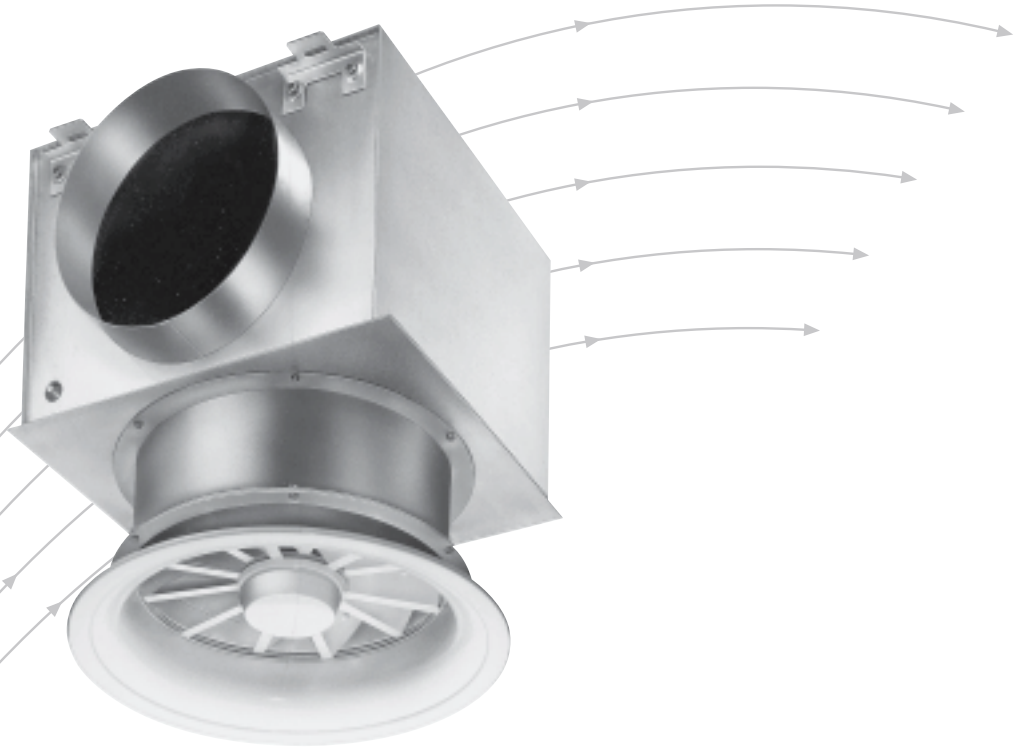
Swirl Diffusers

Type VDL

adjustable, for mounting heights ≥3.80m



TROX® TECHNIK

TROX Malaysia Sdn. Bhd.
20 Persiaran Bunga Tanjung 1
Senawang Land Industrial Park
70400 Seremban
Negeri Sembilan Darul Khusus
Malaysia

Telephone + 606-678 8188
Telefax + 606-678 8288 / 388
E-mail enquiry@troxapo.com
www.troxapo.com

Contents · Description

Blade position for horizontal air discharge
(supply air – cool)

Blade position for 45° air discharge
(supply air – isothermal)

Blade position for vertical air discharge
(supply air – warm)

For spaces with varying heat loads, the supply air can be either cool, isothermal or warm as required.

With type VDL swirl diffusers, the discharge angle can be altered to discharge horizontally, vertically or angled, depending on blade position to give optimum penetration into the occupied zone.

With high air handling capacity, the swirl diffuser is suitable for use for either industrial or comfort application.

The diffuser can be used with large floor to ceiling heights (e. g. factories, airport terminals, theatres, banking halls) with ceiling heights ≧ 3.80 m where the supply air temperature differential varies between –10 K to +15 K.

Construction

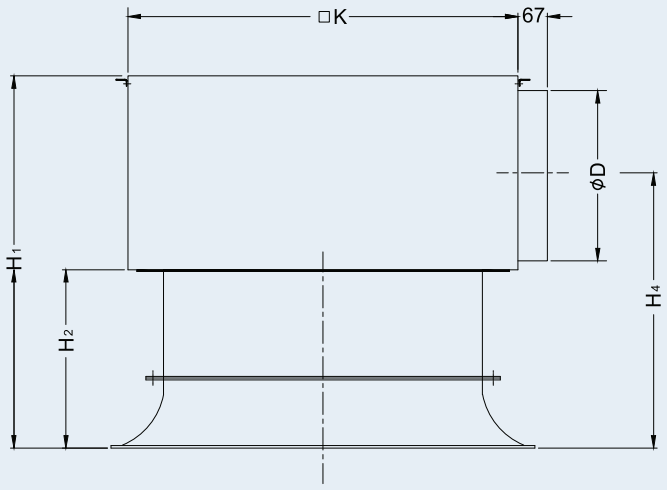
Type VDL swirl diffusers are available in four sizes. The diffuser face includes adjustable blades and outer discharge nozzle and has a rear mounted circular housing. The blade position can either be adjusted manually or by means of an electric or pneumatic actuator. The plenum box can be supplied with either top or side entry spigots. For the powered application an inspection panel is included in the plenum box.

