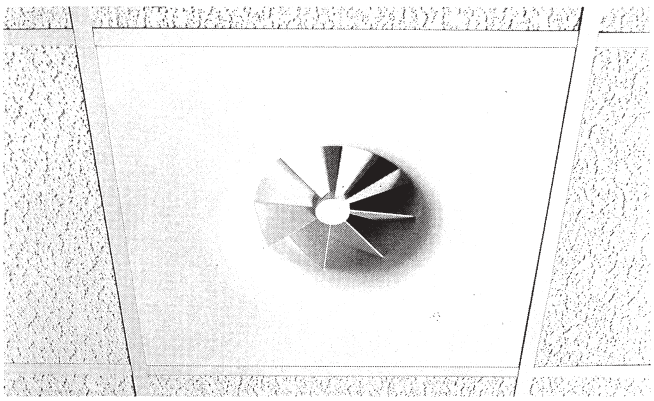
Standard SD swirl diffusers are available with following finishes

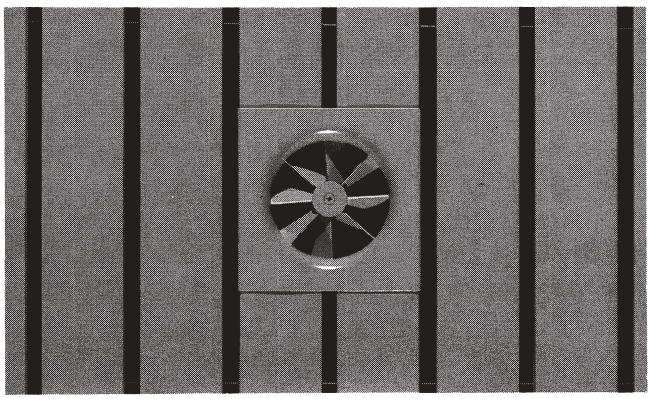
- Powder coated to RAL 9010
- Stove enamelled to RAL or NCS (addition to price)
- Primed (only size 250 to 400)

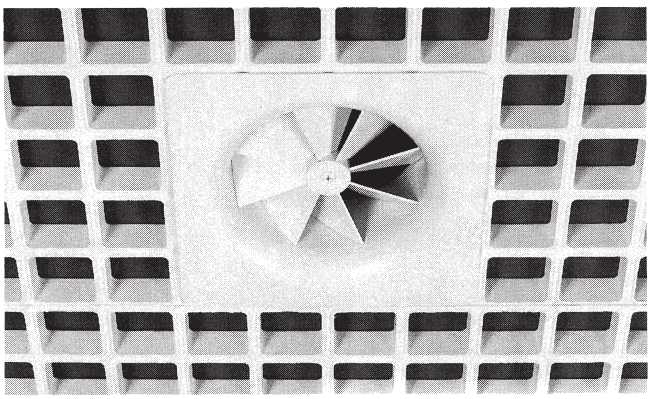


Flange forms









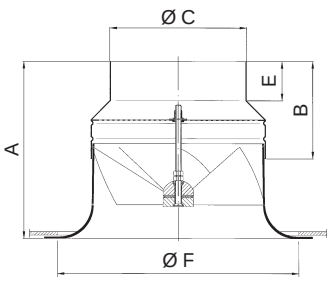
Connection components

Standard SD diffusers can be supplied with different connection components.

The purpose of these components is to achieve:

- the required air direction
- equalisation of the air flow
- the required pressure drop
- a reduction of the duct diameter relative to the normal size of the diffuser

Standard connection cone (Type U)

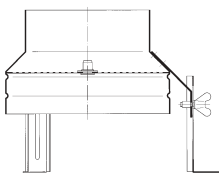


Swirl diffuser fixed to the connection cone by means of centre screw

Nom. size	Dimensions mm				
	A	B	C	E	F
DN 100	114	82	98	37	124
DN 125	144	102	98	43	155
DN 160	170	102	123	41	200
DN 180	200	117	123	43	240
DN 200	205	112	158	45	275
DN 250	235	132	198	45	350
DN 315	298	155	248	50	455
DN 355	340	188	248	50	510
DN 400	415	163	353	57	540

