Technical Information

Ceiling air diffuser
INDULTHERM
INDULTHERM-e

- Effective cooling and heating with a diffuser
- Thermomechanical or electrical switching
- Draught-free air distribution for cooling down to -14 K
FEATURES

Performance features

- Effective cooling and heating using a diffuser
- For high supply air temperature differences
- Low room air velocities
- Draught-free air distribution for cooling down to -14 K
- Small pressure losses
- Large penetration depths in heating mode

INDULTERM

- Fully-automatic switching without any external energy

INDULTERM-e

- Thermomechanical or electrical switching between cooling and heating mode
- Especially in combination with split and multi-split systems
- Flexible selection of switching temperature
FUNCTION

INDULTHERM is a self-regulating diffuser for cooling and heating via supply air

INDULTHERM in cooling mode:
- Air is distributed in the room without any draught and with a temperature difference of up to -14 K.
- INDULTHERM operates as a high-induction ceiling air diffuser.

INDULTHERM in heating mode:
- Despite the difference in density, warm air is distributed throughout the entire room even down to floor level.
- During warm supply air, INDULTHERM automatically switches to vertical air outlet for a large penetration depth without requiring any external energy.
- At the INDULTHERM-e, this is achieved by an electric actuator.

During cooling mode, cooled air is distributed in the room at an optimal mixture and without any draught at a temperature rate down to -14 K.

In heating mode, warm air is distributed throughout the entire room, even down to floor level, despite the difference in density.
**Sizes**

**Size RQ**

INDULTHERM RQ 600 or RQ 625
Nominal size of 600 mm or 625 mm
Hole pattern 600
Air flow 250 m³/h to 1000 m³/h

**Size RR**

INDULTHERM RR 600 or RR 625
Nominal size of 600 mm or 625 mm
Hole pattern 500
Air flow 180 m³/h to 650 m³/h

**The INDULCLIP air guide element**

A proven, highly inductive air guide element permitting the individual arrangement of diffusers. Inside the INDULTHERM, the INDULCLIP air guide element works as a diffuser, distributing supply air during cooling mode without any draught.

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**The INDULCLIP air guide element**

**Thermal insert (with a segment disc)**
**Front plate**

The front plate of the INDULTHERM is coated in RAL 9010. The INDULCLIP air guide elements are black or grey, similar to RAL 7035. Other colours are available on request. The central opening for heating mode is covered with a diagonally-running honeycomb cover in black or grey. Other colours are available on request.

Type RR INDULTHERM ceiling diffusers are secured at three points by countersunk dome-head screws, type RQ diffusers are secured at four points. The front plate can be easily removed from the plenum box for service purposes. The plenum box has a standard butterfly damper for making adjustments from the room. Eight holes of 9 mm in \( \Phi \) are provided in the top of the plenum box for suspension at the point of installation.

**Type of mounting**

![Diagram](image)

**Dimensions for round and square plenum boxes**

<table>
<thead>
<tr>
<th>Size</th>
<th>( A )</th>
<th>( B )</th>
<th>( C )</th>
<th>( D )</th>
<th>( R )</th>
<th>( H1 )</th>
<th>( H2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ 600</td>
<td>598</td>
<td>-</td>
<td>592</td>
<td>568</td>
<td>249</td>
<td>12</td>
<td>185</td>
</tr>
<tr>
<td>RQ 625</td>
<td>623</td>
<td>-</td>
<td>592</td>
<td>568</td>
<td>249</td>
<td>12</td>
<td>185</td>
</tr>
<tr>
<td>RR 600</td>
<td>-</td>
<td>600</td>
<td>592</td>
<td>568</td>
<td>249</td>
<td>12</td>
<td>185</td>
</tr>
<tr>
<td>RR 625</td>
<td>-</td>
<td>625</td>
<td>592</td>
<td>568</td>
<td>249</td>
<td>12</td>
<td>185</td>
</tr>
</tbody>
</table>

**Notes:**

**INDULTHERM-Mechanism**

The INDULTHERM mechanism is maintenance-free under normal operating conditions. At extremely high switching frequencies, the INDULTHERM mechanism should be maintained regularly. It is available as a spare part and can be replaced, if required.

**Control system**

If the control system provided on premises permits, the switching of the room control circuit between cooling and heating modes should be triggered by supply air temperature jump. Switching from heating to cooling should occur gradually and slowly within a time frame of approximately 10 minutes. Permanent heating under comfort conditions according to DIN 13779 is not intended.

**Pressure pad**

The optional pressure pad increases the penetration depth of the supply air stream in heating mode and increases the required static pressure according to the formulas on pages 8 and 9. The pressure pad is subject to maintenance due to the possibility of it becoming soiled by the supply air.
**Ventilation design parameters**

**Supply air temperature 12 °C ... 22 °C**
In cooling mode, the high induction permits temperature differences of up to -14 K. This permits the volumetric flow to be reduced, resulting in a reduction in investment costs for the air conditioner and the ductwork.