Materials

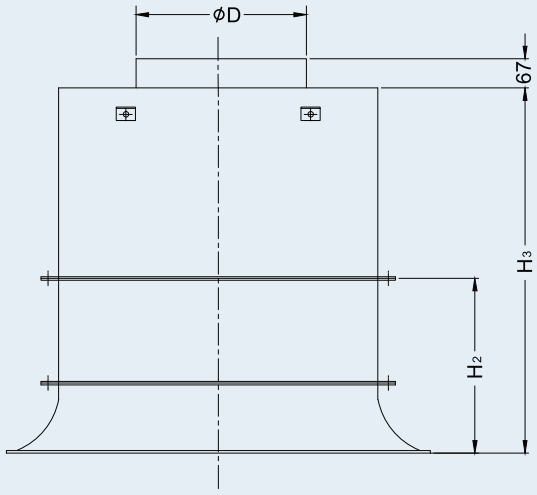
The diffuser face is in galvanised sheet steel, and the outer discharge nozzle is deep drawn aluminium. The surface is powder coated white (RAL 9010).

The plenum box is made from galvanised sheet steel.

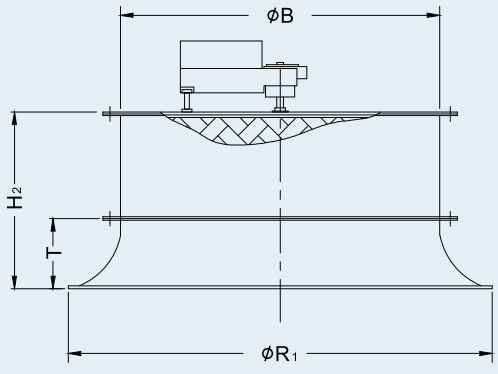
Size	B	D	D_L	H_1	H_2	H_3	H_4	K	R_1	R_2	T	n
315	318.5	248	368	483	203	425	342.5	435	464	382	63	6
400	403.5	313	450	603	238	534	420.5	500	567	464	80	6
630	633.5	398	690	848	383	748	615.5	750	871	708	125	6
800	803.5	498	853	1133	568	998	850.5	1000	1077	871	160	12



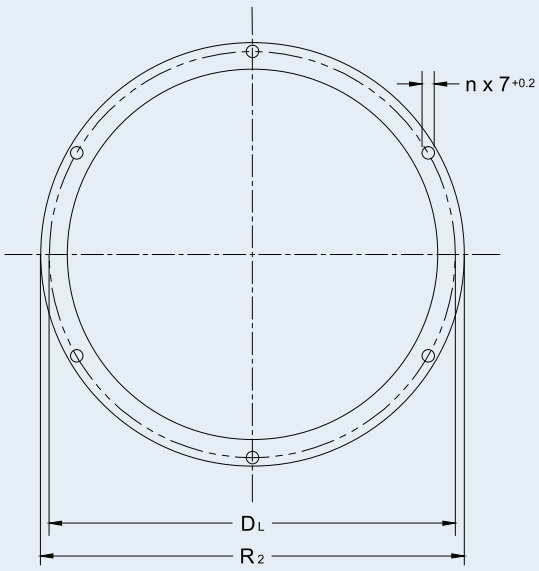
VDL-H



VDL-V



VDL-E...

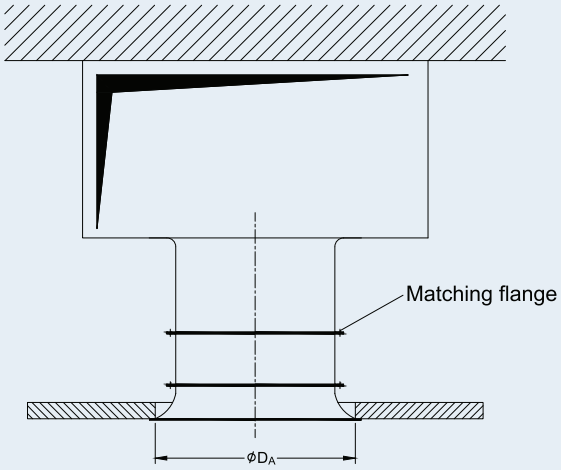


Connecting flange also matching flange

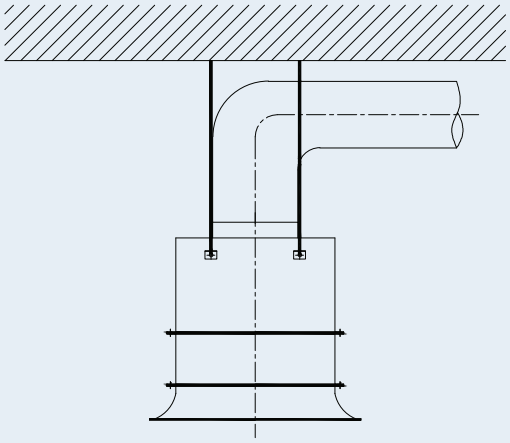
Installation

The type VDL swirl diffusers can, due to their method of operation, be mounted flush in a ceiling or suspended in free space.