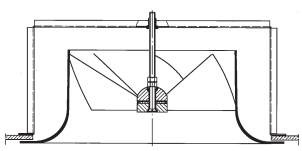
Alternative connection components

Connection cone with fixing lugs (Type UF)



Connection cone with three fixing lugs for mounting direct to the ceiling tile

Fixing bracket for plastered ceiling (Type T)

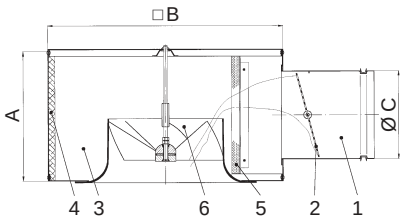


Standard swirl diffuser Type SD

Connection components

Plenum box (Type AK)

The standard plenum box with integral swirl diffuser consists of the following components
Side entry connecting spigot (1) with flow rate damper (2), Galvanised steel casing (3), for diffuser sizes 160 and upwards acoustic insulation material (4) and wavy perforated plate for equalising the air flow to the diffuser (5).
The standard type AK plenum box shown below is intended for use either where there is no ceiling or above an open cell ceiling.

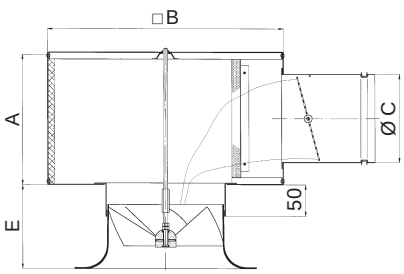


Nom. size	Dimensions mm A	B	C	E	Weight kg
DN 100	155	300	98	65– 85	2,9
DN 125	155	300	98	70– 95	3,0
DN 160	200	400	123	75–105	6,6
DN 180	200	400	123	85–120	6,7
DN 200	200	400	158	90–125	6,8
DN 250	270	585	198	95–140	12,3
DN 315	270	585	248	110–170	12,8
DN 355	300	650	248	115–185	14,8
DN 400	500	650	353	110–215	19,5

Custom made plenum boxes are available on request.

Plenum box (Type AKH)

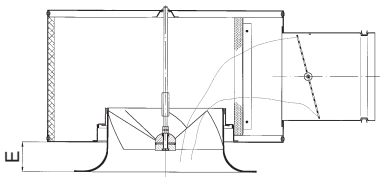
Plenum box with collar (50 mm length) for installation above suspendid ceilings. The swirl diffuser inside the collar is adjustable in vertical direction between 20 and 105 mm (depending on the size of the diffuser.
Dimension E ≈ 0,65 x nominal diameter of swirl diffuser



Standard swirl diffuser Type SD

Connection components

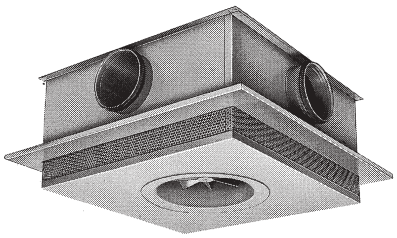
Plenum box with inside collar (Type AKH-S)

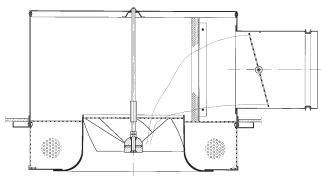


Plenum box with inside collar for restricted height E. ($E \geq 0$)
$E_{max} \approx 0{,}25$ x nominal diameter

Plenum box with displacement section (Type AK/Q)

A combination of swirl diffuser, plenum box and ”displacement“ type outlet. This type has been especially designed for applications with high air change rates ($14 \leq n \leq 30 \cdot h^{-1}$) and low room air velocities.





Standard swirl diffuser Type SD

Supplementary components

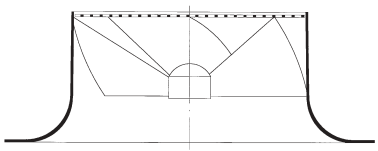
Supplementary components

To meet the necessary technical requirements, the following supplementary components are available.

