Technical Information

Ceiling Air Diffuser
Supply Air / Extract air Combination
INDULCLIP Z-A
INDUDRALL Z-A

- Supply air and extract air in a single compact unit
- Large air flow rates
- High temperature difference
- Size 600 / 625 mm
- INDULVENT design
**Function**

INDULCLIP Z-A and INDUDRALL Z-A is a combination of supply air and extracts air in a compact unit.

The supply air section, at the outer edge of the unit, feeds air into the room through a proven design of swirl diffuser. High-inductive and still comfortable, even at temperature differences of -10K and high air flow rates.

The extract air in the centre of the diffuser is transferred through a connection socket to the exhaust side of the ventilation system.

Each INDULCLIP Z-A and INDUDRALL Z-A unit is made up of a plenum box and the front plate. The front plate is attached to the plenum box with a 4-point connection.

Visually, the two air diffusers correspond to the front plate of our ceiling fan coil system INDULVENT ec. An INDULVENT II installation can, therefore, be supplemented with these innovative units for the supply and extract of air.

**Dimensions and weights**

Both INDULCLIP Z-A and INDUDRALL Z-A are supplied as square units in the nominal sizes 600 and 625.

**Dimensions**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Size 600</th>
<th>Size 625</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>598 mm</td>
<td>623 mm</td>
</tr>
<tr>
<td>C</td>
<td>594 mm</td>
<td>(fits both front plate sizes)</td>
</tr>
<tr>
<td>E</td>
<td>570 mm</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>12 mm</td>
<td></td>
</tr>
<tr>
<td>H1</td>
<td>335 mm</td>
<td></td>
</tr>
<tr>
<td>H2</td>
<td>185 mm</td>
<td></td>
</tr>
<tr>
<td>ØD</td>
<td>198 mm</td>
<td>(supply or extract air)</td>
</tr>
</tbody>
</table>

**Weights**

- Plenum box: 11.5 kg
- Front plate: 2.5 kg

**Dual-chamber plenum box**

Supply-air connection with butterfly damper (optional)

Extract-air connection with butterfly damper (optional)

**Front plate with 4-point mounting**

Ceiling panel

Plenum box

Foam rubber seal

Plastic cap

Front plate

**Please note:**

The products we supply have general tolerances to DIN ISO 2768 Parts 1 and 2, which apply to the mechanical and plant engineering sectors.

Colour deviations due to different degrees of gloss, different ways of applying colour, and different materials are due to the manufacturing processes used and are not justification for complaints.
**View of front plate of INDULCLIP Z-A (RQD)**

Suitable for ceiling installation

**View of front plate of INDUDRALL Z-A (RQF)**

Suitable for ceiling installation and mounting without a suspended ceiling

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**Design information**

The "local air velocity EN 7730:2006" is the average air velocity at any desired location within the common area.

Method of measurement: DIN EN 13182:2002  
Common area: DIN EN 13779:2007

The limits of the "common area" and the highest permissible "local air velocity" must be agreed between the owner and the planner or installer.

Our selection graphs give the "average local air velocity" when cooling at a supply air temperature difference of -6 K. It is determined from numerous measurement points uniformly distributed in a room. Half of the velocities are higher than the value given by the graph and half are lower.

The "local air velocities" that occur in practice may differ from the predicted values due to, on the one hand, the degree of turbulence in the mixing air flows, or, on the other, to room air motions not caused by the air guidance system, such as cold facades, heating, proximity to a door and similar factors.

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**Arrangement information**

The degree of comfort provided by an air-conditioning system is determined not just by having a low ambient air velocity at the smallest possible temperature difference in a room, but also by constant air distribution in the common area.

**We recommend:**  
Air outlets should be uniformly distributed throughout the room.
Ventilation system design

Design is carried out using the smallest x dimension. The “average local air velocity” given in the graph is for $\Delta t_{SUP} = -6$ K. Correction factors for other supply air temperature differences are given in the table below.