**Supply air temperature 22 °C ... 28 °C**
Switching phase between the cooling/heating air directions, limited comfort conditions.

**Supply temperature 28 °C ... max. 40 °C**
In heating mode, the supply air should circulate deep into the room, if possible down to floor level. The penetration depth depends on the supply air volumetric flow and on the temperature difference between supply air and room air (see design diagram on pages 8 and 9).

**Empfehlung:**
Room air velocity of: $v = 0.12...0.15$ m/s at seat height for premium demands.

Room air velocity of: $v = 0.15...0.17$ m/s at seat height for premium demands.

For VVS systems (variable volumetric flow systems), the flow through the supply air diffusers can be increased by 5 to 10%. The bandwidth of the sound pressure levels according to DIN 13779 can be utilised.

**Note:**
The acoustic diagrams on pages 8 and 9 indicate the average sound pressure level. For diffusers evenly distributed over the ceiling surface, the sound pressure level is also even.

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**Measurement methods and standards**

According to DIN EN ISO 7730:2007, the "local air velocity" is measured at an arbitrary point in the common area and averaged over 3 minutes.

- **Permissible velocity:** DIN EN ISO 7730:2007
- **Measurement method:** DIN EN 13182:2002
- **Common area:** DIN EN 13779:2007

The limits of the "common area" and the maximum permissible "local air velocity" must be coordinated between the building owner and planners or installers.

Our selection diagrams indicate the "average local air velocity" during cooling mode. It was determined from numerous measurement points distributed evenly in the room, of the reference level relevant to the design. 50% of the velocities are greater than the diagram value and 50% are less.

On the one hand, the actual "local air velocities" that occur can be influenced by the level of turbulence from mixed-air streams, and on the other hand by room air movements not caused by the air flow system, such as cold facades, heaters and the like.

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**We supply products complying with the standards of machine and equipment manufacturing with dimensional tolerances in accordance with DIN ISO 2768 Part 1 and 2. In contrast, the extruded aluminium profiles often used in many other products have tolerances according to DIN EN 755-9:2008-06. Depending on the combination and surface treatment of the components and extruded profiles, additional dimensional deviations of 2 mm can occur. Due to manufacturing tolerances, the caloric performance is subject to a tolerance range of ± 10%, and the acoustic values to ± 2 dB.**
**Arrangement**

Acoustic arrangement

Acoustic diagrams applied to:
- Room height $H = 3.0 \, \text{m}$
- Reverberation time $T_N = 0.6 \, \text{s}$
- Socket velocity $\leq 5 \, \text{m/s}$ for open damper

**Correction values $\Delta L_{HR}$ for other room heights**

<table>
<thead>
<tr>
<th>$H_h , [\text{m}]$</th>
<th>2.5</th>
<th>2.7</th>
<th>3.0</th>
<th>3.5</th>
<th>4.0</th>
<th>4.5</th>
<th>5.0</th>
<th>6.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta L_{HR} , [\text{dB(A)}]$</td>
<td>+0.8</td>
<td>+0.4</td>
<td>0</td>
<td>-0.7</td>
<td>-1.2</td>
<td>-1.8</td>
<td>-2.2</td>
<td>-3.0</td>
</tr>
</tbody>
</table>

**Correction values $\Delta L_{TN}$ for other reverberation times**

<table>
<thead>
<tr>
<th>$T_N , [\text{s}]$</th>
<th>0.4</th>
<th>0.5</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
<th>0.9</th>
<th>1.0</th>
<th>1.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta L_{TN} , [\text{dB(A)}]$</td>
<td>-1.8</td>
<td>-0.8</td>
<td>0</td>
<td>+0.7</td>
<td>+1.2</td>
<td>+1.8</td>
<td>+2.2</td>
<td>+3.0</td>
</tr>
</tbody>
</table>

**Relative sound power level**

<table>
<thead>
<tr>
<th>Frequency $[\text{Hz}]$</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1K</th>
<th>2K</th>
<th>4K</th>
<th>8K</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta L , [\text{dB}]$</td>
<td>+12</td>
<td>+5</td>
<td>-2</td>
<td>-5</td>
<td>-6.5</td>
<td>-8</td>
<td>-9</td>
<td>-15</td>
</tr>
</tbody>
</table>

**Input attenuation**

<table>
<thead>
<tr>
<th>Frequency $[\text{Hz}]$</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1K</th>
<th>2K</th>
<th>4K</th>
<th>8K</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta L , [\text{dB}]$</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-4</td>
<td>-5</td>
<td>-6</td>
</tr>
</tbody>
</table>

**Recommendation:**

Parallel distances $2 \times x_1$ and $2 \times x_2 \leq 4 \, \text{m}$ as well as an even air distribution in the common area.