Vane blanking (Type FA)

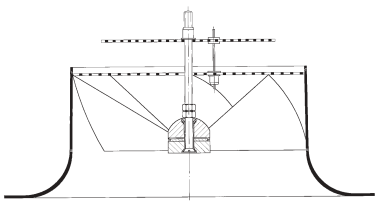
With vane blanking using Recticel, the air flow pattern in horizontal direction can be changed, f.i. to reduce the minimum distance between two diffusers or between diffuser and wall.

Perforated plate mounted to top of diffuser (Type L)



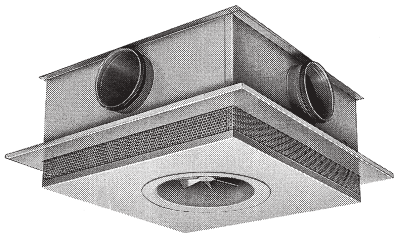
Swirl diffuser with perforated plate for direct connection to duct.

Damper integrated into diffuser (Type D)



Swirl diffusers with integrated damper can't be fixed to cone connection or plenum box by means of centre screw.

Plenum box fixing bracket (Type AW)

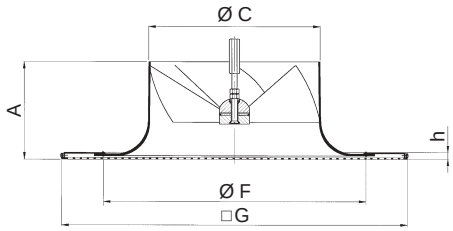


Plenum box fixing bracket, made in one piece (only for SD-AK/Q).

Standard swirl diffuser Type SD

Supplementary components

Rectangular perforated face plate finishes (Type LA/Q)



Standard swirl diffusers can be covered with perforated plate finishes to accommodate architectural requirements.

The covering does not influence the air flow pattern of the diffuser. Sound power level will increase about 1 dB(A), pressure loss 2–3 Pa.

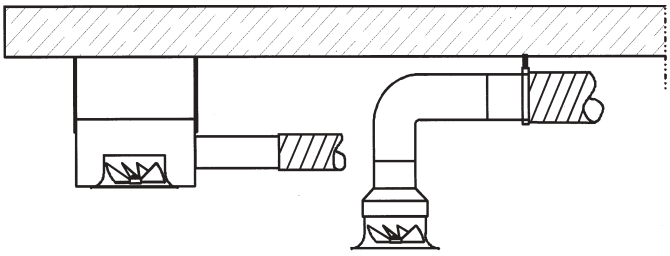
Dimensions mm
G (for grid ceilings)

Size Diffuser	G Standard	G Modul 600		Modul 625		A	C	F	M
DN 200	400	600	594	625	619	123	198	275	13
DN 250	450	600	594	625	619	143	248	350	13
DN 315	550	600	594	625	619	188	313	455	13
DN 355	600	600	594	625	619	218	353	510	13

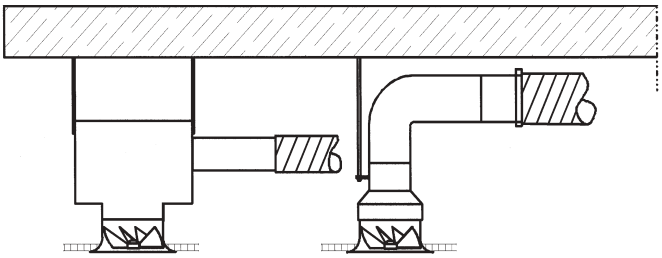
Standard swirl diffuser Type SD

Installation details

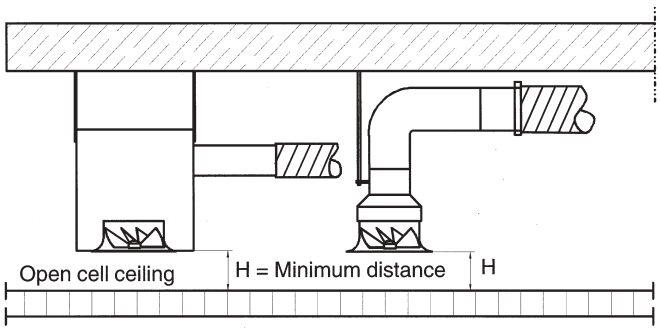
Installation



Visible installation without ceiling



Installation in suspended ceiling



Installation above open cell ceiling

For installation above an open cell ceiling, the minimum distance H between the top surface of the ceiling and the bottom of the diffuser should be as follows:

Nom. size	100	125	160	180	200	315	355	400
Distance "H" mm	100	125	160	180	200	300	350	400

Standard swirl diffuser Type SD

Selection data

Selection data

To achieve the required comfort conditions in the occupied zone it is necessary to consider the supply to room air temperature difference and the following criteria:

- Selection of the correct diffuser size
- Air flow rate
- Correct positioning of the diffusers especially the minimum distance between diffusers

Selection of the correct diffuser size

The diffuser size is initially based on the minimum and maximum air flow rate.

Minimum air flow for stable air movement conditions at the diffuser

The minimum air flow rate is governed by the requirement to guarantee a horizontal air pattern at up to 8 K cooling.

Maximum air flow rate

The maximum air flow rate depends on one or both of the following

- the maximum allowed noise level
- the maximum air velocity for comfort conditions in the occupied zone.

Fig. 1 shows the maximum and minimum flow rates for each size of diffuser, with the maximum value based on a noise level of 35 NR.

The maximum flow rate as a function of the allowed noise level for each diffuser size is given in the following Pressure loss-Noise level graphs.

The maximum air flow rate for comfort conditions in the occupied zone is a function of the mounting height of the SD diffuser.

The selection data as shown in **Fig. 2** results from tests where, within the height of the occupied zone (1,8 m) and at a room temperature of 22°C, 84% of the measured velocity readings were less than 0,22 m/s measured with an instrument having a time constant of 0,1 s. These values conform with DIN 1946 Part 2 except that in this standard a time constant up to as high as 2,0 s is allowed.

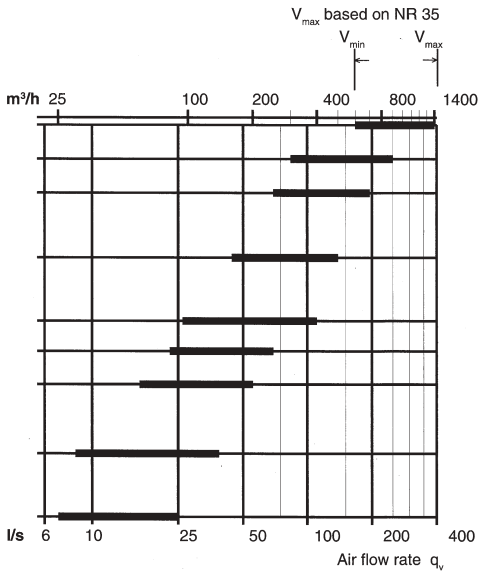


Fig. 1: Air flow rate ranges for standard swirl diffusers

Standard swirl diffuser Type SD

Selection data

Fig. 1 shows the maximum air flow rate relative to the mounting height of each size of SD diffuser to achieve comfort conditions in the occupied zone.

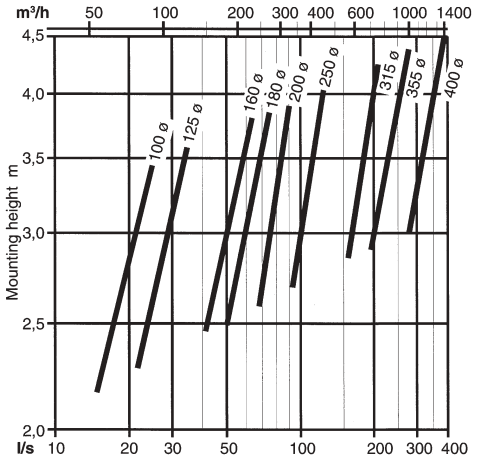


Fig. 2 Maximum air flow rate for the standard SD diffuser to guarantee comfort conditions in the occupied zone

Air flow rate required to achieve correct room air movement

In the case of isothermal or low heating ($t \leq 6$ K) applications it is necessary to achieve good air movement down to the floor, therefore the flow rate should be at least 70% of the maximum flow rate value in **Fig. 2.**

