Ceiling mounted air diffuser

Type VDR

Recommended for Room heights of ≧ 3.80 m

TROX® TECHNIK

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Contents · Description

In rooms with changing heat loads the supply air is delivered into the room with either a heating or cooling temperature differential.
The type VDR ceiling air diffuser is suitable for both heating and cooling operations. An optimum movement of air through the occupied zone is achieved by changing the blade setting. High penetration of warm air is achieved at low acoustic levels when the blades are opened. Cold air is discharged horizontally when the blades are closed. The operation of the blades can be by hand or by electric actuator.

The type VDR ceiling diffuser can be used in industrial and office areas because of its attractive design and range of volume flow rates.

Suitable for mounting in very high ceilings, (e.g. factory areas, airports, theatres, banking halls) and also for lower ceilings ≧ 3,80 m (e.g. assembly rooms), especially suitable for systems having temperature differentials of between –10 K to +15 K.

Construction

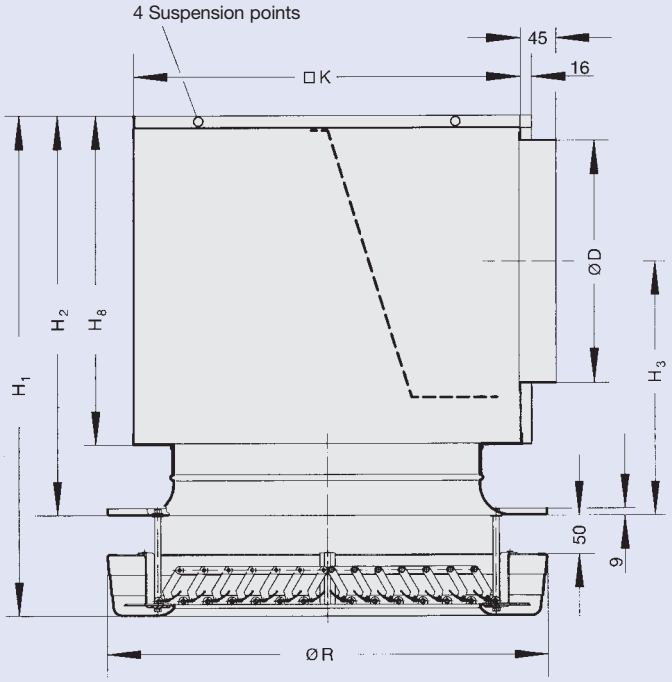
Ceiling diffusers Type VDR are available in four sizes. The front face comprises a circular shaped discharge section with two sections of blades and spigot ring. The blades can be adjusted by hand or by electric actuator. The plenum box can be supplied with a circular spigot with side or top air entry spigots. The design with actuator is provided with an inspection panel mounted on the side of the plenum box.

Material

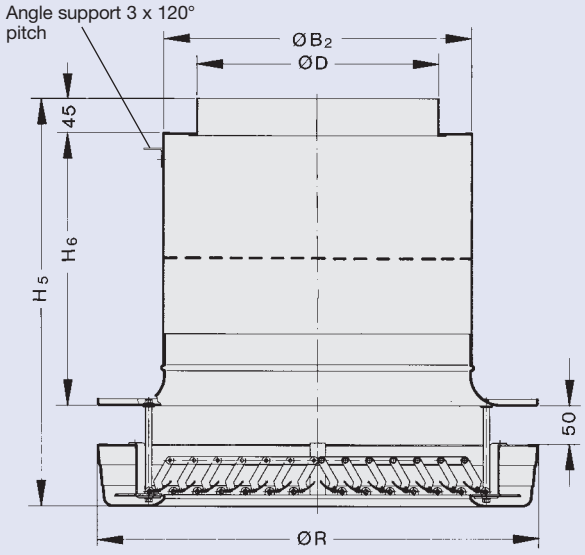
Aluminium discharge face, spigot ring and adjustable blades. Surface finish pre-treated and powder-coated white RAL 9010, gloss level 50 %, any other RAL colour is optional. Plenum box and actuator support frame in galvanized sheet steel.

