

Ceiling diffuser

Type VPD



TROX[®] TECHNİK

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Description

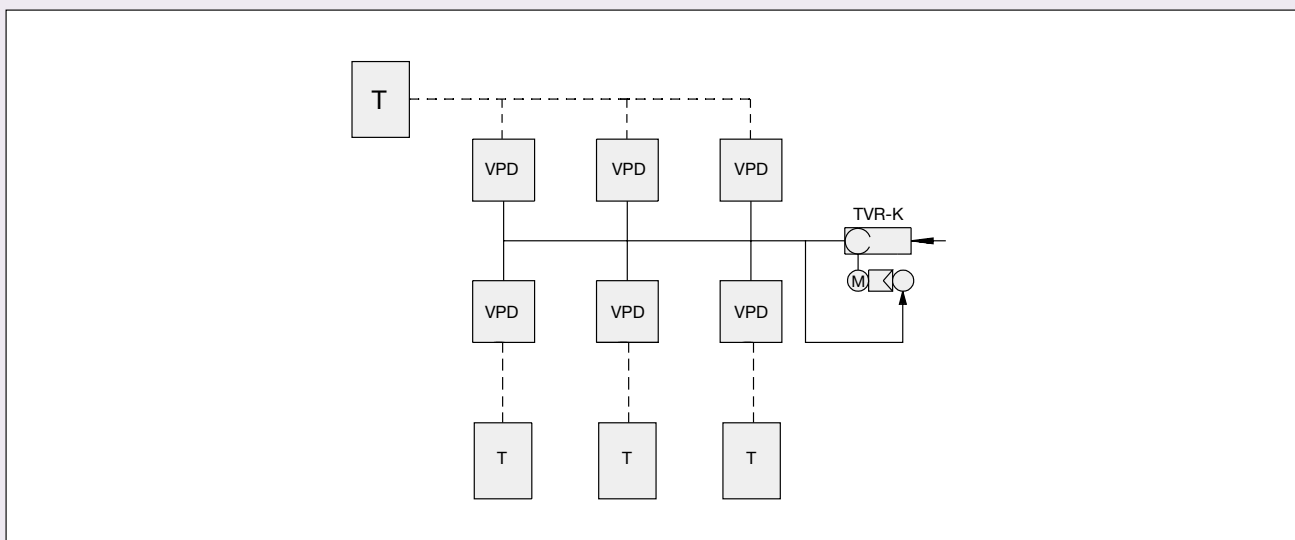
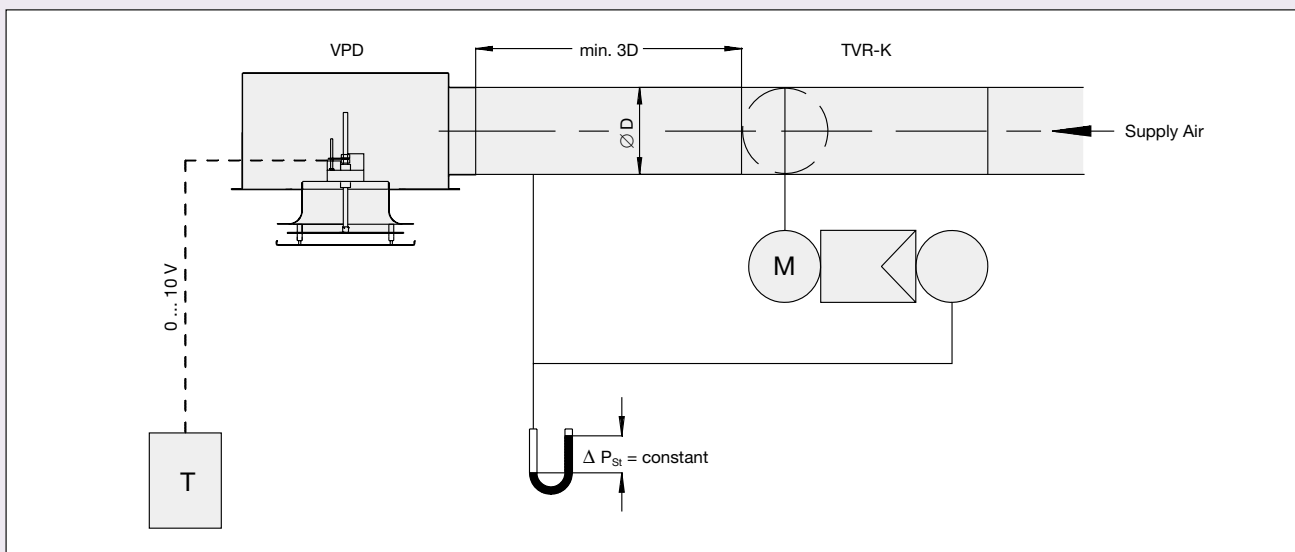
Ceiling diffusers Type VPD are particularly suitable for use in systems with variable volume flows (VAV systems).

