Krantz

Opticlean® OC-V
Thermostatic control unit

Air Distribution Systems

DS 4204e 05 .2022

Opticlean® OC-V

Scope

The Opticlean OC-V with thermostatic control unit significantly shortens the heating-up time for occupied zones when compared to the non-adjustable version. The resulting advantages include significantly lower energy requirements and rapid reduction of vertical temperature stratification while heating. These lower energy requirements mean significant cost savings compared to non-adjustable outlets. Such energy savings can be even further increased by an optional temperature reduction at night, which also has an enormous impact on operating costs.

The temperature-dependent behavior of the OC-V – blowing horizontally when cooling and vertically when heating – always guarantees a high level of thermal comfort in the occupied zones. The variable air discharge direction is possible due to a movable air guide frame placed in the supply air volume flow that is adjusted through a thermostatic control unit. This type of regulation does not require any cabling or auxiliary energy and is therefore a cost-effective alternative to electric actuators. The energy required to regulate the air guide ring is obtained exclusively from the temperature of the supply air.

In heating-up mode, depending on the supply air temperature and room height, supply air can penetrate the room air all the way to the floor of the room. Thanks to this deep vertical penetration, glass facades can be thermally shielded and thus do not require static heating equipment.

The OC-V offers the same advantages as the non-adjustable Opticlean (OC-Q and OC-R):

- High thermal comfort
- Invisible integration in suspended ceilings
- Extremely low pollution of the ceiling

The adjustable Opticlean OC-V is primarily intended for installation in suspended ceiling systems. It can be mounted from above in place of a ceiling tile onto the T-profiles of any ceiling system with a grid of 625 x 625 mm or 600 x 600 mm and then be connected to the supply air duct.

For numerous other common ceiling systems, such as metal ceilings, Krantz provides customized solutions.

The face plate comes perforated with round holes in diagonal pitch. The hole diameter is 2.8 mm and the spacing is 5.5 mm (**Figure 3**). This hole pattern corresponds to the typical appearance of the most common metal ceiling tiles. In this way, an air outlet can be integrated into the ceiling of a room completely unobtrusive. With a matching hole pattern, the Opticlean cannot be distinguished from any other normal ceiling tile.
The actual air outlet element is firmly connected to the air connection box **1** and is either attached to the ceiling tile **4** on site or at the factory (**Figure 1**).

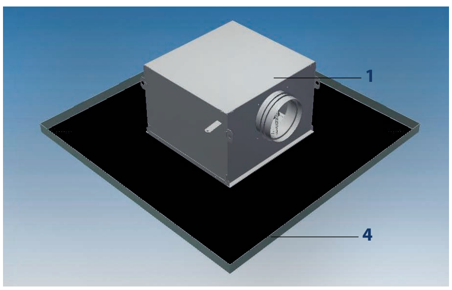

Figure 1: Air connection box

Applications

– Room heights up to 3 m
– Supply air temperatures from 16 to 30 °C
– Volume flow range from 150 to 300 m³/h

Dimensions

Table 1 shows the dimensions of the OC-V. The designated distances are shown in **Figure 2**.