### Corrections for local air velocities at $\Delta t_{SUP} \neq -6$ K

<table>
<thead>
<tr>
<th>Supply air temp. difference $\Delta t_{SUP}$ [K]</th>
<th>-2 K</th>
<th>-6 K</th>
<th>-10 K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approx. velocity change $\Delta v$ [m/s]</td>
<td>-0.02</td>
<td>0</td>
<td>+0.04</td>
</tr>
</tbody>
</table>

**Please note:**
Be sure to follow the instructions on page 3 of this Technical Information! The design information lays down definitions and terminology. The permissible “local air velocity” must be determined in accordance with DIN EN ISO 7730.

This Technical Information become invalid if combined with other diffuser types. In case of doubt, please ask our technical consultants.

Minimum supply air flow rate

If these diffusers are operated at supply air temperature differences down to $\Delta t_{SUP} = -10$ K, make sure the minimum supply air flow rate does not fall below $V_{SUP}=150$ m³/h.

**Definitions of x and y jet paths**

Average local air velocity $\bar{v}_y$ [m/s] for 1.5 … 12 h⁻¹ air exchange rate/h

![Graph showing average local air velocity $\bar{v}_y$ for different supply air flow rates and jet paths.](image)

Supply air flow rate $V_{SUP}$ [m³/h] for 1.5 … 12 h⁻¹ air exchange rate/h

![Graph showing supply air flow rate $V_{SUP}$ for different jet paths and air exchange rates.](image)

Horizontal jet path $x$ [m]

Vertical jet path $y$ [m]
Acoustic design and pressure loss

**Acoustic diagrams**

The graphs apply for:
- Room height \( H_R = 3.0 \text{ m} \)
- Reverberation time \( T_N = 0.6 \text{ s} \)
- Air flow rate \( V_{SUP} = V_{ETA} \)

**Acoustic power**

\[
\begin{align*}
\text{INDULCLIP Z-A: } \quad L_W &= 60 \times \log(V_{SUP}) - 120 + \sum \Delta L_i [\text{dB(A)}] \\
\text{INDUDRALL Z-A: } \quad L_W &= 60 \times \log(V_{SUP}) - 120 + \sum \Delta L_i [\text{dB(A)}]
\end{align*}
\]

**Correction factor \( \Delta L_1 \) for other room heights \( H_R \)**

\[
\begin{align*}
H_R [\text{m}] & \quad \Delta L_1 [\text{dB(A)}] \\
2.5 & \quad +0.8 \\
2.75 & \quad +0.4 \\
3.0 & \quad 0 \\
3.5 & \quad -0.7 \\
4.0 & \quad -1.2 \\
4.5 & \quad -1.8 \\
5.0 & \quad -2.2 \\
6.0 & \quad -3.0
\end{align*}
\]

**Correction factor \( \Delta L_2 \) for other reverberation times \( T_N \)**

\[
\begin{align*}
T_N [\text{s}] & \quad \Delta L_2 [\text{dB(A)}] \\
0.4 & \quad -1.8 \\
0.5 & \quad -0.8 \\
0.6 & \quad 0 \\
0.7 & \quad +0.7 \\
0.8 & \quad +1.2 \\
0.9 & \quad +1.8 \\
1.0 & \quad +2.2 \\
1.2 & \quad +3.0
\end{align*}
\]

**Correction factor \( \Delta L_3 \) for an extract air flow rate \( V_{SUP} \) which differs from the supply air flow rate \( V_{ETA} \):**

\[
\text{Deviation} = \left( \frac{V_{ETA}}{V_{SUP}} - 1 \right) \times 100 \%
\]

\[
\begin{align*}
\text{Deviation} [%] & \quad -50 \quad -25 \quad -10 \quad 0 \quad +10 \quad +20 \quad +30 \quad +50 \\
\Delta L_3 [\text{dB(A)}] & \quad -3.0 \quad -2.0 \quad -1.3 \quad 0.0 \quad +1.5 \quad +3.0 \quad +4.5 \quad +8.0
\end{align*}
\]

**Relative sound power level**

\[
\begin{align*}
\text{Frequency [Hz]} & \quad 63 \quad 125 \quad 250 \quad 500 \quad 1K \quad 2K \quad 4K \quad 8K \\
\Delta L [\text{dB}] & \quad +12 \quad +5 \quad -2 \quad -5 \quad -6.5 \quad -8 \quad -9 \quad -15
\end{align*}
\]