Size	∅ B_1	∅ B_2	∅ D	H_1	H_2	H_3	H_4	H_5	H_6	H_7	H_8	□ K	∅ R
315	313	314	248	570	457	301	199	427	270	280	350	415	450
400	398	399	313	667	537	348	223	550	375	305	425	500	570
630	628	629	398	807	632	401	298	670	450	380	490	750	870
800	798	799	498	965	754	473	355	790	535	438	590	920	1070

VDR-H

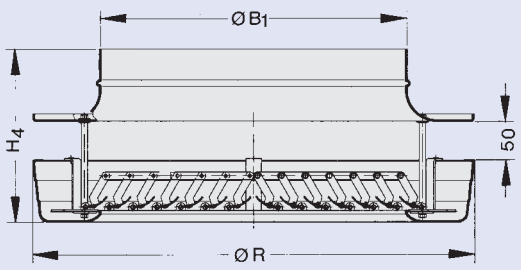


VDR-V

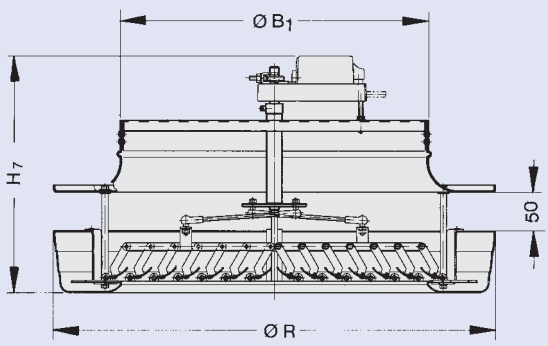


Size 315 and 400 without perforated plate

VDR



VDR-E1…E3



Installation · Fixing

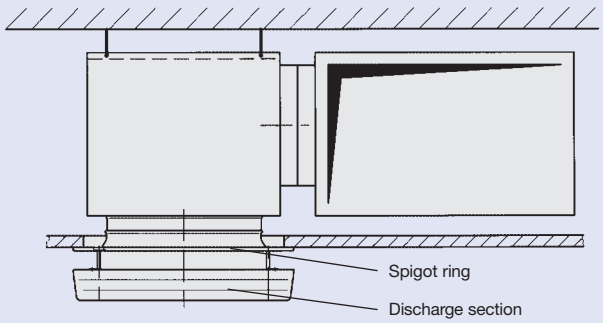
Installation

Because of the excellent performance, Type VDR ceiling diffusers, can be installed up to spigot ring flush with the ceiling or freely suspended.
Modulating control is only possible in the heating operation when diffusers are freely suspended.

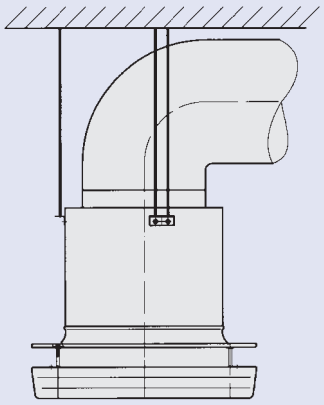
Fixing

The plenum box is suspended by wire or drop rods through the holes or angle provided. When supplied without a plenum box the diffuser must be fixed on site directly to the duct by others.

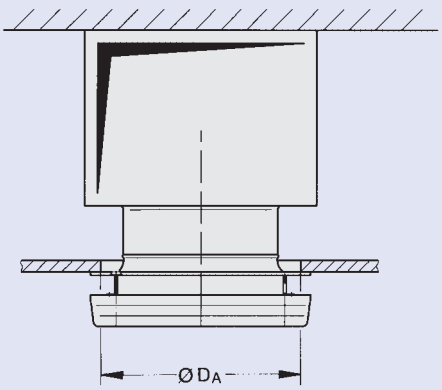
Horizontal connection



Vertical connection



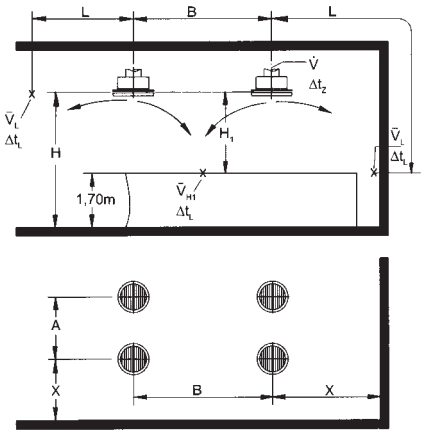
Direct duct connection – without plenum box
(duct and spigot connection on site by others)



