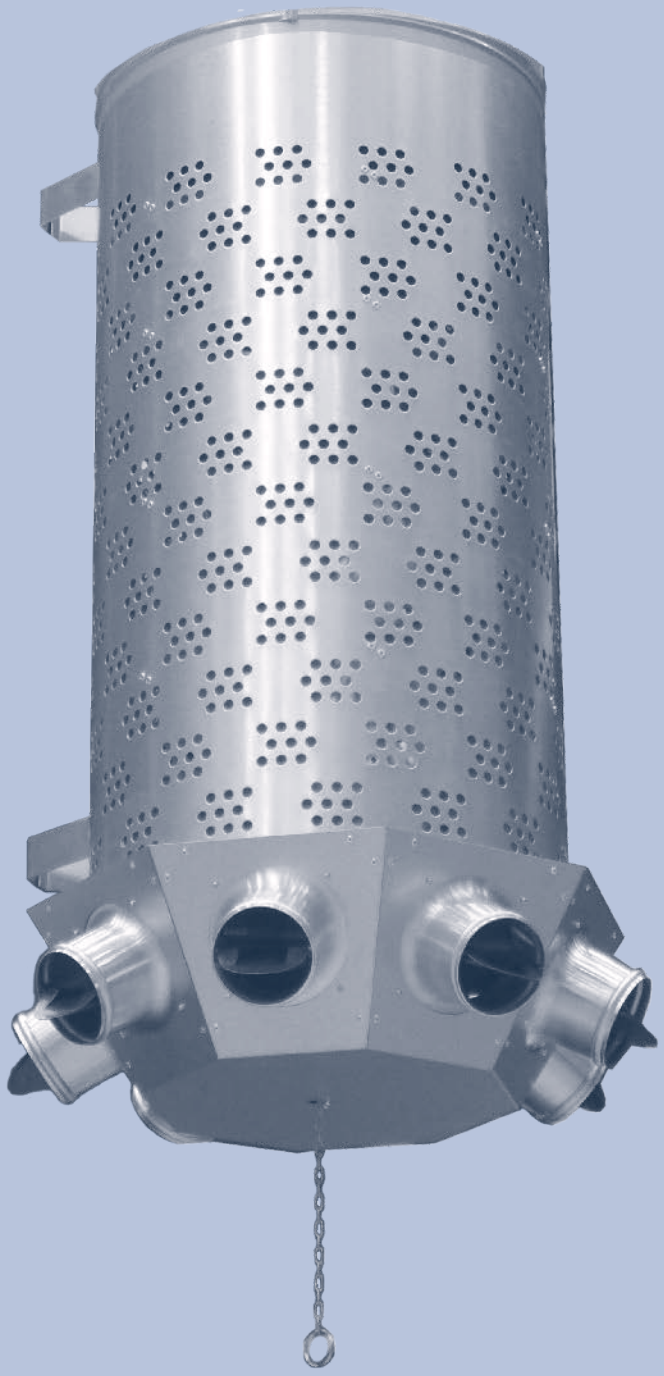
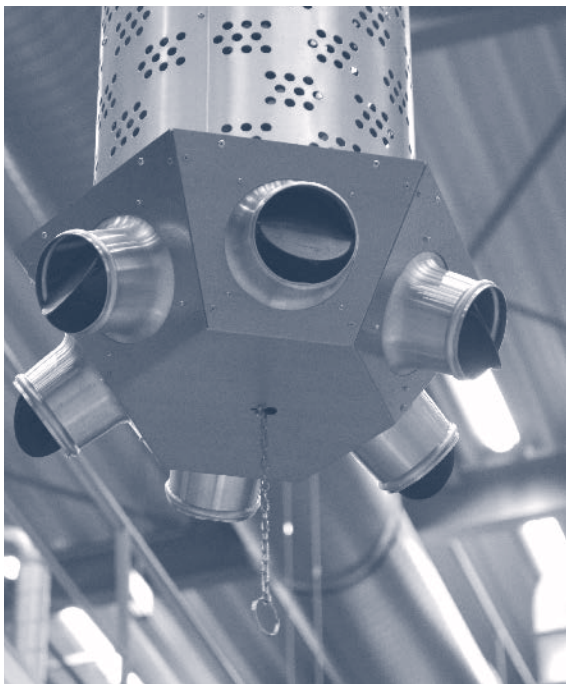