Size 400							
Bg	Ba	H	Ha	ø D	Hs	B	Ls
mm							
403	389	242	220	159	145	391	39

Table 1: Dimensions of Opticlean OC-V with air connection box

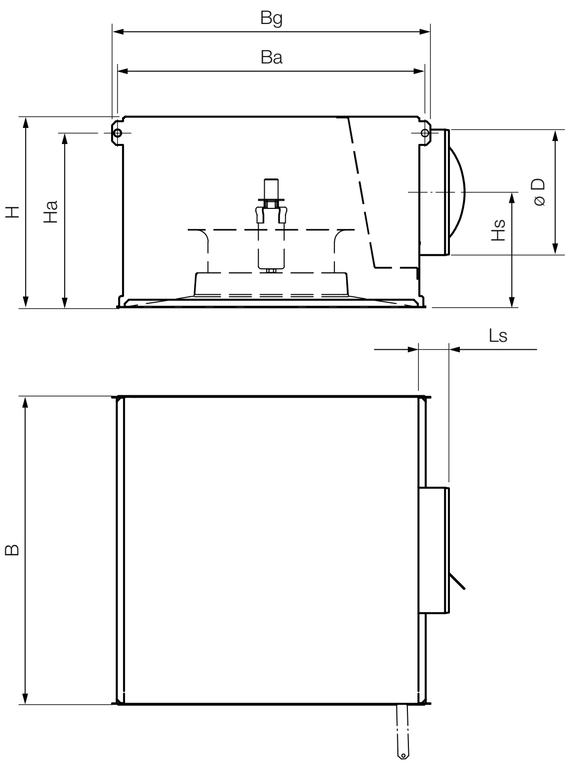

Figure 2: Dimensions of Opticlean OC-V with air connection box

The Opticlean OC-V with thermostatic control unit can be used with the ceiling tile type 2820 (**Figure 3**).

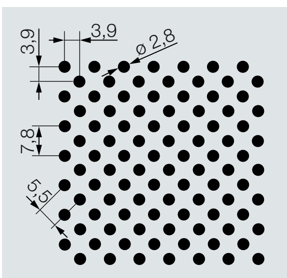

Figure 3: Ceiling tile type 2820 ø 2.8 mm; free area 20 %; Rd 2.8 - 5.5 (according to DIN 24041)

Construction design and operation mode

The Opticlean OC-V with thermostatic control unit consists of an air connection box **1** with side connector **2** and an air discharge element **3** that sits atop the perforated ceiling tile **4**. Adjustments are made by the thermostatic control unit **5** and an air guide frame **7**, which is in the upper position when cooling **7a** and in the lower position when heating-up **7c**.

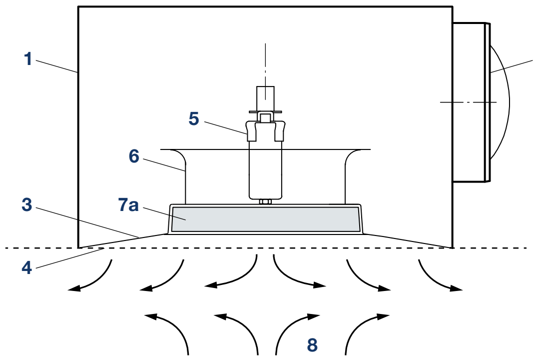

Figure 4: Air guide frame 7a in cooling mode

When the air guide frame is positioned as shown **7a (Fig. 4)**, supply air is discharged horizontally and, due to its higher density and after its momentum has been reduced, sinks into the occupied zones. Room air **8** is induced below the outlet. The induced air does not touch the underside of the perforated ceiling tile **4** because an air cushion forms below the face plate. The air cushion prevents the deposit of airborne particles.

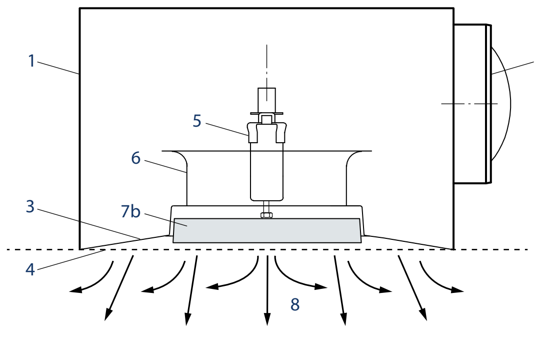

Figure 5: Air guide frame position 7b in permanent heating mode

Under permanent heating conditions, supply air is discharged into the occupied zones both horizontally and vertically. This is achieved by setting the air guide frame **7b** into the position shown in Figure **5**. The vertical penetration depth of the supply air is reduced, which in permanent heating mode leads to reduced air velocity and lowers the sound power level in the room. The air guide ring moves to this position if, after heating-up, only the transmission heat loss is to be covered by the supply air.