Size	315	400	630	800
∅ D_A	398	518	808	1008

Nomenclature · Technical data

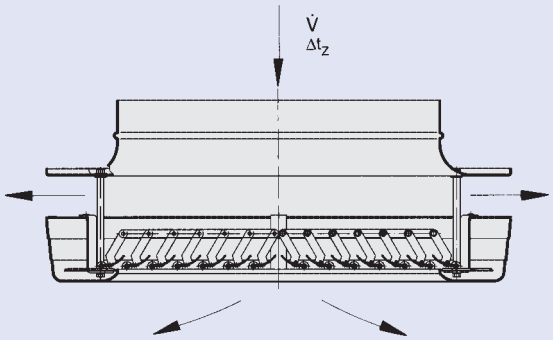
Definitions



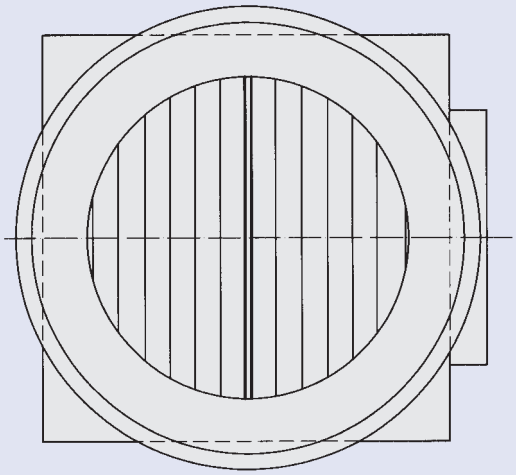
$\dot{V}$	in l/s:	Supply volume flow per diffuser
$\dot{V}$	in m³/h:	Supply volume flow per diffuser
A, B	in m:	Spacing between two diffusers
X	in m:	Distance between centre of diffuser and wall

H_1	in m:	Distance between discharge level and occupied zone
$\bar{v}_{H1}$	in m/s:	Time average air velocity between two diffusers at distance H_1
L	in m:	Distance from centre of diffuser including distance H_1 for wall
$\bar{v}_L$	in m/s:	Time average air velocity at wall
$H_{1\,max}$	in m:	Vertical penetration depth of air with heating differential
Δt_Z	in K:	Temperature differential between supply air and room air
Δt_L	in K:	Differential between core and room temperature at distance $L = A/2 + H_1$ or L down wall
A_{eff}	in m²:	Effective area
Δp_t	in Pa:	Total pressure drop
L_{WA}	in dB(A):	A-weighted sound power level
$L_{W\,NC}$	:	NC rating of sound power level
$L_{W\,NR}$	:	$L_{W\,NR} = L_{W\,NC} + 2$
ΔL	in dB/Oct.:	Relative sound power level with respect to L_{WA}
L_W	in dB/Oct.:	Octave band sound power level of regenerated noise $L_W = L_{WA} + \Delta L$
L_{pA}, L_{pNC}	:	A-weighted or NC rating of sound pressure level in room $L_{pA} \approx L_{WA} - 8$ dB $L_{pNC} \approx L_{W\,NC} - 8$ dB

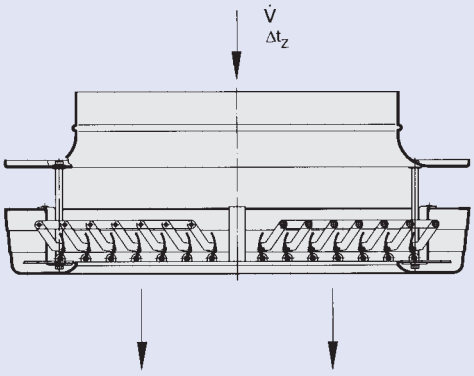
Horizontal discharge
(Cooling operation)



Orientation of blades on type VDR-H
at right angles to supply air spigots



Vertical discharge
(Heating operation)



Acoustic data

Example

Data given: Type VDR-V; size 315

Volume flow per diffuser $\dot{V} = 300$ l/s

Required: Sound power level, pressure drop and effective discharge velocity of air