Krantz

Circular Hybrid
Displacement Outlet VA-ZH

Air distribution systems

DS 4203 E 01.2020

Circular Hybrid Displacement Outlet VA-ZH

Preliminary remarks

The Circular Hybrid Displacement Outlet VA-ZH by Krantz is designed for use in HVAC systems in manufacturing and production facilities with low to medium pollution levels and without mechanical refrigeration systems.
It is particularly suitable for improving the air quality in factory halls of, for example, printing plants, metal processing plants, injection moulding plants or the automotive industry. Its installation above workstations and alongside production machines has proven itself many times over.
The installation is carried out on walls and on columns, as well as freely suspended at an installation height of approx. 3 m above the hall floor.

In addition to a perforated discharge surface, the Circular Hybrid Displacement Outlet VA-ZH is equipped with a distribution box with jet nozzles. By pulling on a chain - and thus actuating an adjustment flap - the jet nozzles can also be charged with
supply air.
In this way, the outlet can be successively adjusted between displacement ventilation and mixed displacement ventilation.

By switching on the jet nozzles as required, the air in the occupied zone is quickly set to a higher, constant air velocity level (**Figure 1**). This means that for room air temperatures > 26°C, the heat exchange between those present and the air surrounding them is greatly improved.

The jet nozzles are also equipped with nozzle flaps, which allow the discharge direction and air velocity to be variably adjusted. The settings can be changed according to individual requirements for each nozzle flap.

In addition, the VA-ZH enables the user to displace or rapidly dilute pollutant concentrations.
This versatile air outlet is likewise ideally suited for cooling or rapid heating of occupied areas

The Circular Hybrid Displacement Outlet VA-ZH is also suitable for HVAC systems with cost-saving free cooling and adiabatic cooling.

Figure 1: **Flow pattern visualised by smoke; displacement mixing flow**

Features at a glance

- Low secondary air induction due to jet nozzles located below the discharge surface
- Air discharge direction and room air velocity adjustable for each nozzle via deflection flaps that are adjustable in three dimensions
- Nozzles can be switched on successively by means of integrated air deflection device (via chain pull)
- Low-turbulence displacement flow with low induction effect for minimum mixing of primary air with room air (for optimum displacement of dust particles and pollutants from the occupied zone)
- Displacement mixing flow (boost mode) for:
  - rapid heating of working areas
  - Noticeable movement of indoor air in case of strong heat load
  - rapid dilution (flushing) of temporary pollutant accumulation
- Standard installation height of 3 m above the floor
- Also ideally suited for HVAC systems with free or adiabatic cooling

Construction design

The Circular Hybrid Displacement Outlet VA-ZH is available in sizes 315, 450 and 560. Depending on these sizes, the length and width vary according to the values in **Table 1** (Page 3).

The main component of the outlet is a perforated casing **1** at the top.

At the bottom is a distribution box **4** with radially arranged jet nozzles **2**. Whether or how much air flows through the distribution box depends on the position of a shut-off damper **5** located on the inside, which can be adjusted manually via a chain **6**.

By pulling the chain **6,** the shut-off damper **5** can be opened successively. The chain is hooked into a keyhole **7** in the floor in the desired position of the shut-off damper.
After loosening the chain, the shut-off damper closes automatically by use of a return spring.