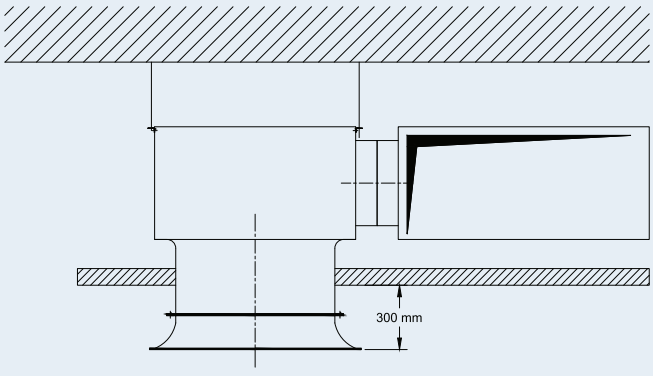
When fitted flush in open grid ceilings, the discharge characteristics are the same as suspended in free space. The angle of the air discharge is continuously adjustable.



Flush installation in a flat ceiling, two stable directions of discharge (horizontal and vertical)



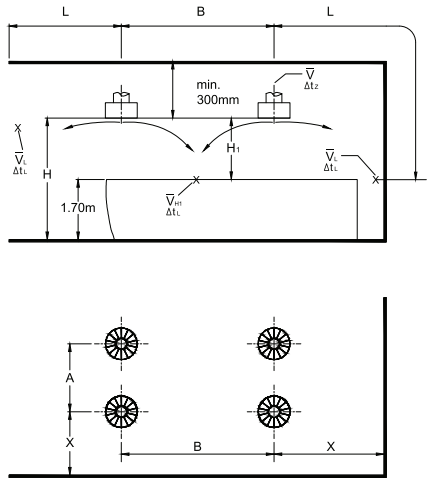
Suspended in free space: e. g. for industrial use, suitable for continuous adjustment of air discharge angle



Installed 300 mm below a flat ceiling for continuous adjustment of the air discharge angle

Size	315	400	630	800
∅ D_A	412	515	810	1015

Nomenclature



$\dot{V}$	in l/s:	Volume flow per diffuser
$\dot{V}$	in m³/h:	Volume flow per diffuser
A, B	in m:	Spacing between two diffusers

X	in m:	Distance between centre of diffuser and the wall
H_1	in m:	Distance between diffuser face and occupied zone
f_{H1}	in m/s:	Average air velocity between two diffusers at distance H_1 from diffuser face
L	in m:	Distance from diffuser centre line to the wall + H_1
f_L	in m/s:	Time average air velocity at the wall
$H_{1\,max}$	in m:	Maximum penetration depth of the air flow for heating
Δt_Z	in K:	Temperature difference between supply and room air
Δt_L	in K:	Difference between core and room temperature at distance L = A/2 + H_1 or L to wall
A_{eff}	in m²:	Effective outlet area
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 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-weighting and NC rating of room sound pressure level $L_{pA} \approx L_{WA} - 8$ dB, $L_{pNC} \approx L_{WNC} - 8$ dB