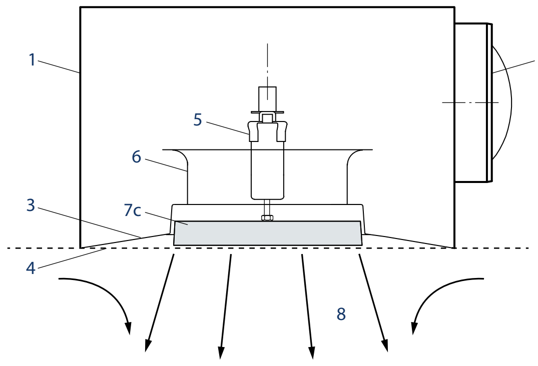

Figure 6: air guide frame 7c in heating mode

When the air guide frame is positioned for heating-up **7c**, the supply air is concentrated in the centre of the outlet's face plate. The resulting increased air discharge velocity is directed vertically downwards. This considerably increases the penetration depth of the warm supply air, significantly reduces the time it takes to heat, and lowers the vertical temperature gradient. The induction of room air **8** takes place from the surrounding area of the diffuser, due to which no pronounced layer of warm air can build up under the ceiling.

These adjustments are carried out with the aid of a thermostatic control unit **5**, drawing its energy from the temperature of the supply air. Therefore, no electrical components such as actuators are required. The thermostatic control unit **5** is located above the rounded air inlet **6** for optimal detection of the particular supply air temperature.

Legend

1 Air connection box
2 Side connector with optional volume flow damper
3 Air discharge element
4 Perforated ceiling tile
5 Thermostatic control unit
6 Rounded air inlet
7 Air guide frame
a Cooling
b Permanent heating
c Heating-up
8 Room air

Opticlean® OC-V

Operation mode

The adjustable discharge characteristics result in different indoor air flow for cooling and heating. When cooling, (**Figure 8**) it does not differ from the well-known non-adjustable Opticlean. The supply air flows evenly through the perforated face plate and spreads radially in a horizontal direction. The induction of room air quickly reduces both the air flow velocity and the temperature difference between the supply air and room air. This leads to a pleasant indoor climate with low indoor air velocities and uniform indoor air temperatures in the occupied zones.

The perforated surface does not come into contact with the induced room air because a barrier layer of supply air forms under the air outlet. As a result, the pollution of ceilings that would otherwise occur with turbulent air outlets is greatly reduced.

Starting at a supply air temperature of 21 °C, the adjustable air guide frame moves into the heating position by means of the thermostatic control unit. As the supply air temperature rises, this frame is shifted further and further down. As a result, the relevant areas are heated significantly faster by warm supply air flowing vertically into the space. The **Figures 9 and 10** show the respective flow patterns.

The characteristics of the thermostatic control unit (hysteresis) for heating and cooling can be seen in **Figure 7**. As a result, an almost identical position of the air guide frame is achieved with the same supply air temperature during heating or cooling.

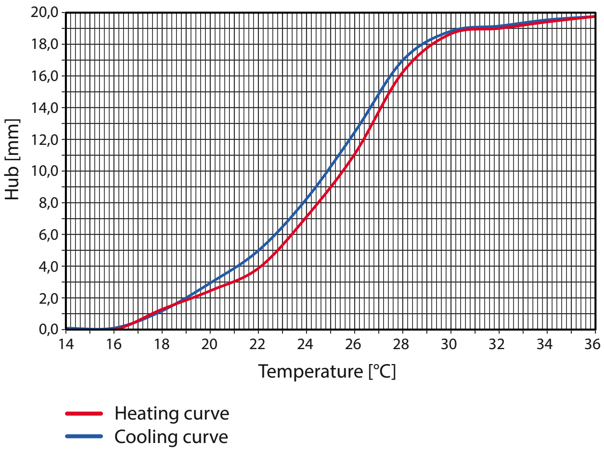

Figure 7: Hysteresis - Characteristic curve of the thermostatic control unit

Figure 8: Cooling mode, supply air temperature 16 to 21 °C

Figure 9: Permanent heating mode, supply air temperature 22 to 26 °C

Figure 10: Heating-up mode, supply air temperature 27 to 30 °C

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Heating operation

Figures 11 (OC-Q) and 12 (OC-V) show the temperature curve over time at four different vertical measurement heights compared to the globe temperature. The specific initial heating power is 53 W/m² related to a test area of 18 m². The introduced supply air volume was 250 m³ /h at a temperature of 30 °C and an outlet height of 3.0 m. Table 2 lists the test parameters.