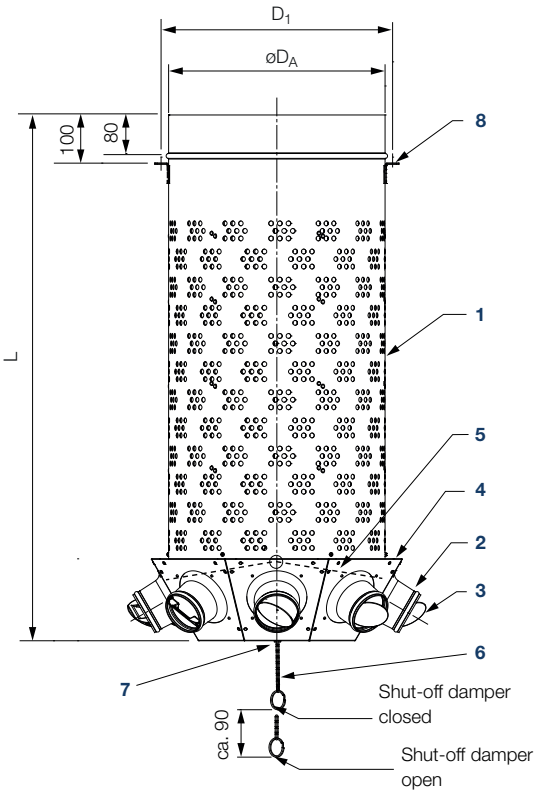
The individual jet nozzles (either six, eight or twelve, depending on the size of the outlet) are equipped with individually adjustable nozzle flaps **3**.

The VH-ZH is available in two variants:
1. with brackets **8** for freely suspended mounting or
2. with fasteners **9** for mounting on walls. To ensure optimum wall mounting, the jet nozzle on the corresponding side of the outlet is removed.

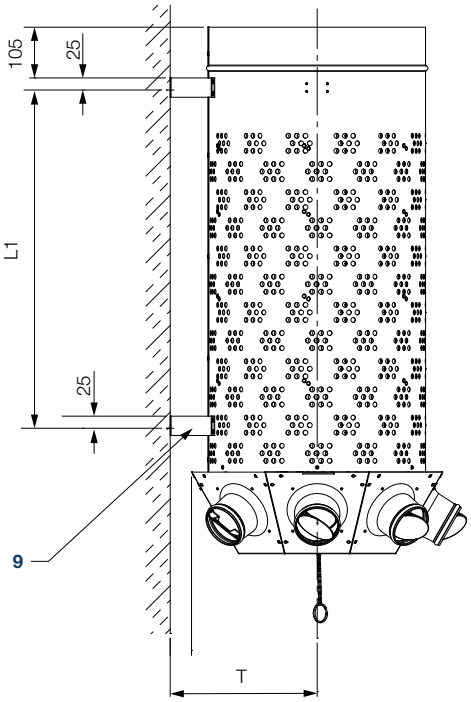
www.krantz.de DS 4203 E Bl. 2 01.2020

Circular Hybrid Displacement Outlet VA-ZH

Construction design and dimensions



Wall/Column mounting



Key (for all pages)**:**

1 Perforated casing
2 Jet nozzle
3 Nozzle flap
4 Air distribution box
5 Shut-off damper
6 Chain
7 Keyhole
8 Bracket for ceiling suspension
9 Fastener for wall mounting

Table 1: Technical specifications

Size	Volume flow rate range in		Quantity of nozzles	Dimensions in mm					Weight in kg	Heating mode		Cooling mode
										Horizontal penetration depth at $\dot{V}_{max}$ in m		Horizontal penetration depth at $\dot{V}_{max}$ in m
	l/s	in m^3/h		D_A	D_1	L	L_1	T		at 4 K	at 8 K	
315	333 - 556	1200 - 2000	6	314	344	906	560	235	10	10	7	12
450	417 - 972	1500 - 3500	8	449	480	1090	700	305	17	14	10	16
560	833 - 1944	3000 - 7000	12	558	590	1470	950	360	28	17	14	20

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Circular Hybrid Displacement Outlet VA-ZH

Mode of operation

Adjusting the shut-off damper **5** with the aid of the chain **6** allows a quick change between two flow types, which is described as follows:

Displacement flow (normal mode)
The air flowing in through the spigot is blown out only through the perforated casing **1**, directed slightly upwards. The jet nozzles **2** are separated from the air flow because the shut-off damper **5** is closed thanks to the spring (**Figure 2**).