Diagram 1: Sound power level and pressure drop

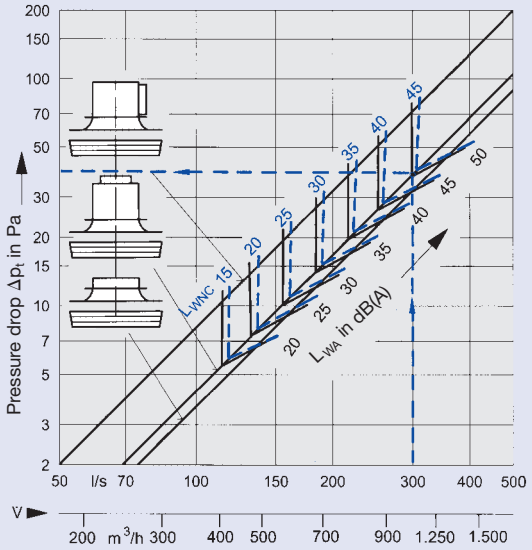
$L_{WA} = 50$ dB(A)

$\Delta p_t = 40$ Pa

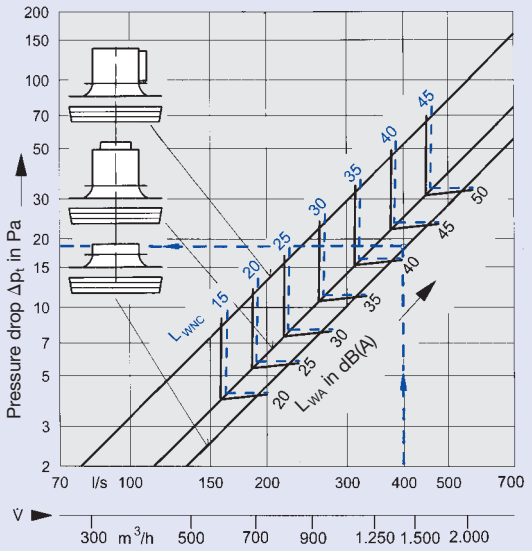
Effective discharge air velocity v_{eff}

$$v_{eff} = \frac{\dot{V}}{A_{eff} \cdot 1000} = \frac{300}{0{,}0885 \cdot 1000} = 3{,}4 \text{ m/s}$$

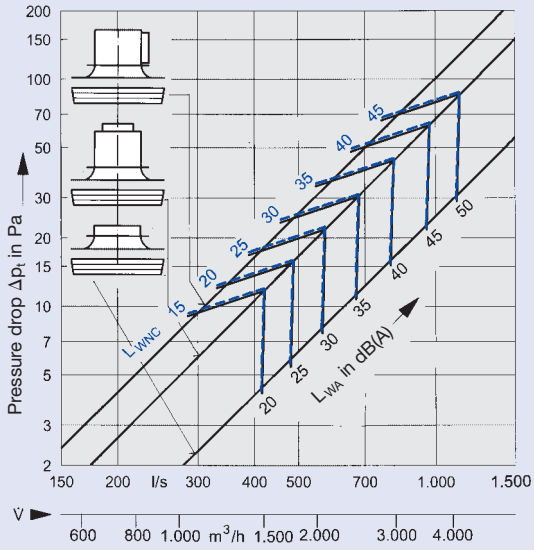
1 Sound power level and pressure drop Size 315



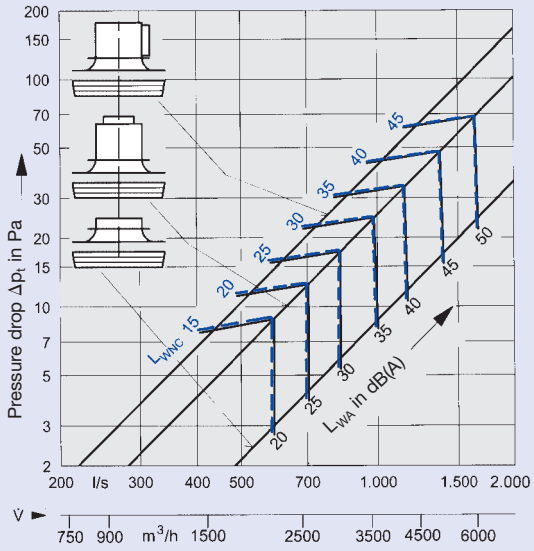
2 Sound power level and pressure drop Size 400



