TTC Active and Passive Chilled Beams
Planning Documentation
for Engineers and Plant Contractors
Contents | Features

Active TTC Chilled Beams

General Information
- Order key for TTC Chilled Beams
- Notes in air conditioning
- Diagram of an air conditioned space
- Controls and schematic diagram of TTC chilled beams

TTC Cassette Chilled Beam ACBLQ
- Installation in panelled ceilings
- Length and width (592 x 592 mm)
- Height 225 mm, side supply air connection
- Air adjustment valve as standard
- Air discharge on 4 sides, individually adjustable
- Recirculating air intake through perforated cover
- White casing (coating similar to RAL9010)
- 3 capacity levels
- Capacity at $\Delta t_m = 10$ K, air volume flow
  80 m$^3$/h (4-sided air discharge); capacity level 9
  Cooling capacity $\dot{Q}_{K(tot)} = 500$ W
  Sound pressure level < 25 dB (A)

TTC Chilled Beam ACBLZ
- Installation preferably in panelled ceilings
- Low height 146 mm, top or end supply air connection
- Air adjustment valve as standard
- Air discharge 2-sided
- Power level adjustable via the air adjustment valve
- White casing (coating similar to RAL9010)
- Capacity at $\Delta t_m = 10$ K, air volume flow
  40 m$^3$/h (2-sided air discharge); capacity level 1, setting 5
  Cooling capacity $\dot{Q}_{K(tot)} = 500$ W
  Sound pressure level < 25 dB (A) for a chilled beam length of 12 dm

TTC Chilled Beam ACBLA
- Installation preferably underneath the ceiling
- Built-in air passage grill
- Length $\approx$ 1200/1800/2400 mm
- Height 171 mm, Width 364 mm
- Recirculating air intake through perforated cover
- Supply air discharge on the side at the top
- Supply air inlet on the end
- White casing (coating similar to RAL9010)
- 4 capacity levels
- Capacity at $\Delta t_m = 10$ K, air volume flow
  60 m$^3$/h (2-sided air discharge); capacity level 8
  Cooling capacity $\dot{Q}_{K(tot)} = 540$ W/m
  Sound pressure level < 25 dB (A) for a chilled beam length of 24 dm

TTC Chilled Beam ACBLE
- Installation preferably in panelled ceilings
- Built-in air passage grill
- Length $\approx$ 1200/1800/2400 mm
- Height 165 mm, Width 592 mm
- Recirculating air intake through perforated cover
- Supply air discharge horizontally underneath the ceiling
- Supply air inlet on the end
- White casing (coating similar to RAL9010)
- 4 capacity levels
- Capacity at $\Delta t_m = 10$ K, air volume flow
  60 m$^3$/h (2-sided air discharge); capacity level 8
  Cooling capacity $\dot{Q}_{K(tot)} = 540$ W/m
  Sound pressure level < 25 dB (A) for a chilled beam length of 24 dm

TTC Chilled Beam ACBLO
- Installation preferably in panelled ceilings
- Cover can be folded up or down
- Length $\approx$ 1200/1800/2400 mm
- Height 255 mm, width 595 mm
- Recirculating air inlet at the top
- Supply air discharge horizontally underneath the ceiling
- Supply air inlet on the end
- White casing (coating similar to RAL9010)
- 3 capacity levels
- Capacity at $\Delta t_m = 10$ K, air volume flow
  50 m$^3$/h (2-sided air discharge); capacity level 9
  Cooling capacity $\dot{Q}_{K(tot)} = 835$ W/m
  Sound pressure level < 25 dB (A) for a chilled beam length of 24 dm
Passive TTC Chilled Beams

**TTC Chilled Beam AECAK**
- Installation underneath a ceiling
- Built-in air passage grill
- Length 10–40 dm in 5dm-increments
- Height 142 mm
- Width 45/60 cm
- Recirculating air inlet at the top
- Cool air discharge at the bottom
- White casing (coating similar to RAL 9010)