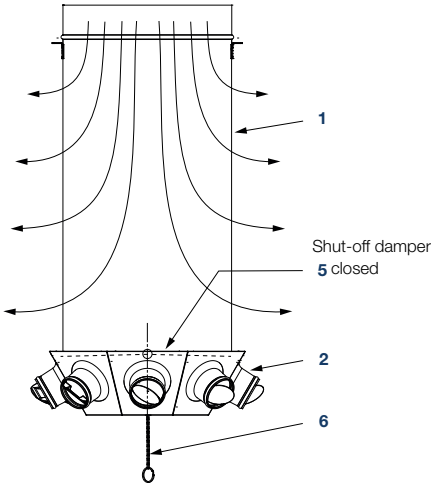

Figure 2: Schematic illustration;
air discharge with shut-off damper closed

The resulting sheer displacement flow (**Figure 3**) is best suited for cooling purposes if the supply air is colder than the room air. The colder supply air, flowing slightly upwards, sinks into the occupied zone due to the difference in density.
Due to the relatively limited induction, the pollutant and temperature load factor in the occupied zone is low.

Figure 3: Displacement flow

Displacement mixing flow with nozzles (boost mode)
By pulling the chain **6** to the end, the maximum amount of supply air flows through the nozzles **2** (**Figure 4**). This causes a boost which increases the air movement in the discharge area and the occupied zone (**Figure 5**).
Even if the supply air has the same temperature as the room air, the increased air movement causes a cooling effect for the user, as heat due to forced convection is removed more quickly from the body.
If the supply air is warmer than the room air, occupied zones can also be heated by switching on the downward sloping nozzles:
- Boost mode for a reduction of the heating-up period
- Intermediate position (of shut-off damper **5**) for permanent heating.

In the event of a temporary pollutant accumulation, a flushing operation can furthermore be generated by switching on the nozzles. This leads to a rapid dilution of the pollutant concentration.

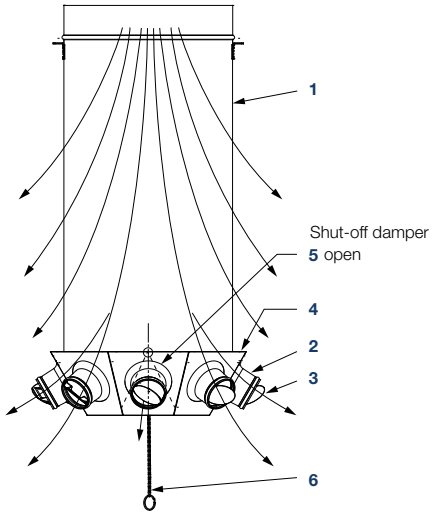

Figure 4: Schematic illustration;
Air discharge with shut-off damper open

Figure 5: Displacement mixing flow with focused nozzle position

www.krantz.de DS 4203 E Bl. 4 01.2020

Circular Hybrid Displacement Outlet VA-ZH

The jet nozzles **2**, which are switched on together via the chain **6**, can be adjusted individually by hand as explained below:

On the one hand, the plastic flap of each nozzle can be turned on its axis up to 360° (**Figure 6**).

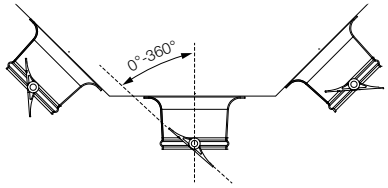

Figure 6: Top view; Nozzle flap rotatable by 360°

This allows the discharge direction of the individual nozzles to be changed, **Figure 6a** and **Figure 6b**.