3 Sound power level and pressure drop Size 630



4 Sound power level and pressure drop Size 800



Aerodynamic data for warm air operation

Example

Data given:
Type VDR (connection directly from above): size 400

Volume flow per diffuser	$\dot{V}$ =	400 l/s
Air supply temperature differential:		
Horizontal for cooling operation	Δt_z =	– 8 K
Vertical for heating operation	Δt_z =	+ 15 K
Sound power level	L_{WA} =	45 dB(A)
Distance between diffusers	A =	3.00 m
Distance from centre of diffuser to wall	X =	1.50 m
Distance between discharge level and occupied zone	H_1 =	4.00 m

Diagram 2: Sound power and pressure drop
L_{WA} = 41 dB(A) (L_{WNC} = 35 NC)
Δp_t = 19 Pa

The selected sound power level of 41 dB(A) is below the required 45 dB(A). For calculating room noise levels the number of diffusers and the room attenuation should be taken into account.

Diagram 8: Max. jet penetration distance vertical discharge
$\dot{V}$ = 400 l/s
Δt_Z = + 15 K
$H_{1\,max}$ = 5.9 m

The warm air jet penetrates the occupied zone during the heating-up period.

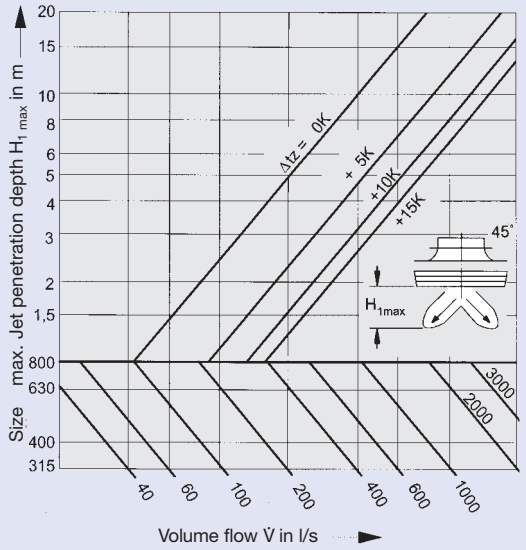
Diagram 10: Air velocity in room, on cooling operation

A = 3.00 m
H_1 = 4.00 m
$\bar{v}_{H1}$ = 0.15 m/s

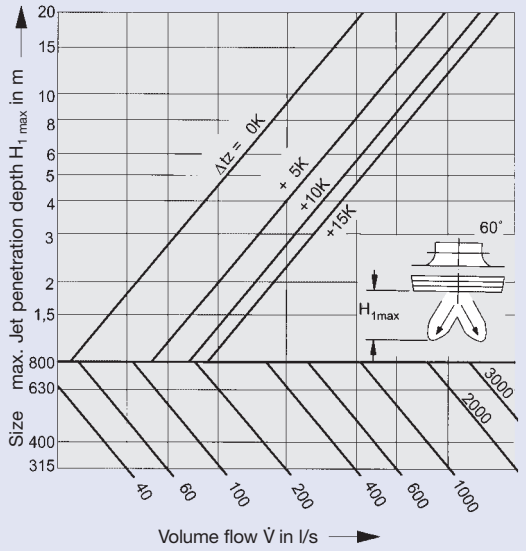
Diagram 14: Air velocity down wall and temperature quotient

L = A/2 + H_1 = 1.50 + 4.00 = 5.50 m
$\bar{v}_L$ = 0.32 m/s
$\Delta t_L/\Delta t_Z$ = 0.083
Δt_L = – 8 x 0.083 = – 0.66 K

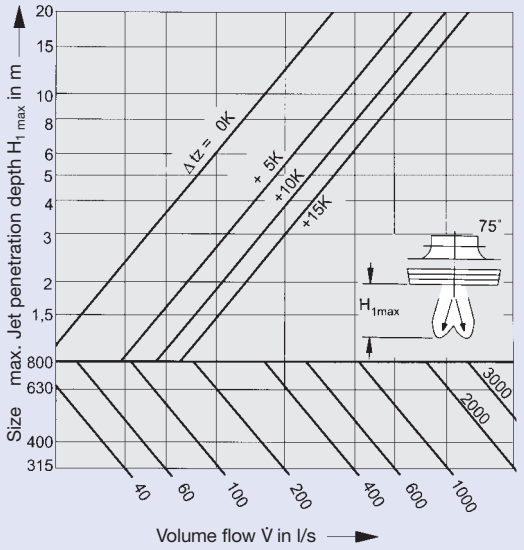
5 Max. jet penetration distance 45° – discharge