DISTANCE BETWEEN DIFFUSERS

The following diagram shows the minimum distance allowed between diffusers as a function of the air flow rate and mounting height, the formula for the distance between diffusers "t" is:

$$t = \sqrt{(q \cdot 3{,}6 / n \cdot H)} \quad \text{or} \quad t = \sqrt{(q / n \cdot H)}$$

where

q = Air flow rate l/s — where q = Air flow rate m³/h

n = Air change rate/h

H = Diffuser mounting height m

For the minimum distance between diffusers a maximum air change rate of 12/h is used for the calculation. For the maximum allowable distance between diffusers the actual air change rate is used for the calculation.

$$t_{min} = \sqrt{(q \cdot 0{,}3 / H)} \quad q = l/s \quad \text{or} \quad t_{min} = \sqrt{(q / 12 \cdot H)} \quad q = m^3/h$$

If diffusers are positioned too close to each other, the air flows will interact and create a downwards projection resulting in undesirable high room air velocities and subsequently draughty conditions.
If the diffusers are positioned too far apart then areas can be starved of supply air due to the air not penetrating into the occupied zone.

Fig. 3 shows the minimum distance between diffusers as a function of the air flow rate and the mounting height.

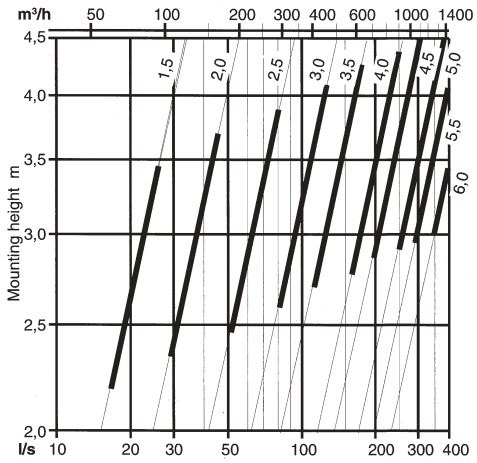
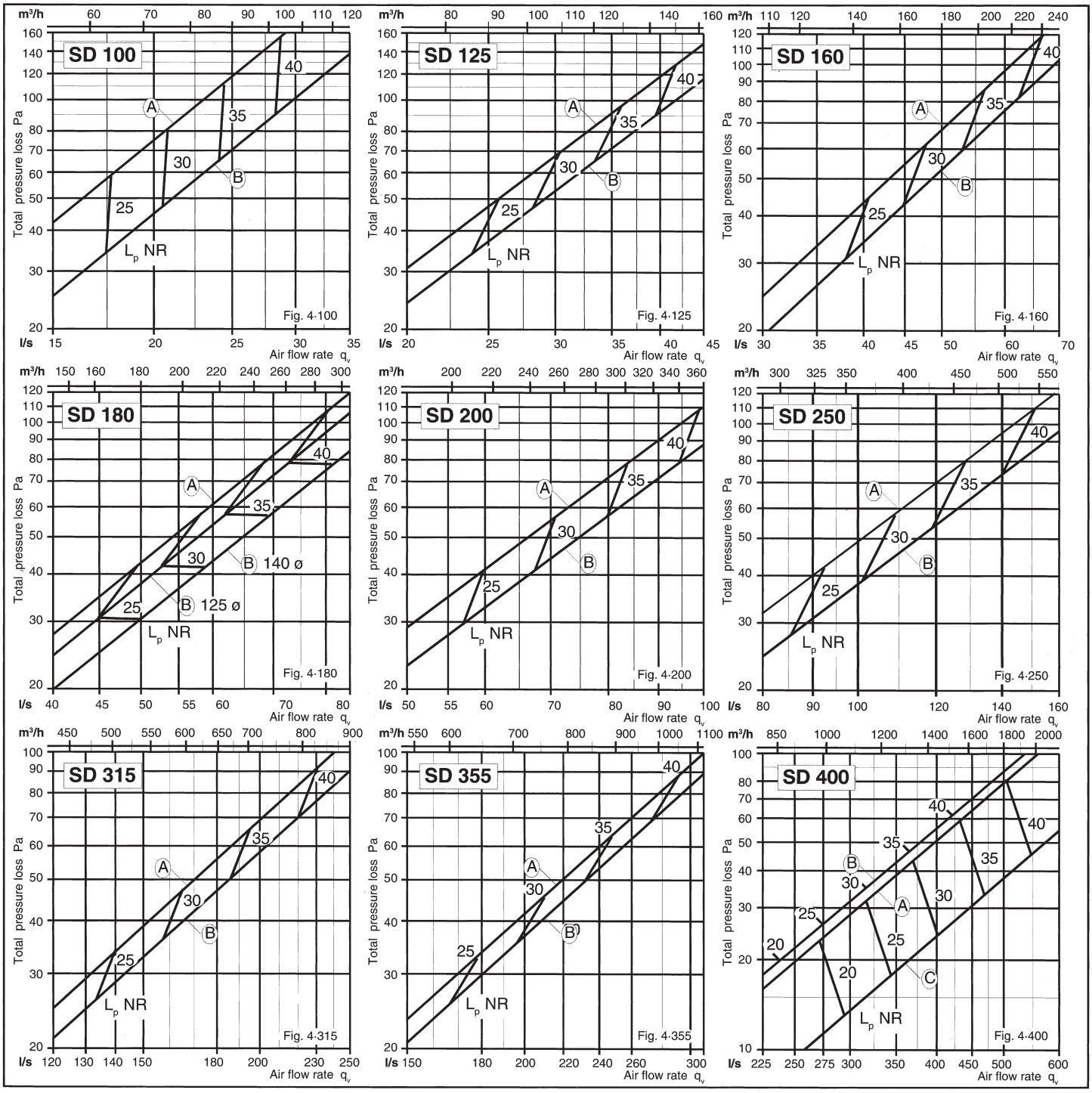