Figure 6a: Flap angle 0° to horizontal

Figure 6b: Flap angle 45° to horizontal

If the damper is set to block the discharge direction, the volume flow and velocity of the supply air discharged from this nozzle can be reduced considerably.
This is advantageous when the same displacement outlet supplies working areas located in different directions, with different requirements for volume flow and air velocity.

On the other hand, each nozzle flap can be rotated by 360° around its flow axis (**Figure 7**).

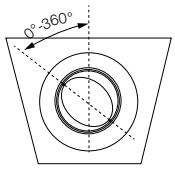

Figure 7: Front view; flap rotatable by 360° around flow axis

By adjusting the opening angle (**Figure 6**) and the flow axis (**Fig. 7**), the direction of the discharged air can be continuously adjusted (for each nozzle) to left, right, up or down.

Arrangement and connection

Depending on the spatial conditions, the VA-ZH can be installed on walls or columns (**Figure 8**).

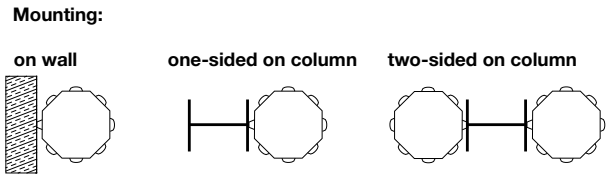

Figure 8: Example of mounting on walls and columns

For mounting on a wall or column, the nozzles facing the wall/ column are omitted (**Figure 9**).

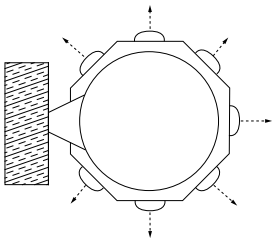

Figure 9: Outlet for wall mounting

For a freely suspended installation, e.g. in the centre of the room ceiling, all nozzles are attached to the VA-ZH.

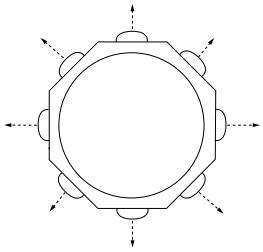

Figure 10: All nozzles attached for free suspension mounting

An arrangement in a continuous row is recommended if, for example, a crane runway has to maintain its manoeuvrability (**Figure 11**).

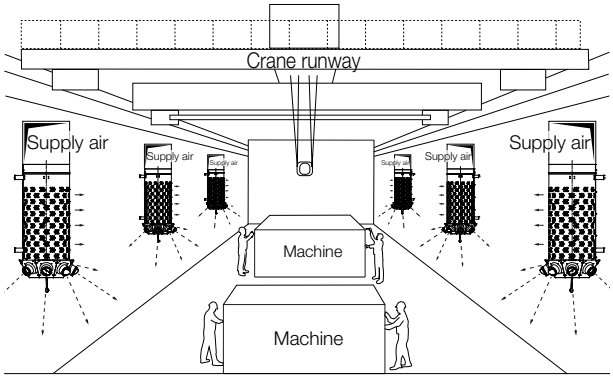

Figure 11: Example of arrangement in series below a crane runway

Circular Hybrid Displacement Outlet VA-ZH

Selection and layout

Layout example: industrial hall

The HVAC system has no mechanical refrigeration system. The specific supply air volume flow rate should be calculated with the aid of VDI 3802 “Air conditioning systems for factories“.
For assembly areas, for example, a range of 20 to 30 $m^3/(h \cdot m^2)$ [= 5.6 to 8.3 $l/(s \cdot m^2)$] floor area is provided there, and for mechanical production from 20 to 75 $m^3/(h \cdot m^2)$ [= 5.6 to 21$l/(s \cdot m^2)$].
When selecting the specific supply air volume flow rate, it should be noted that no mechanical coldness is available. Consequently, it should be laid out in the upper part of the specified air volume range according to VDI 3802.
Based on an operation according to **Figure 12**, the following layout would result:

Specific air volume flow rate $\dot{V}_{Sp}$:	50 $m^3/(h \cdot m^2)$ [= 14 $l/(s \cdot m^2)$]
Supply area:	B · L = 30 m · 75 m
Supply surface:	2,250 m^2
Total supply air volume flow:	112,500 m^3/h [= 31,250 l/s]
Column distance:	15 m
Size of Hybrid Outlet:	560
Quantity:	20
Supply air volume flow per outlet $\dot{V}_A$:	5,625 m^3/h [= 1,562.5 l/s]

Read from diagram Size 560 (Page 7):

Normal Mode
Total pressure drop: 76 Pa
Sound power level: 65 dB(A)

Boost and Rapid Heating
Total pressure drop: 53 Pa
Sound power level: 62 dB(A)

Key for the selection:

L	=	Length of supply area
B	=	Width of supply area
$\dot{V}_A$	=	Volume flow rate per air outlet in m^3/h [l/s]
L_{WA}	=	Sound power level in dB(A)
Δp_t	=	Total pressure drop in Pa
$\dot{V}_{Sp}$	=	Specific area-related air volume flow rate in $m^3/(h \cdot m^2)$ [$l/(s \cdot m^2)$]

Figure 12: Possible arrangement according to layout example

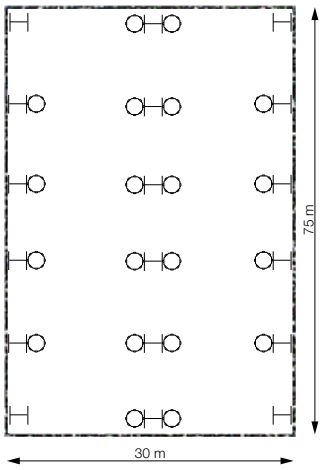

Table 2: Octave spectra in normal mode

Air outlet volume flow rate $\dot{V}_A$		Shut-off damper [1]	Total pressure drop	Sound power level L_W in dB								
			Δp_t	L_{WA}	Octave band centre frequency in Hz							
l/s	m^3/h		Pa	dB(A)	63	125	250	500	1 K	2 K	4 K	8 K
Size 315												
333	1200	open	40	51	51	46	48	47	46	43	33	22
		closed	51	55	50	47	50	51	51	47	39	27
444	1600	open	71	59	59	55	57	56	55	51	42	31
		closed	92	63	59	56	59	59	59	56	47	36
556	2000	open	112	66	66	62	64	63	61	58	49	36
		closed	144	70	65	62	65	66	66	63	54	41
Size 450												
417	1500	open	13	40	35	34	37	37	36	32	21	9
		closed	21	45	38	37	40	41	41	38	29	17
694	2500	open	35	56	53	53	56	54	52	45	31	14
		closed	59	61	57	56	60	59	57	52	40	23
972	3500	open	70	65	61	60	64	63	62	56	45	30
		closed	116	70	64	63	66	66	66	62	53	39
Size 560												
833	3000	open	15	41	38	43	39	41	36	24	8	< 5
		closed	21	45	40	50	46	44	39	28	13	< 5
1389	5000	open	42	58	51	57	53	56	54	47	34	18
		closed	60	61	52	61	59	59	58	52	40	25
1944	7000	open	84	69	60	66	62	66	66	62	51	35
		closed	120	72	59	69	68	69	70	67	58	43

[1] open = Boost mode; Shut-off damper **5** opened
closed = Normal mode; Shut-off damper **5** closed