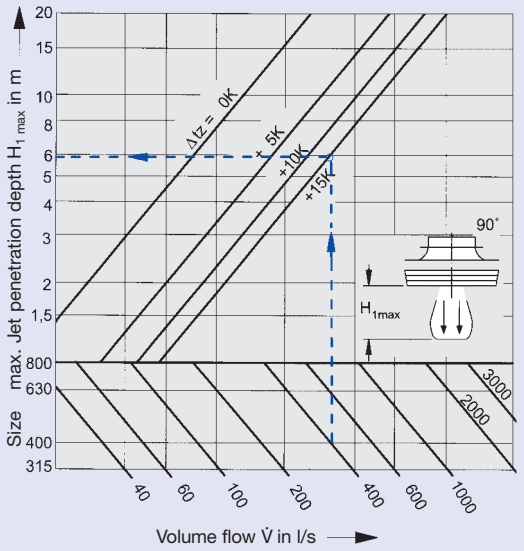
6 Max. jet penetration distance 60° – discharge



7 Max. jet penetration distance 75° – discharge



8 Max. jet penetration distance 90° – discharge



Aerodynamic data

Diagrams apply to cooling operation, horizontal discharge and freely suspended diffusers.

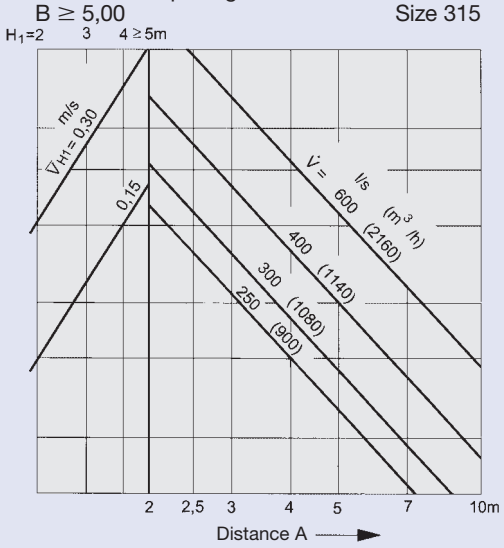
Correction Factor!

For flush installations with ceiling, the values $\bar{v}_{H1}$, $\bar{v}_L$, and $\Delta t_L/\Delta t_Z$ must be multiplied by 1.4!

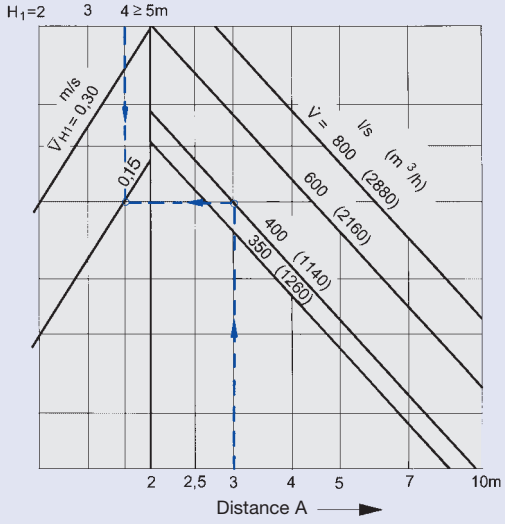
Effective outlet area

Size	315	400	630	800
A_{eff} in m²	0,0885	0,1260	0,2450	0,3480

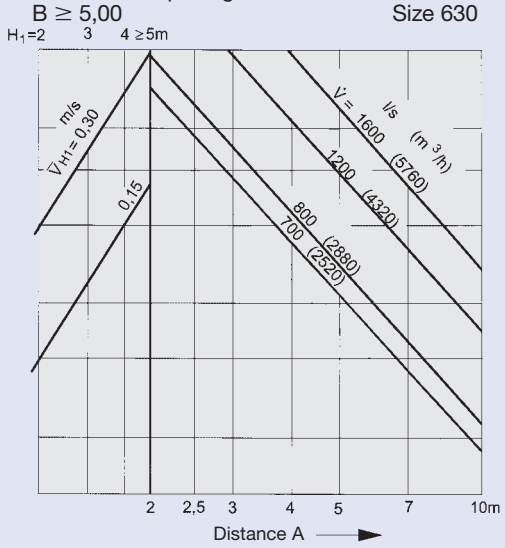
9 Selection of spacing A
B ≥ 5,00 Size 315