Relative Spectra ΔL

Size	Effective jet velocity v_{eff} in m/s	VDL								VDL-H								VDL-V							
		Octave band centre frequency in Hz																							
		63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000
315	3	10	2	2	- 1	- 5	- 18	- 28	- 37	10	6	2	- 1	- 6	- 17	- 28	- 30	8	4	2	0	- 6	- 16	- 28	- 36
400		6	4	2	- 1	- 5	- 21	- 36	- 44	7	7	0	- 1	- 5	- 15	- 26	- 30	7	4	2	0	- 6	- 16	- 28	- 36
630		7	3	2	- 1	- 5	- 20	- 33	- 41	9	6	1	- 1	- 6	- 16	- 27	- 30	6	4	2	0	- 6	- 15	- 27	-37
800		7	3	2	- 1	- 5	- 20	- 33	- 42	14	6	3	- 1	- 7	- 20	- 31	- 31	10	4	3	0	- 7	- 17	- 31	- 36
315	5	7	1	1	-2	- 4	- 14	- 20	- 29	8	5	1	- 1	- 5	- 13	- 21	- 25	6	3	1	- 1	- 5	- 12	- 21	- 29
400		4	4	1	- 1	- 5	- 16	- 28	- 36	5	5	- 1	- 2	- 4	- 11	- 19	- 25	6	3	1	-1	- 5	- 12	- 21	- 29
630		5	3	1	- 1	- 4	- 15	- 25	- 33	7	5	0	- 1	- 5	- 12	- 20	- 25	4	3	1	- 1	- 5	- 11	- 20	- 30
800		5	3	1	- 1	- 5	- 15	- 25	- 34	12	4	2	- 1	- 6	- 15	- 23	- 26	9	3	2	- 1	- 6	- 13	- 23	- 28
315	8	5	0	0	- 3	- 5	- 10	- 13	- 22	6	3	- 1	- 2	- 5	- 9	- 15	- 21	4	1	0	- 2	- 5	- 9	- 14	- 23
400		1	3	0	- 2	- 4	- 11	- 21	- 29	2	3	- 3	- 3	- 4	- 8	- 13	- 21	4	1	0	- 2	- 5	- 9	14	- 23
630		3	2	0	- 2	- 4	- 11	- 18	- 26	4	3	- 2	- 3	- 4	- 9	- 14	- 21	2	1	- 1	- 3	- 5	- 8	- 13	- 23
800		3	2	0	- 2	- 4	- 11	- 18	- 26	10	3	1	- 2	- 5	- 11	- 17	- 21	7	2	1	- 2	- 5	- 10	- 16	- 22
315	12	1	- 1	- 2	- 5	- 6	- 7	- 8	- 17	3	1	- 3	- 4	- 5	- 7	- 10	- 18	1	- 1	- 2	- 4	- 5	- 7	- 10	- 18
400		- 1	2	- 1	- 3	- 5	- 8	- 15	- 23	- 1	0	- 5	- 5	- 5	- 6	- 9	- 19	1	- 1	- 2	- 4	- 5	- 7	- 10	- 18
630		0	1	- 1	- 3	- 5	- 8	- 12	- 20	1	0	- 4	- 5	- 5	- 7	- 10	- 19	0	- 1	- 3	- 5	- 5	- 7	- 9	- 19
800		0	1	- 1	- 3	- 5	- 8	- 13	- 21	7	1	0	- 3	- 5	- 8	- 12	- 18	5	0	- 1	- 4	- 5	- 8	- 11	- 17

Acoustic Data

Example

Data given:
Type VDL-V; size 400
volume flow per diffuser $\dot{V} = 250$ l/s

Required: Octave band sound power level of regenerated noise L_W

Octave band centre frequency in Hz	63	125	250	500	1000	2000	4000	8000
L_{WA} in dB(A)	41	41	41	41	41	41	41	41
ΔL in dB	+ 6	+ 3	+ 1	– 1	– 5	– 12	– 21	– 29
L_W in dB	47	44	42	40	36	29	20	12

Diagram 2: Sound power level and pressure drop

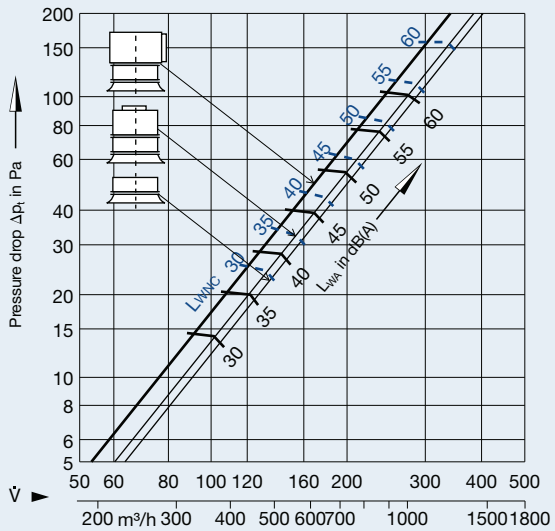
$L_{WA} = 41$ dB(A)
$\Delta p_t = 25$ Pa

Effective jet velocity v_{eff}:

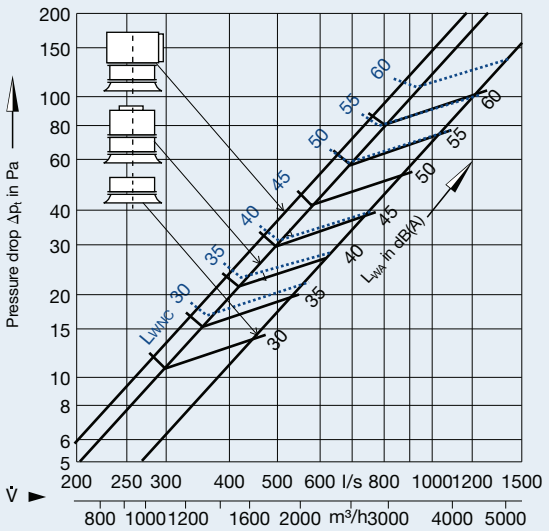
$$v_{eff} = \frac{\dot{V}}{A_{eff} \cdot 1000} = \frac{250}{0.051 \cdot 1000} = 4.9 \text{ m/s}$$