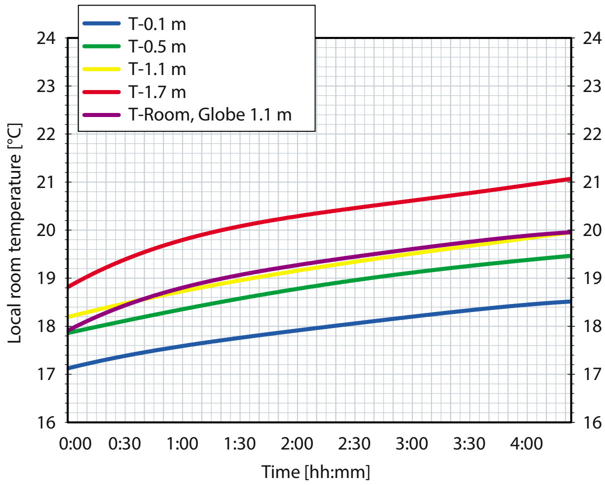

Figure 11: Course of the dynamic heating-up phase without thermostatic control unit

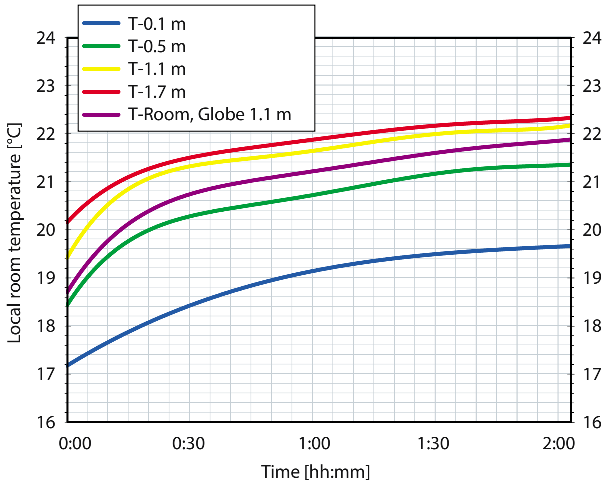

Figure 12: Course of the dynamic heating-up phase with thermostatic control unit

Heating-up experiments

Measuring zones	Measuring heights	Target temperature	OC Standard	OC Adjustable
	m	°C	Heating-up time in hh:mm	
Foot area	0.1	19	> 05:00	00:55
Head area	1.1	21	> 06:00	00:18

Table 2: Comparison of Opticlean diffuser with or without thermal control unit

Opticlean standard OC-Q
Opticlean adjustable OC-V

Parameters	
Supply air volume flow rate	250 m³/h
Supply air temperature (constant)	30 °C
Room height	3 m
Floor area	18 m²
Specific heating capacity	50 W/m²

Table 3

When using the OC-V, the heating-up time required to reach the desired target temperature at a height of 1.1 m is less than 20 minutes **(Table 2)**. The target temperature at a height of 0.1 m (foot area) is reached in 55 minutes **(Table 2)**. Both values showcase that heating-up times can be shortened enormously when compared to the heating-up times required by a non-adjustable Opticlean.

Furthermore, when using the OC-V, the vertical room air temperature gradient is well below 3 K between the measuring heights of 0.1 m and 1.1 m, which means that the requirements for Category B of ISO 7730 are met. This fact makes the difference between the adjustable and non-adjustable Opticleans all the more clear, as the non-adjustable diffuser cannot reach this category within a reasonable heating-up time. In ISO 7730, thermal comfort criteria are classified, among other criteria, with reference to the upper and lower deviations from the operative room temperature and the permissible temperature gradient.