Despite the large volume flow range of 100 % to 10 %, Type VPD diffusers have a very stable discharge characteristic even when cooling. It is possible to shut off individual diffusers. Leakage due to construction must be calculated in relation to the existing pressure drop across the closed unit.

The electric actuator for regulating the discharge slot is controlled by a room thermostat using 0 ... -10 V (other methods of operation e.g. open/shut or manual adjustment are also possible).

To keep the duct pressure at a constant level a TROX VARYCONTROL VAV controller Type TVR must be provided per circuit.

Control principle



Construction · Dimensions

Construction

Ceiling diffusers Type VPD are available in three sizes. The diffuser face comprises a face plate with discharge nozzle, an internal adjustable baffle plate and special fixing (for assembly to the plenum box).

For flush installation the diffuser face is also available in a circular or square configuration.

The internal baffle plate can be adjusted manually or by an electric actuator.

The plenum box is supplied with circular side entry spigot and circular fixing for the diffuser with stop bolts.

The assembly is suspended from the ceiling slab by means of wires or slotted bars using the hangers provided.

Materials

The border section for flush installation and discharge nozzle are aluminium. Special suspension, baffle plate and face plate in galvanized sheet steel.

The surfaces of the border section, face plate and bayonet fixing section are powder-coated white (RAL 9010), the baffle plate is stove-enamelled black (RAL 9005).

Galvanized sheet steel plenum box.

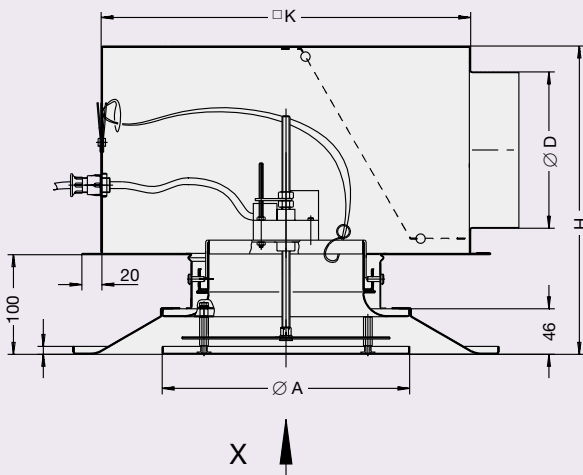
Dimensions

Size	□ K	H	∅ D	∅ A	∅ B	□ C1
125	295	275	123	200	380	598 ¹⁾ bzw. 623 ¹⁾
160	352	310	158	250	430	
200	395	360	198	300	480	
250	456	410	248	350	530	

1) Depending on ceiling grid

Diagram with electric actuator

VPD - B - ...



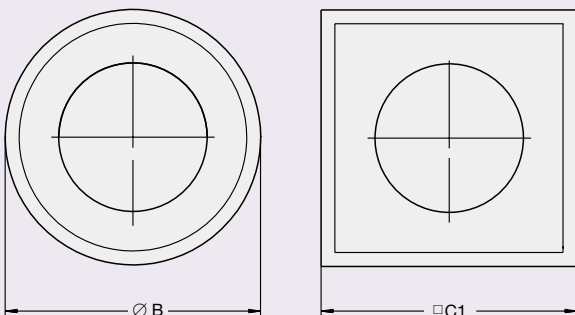
X ↑

View X

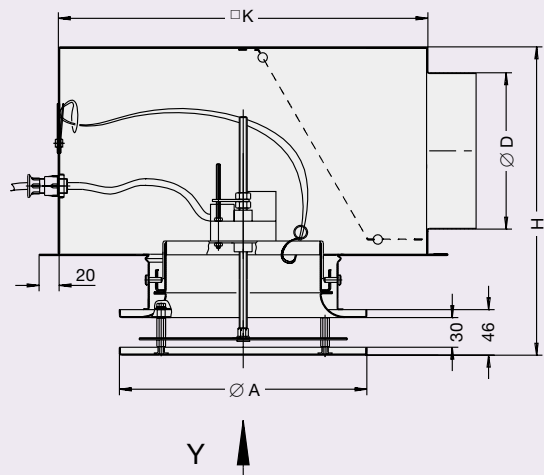
(Without plenum box)

Plain face plate "G"

(alternatively available with annular slots "S")



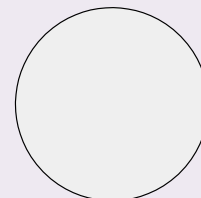
VPD - A - ...