Capacity at $\Delta h_m = 10 K$
- Width 45 cm
  - Capacity $q_{tot} = 275 W/m$
- Width 60 cm
  - Cooling capacity $q_{tot} = 415 W/m$

**TTC Chilled Beam AECBK**
- Installation underneath a ceiling
- Built-in air passage grill
- Length 10–40 dm in 5dm-increments
- Height 156 mm
- Width 45/60 cm
- Recirculating air inlet at the top
- Cool air discharge at the bottom
- White casing (coating similar to RAL 9010)

Capacity at $\Delta h_m = 10 K$
- Width 45 cm
  - Capacity $q_{tot} = 340 W/m$
- Width 60 cm
  - Cooling capacity $q_{tot} = 470 W/m$

**TTC Chilled Beam AECBU**
- Installation underneath a panelled ceiling
- Built-in air passage grill
- Length 10–40 dm in 5dm-increments
- Height 122 mm
- Width 45/60 cm
- Recirculating air inlet at the top
- Cool air discharge at the bottom
- Casing made of galvanized steel plate

Capacity at $\Delta h_m = 10 K$
- Width 45 cm
  - Capacity $q_{tot} = 265 W/m$
- Width 60 cm
  - Cooling capacity $q_{tot} = 355 W/m$

**TTC Chilled Beam AECEU**
- Installation underneath a panelled ceiling
- High performance chilled beam (ideal for sound and TV studios)
- Length 10–40 dm in 5dm-increments
- Height 187 mm
- Width 45/60 cm
- Recirculating air inlet at the top
- Cool air discharge at the bottom
- Casing made of galvanized steel plate

Capacity at $\Delta h_m = 10 K$
- Width 45 cm
  - Capacity $q_{tot} = 425 W/m$
- Width 60 cm
  - Cooling capacity $q_{tot} = 575 W/m$

**Design Example for Passive Chilled Beam & Mollier-hx-Diagram**

**Products in Use | Project Examples and combined with LED light**
- Project »Dexia Bank«
- Project »Altstadtpalais«
- Example Wall/Ceiling Installation
- Combination with Multifunctional Ceiling Covers and LED Lights

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### Order Key for Floor Units

**Air discharge direction**
- **S** = Vertical air discharge (passive chilled beams)
- **B** = 2-sided air discharge (in air flow direction)
- **R** = Single-sided air discharge to the right (in air flow direction)
- **L** = Single-sided air discharge to the left (in air flow direction)
- **4** = 4-sided air discharge

**Power level**

<table>
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<th>ACBLZ</th>
<th>ACBLA</th>
<th>ACBLE</th>
<th>ACBLO</th>
<th>AECAK</th>
<th>AECBK</th>
<th>AECBU</th>
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</table>

*Power level 6 on request*

**Water supply connection**
- **H** = Horizontal
- **V** = Vertical

**Pipe divisions**
- 1 (2, 3, 4 on request)

**Unit width W_{tot}[mm]**
- 36 = for depth 362 mm
- 45 = for depth 455 mm
- 60 = for depth 605 and 592 mm

**Unit length L_{tot}[mm]**

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**Models**

- **Active Chilled Beams**
  - ACBLQ
  - ACBLZ
  - ACBLA
  - ACBLE
  - ACBLO

- **Passive Chilled Beams**
  - AECAK
  - AECBK
  - AECBU
  - AECEU

Subject to technical changes - Issued 10/2010
Why air conditioning?

The benefit of air conditioning

Our thermal well-being depends on a number of factors. Our body will always try to balance its heat regulation so that all organs can work properly. In order for our organs and circulation to perform at optimum level our body temperature needs to remain at a constant 37°C. This can only be achieved if both all sources that may generate heat (such as muscle activity, the burning of calories, etc.) and all ways to get rid of surplus heat (such as chivering, thin clothes, etc.) are in balance. Studies by P. O. Fanger have shown that people will only feel comfortable if they are in a neutral thermal state (Fig. 5.2), i.e. their ideal temperature is not disturbed. However, this ideal temperature may vary slightly from person to person.

