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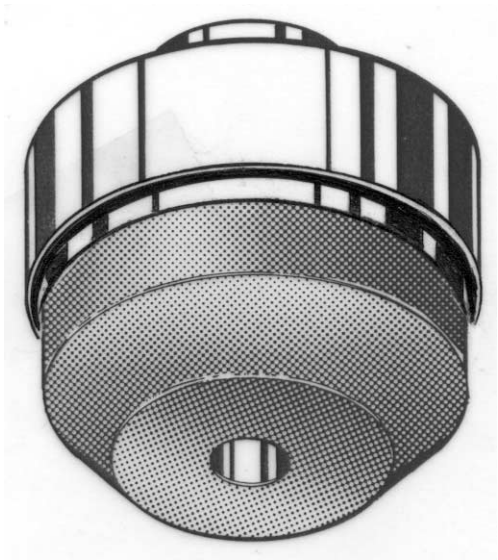
Technical Selection



Conical
displacement outlet VA-K....

Air-conditioning components

DS 4011 E 05.2005

KOMPONENTEN ®

Applied system solutions

Conical displacement outlet

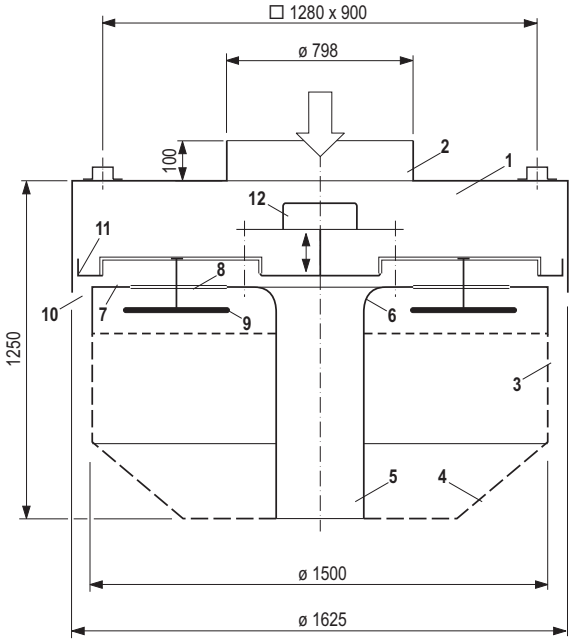
Preliminary remarks

To generate a stable displacement air flow, the supply air is either discharged via the floor or at low room height – with few exceptions. Discharge height rarely exceeds 4 m.

In some cases, however, – in aircraft painting hangars for example – supply air is discharged from a great height, some 25 m and more. Pollutants such as solvent vapours, paint aerosols, grinding residue are displaced downward from the work zone to the return air openings. Supply air can be colder or warmer than indoor air depending on outside climate and working conditions.

A permanent requirement is the generation of a stable downward-directed low-turbulence displacement air flow.

Just for this purpose, KRANTZ KOMPONENTEN has developed the conical displacement outlet which is ideally suited to the requirements.



Key

1 Housing
2 Connection spigot [1)]
3 Perforated sheet metal cylinder
4 Conical neck
5 Core tube
6 Inlet
7 Circular disc
8 Cutout
9 Valve disc
10 Peripheral annular gap
11 Formed gasket
12 Servomotor

Fig. 1: Conical displacement outlet, dimensions

Construction design

The upper part of the conical displacement outlet consists of the circular housing **1** with connection spigot **2**, and the lower part is made up of a perforated sheet metal cylinder **3** with conical neck **4** to generate a low-turbulence displacement air flow. In the outlet centre there is a core tube **5** whose inlet **6** leads into a circular disc **7** with several cutouts **8** on its surface. The inlet **6** to the core tube **5** and the cutouts **8** can be opened or closed with a valve disc **9** as required.

A peripheral annular gap **10** results from the different diameters of housings **1** and **3**, which can be covered by a surrounding formed gasket **11**.

The valve disc **9** and the formed gasket **11** are linked mechanically. With an open core tube **5** and open annular gap **10** the cutouts **8** are closed and vice versa. Adjustment is by means of a lift movement using a servomotor **12**.

The conical displacement outlet is made of galvanized sheet metal.