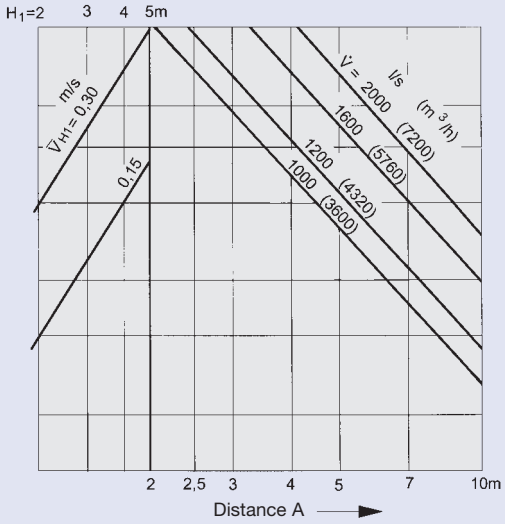
10 Selection of spacing A
B ≥ 5,00 Size 400



11 Selection of spacing A
B ≥ 5,00 Size 630



12 Selection of spacing A
B ≥ 5,00 Size 800

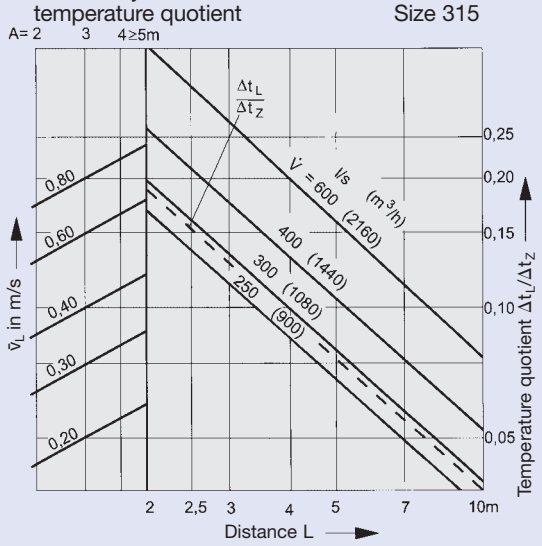


Diagrams apply to cooling operation, horizontal discharge and freely suspended diffusers.

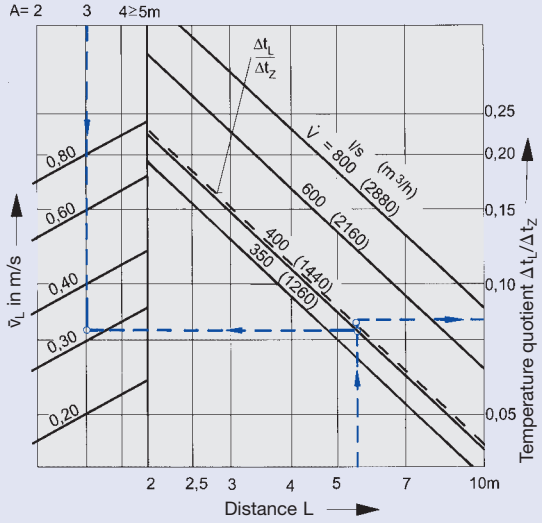
Correction Factor!

For flush installations with ceiling, the values $\bar{v}_{H1}$, $\bar{v}_L$, and $\Delta t_L/\Delta t_Z$ must be multiplied by 1.4!