Y ↑

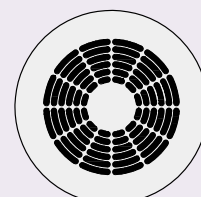
View Y

Face plate plain construction "G" (without perforations)



View Y

Face plate with annular slots "S"



Different versions of the face plate, similar to the above, are available on request!

Installation · Assembly

Installation

Type VPD ceiling mounted diffusers can be used in continuous ceilings e.g. plasterboard) and in grid ceilings of standard dimensions (600 and 625 mm ceiling tiles).

The square or circular border section must be used for flush mounting.

The plenum box can be suspended from the ceiling slab using standard fittings. Once the plenum box has been positioned, a bayonet fixing section is used to install the diffuser face.

Size	125	160	200	250
D_{A1}	185	235	285	335
D_{A2}	350	415	465	515

Assembly sequence

Suspend the plenum box and align flush with ceiling (Figure 4). Thread the safety cable on the motor variant through the drillings in the bridge rail and secure by means of key ring. Then lock the complete diffuser face by slightly turning the bayonet fixing section onto the stop bolts.

The diffuser face is fitted and stands proud approx. 50 mm from the ceiling. Please check that it is fitted firmly.

On the variants with border sections (circular or square) for flush mounting, the plenum box must be set back from the ceiling at a dimension of 46 or 38 mm between the room side ceiling surface and top of the plenum spigot return edge. See figures 1 and 2.

To allow for the rotary locking movement the diffuser face with square border section, when finally fitted, must not be near ceiling tiles.

A further fitting possibility is to suspend the diffuser face complete with the plenum box and correctly level the whole assembly with respect to the ceiling line.

Figure 1

Flush mounting in ceiling tile

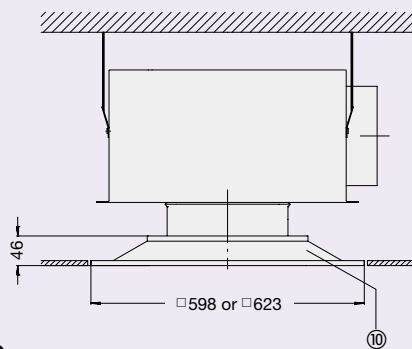


Figure 2

Flush mounting in plaster ceiling

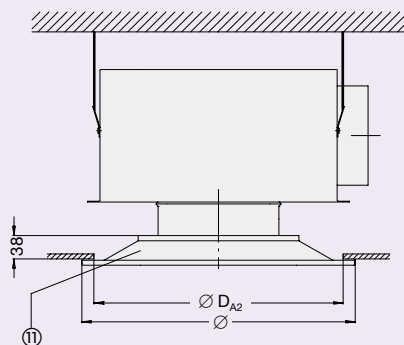


Figure 3

Installation below ceiling slab

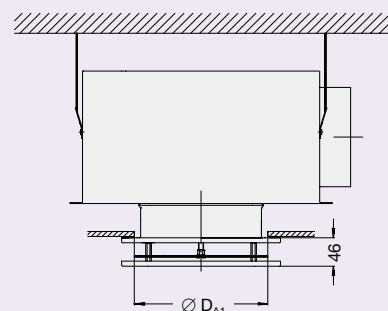
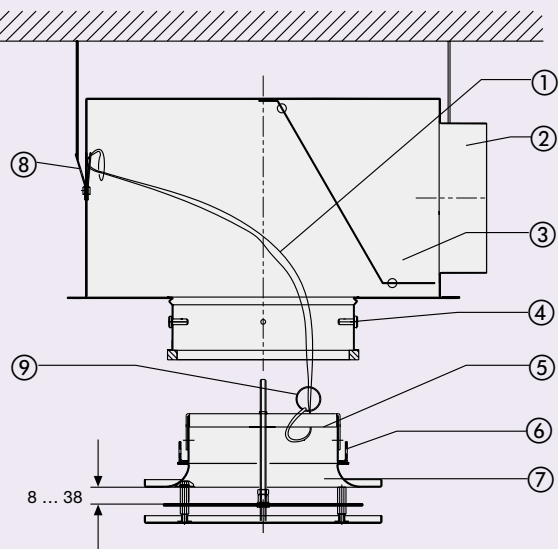