Fig. 3 Minimum distance between diffusers for the standard SD diffuser

Standard swirl diffuser Type SD

Fig. 4: Total pressure loss and noise levels for the standard swirl diffuser:
A = With connection cone (SD-U)
B = With plenum box (SD-AK/AKH)
C = Diffuser only (SD) for size 400

Selection data



Standard swirl diffuser Type SD

Sound power level per octave band

The sound power level for each octave (centre) band can be calculated from the sound pressure levels given as follows:

$$L_w = L_p + K$$

where

L_w = Sound power level

L_p = Noise level from **Fig. 4**

K_o = Correction factor from **Fig. 5** or **Fig. 6**

Example: For a size 100 diffuser SD-U at 20 l/s the noise level L_p from **Fig. 4.100** is 29 NR, the sound power level at 1000 Hz is therefore calculated as:

$L_w = 29 + 1 = 30$ dB

Nom. size	Correction factor K_o					
	Third octave band frequency Hz					
	125	250	500	1000	2000	4000
100	4	4	2	1	- 3	-10
125	6	4	2	1	- 4	-10
160	6	3	2	1	- 4	-11
180	6	4	2	1	- 4	-11
200	4	3	2	1	- 4	-10
250	5	4	2	1	- 4	-13
315	6	5	3	1	- 6	-16
355	6	4	5	-2	-10	-18
400	6	4	3	-1	-10	-18

Fig. 5 Correction factors (dB/oktave band) for standard diffusers with connecting cone SD-U

Nom. size	Correction factor K_o					
	Third octave band frequency Hz					
	125	250	500	1000	2000	4000
100	11	6	2	0	-4	-15
125	13	7	2	-1	-5	-17
160	12	4	1	1	-4	-15
180	14	6	0	0	-4	-15
200	11	4	1	2	-4	-13
250	6	3	1	2	-2	-14
315	3	1	1	2	-4	-15
355	2	1	1	2	-4	-16
400	3	1	0	2	-5	-17

Fig. 6 Correction factors (dB/oktave band) for standard diffusers with plenum box SD-AK or AKH

Effect of a damper on the pressure loss

The plenum boxes AK and AKH have an air flow rate control damper at the inlet, adjustment of the damper will affect the pressure loss,

Fig. 7 shows the correction factor by which the pressure loss obtained from **Fig. 4** for a fully open damper should be multiplied.

See page 15 for a typical example.