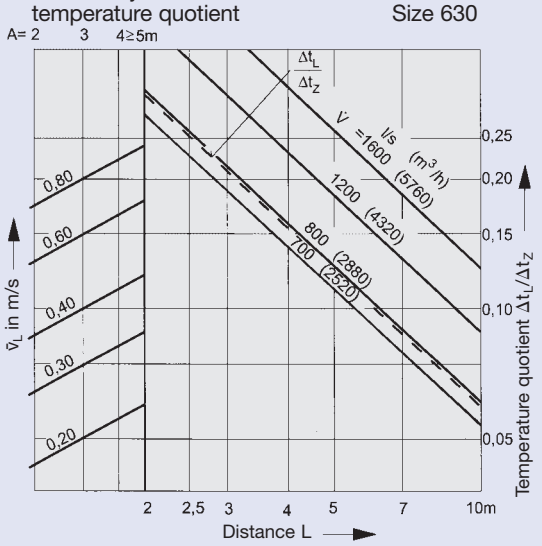
13 Air velocity at the wall and temperature quotient — Size 315



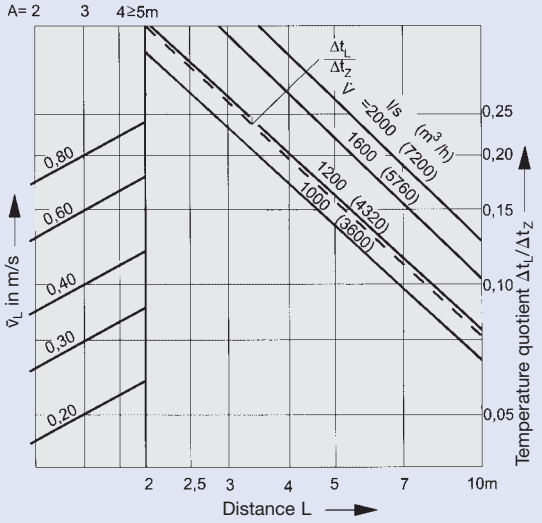
14 Air velocity at the wall and temperature quotient — Size 400



15 Air velocity at the wall and temperature quotient — Size 630

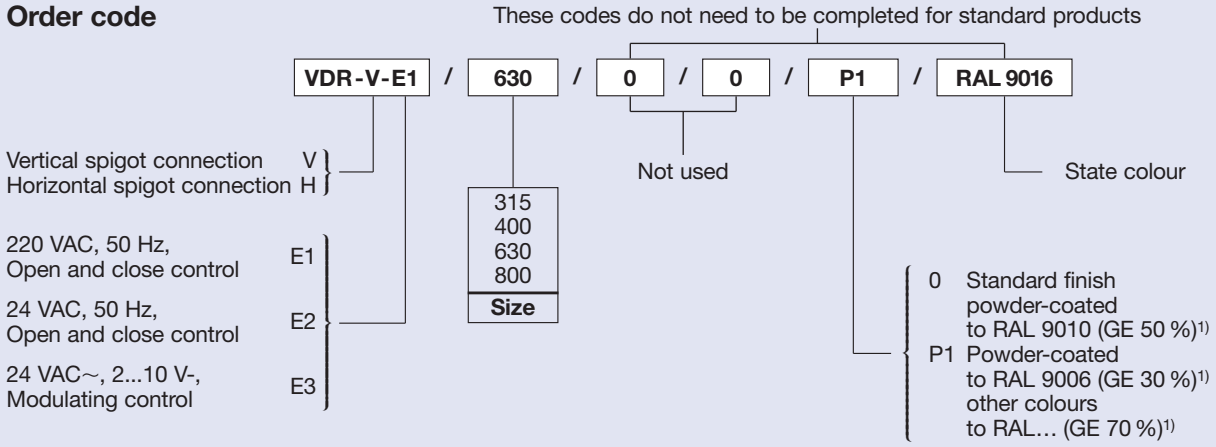


16 Air velocity at the wall and temperature quotient — Size 800



Order Details

Order code



1) GE = gloss level

Specification Text

Ceiling diffuser with adjustable blades, circular construction with nozzle-shaped discharge ring, suitable for horizontal, angled or vertical discharge direction according to blade setting, suitable for installation at heights of ≧ 3.80 m and for supply air temperature differentials of –10 K to +15 K, comprising front diffuser with electrically or hand-adjusted blades, spigot ring. Available with plenum box having top or side entry spigots.

Material:
Aluminium discharge face, spigot ring and adjustable blades. Surface finish pre-treated and powder-coated white RAL 9010, gloss level 50 %, any other RAL colour is optional.
Plenum box and actuator support frame in galvanized sheet steel.

Order Example

Make: TROX
Type: VDR-V-E1 / 630 / 0 / 0 / P1 / RAL 9016