Any deviation from this ideal temperature will result in a drop in performance from this person and reduce his productivity as well as his sense of well-being (Fig. 5.1). This important fact should always be taken into account when making an investment. Depending on ambient temperature, clothing and type of activity performed we regulate our body heat through convection and radiation (sensible heat discharge) or the evaporation of sweat (latent heat discharge) as illustrated in Fig. 5.3.

- Type of clothing worn
- Air temperature
- Relative humidity
- Air flow
- Temperature of the surrounding surfaces
- Level of a person’s physical activity, etc.

Is ventilation necessary?

The German Standard DIN 1946/Part 2/Section 3.2 makes outside air flow rates compulsory for enclosed spaces so that people who work in these rooms are supplied with pre-conditioned outside air.

In addition, a central ventilation system will remove the latent cooling percentage (air humidity) and any smells from the rooms. However, the air volume flow may be reduced to the legal requirement. This would result in a substantial reduction in the size of the ventilation system needed.

How do chilled beams work?

TTC chilled beams always directly affect the air that circulates in a room and any heat sources present. A chilled beam’s cooling capacity is always supplied to the room in the form of a natural no-draught convection. This ensures a high level of comfort as regards the protection from draughts and noises.

TTC chilled beams are available in two designs:
- Active chilled beams with air supply connection
- Passive chilled beams

Active chilled beams have a constant air flow rate because of the central ventilation system. Passive chilled beams change their air flow rate and cooling capacity dependent on the temperature difference between the room temperature and the surface temperature of the chilled beams. For this Type of chilled beam the supply air flow rate, a compulsory requirement of the German Standard DIN 1946/Part 2/Section 3.2, must be provided using an additional ventilation system.

Note!

Please refer to our planning document »TTC Silent Gravity Cooling Modultherm« where you will find further information on how temperature differences cause people discomfort and how well various air conditioning systems are accepted.

\[ a_L = 47 \, \text{m}^3/(\text{h} \cdot \text{m}) \cdot 0,5 = 23.5 \, \text{m}^3/(\text{h} \cdot \text{m}) \]

The \( a_L \) spacing between the chilled beams can now be calculated as follows:

\[ A_{\text{min}} = a_L \cdot 1,4 \cdot 1,2 \cdot 1,4 = 1,68 \, \text{m} \]

If there are very high thermal loads the parameter \( A_{\text{min}} \) can be reduced.

\[ a_L = 47 \, \text{m}^3/(\text{h} \cdot \text{m}) \cdot 0,5 = 23.5 \, \text{m}^3/(\text{h} \cdot \text{m}) \]

\[ A_{\text{min}} = a_L \cdot 1,4 \cdot 1,2 \cdot 1,4 = 1,68 \, \text{m} \]

If there are very high thermal loads the parameter \( A_{\text{min}} \) can be reduced.
Cooling, Heating, Ventilation

Fig. 6.1 shows an example how a room can be fully air conditioned – cooled, heat- ed and ventilated – with TTC model ACBLE chilled beams and underfloor convectors for the heating mode.

- The illustration does not show the air handling unit required to pre-condition the primary air supply.
- To supply the chilled beams with cold water you can either use suitable cold water generators in heat pump mode or dry cooling towers to benefit from energy saving »freecooling«.

You will find more information on how to correctly control chilled beams on page 7.

Heat transfer through people [W]

<table>
<thead>
<tr>
<th>Activity</th>
<th>≈ W</th>
<th>Level of Activity</th>
<th>≈ W/m³</th>
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<td>Sleeping</td>
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<td>--</td>
<td>35</td>
</tr>
<tr>
<td>Lying down</td>
<td>80</td>
<td>--</td>
<td>45</td>
</tr>
<tr>
<td>Normal office work</td>
<td>100</td>
<td>I</td>
<td>55</td>
</tr>
<tr>
<td>Typing</td>
<td>150</td>
<td>II</td>
<td>85</td>
</tr>
<tr>
<td>Walking slowly 3 km/h</td>
<td>200</td>
<td>III</td>
<td>110</td>
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<tr>
<td>Walking fast 6 km/h</td>
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<td>IV</td>
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<tr>
<td>Heavy physical work</td>
<td></td>
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Air conditioning a room using TTC Chilled Beams