A high level of room comfort is not only determined by a low room air velocity with as small temperature differences in the room as possible, but also an even air distribution in the common area.

**Recommendation:**

Wall distance $X_{w1}$ and $X_{w2} \geq X_1$ and $X_2$

**Discharge characteristics in cooling mode:**

A symmetric distribution of air diffusers in the room.

The discharge characteristics in cooling mode guarantee a stable room flow over a wide range of temperature differences of $-14 \, \text{K}$ to $0 \, \text{K}$ and volumetric flows of $100...25 \%$.

The discharge characteristics in heating mode are characterised by a vertical supply air jet directed downward. You can find the penetration depth as a function of supply air volumetric flow and on the temperature difference between supply and room air in the design diagrams on pages 8 and 9. If the penetration depth is insufficient in individual cases, it can be increased by installing an optional pressure pad.

The pressure pad is subject to maintenance due to the possibility of contamination by supply air.
Ventilation design parameters – Hole pattern 500

### Cooling

- **Average air velocity** $\bar{v}$ [m/s]: 0.30, 0.22, 0.17

#### Pressure loss
- **Standard design**
  - $\Delta p_{St} = \frac{v^2}{6000}$ [Pa]
- **Pressure pad (optional)**
  - $\Delta p_{St} = \frac{v^2}{3200}$ [Pa]

#### Supply air temperature difference
- $t_{sup} - t_{Raum}$ [K]

#### Acoustic layout
- **Specific air change rate** $[\text{m}^3/\text{hm}^2]$: 50, 45, 40, ..., 5
- **Sound pressure level in the area** [dB(A)]

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- The layout diagrams apply to air replacement values from 1.5 to 12 h$^{-1}$ with simultaneously even arrangement of the supply air diffusers in the ceiling and with a temperature difference of -12 K in cooling mode.
Ventilation design parameters – Hole pattern 600

### Cooling

- **average air velocity** $\bar{v}$ [m/s]: 0.30, 0.22, 0.17
- **vertical jet path** $x$ [m]: 0.5, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0
- **horizontal jet path** $y$ [m]:

  - **Supply air flow rate** $V$ [m³/h]:
    - 150
    - 200
    - 250
    - 300
    - 350
    - 400
    - 450
    - 500
    - 550
    - 600
    - 650
    - 700
    - 750
    - 800
    - 850
    - 900
    - 950
    - 1000
    - 1050
    - 1100
    - 1150
    - 1200
    - 1250
    - 1300
    - 1350
    - 1400
    - 1450
    - 1500

- **Pressure loss cooling mode** $\Delta p = \frac{V^2}{22600}$ [Pa]
- **Pressure pad (optional)** $\Delta p = \frac{V^2}{4800}$ [Pa]

### Heating

- **Supply air temperature difference** $t_{sup} - t_{Raum}$ [°C]: +15, +12
- **Maximum supply air** $V$ [m³/h]:
  - 10
  - 8
  - 6
  - 5

### Acoustic layout

- **Specific air change rate** $\frac{m^3}{h \cdot m^2}$: 50.40302615 10
- **Sound pressure level in the area** [dB(A)]:
  - 30
  - 35
  - 40
  - 45
  - 50

### Example

- **Jet paths:** horizontal $x = 2.5$ m, vertical $y = 2.0$ m
- **Average room velocity:** 0.15 m/s
- **Heating mode Maximum** $\Delta t_{supply} = +12$ K
- **Floor area:** 32 m²

### Results for cooling operation:

- **Permissible supply air volumetric flow** 620 m³/h
- **Pressure loss standard design** 17 Pa
- **Pressure loss with pressure pad** 80 Pa
- **Heating mode penetration depth standard** 2.7 m
- **Penetration depth with pressure pad** 3.4 m
- **Acoustic spec. air replacement** $= 620$ m³/h : 32 m²
  - $= 20$ m³/h m²

### Sound pressure level read off of diagram 37.5 dB(A)

- **Note correction values on page 7!**

- The layout diagrams apply to air replacement values from 1.5 to 12 h⁻¹ with simultaneously even arrangement of the supply air diffusers in the ceiling and with a temperature difference of -12 K in cooling mode.
Ceiling air diffuser INDULTHERM - Thermo-mechanical switching from cooling to heating

Ceiling air diffuser INDULTHERM-e - Electrical switching from cooling to heating

consisting of:
- highly inductive discharge elements INDULCLIP black and grey, similar to RAL 7035, active in cooling mode
- of a low-inductive outlet opening in the middle of the plate (open in heating mode), with honeycomb cover 13 x 13 mm.
  Colours black or grey.
- a galvanised sheet metal front plate, painted in RAL 9010