$v_{eff} \approx 5.0$ m/s

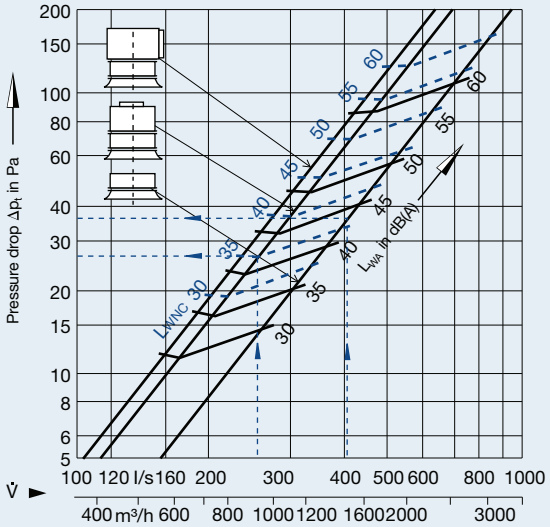
1 Sound power level and pressure drop
Size 315



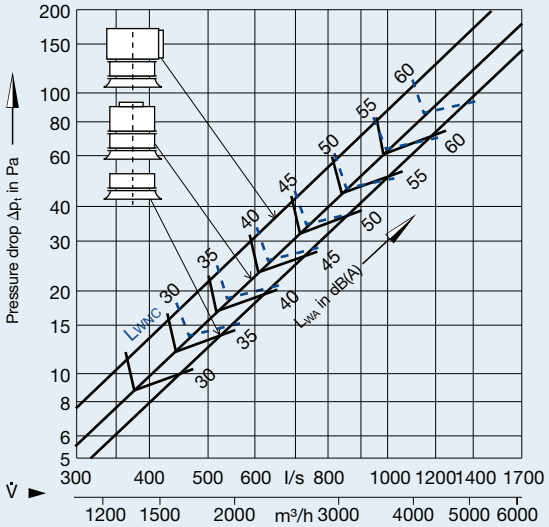
3 Sound power level and pressure drop
Size 630



2 Sound power level and pressure drop
Size 400



4 Sound power level and pressure drop
Size 800



Example

Data given:
Type VDL (top entry connection); size 400

Volume flow per diffuser	$\dot{V}$ = 400 l/s
Supply air temperature difference:	
horizontal for cooling	Δt_z = – 8 K
vertical for heating	Δt_z = + 15 K
Sound power level	L_{WA} = 45 dB(A)
Spacing between diffusers	A = 3.00 m
Distance between centre of diffuser and wall	X = 1.50 m
Distance between diffuser face and occupied zone	H_1 = 2.70 m

Diagram 2: Sound power level and pressure drop
L_{WA} = 42 dB(A) (L_{WNC} = 36 NC)
Δp_t = 34 Pa

The resulting sound power level of 42 dB(A) is below the specified level of 45 dB(A). To determine the room level, the number of diffusers and the room absorption must be taken into account.

Diagram 8: Max. penetration depth for vertical discharge

$\dot{V}$ = 400 l/s
Δt_Z = + 15 K
$H_{1\ max}$ = 4.1 m

Hence the warm air penetrates into the occupied zone during heating.

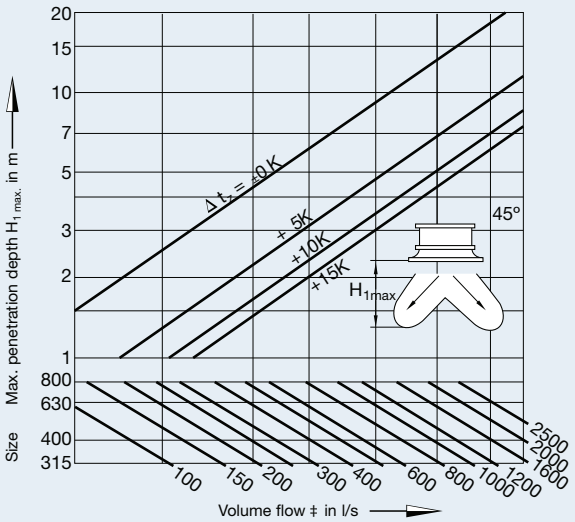
Diagram 10: Air velocity in occupied zone during cooling

A = 3.00 m
H_1 = 2.70 m
$\bar{v}_{H1}$ = 0.17 m/s

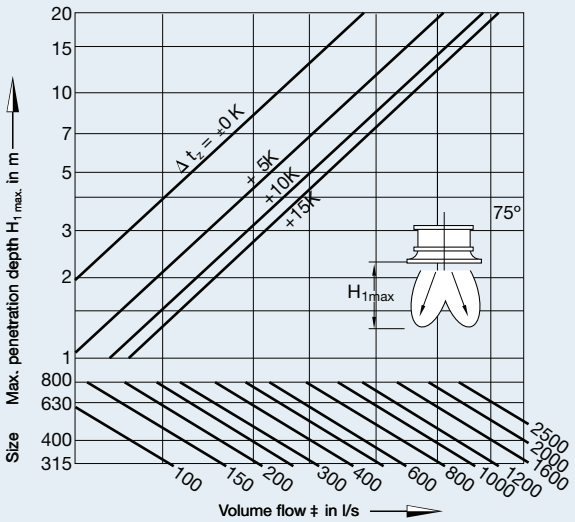
Diagram 14: Air velocity at the wall and temperature quotient