Due to its enormously reduced heating-up time and in conjunction with the reduced vertical temperature gradient, the operating time of the HVAC system at a high supply air temperature is also shortened. This leads to reduced energy costs. Furthermore, because of the excellent vertical penetration depth of the OC-V, additional heating equipments in the occupied zone can often be dispensed with.

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Acoustics and pressure loss

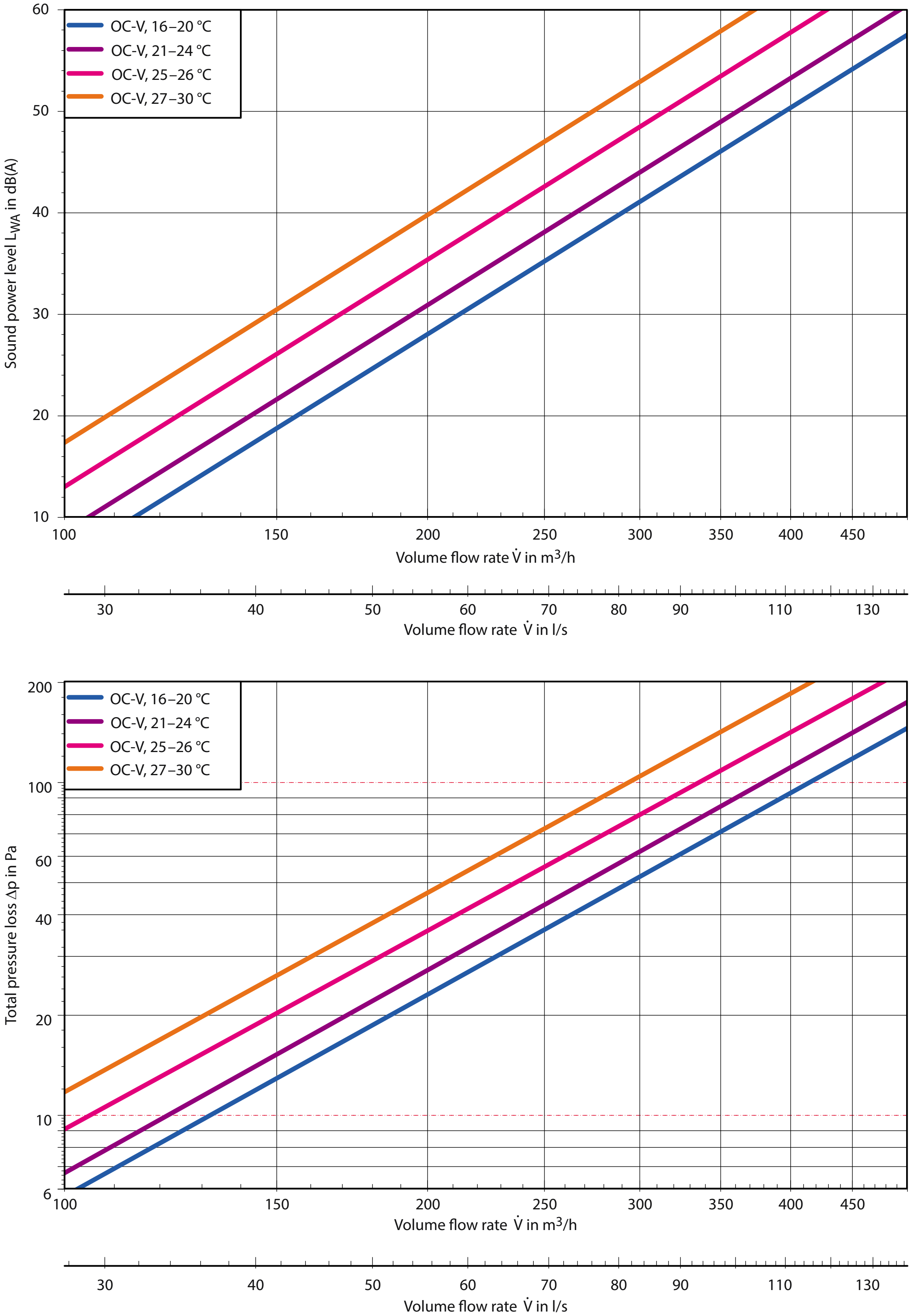

Figure 13

Sound power levels as dependent on supply air temperature

Supply air temperature	Volume flow rate		Pressure loss	Sound power level	L_W in dB, octave							
					63	125	250	500	1 000	2 000	4 000	8 000
°C	m³/h	l/s	Pa	dB(A)	Hz							
16 – 20	150	42	13	19	7	20	17	9	13	13	8	1
	200	56	23	28	15	29	26	19	22	22	17	10
	250	69	36	35	22	37	34	26	29	29	24	17
	300	83	52	41	27	42	39	32	35	35	30	23
21 – 24	150	42	15	22	17	22	19	13	16	15	12	5
	200	56	27	31	27	31	28	22	25	25	21	14
	250	69	43	38	34	38	36	30	32	32	28	22
	300	83	62	44	40	44	41	35	38	38	34	28
25 – 26	150	42	20	26	7	21	19	15	19	20	18	11
	200	56	36	35	14	30	29	24	29	30	27	20
	250	69	56	43	21	37	36	31	36	37	35	27
	300	83	80	49	27	43	42	37	42	43	41	33
27 – 30	150	42	26	31	7	21	20	16	22	25	24	16
	200	56	47	40	14	30	29	26	31	34	33	25
	250	69	73	47	21	38	36	33	38	41	41	32
	300	83	105	53	27	44	42	39	44	47	46	38

Table 4: Octave band values for ceiling tile, perforation Rd 2.8 - 5.5

Note: Recommended supply air temperature max. 30 °C!

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Opticlean® OC-V

Quick features

- Temperature-dependent supply air discharge pattern (patented diffuser)
- Thermostatic control unit without external auxiliary energy
- Short heating-up time and low vertical temperature stratification
- Reduced energy costs during heating-up and with night setback
- Unobtrusive integration in suspended ceilings
- Low sound power level
- Low ceiling pollution
- High thermal comfort

Type code

OC-V – ___ – ___ – 0 – F – ___ -___