INDULTHERM
- a thermostatically adjustable THERM insert, easily accessible, attached directly to the front plate

INDULTHERM-e
- an electrically adjustable THERM insert, easily accessible, attached directly to the front plate

Functions:
- Room cooling and ventilation in normal mode (cooling mode under comfort conditions)
- Room heating in startup mode (heat-up without comfort). The heating jet flows through the room according to layout

INDULTHERM
- Switching is controlled through supply air temperature without the need for an external energy source

INDULTHERM-e
- Switching between cooling and heating mode by means of an electrical drive
- Switching is controlled by the BMS on premises

INDULTHERM          INDULTHERM-e

Type
- Ceiling air diffuser Type RR (round front plate) - Three-point fastening at the plenum box
- Ceiling air diffuser Type RQ (square front plate) - Four-point fastening at the plenum box

Size
Nominal front plate dimensions

600 mm  625 mm

Hole pattern

500 mm  600 mm

Manufacturer: Kiefer

<table>
<thead>
<tr>
<th>Pos</th>
<th>Units</th>
<th>Individual Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</table>

Additional cost for coating of front plate in selected RAL tones

<table>
<thead>
<tr>
<th>Pos</th>
<th>Units</th>
<th>Individual Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</table>

Additional cost for honeycomb cover coated in selected RAL tones

<table>
<thead>
<tr>
<th>Pos</th>
<th>Units</th>
<th>Individual Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Additional cost for pressure pad for enlarging the penetration depth in heating mode

Plenum box

For ceiling air diffuser INDULTHERM, made of Zincor sheet metal, 8 points of suspension Ø 9 mm, with round connection socket and butterfly damper operable from the room

Size

600/625 mm, connection socket Ø 249 mm

Complete download of the call for bids at www.kieferklima.de
Data required for the technical design and offer preparation:

Recipient:  
Fax-No.: 0711/8109-205  
Maschinenfabrik Gg. Kiefer GmbH  
Heilbronner Straße 380-396  
70469 Stuttgart

Sender:  

Ceiling air diffuser  
☐ INDULTHERM  
☐ INDULTHERM-e

Project:

<table>
<thead>
<tr>
<th>Room or module name</th>
<th>Sample room</th>
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<tbody>
<tr>
<td>Number of these rooms/modules</td>
<td>1</td>
</tr>
<tr>
<td>Spec. supply air volumetric flow \ [m³/hm²]</td>
<td>10</td>
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<tr>
<td>Room width \ [m]</td>
<td>4</td>
</tr>
<tr>
<td>Room length \ [m]</td>
<td>5</td>
</tr>
<tr>
<td>Area \ [m²]</td>
<td>20</td>
</tr>
<tr>
<td>Room height \ [m]</td>
<td>3</td>
</tr>
<tr>
<td>Cooling capacity \ [W/m²]</td>
<td>80</td>
</tr>
<tr>
<td>Room air temperature \ [°C]</td>
<td>26</td>
</tr>
<tr>
<td>Supply air temperature \ [°C]</td>
<td>14</td>
</tr>
<tr>
<td>Average room air velocity \ [m/s]</td>
<td>0.15</td>
</tr>
<tr>
<td>at room height \ [m]</td>
<td>1.3</td>
</tr>
<tr>
<td>Sound pressure level in the room \ [dB(A)]</td>
<td>38</td>
</tr>
<tr>
<td>at reverberation time \ [s]</td>
<td>0.8</td>
</tr>
</tbody>
</table>
**Product Range**

**Components:**
Linear, wall, ceiling and air outlet diffusers, recirculation coolers, cross-flow units, concrete core cooling with air. Axial and radial ventilators, hot-gas ventilators, plastic ventilators.

**Systems:**
Air conditioning plants of all kinds for comfort (office, administration, shopping centres, hospitals, libraries, museums, etc.) and industrial applications (machine construction, high-tech, textile, plastics, chemicals, automotive, soft drinks, food industry, etc.).

**Services**

**Consulting and planning**
We provide advice concerning all aspects of our systems and create system analyses and cost estimates based on cooling load / pipe network / energy cost / efficiency calculations. We also develop proposals concerning suggested layouts for air distribution, lighting and ceiling systems; and compile lighting-related data using the latest software tools, as well as developing and implementing control-technology related concepts in our own MSR division.

We are furthermore able to draw on a wealth of experience from previous projects when it comes to designing innovative products and new projects.

**Laboratory:**

**Maintenance and servicing**
All kinds of air-conditioning and climate control systems as part of maintenance and service contracts.

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Internet: www.kieferklima.de

With release of this printing, all earlier versions of the Technical Information INDULTHERM / INDULTHERM-e lose their validity.