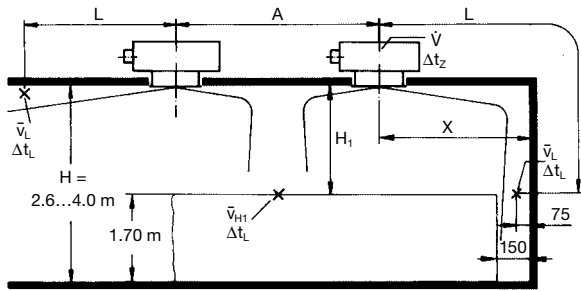
Figure 4



- ① Safety cable
- ② Side entry spigot
- ③ Plenum box
- ④ Stop bolts
- ⑤ Bridge
- ⑥ Bayonet fixing section
- ⑦ Diffuser face
- ⑧ Suspension hangers
- ⑨ Key ring
- ⑩ Square border section
- ⑪ Circular border section

Nomenclature · Acoustic Data

Nomenclature



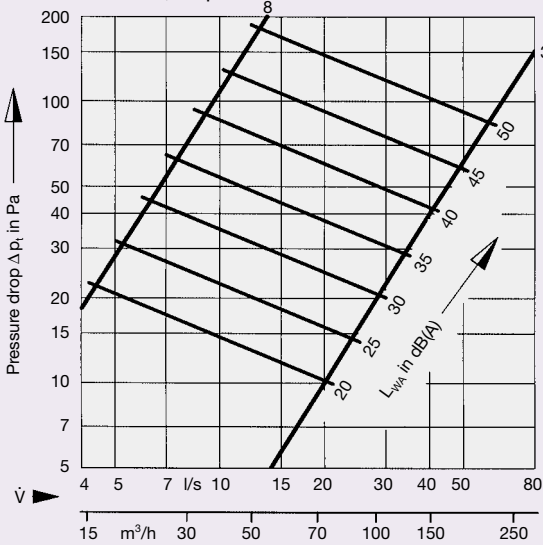
- A_{eff} in m^2 : Effective discharge area
- \dot{V} in l/s : Volume flow per diffuser
- \dot{V} in m^3/h : Volume flow per diffuser
- A in m : Spacing between two diffusers
- H_1 in m : Distance between ceiling and occupied zone
- X in m : Distance from centre of diffuser to wall
- \bar{v}_{H1} in m/s : Time average air velocity between two diffusers at distance H_1 from ceiling
- L in m : Discharge distance horizontal + vertical distance ($X + H_1$) when discharging to a wall

- \bar{v}_L in m/s : Time average air velocity at wall
- Δt_z in K : Temperature difference between supply air and room air
- Δt_L in K : Difference between core temperature and room air temperature at distance $L = A/2 + H_1$ or $L = X + H_1$
- Δp_t in Pa : Total pressure drop
- L_{WA} in $dB(A)$: A-weighted sound power level
- L_{WNC} : NC rating of sound power level
- L_{WNR} : $L_{WNR} = L_{WNC} + 2$
- ΔL in $dB/oct.$: Relative sound power level with respect to L_{WA}
- L_W in $dB/oct.$: Octave band sound power level of flow generated noise $L_W = L_{WA} + \Delta L$
- L_{pA}, L_{pNC} : A-weighting and NC rating respectively of room sound pressure level
- $L_{pA} \approx L_{WA} - 8 \text{ dB}$
- $L_{pNC} \approx L_{WNC} - 8 \text{ dB}$

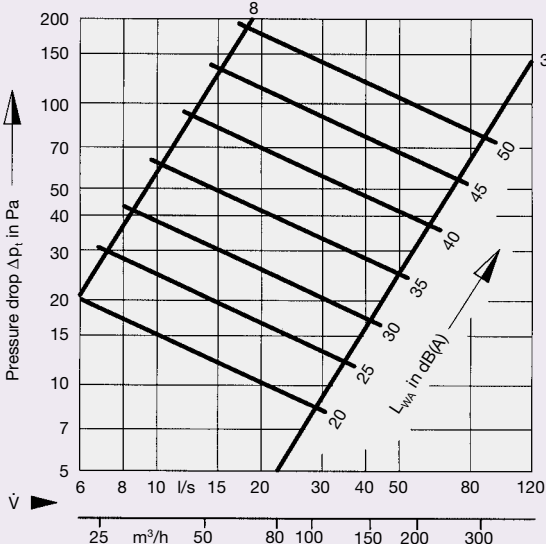
Effective discharge area (baffle plate open to maximum)