L = A/2 + H_1 = 1.50 + 2.70 = 4.20 m
$\bar{v}_L$ = 0.29 m/s
$\Delta t_L/\Delta t_Z$ = 0.10
Δt_L = – 8 x 0.10 = – 0.8 K

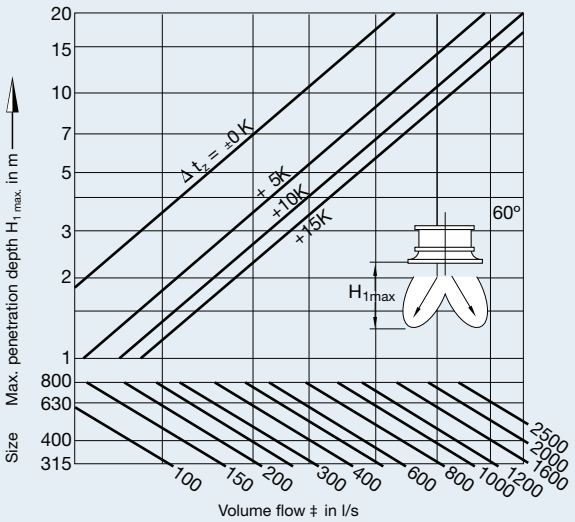
5 Max. penetration depth discharge angle 45°



7 Max. penetration depth discharge angle 75°

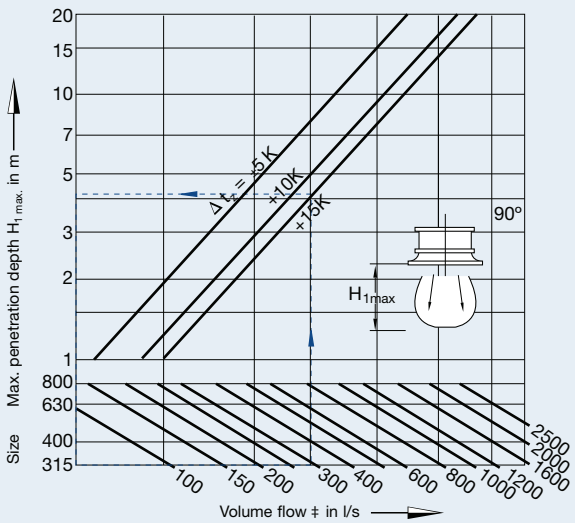


6 Max. penetration depth discharge angle 60°



$\dot{V}$ [m³/h] = $\dot{V}$ [l/s] x 3.6

8 Max. penetration depth discharge vertical



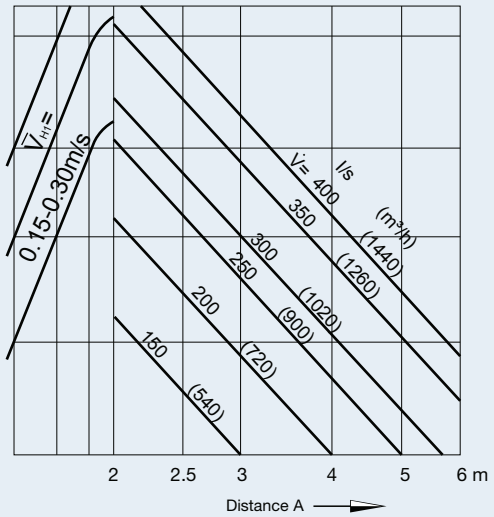
The diagrams are applicable to cooling mode, horizontal discharge diffuser in free space – no ceiling.
Supply air temperature difference: isothermal to –10 K

Correction:
For flush mounting in continuous ceiling, the values for $\bar{v}_{H1}$, $\bar{v}_L$ and $\Delta t_L / \Delta t_Z$ must be multiplied by 1.4.