Opticlean
Geometry
Size
Segment cover
Connection type
Damper
Surface

Geometry
0 = Externally manufactured faceplate (technical clarification required)
Q1 = Square faceplate 600 x 600 mm
Q2 = Square faceplate 625 x 625 mm

Size
400 = Size 400

Segment cover
0 = none (4-way discharge)

Connection type
F = Flat air connection box

Damper
O = No volume flow damper
S = Volume flow damper, adjustable at spigot

Surface
9010 = Colour of visible surface according to RAL 9010, silk matting
.. = Colour of visible surface according to RAL ...

Tender text

.... pcs
Opticlean with thermostatic adjustment unit – supply air ceiling outlet with adjustable discharge direction – for insertion into suspended ceiling systems with grid of 625 x 625 mm and 600 x 600 mm in order to generate high-quality indoor air flows with low velocities and uniform air temperatures. Unobtrusive integration into suspended ceiling systems. Strong reduction of ceiling pollution through a discharge-related barrier layer of supply air and a very even radial air distribution. Rapid heating-up of relevant areas through the automatic adjustment of air discharge direction.

Consisting of:
Air connection box with side entry with side connector with optional volume flow damper (adjustable at the connection spigot), outlet element with air guide frame, and thermostatic control unit (automatic and with no auxiliary energy required).

Connected with or without a perforated ceiling tile, type Rd withperforation ø = 2.8 mm / spacing = 5.5 mm or special type, other perforations on request and after technical clarification.

Material:
- Front panel made of galvanized sheet steel, coated according to RAL 9010, semi-matt (other colors on request).
- Air distribution element made of galvanized sheet steel.
- Air connection box made of galvanized sheet steel.

Brand: Krantz
Model: OC-V – ___ – ___ – 0 – F – __ – __

Subject to technical alterations.

Krantz GmbH
Uersfeld 24, 52072 Aachen, Germany
Telefon: +49 241 441-1
Telefax: +49 241 441-555
info@krantz.de | www.krantz.de