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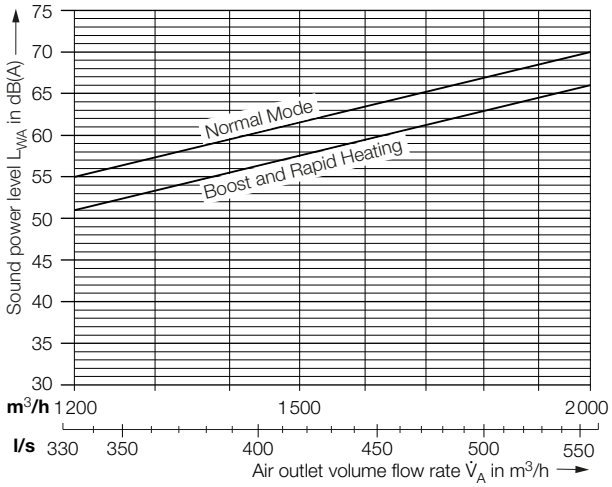
Circular Hybrid Displacement Outlet VA-ZH

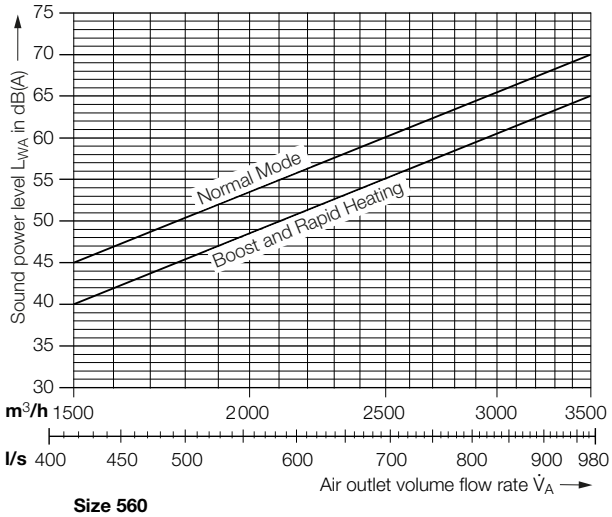
Sound power level and pressure drop

Sound power level

Size 315



Size 450



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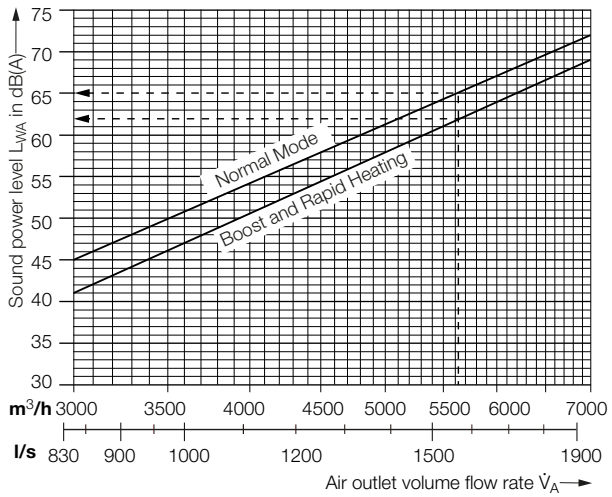
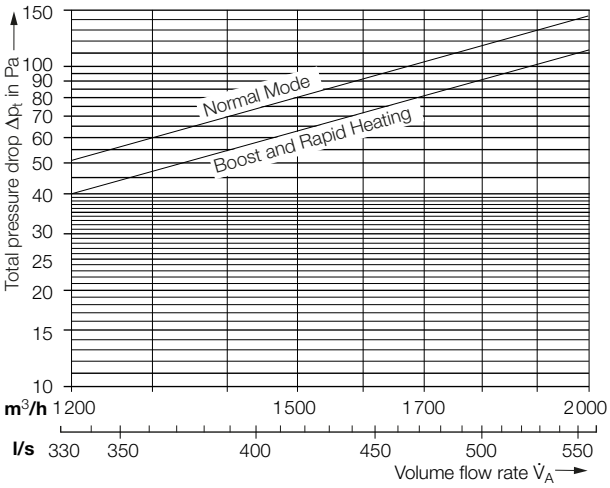