Size	125	160	200	250
A_{eff} in m^2	0.0058	0.01068	0.01626	0.02324

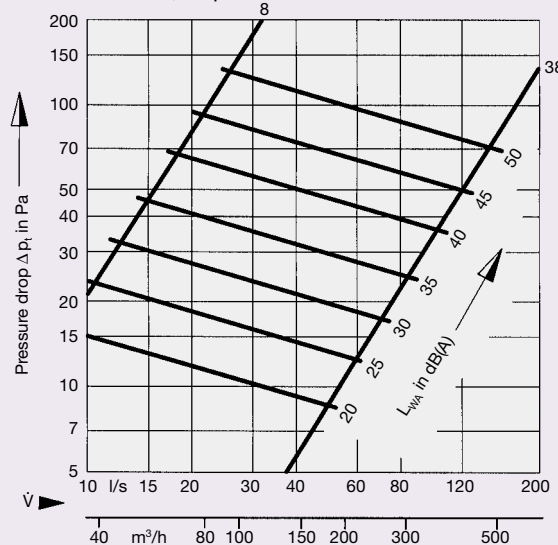
1 Sound power and pressure drop
Size 125, Gap dimension G 8 and 38 mm



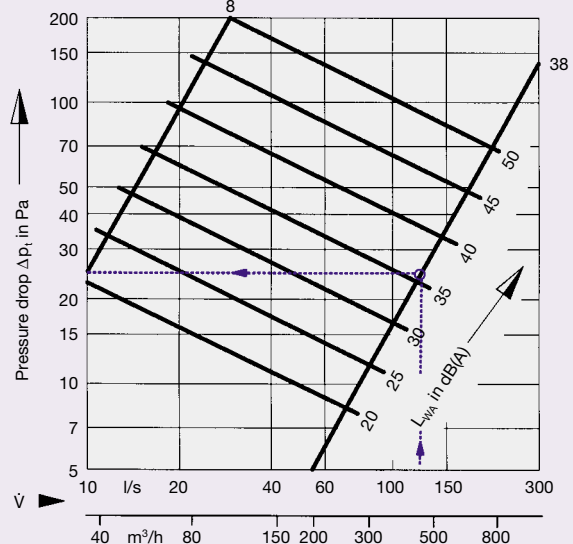
2 Sound power and pressure drop
Size 160, Gap dimension G 8 and 38 mm



3 Sound power and pressure drop
Size 200, Gap dimension G 8 and 38 mm



4 Sound power and pressure drop
Size 250, Gap dimension G 8 and 38 mm



Aerodynamic Data

Example of VPD Lay-out

Data given:	
Individual office dimensions	15 x 10 x 3 m
Air change rate	6 times H ⁻¹
V̇ per room	2700 m ³ /h
VAV system	100 ... 10 %
No. of diffusers	6
Size	250
V̇ per diffuser	450 ... 45 m ³ /h
Arrangement	2 rows of 3 VPD's
Δt _z	-10 K

Calculation:	
H ₁ = H - 17 = 3.0 - 1.7	= 1.3 m
A _{min}	= 4.5 m
X _{min}	= 2.75 m
L _{H1} = $\frac{A_{min}}{2} + H_1 = \frac{4.5}{2} + 1.3$	= 3.55 m
L _x = X + H ₁ = 2.75 + 1.3	= 4.05 m

Selected from Diagram 4:	Sound power level and pressure drop
L _{WAmax.}	= 36 dB(A)
Δp _t	= 27 Pa

From Diagram 8: Air velocity and temperature quotient at wall
 \bar{v}_L
 $\Delta t_L / \Delta t_z$
 = 0.25 m/s
 = 0.05

$$\Delta t_L = \frac{\Delta t_L}{\Delta t_z} \cdot \Delta t_z = 0.05 \cdot 10 = 0.5 \text{ K}$$

From Diagram 12: Air velocity between two diffusers
 \bar{v}_{H1}
 = 0.15 m/s

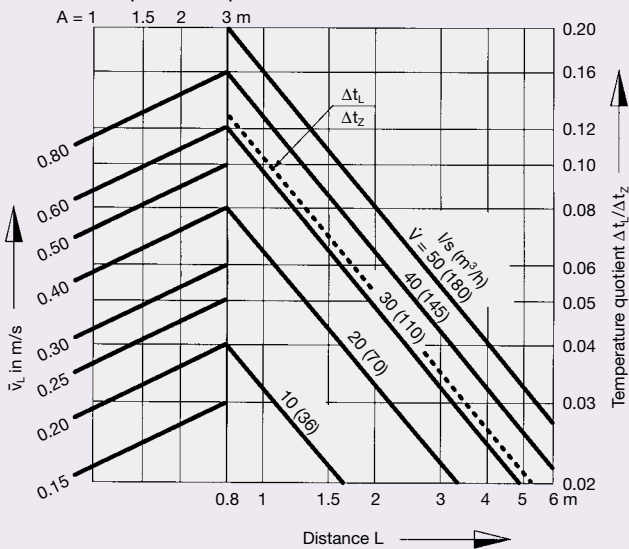
From Diagram 13:
 $\frac{\Delta t_{H1}}{\Delta t_z} = 0.06$

$$\Delta t_{H1} = \frac{\Delta t_{H1}}{\Delta t_z} \cdot \Delta t_z = 0.06 \cdot 10 = 0.6 \text{ K}$$