Fig. 2: Conical displacement outlet on the ceiling of a 26 m high hall

1) Spigot with flange on request

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Mode of operation

The supply air flows through the connection spigot into the air outlet. Depending on the lift position of the valve disc and the gasket, more or less supply air flows through the perforated sheet metal cylinder or the core tube and the peripheral annular gap (Fig. 4).

The perforated metal sheet ensures low-turbulence supply air jets. The discharge direction is vertical downward, at an incline, or horizontal. When cooling, a pronounced displacement air flow is formed down to the floor.

With declining cooling load and rising heating load more air is discharged through the core tube and the annular gap. With their strong discharge momentum, the resultant vertical support jets induce air jets from the perforated sheet metal cylinder. This produces a stable low-turbulence overall jet downward as far as the occupied zone. Also at maximum heating operation, the pollutants are effectively displaced downward to the return air openings and removed.

The vertical temperature gradient when heating is low. At a temperature difference between supply air and return air of $\Delta\vartheta$ = + 5 K, the temperature gradient amounts to a maximum of ± 1 K (Fig. 3) up to 20 m height.

The conical displacement outlet is designed for a volume flow rate range of 2 000 to 2 800 l/s (8 000 to 10 000 m^3/h).

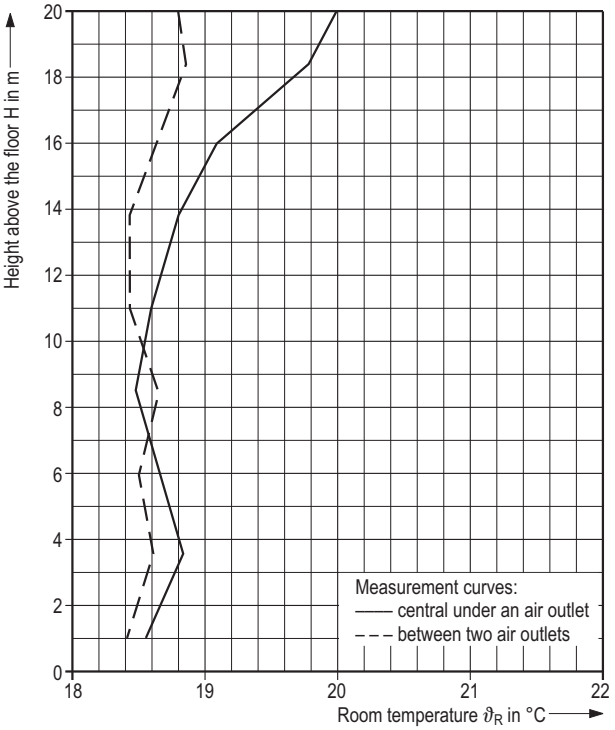

Fig. 3: Example of a vertical temperature gradient with a conical displacement outlet

The following specifications apply for the example:
Air outlet volume flow rate $\dot{V}_A$ = 2 800 l/s
Temperature difference supply air – return air $\Delta\vartheta$ = + 5 K
Discharge height H = 26 m; valve disc lift h = 115 mm