Normal Mode: Cooling, heating, isothermal; with displacement flow as well as partially switched on nozzles

Boost and Rapid Heating: Nozzles completely open, Displacement mixing flow

Pressure drop

Size 315



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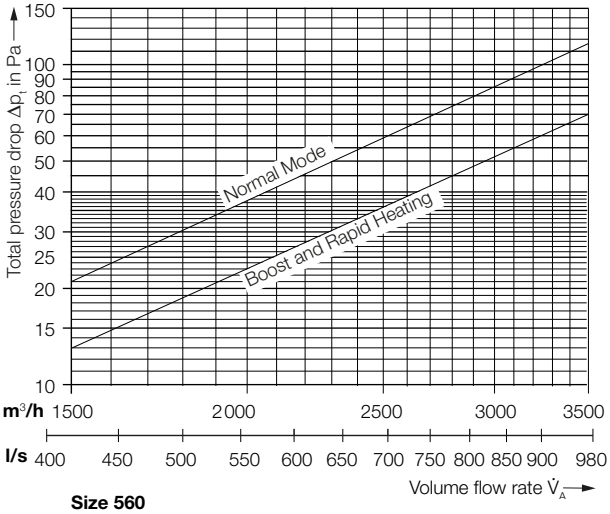

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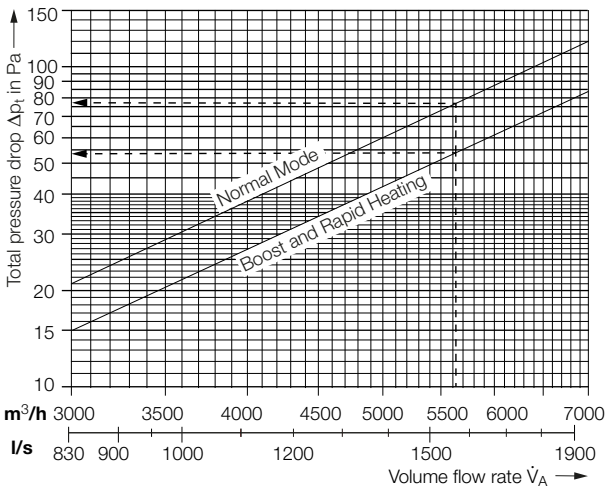

Circular Hybrid Displacement Outlet VA-ZH

Type code

VA – ZH –___– K – ___– ___

Function / Type
ZH = Cylindrical Hybrid

Size
315 = Size 315
450 = Size 450
560 = Size 560

Adjustment
K = Chain

Surface
galv = galvanized
.... = on request color of the visible surface according to RAL

Additional
H = Fastener for wall mounting on the rear side [1)]
W = Bracket for free hanging installation
O = Without fixture

[1)] When ordered with a rear fastener, the jet nozzle facing the wall is removed.

Tender text

…units

Circular Hybrid Displacement Outlet VA-ZH, especially for use in systems without mechanical cooling or with adiabatic cooling. Available in three different sizes for optimum removal of heat and pollutant loads from manufacturing and production facilities.

VA-ZH consisting of:
Cylindrical housing with top-mounted round connection spigot, perforated discharge surface and bottom-mounted distribution box with jet nozzles.

Integrated air deflection device with chain, for manual change of operating modes:
- Displacement flow from discharge surface
- Displacement mixing flow from nozzles and discharge surface

Rotation axes, orthogonal to one another, allow three-dimensional rotations of all nozzle flaps, for individual regulation of air discharge direction and room air velocity.

Materials:
Housing and perforated metal sheet made of galvanised sheet metal, nozzles of aluminium, unpainted.
Nozzle flaps made of polycarbonate (PC, GF 10).
Powder coating according to RAL... on request.

Make: Krantz
Type: VA – ZH – ____ – K – ____ – ____

Subject to technical alteration.

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