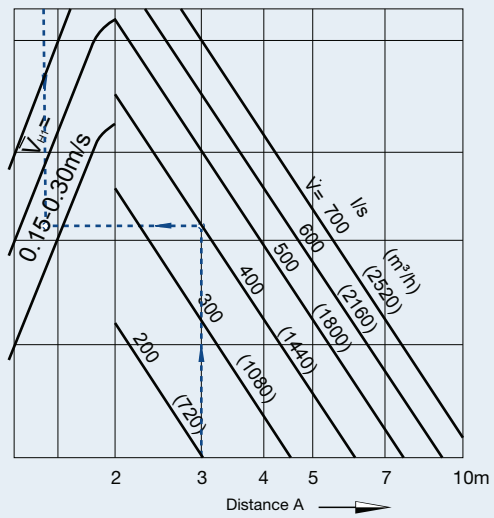
Effective Outlet Area

Size	315	400	630	800
A_{eff} in m^2	0.0272	0.051	0.098	0.113

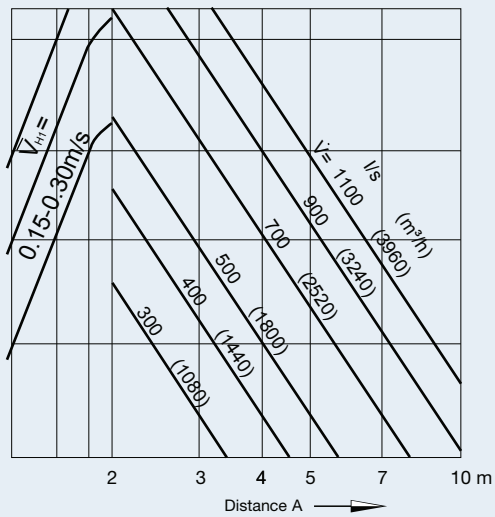
9 Determination of spacing between diffuser centres A
B ≧ 5,00 m Size 315
H_1= 2 3 4≥5 m



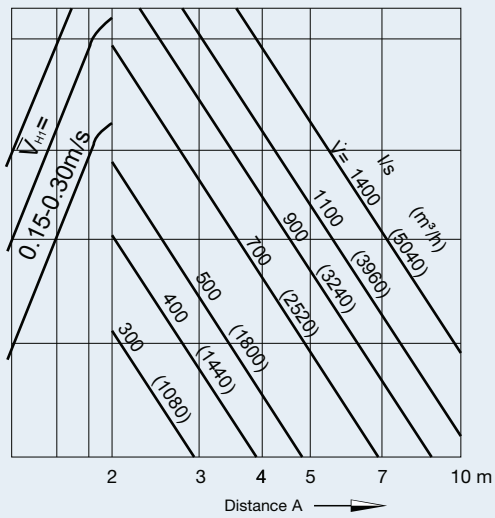
10 Determination of spacing between diffuser centres A
B ≧ 5,00 m Size 400
H_1= 2 3 4≥5 m



11 Determination of spacing between diffuser centres A
B ≧ 5,00 m Size 630
H_1= 2 3 4≥5 m



12 Determination of spacing between diffuser centres A
B ≧ 5,00 m Size 800
H_1= 2 3 4≥5 m



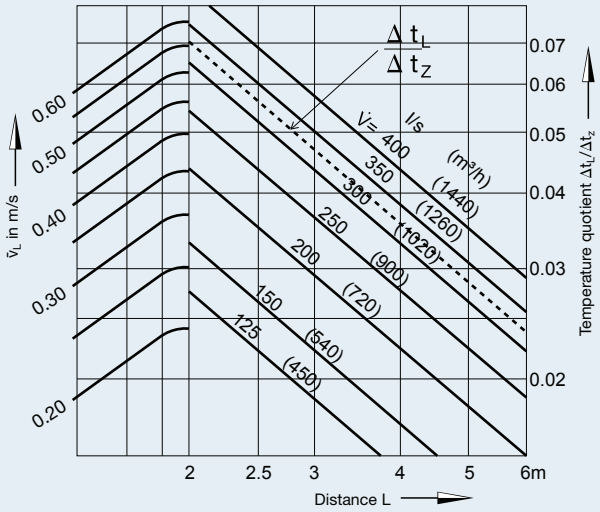
Aerodynamic Data

The diagrams are applicable to cooling mode, horizontal discharge diffuser in free space – no ceiling.
Supply air temperature difference: isothermal to –10 K

Correction:
For flush mounting in continuous ceiling, the values for $\bar{v}_{H1}$, $\bar{v}_L$ and $\Delta t_L / \Delta t_Z$ must be multiplied by 1.4.

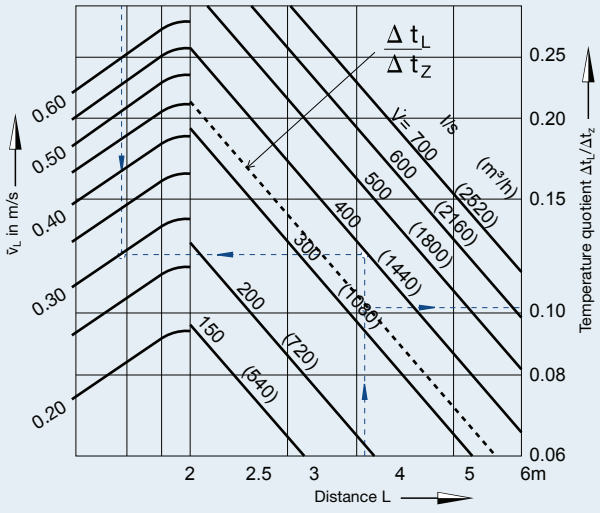
13 Air velocity at the wall and temperature quotient — Size 315