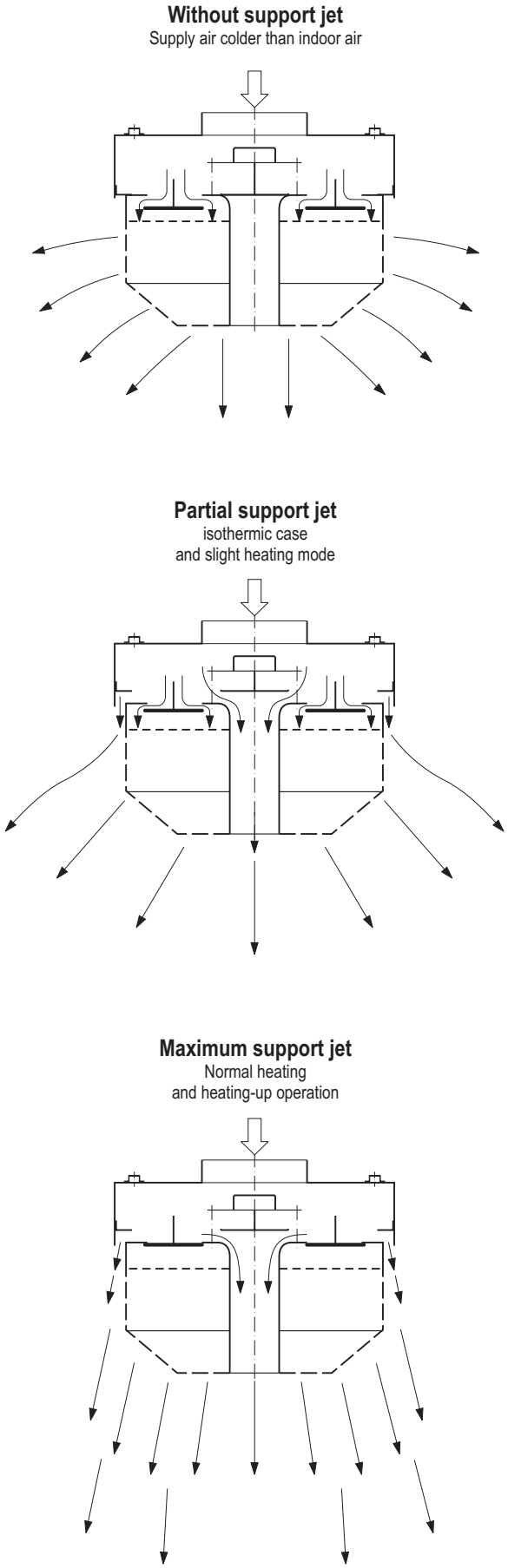

Fig. 4: Diagram of discharge pattern

Conical displacement outlet

Discharge characteristics

The discharge characteristics for different heat load conditions is depicted in Fig. 4. With increasing heat loads an increasing quantity of air is discharged downward through the core tube and the peripheral annular gap. The penetration depth of the supply air is continually adjusted by altering the lift of the valve disc and the formed gasket.

The optimum discharge characteristics depend on discharge height and temperature difference between supply air and return air. The lift for any working height and different temperature differences can be read off the chart in Fig. 6.

The maximum temperature difference $\Delta\vartheta$ between supply air and return air is – 5 K (when cooling) and up to + 5 K (when heating). This air outlet is also well suited for sporadic heating-up operations with temperature differences $\Delta\vartheta$ of up to + 10 K where the supply air still reaches the floor area.

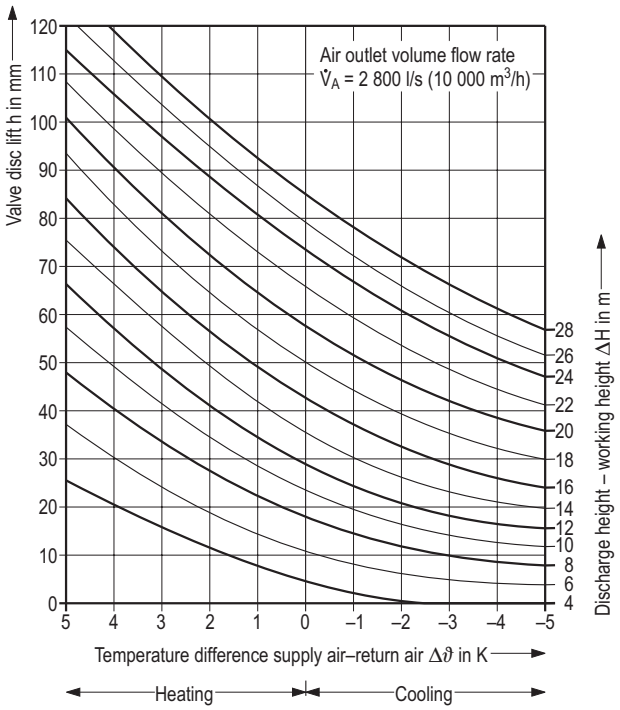

Fig. 6: Valve disc lift depending on temperature difference between supply air and return air at different distances between discharge height and working height

Fig. 5: Penetration depth of supply air jets made visible with a smoke tracer

Selection and layout

Conical displacement outlets generate low-turbulence displacement air flow at the supply air from great heights (from 10 to 30 m). They are positioned under the hall ceiling. Supply air penetrates deep into the room when heating and cooling, and is removed in the floor zone.

The supply air jet coverage of an air outlet amounts to about 5 m and the recommended distance between outlets about 7 to 9 m.