Effect of a damper on noise level

The noise level resulting from a change in setting of a damper is a function of:

- The diffuser size
- Damper setting position
- The air velocity at the inlet spigot

Fig. 8 shows the noise levels which should be added to those obtained from the selection data in **Fig. 4** and are based on the effect on velocity at the inlet spigot caused by the setting of the damper.

See page 15 for a typical example.

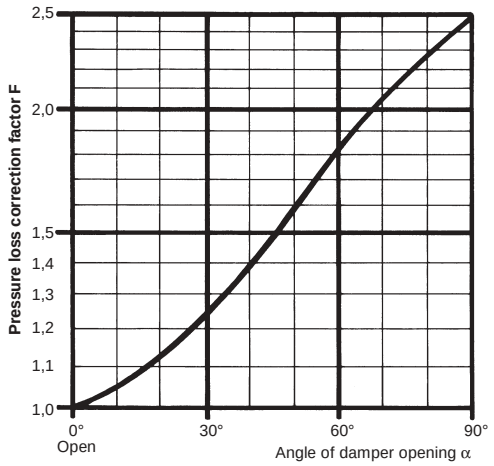


Fig. 7 Pressure loss correction factors for different damper positions

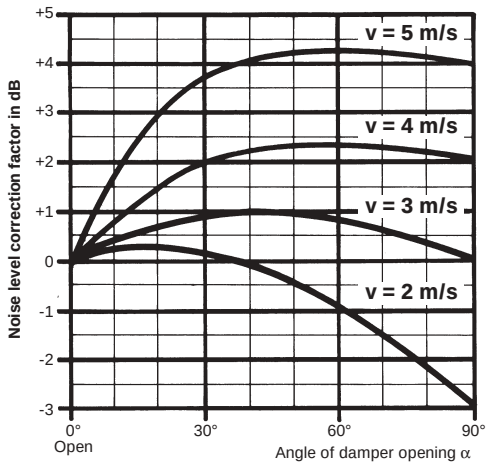


Fig. 8 Noise level correction values for different damper positions and air velocity at the inlet spigot

Standard swirl diffuser Type SD

Selection example

Selection example

Given:

An office with dimensions of:

Length	=	12,5 m
Width	=	9 m
Floor to ceiling	=	3 m
Floor to slab	=	3,25 m
Air flow rate q	=	660 l/s (2380 m³/h)
Temp. diff: Cooling	=	8K
Temp. diff: Heating	=	2K
Pressure at the inlet	=	60 Pa
Maximum noise level	=	35 NR

Required:

Number of diffusers
Air flow rate/diffuser
Arrangement of the diffusers
Damper position
Noise level

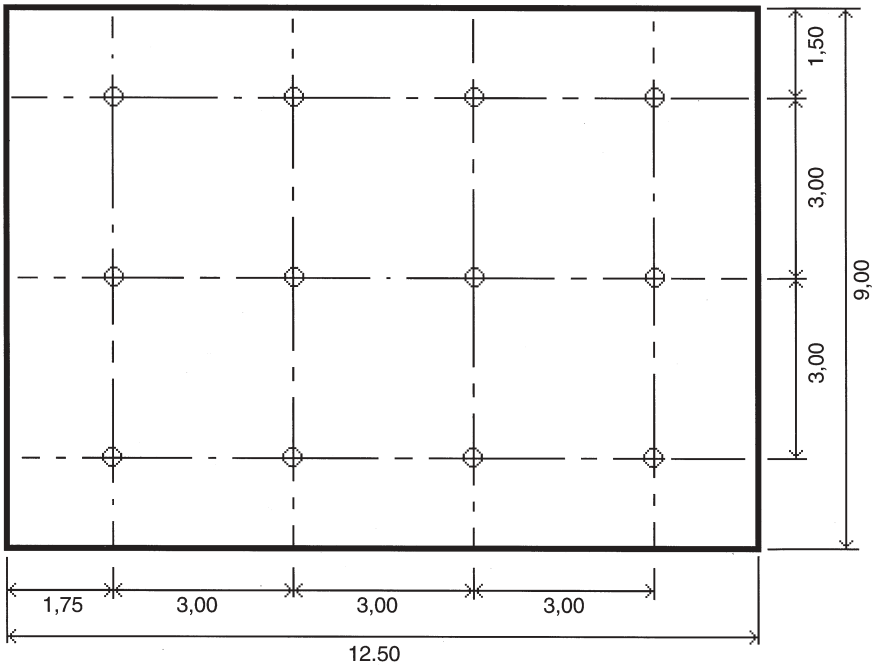


Fig. 9 Diffuser arrangement for example

Air flow rate per diffuser

From **Fig. 2** the flow rate for a size 180 diffuser is 55,5 l/s (200 m³/h).