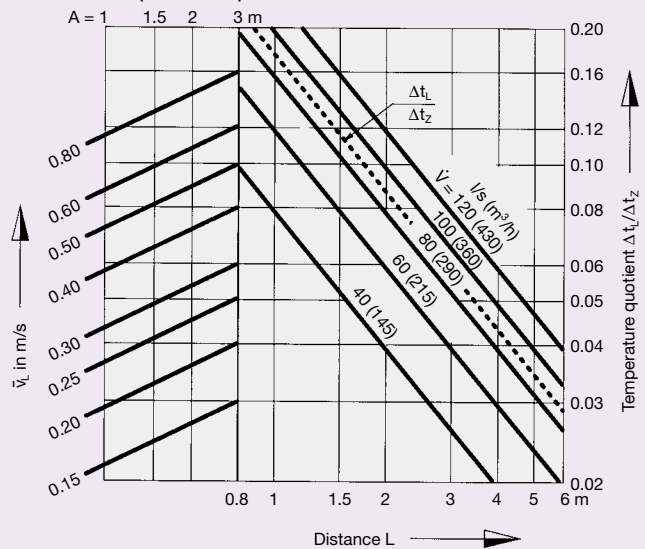
All the technical data calculated is lower than the limiting requirements of DIN 1946/2 for conditions in the occupied zone. Therefore the best choice is made. Type VPD-B-Q-S-E3-H size 598 x 250 should be used.

Control signal 0 V – baffle plate closed
 Control signal 10 V – baffle plate open

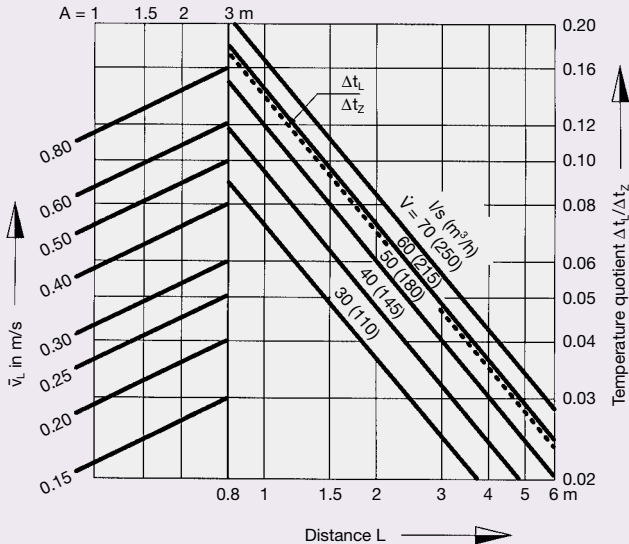
5 Air velocity at wall
 Temperature quotient: size 125



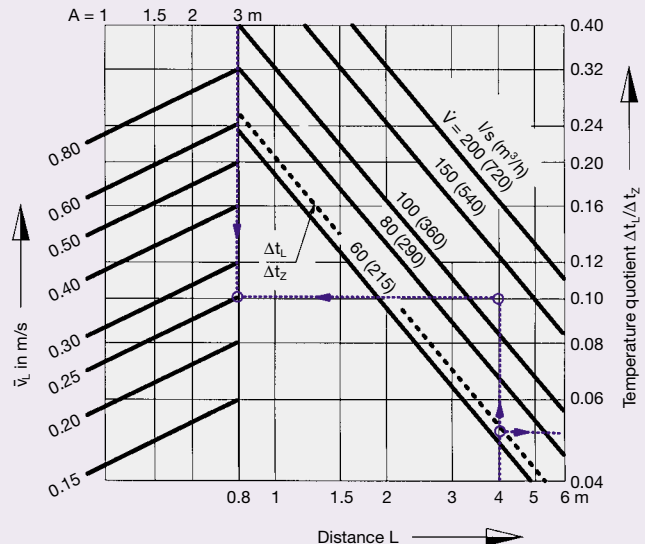
7 Air velocity at wall
 Temperature quotient: size 200