A = 2 3 4≥5 m



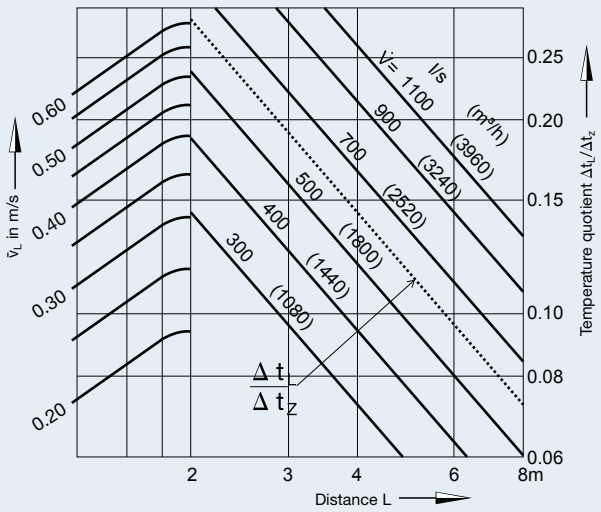
14 Air velocity at the wall and temperature quotient — Size 400

A = 2 3 4≥5 m



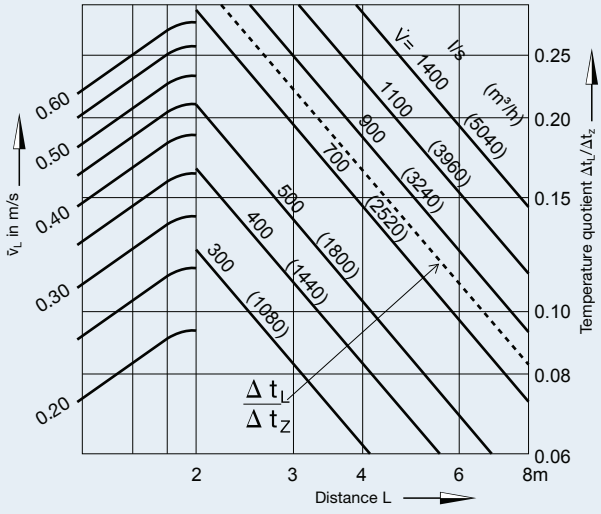
15 Air velocity at the wall and temperature quotient — Size 630

A = 2 3 4≥5 m



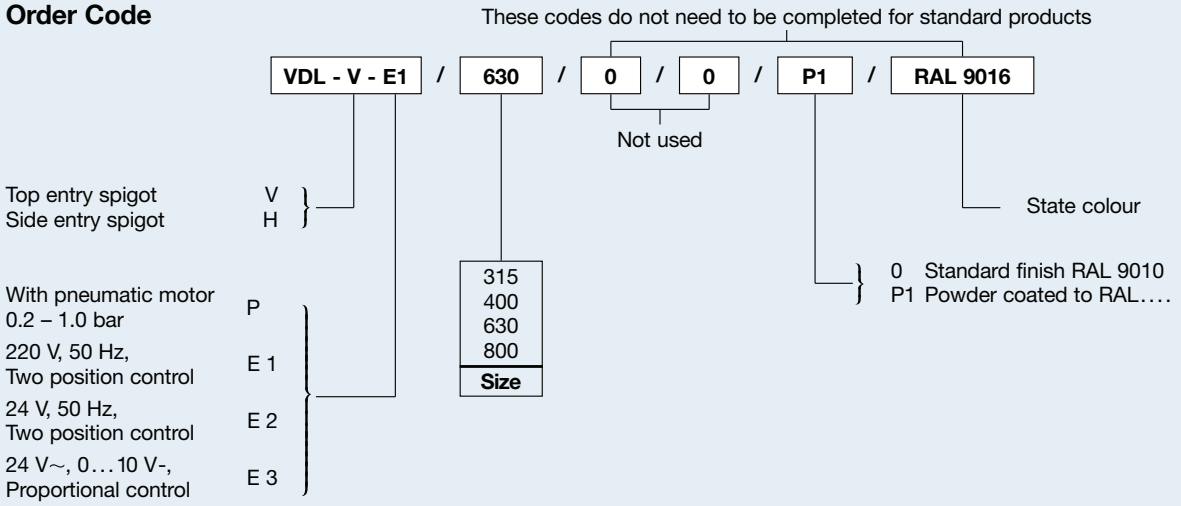
16 Air velocity at the wall and temperature quotient — Size 800

A = 2 3 4≥5 m



Order Details

Order Code



Specification Text

Circular swirl diffuser with adjustable blades complete with outer discharge nozzle, suitable for horizontal, angled or vertical air discharge controlled by blade position. Suitable for mounting heights of ≧ 3.80 m and variations in supply temperature differentials between –10 K to +15 K. Comprising of diffuser face with rotating blades adjustable either manually or with electric or pneumatic actuators, with top or side entry plenum box.

Materials:
Diffuser face in galvanised sheet steel, outer discharge nozzle in aluminium. The face of the diffuser, discharge nozzle and connecting section are pre-treated and powder coated white (RAL 9010). The plenum box is galvanised sheet steel.

Order Example

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

Accessories:
Matching flange GF, please order separately GF / 630