**Pressure losses:**

\[
\begin{align*}
\text{INDULCLIP Z-A: } \quad \Delta p_{SUP} &= \frac{V_{SUP}^2}{16400} [\text{Pa}] \\
&= \frac{V_{ETA}^2}{8600} [\text{Pa}] \\
\text{INDUDRALL Z-A: } \quad \Delta p_{SUP} &= \frac{V_{SUP}^2}{21800} [\text{Pa}] \\
&= \frac{V_{ETA}^2}{8600} [\text{Pa}]
\end{align*}
\]
Ceiling air diffuser supply air/extract air combinations INDULCLIP Z-A and INDUDRALL Z-A

Compact unit providing combined air supply and extract air as square panel, supply side as high inductive swirl diffusers which can accommodate a supply air temperature difference up to -10K over a wide range of air flow rate. Also suitable for variable air flow rate systems (VVS).

- **Front plate consisting of:**
  - Zinc-plated steel sheet, coated (colour RAL 9010), with high-induction, matt-black or grey (similar to RAL 7035) INDULCLIP / INDUDRALL discharge elements.
  - Outlet hole in the centre of the front plate with a wire grille, matt black or grey (similar to RAL 7035).
  - Four-point fastening between front plate and plenum box: four fastening screws with white plastic caps.

  **Size:** 600 x 600 mm or 625 x 625 mm

  **Manufacturer:** Kiefer

  **Type:** INDULCLIP Z-A or INDUDRALL Z-A

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Quantity</th>
<th>Type</th>
<th>Size: mm</th>
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<tbody>
<tr>
<td></td>
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</table>

- **Extra charge for coating front plate in an RAL-colour of your choice**

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Quantity</th>
<th>Type</th>
<th>Size: mm</th>
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</table>

- **Dual-chamber plenum box consisting of:**
  - Zinc-plated steel sheet with peripheral supply air pressure chamber and central extract air tube, inner cylinder in plenum box, visible parts painted black, two connection sockets Ø 198 mm on opposite sides for supply air and extract air, eight mounting points Ø 9 mm in housing cover.

  **Manufacturer:** Kiefer

  **Type:** INDULCLIP Z-A / INDUDRALL Z-A

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Quantity</th>
<th>Type</th>
<th>Size: mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

- **Additional charge for supply air butterfly damper (controllable from the room side without dismounting the front plate)**

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Quantity</th>
<th>Price per piece: €</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

- **Additional charge for extract air butterfly damper (controllable from the room side without dismounting the front plate)**

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Quantity</th>
<th>Price per piece: €</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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</tbody>
</table>
Index to Technical Information - Ventilation System Components

Jet paths

- $x_1$, $x_2$, ..., $x_n$ Horizontal ceiling jet paths to point where two ceiling jet paths meet
- $x_{W1}$, $x_{W2}$, ..., $x_{Wn}$ Horizontal ceiling jet paths to wall or facade
- $y$ Vertical jet path

Media flows

- $V$ Air flow rate, general [m$^3$/h]
- $V_S$ Specific air flow rate, general [m$^3$/hm$^2$]
- $V_{Spez}$ Specific air flow rate per metre [m$^3$/hm]
- $V_{ges}$ Total air flow rate [m$^3$/h]
- $V_{RCA}$ Recirculation air flow rate [m$^3$/h]
- $V_{k1}$ Recirculation air flow rate, set value [m$^3$/h] for INDULVENT remote switch
- $V_{k2}$ Recirculation air flow rate, set value for INDULVENT remote switch
- $V_1$ Recirculation air flow rate, min. setting [m$^3$/h] for automatic operation of INDULVENT
- $V_2$ Recirculation air flow rate, max. [m$^3$/h] for automatic operation of INDULVENT
- $V_{SUP}$ Supply air flow rate per diffuser [m$^3$/h]
- $V_{AB}$ Extract air flow rate [m$^3$/h]
- $V_{ODA}$ Extract air flow rate per room [m$^3$/h]
- $V_{TRA}$ Cross flow air flow rate per diffuser [m$^3$/h]
- $V_{ETA}$ Extract air vol. flow per diffuser [m$^3$/h]
- $V_{RCA}$ Recirculation air flow rate per room [m$^3$/h]
- $V_{EHA}$ Exhaust air flow rate per room [m$^3$/h]
- $V_{SEC}$ Secondary air flow rate per diffuser [m$^3$/h]
- $\bar{m}_W$ Cooling water mass flow [kg/h]
- $\bar{m}_K$ Condensate mass flow [kg/h]