6 Air velocity at wall
 Temperature quotient: size 160

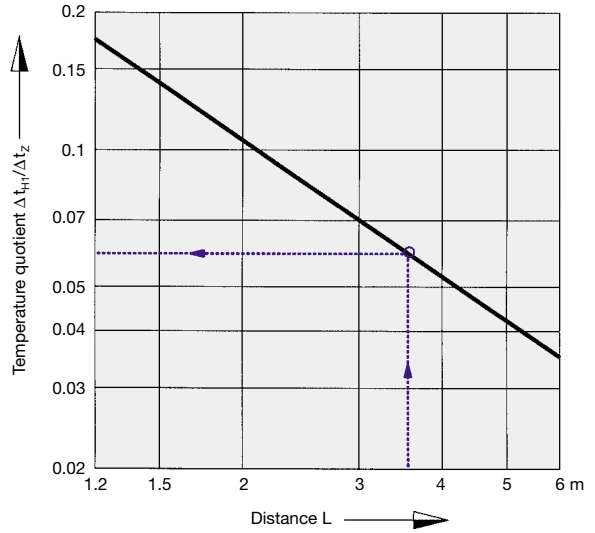


8 Air velocity at wall
 Temperature quotient: size 250



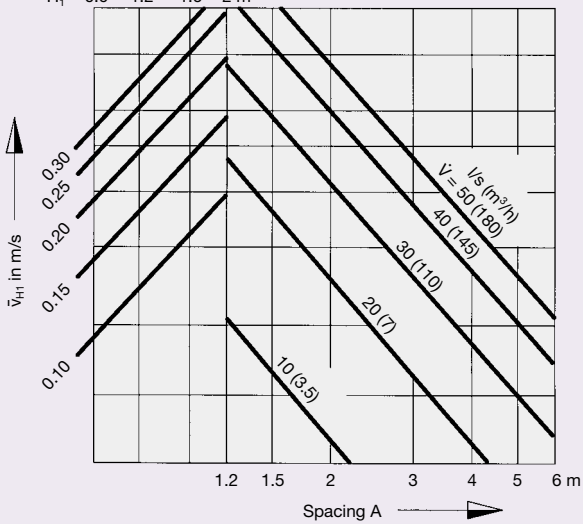
Aerodynamic Data

13 Temperature quotient



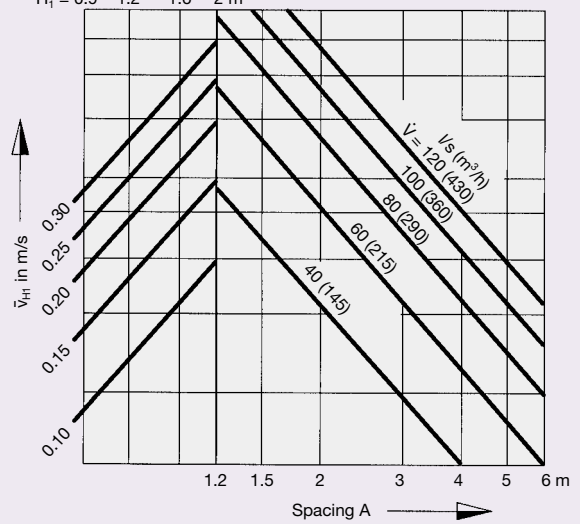
9 Air velocity between two diffusers: size 125

$H_1 = 0.9 \quad 1.2 \quad 1.6 \quad 2 \text{ m}$



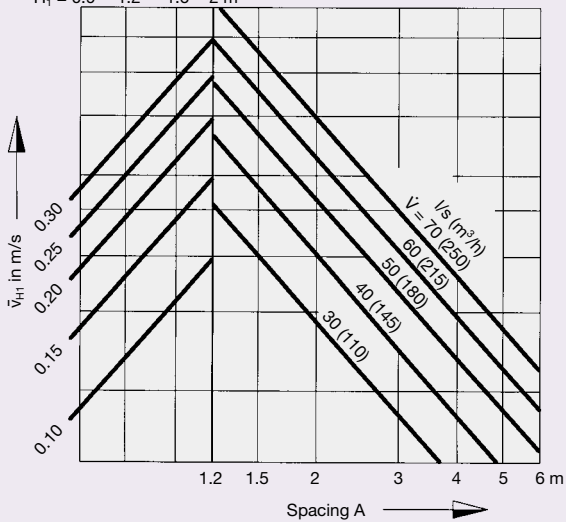
11 Air velocity between two diffusers: size 200

$H_1 = 0.9 \quad 1.2 \quad 1.6 \quad 2 \text{ m}$



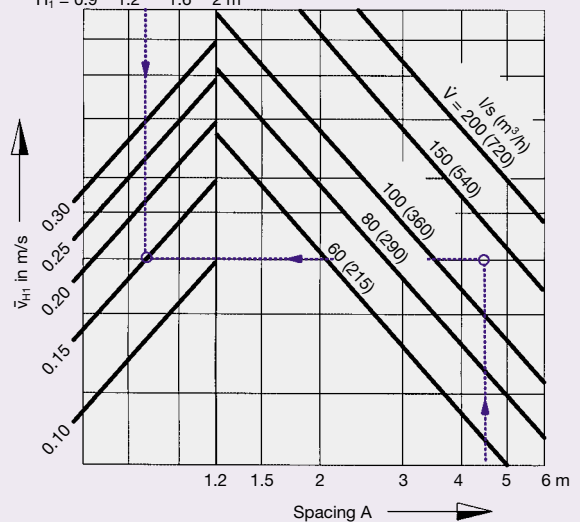
10 Air velocity between two diffusers: size 160