To find number of diffusers:

$$\text{Theoretical number} = \frac{\text{Total flow rate}}{\text{Nominal flow rate}}$$

= 660/55,5

= 11.9 say **12 diffusers,**

therefore the actual flow rate per diffuser

= 660/12 = **55 l/s (198 m³/h)**

Position of diffusers

By setting out the diffusers as **Fig. 9,** it can be seen that the diffusers will be **3 m** apart.

Minimum distance between diffusers

$t_{min} = \sqrt{(q \cdot 0{,}3/12 \cdot H)} = \sqrt{(55 \cdot 0{,}3/12 \cdot 3)}$

= 2,35 m

Maximum distance between diffusers

$t_{max} = \sqrt{(q \cdot 3{,}6/12 \cdot H)} = \sqrt{(55 \cdot 3{,}6/12 \cdot 3)}$

= 3,06 m

Plenum box selection

With only a 250 mm ceiling void the plenum box Type AKH with recessed collar which has an overall height of 225 mm should be used.

Pressure loss and noise level

From **Fig. 4,** 180 for a size 180 at 198 55 l/s with AKH plenum box, 125 ø spigot and fully open damper:
noise level is 31 NR
pressure loss is 44 Pa.
With a 125 ø inlet spigot the inlet velocity can be calculated at 4,78 m/s.

Damper setting position

With an inlet pressure of 60 Pa the damper would need to be adjusted to obtain the required air flow rate, therefore from **Fig. 7** for a correction factor of 60/44 = 1,36 the damper will need to be set to **36°.**

Resultant noise level

At a damper setting of 36° and an inlet velocity of 4,78 m/s a noise level correction of 3,5 dB can be read from **Fig. 8** therefore the corrected noise level is 31 + 3,5 = **34,5 NR.**

The requirement of 35 NR can therefore be met.

Tender text

Position	Description	No. of units	Unit price	Extended price
	Supply air swirl diffusers for applications requiring even air diffusion and the minimum possible temperature gradient. The air is introduced in the form of eight horizontally projecting swirling air streams. The diffuser is manufactured from aluminium and consists of an outer cylinder and a hub to which is attached the swirl blade elements, the face flange is designed to stabilise the air flow and can be circular, rectangular or to special design. Rectangular connection plenum boxes are from zinc plated steel with internal insulation (from size 160) and adjustable damper. **Swirl diffuser:** Nom. diameter . . . . . . **Face flange form:** ☐ Circular flat flange (Standard dimension) **(SD)** ☐ Circular flange with returned edge (Stand. dim.) **(SD-B)** ☐ Square form, dimension: . . . . . mm **(SD-SF/. . .)** ☐ Special design . . . . . . **Surface finish swirl diffuser:** ☐ Powder coated to RAL 9010 (Standard) ☐ Enamelled to RAL colour . . . . . **(SD-RAL)** ☐ Primed (size DN 250 – DN 400) ☐ Special requirements . . . . . . **Connection components:** ☐ Connection cone **(U)** ☐ Connection cone **(UF)** ☐ Plenum box **(AK)** ☐ Plenum box with collar **(AKH)** ☐ Plenum box with internally mounted spigot **(AKH/S)** ☐ Plenum box with displacement section **(AK/Q)** **Supplementary components:** ☐ Vane blanking **(FA)** ☐ Perforated plate **(L)** ☐ Damper inside diffuser **(D)** ☐ Perforated face plate of diffuser **(LA/Q)** ☐ Plenum box fixing bracket **(AW)** Air flow rate . . . . . l/s or m^3/h Max. noise level . . . . . NR or dB (A) Max. pressure loss . . . . . Pa Manufacturer: STRULIK Type: **SD**			