The volume flow rate range of an air outlet is between 2 000 to 2 800 l/s (8 000 to 10 000 m^3/h). Pressure loss can be read off the chart in Fig. 7 in correlation with the air outlet volume flow rate.

The conical displacement outlet is supplied with a built-in servomotor to alter jet penetration depth in response to room heat load. Servomotors with electric and pneumatic drives are available.

Conical displacement outlet

Sound power level and pressure loss

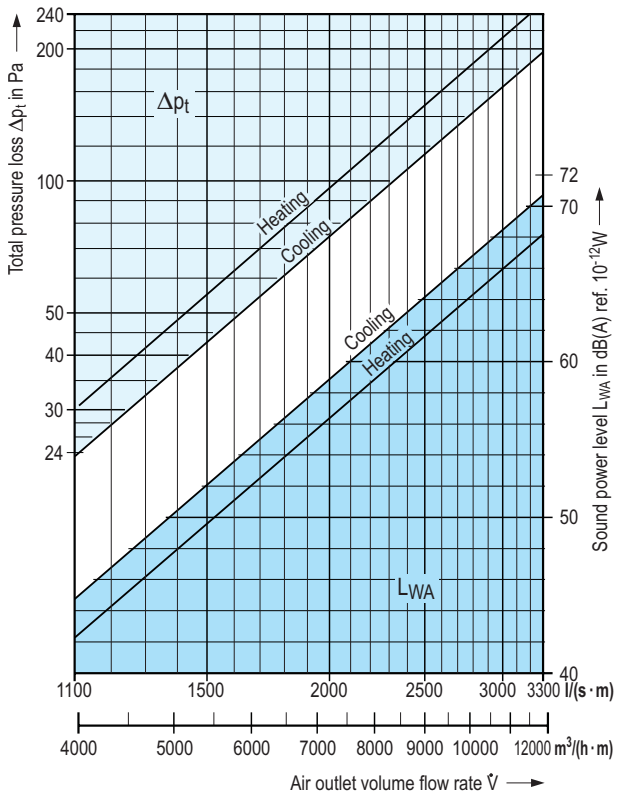

Fig. 7: Pressure loss of conical displacement outlet

Type code

VA – K – ____

- Displacement outlet
- Design
- Type of adjustment

Design
K = Conical displacement outlet

Type of adjustment
E = Electric servomotor
P = Pneumatic servomotor

Example:
Conical displacement outlet with electric servomotor

Type VA - K - E

Features

- Generation of low-turbulence displacement air flow
- Discharge height 10 to 30 m
- Air discharge direction adjustable to heat load conditions
- Volume flow rate range 2 000 to 2 800 l/s (8 000 to 10 000 m^3/h)
- Maximum pressure loss 200 Pa
- Temperature difference between supply air and return air up to ± 5 K in steady operation
- Smooth operation in heating-up processes up to $\Delta\vartheta$ = +10 K
- Nominal diameter of outlet 1.5 m, overall height 1.25 m
- Built-in servomotor to adjust jet penetration depth

Tender text

..... units

Conical displacement outlet
– KRANTZ KOMPONENTEN system –

for air supply from great height with minimum admixture of supply air and indoor air for maximum displacement of dust particles and pollutants from the occupied zone, consisting of:
air outlet housing including built-on perforated sheet metal cylinder with conical neck to generate low-turbulence displacement air flow, as well as with core tube and peripheral annular gap to form support jets for adjusting jet penetration depth,

valve disc and formed gasket for regulating jet penetration depth, operated by
☐ electric servomotor,
☐ pneumatic servomotor,

connection spigot for duct connection.

Technical data:

Volume flow rate:	..... l/s (m^3/h)
Pressure loss:	..... Pa
Material:	Galvanized sheet metal
Dimensions	
– nominal diameter:	1500 mm
– overall height:	1250 mm
Make:	KRANTZ KOMPONENTEN
Type:	VA – K – ___

Subject to technical alterations!

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KRANTZ KOMPONENTEN®
Applied system solutions

YIT Germany GmbH
KRANTZ KOMPONENTEN
Uersfeld 24 | D-52072 Aachen | Germany
Phone: +49 241 441-1 | Fax: +49 241 441-555
info@krantz.de | www.krantz.de