Static pressures and pressure differences

- $\Delta p_{SUP}$ Minimum pressure on supply air side [Pa]
- $\Delta p_{RCA}$ Static pressure of recirculation part [Pa]
- $\Delta p_{PS}$ Static pressure loss, general [Pa]
- $\Delta p_{SW}$ Cooling water pressure drop [kPa]
- $\Delta p_{SUP}$ Pressure drop on supply air side [Pa]
- $\Delta p_{ETA}$ Pressure drop on extract air side [Pa]
- $\Delta p_{ges}$ Total pressure drop [Pa]

Velocities

- $v_0$ Velocity of air leaving diffuser [m/s]
- $v_{xy}$ Average ambient air velocity [m/s] after jet path $x + y$
- $v_x$ Average ambient air velocity [m/s] after jet path $x$
- $v_y$ Average ambient air velocity [m/s] after jet path $y$

Cooling capacities

- $Q_W$ Cooling capacity on cooling water side [W]
- $Q_{SUP}$ Cooling capacity on supply air side [W]
- $Q_{ges}$ Total power [W]

Acoustics

- $L_W$ Sound power level [dB(A)]
- $L_P$ Sound pressure level [dB(A)]
- $\Delta L_{..}$ Correction for sound level [dB]
- $D$ Input attenuation [dB]

Other data

- $H$ Room height [m]
- $T_k$ Reverberation time [s]
- $\rho_{rl}$ Room air humidity [%RH]
- $A_{..}$ Area [m$^2$]
- $Y_1$ Control voltage minimum setting [V]
- $Y_2$ Control voltage maximum setting [V]

Cooling capacities

- $Q_{ODA}$ Outdoor air ODA
- $Q_{SUP}$ Supply air SUP
- $Q_{ID}$ Indoor air IDA
- $Q_{TRA}$ Transferred air TRA
- $Q_{TRA}$ Extract air ETA
- $Q_{RCA}$ Recirculation air RCA
- $Q_{EHA}$ Exhaust air EHA
- $Q_{SEC}$ Secondary air SEC
- $Q_{LEA}$ Leakage air LEA
- $Q_{MIA}$ Mixed air MIA

Designation of types of air to DIN EN 13779:2007

- Outdoor air ODA
- Supply air SUP
- Indoor air IDA
- Transferred air TRA
- Extract air ETA
- Recirculation air RCA
- Exhaust air EHA
- Secondary air SEC
- Leakage air LEA
- Mixed air MIA

Status: March 2009
Product Range

Components
Linear, wall, ceiling, and displacement outlets, chilled ceilings, ceiling fan coil systems, transfer grilles, concrete core cooling with supply air.
Axial and radial ventilators, hot gas ventilators, plastic ventilators.

Systems
Air conditioning systems of all types for comfort (offices, administration buildings, department stores, libraries, museums, etc.) and industrial purposes (mechanical engineering, high technology, textile, plastics, chemical, automobile, drinks, foodstuffs and other industries).

Services

Advice and Planning
We will advise you in all questions concerning the application of our systems, carry out system investigations, and prepare cost estimates including calculation of cooling loads, piping networks, energy costs, and operating efficiency. Preparation of structure proposals for air distribution, lighting, ceiling systems. Illumination calculations using the latest software tools. Design and implementation of control concepts in our own instrumentation and control department.
We incorporate our knowledge and experience in product innovations and new projects.

Air-conditioning laboratory
Comfort measurements on site to assess thermal comfort and room air quality.

Maintenance and Service
Maintenance service contracts for all types of ventilation and air-conditioning systems.

With release of this publication, all earlier versions of the INDULCLIP Z-A Technical Information lose their validity.

Kiefer Klimatechnik GmbH
Heilbronner Straße 380 – 388
70469 Stuttgart, Germany
Tel.: +49 (0)711 8109-0
info@kieferklima.de
www.kieferklima.de

We reserve the right to make technical changes.