$H_1 = 0.9 \quad 1.2 \quad 1.6 \quad 2 \text{ m}$



12 Air velocity between two diffusers: size 250

$H_1 = 0.9 \quad 1.2 \quad 1.6 \quad 2 \text{ m}$



Order Details

Specification text

Ceiling diffusers with adjustable baffle plate, suitable for installation in variable volume systems. Comprising discharge nozzle with plain or slotted face plate mounted below. With internal baffle plate which can be adjusted manually or by an electric actuator.

Depending on the method of installation available without border section (for installation below ceiling slab) or with circular border section (for flush mounting in a continuous ceiling) or with square border section for grid ceilings.

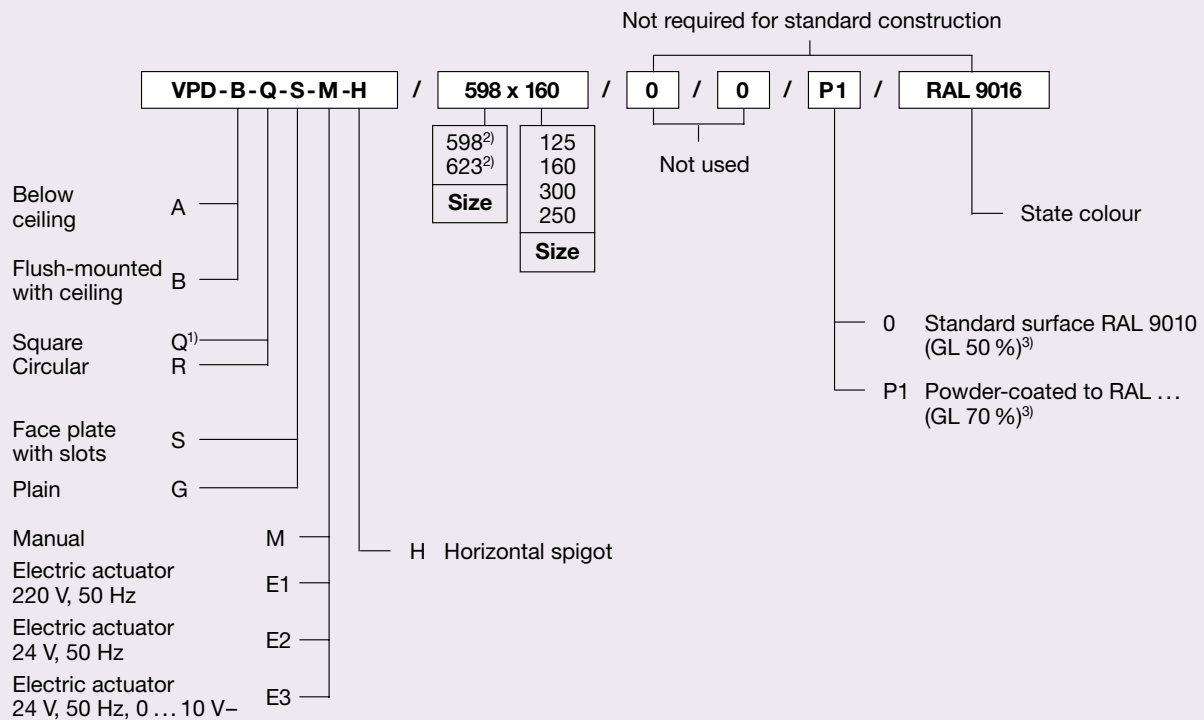
The complete diffuser is connected to the plenum box by a bayonet fix. The plenum box has a side-entry circular spigot and suspension drillings for fitting to ceiling slab. An opening for the cable is included on variants with motor.

Materials

Aluminium border section and discharge nozzle. Galvanized sheet steel baffle plate and face plate. Baffle plate stove-enamelled black (RAL 9005). Complete diffuser face powder-coated white (RAL 9010).

Galvanized sheet steel plenum box.

Order code



- 1) Only on square arrangement!
 2) Only on square flush-mounted version!
 3) GL = Gloss level!

Order example

Make: TROX
 Type: VPD-B-Q-S-M-H / 598 x 160 / P1 / RAL 9016

Order example

Make: TROX
 Type: VPD-A-R-G-E1-H / 160 / P1 / RAL 9016