[1] TTC chilled beam, e.g. model ACBLE
[2] Cold water return
[3] Flexible pipe for the pre-conditioned outside air
[4] Cold water flow
[5] Dew sensor to prevent the temperature in the chilled beam from falling below the dew point (to be installed in the cold water flow insides the chilled beam to pick up the condition in the room)
[6] Cooling mode control valve
[7] Sequential controller for heating or cooling mode with a neutral zone between the two modes
[8] Heating flow
[9] Heating return
[10] Heating mode control valve (inside the floor channel)
[11] Radiator, e.g. TTC underfloor trenchheater
[12] Cold water return
[13] Cold water flow

AL Supply air to ventilate the room and possibly to absorb humidity from the room (minimum supply air flow rates need to be complied with in line with German Standard DIN 1946/Part 2/Section 3.2)
U Warm recirculating air
Z Outside and recirculating air that has been cooled in the chilled beam

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AL Supply air to ventilate the room and possibly to absorb humidity from the room (minimum supply air flow rates need to be complied with in line with German Standard DIN 1946/Part 2/Section 3.2)
U Warm recirculating air
Z Outside and recirculating air that has been cooled in the chilled beam

Subject to technical changes – Issued 10/2010
Chilled beams are generally controlled with individual room or zone thermostats. This aims to satisfy the individual needs of the users. Room thermostats are installed to sequentially control the cooling and heating valve. This prevents any overlap between the heating and the cooling mode. The thermoelectrical actuators are applied to the room thermostat which is used to control the system based on a variance comparison.

As the chilled beams are to remove sensible cooling loads only, a drop below the dew point must be avoided. It makes sense to install a dew sensor in the control circuit which will close the cooling valve if a drop below the dew point is detected. The chilled beams will discharge the cool air in a very natural way. The difference in temperature between the air in the room and on the surface of the air cooler (floating temperature difference) automatically controls the level of cool air that is discharged.

A two-point valve control (OPEN-CLOSED) for the chilled beams is totally adequate and has the benefit of providing you with a considerable cost saving.

**Components needed**

A zone can be controlled (sequential control) with the following components:
- 1 off valve box (valve gate), suitable for the installation of an electrical actuator
- 1 off valve box (three-way valve) for the zone mixing control, suitable for the installation of an electrical actuator
- 2 off 24 V actuators (currentless, normally closed)
- 1 off dew sensor
- 1 off room thermostat
- 1 off chilled beam controller, suitable for heating/cooling mode and the connection of a dew sensor
- 1 off circulating pump to control the flow temperature

**Note!**

Please do not hesitate to contact us with any questions you might have concerning your planning requirements.

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**Controls and schematic diagram for an air conditioning system using chilled beams in cooling mode**

1. TC chilled beams (active)
2. Sequential control for one zone to be air conditioned
3. Room thermostat or room sensor for cooling/heating (incl. a neutral zone)
4. Overflow valve to avoid an increase of pressure in the pipe system
5. Three-way control valve for one zone
6. Secondary pump for one cooling circuit
7. Zone control valve with thermoelectrical actuator (currentless, normally closed)
8. Dew sensor to monitor the dew point
9. Electrical stop valves (OPEN-CLOSED)
10. Water circulating pumps for operation with a cooling tower
11. Dry cooling tower
12. Three-way switching valve
13. Water cooled cold water set
14. Three-way control-valve to cool the outside air
15. Plate heat exchanger

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*Note! This diagram does not show the mandatory heaters.*
Cassette Chilled Beam ACBLQ 0660 (active)

Specification | Capacity Charts

**Dimensions**

8.2 ACBLQ0660 side view

**Note!**
4 air discharge directions for the air supply. Air adjustment valves which come as standard allow 4 different settings for the air volume flow. The power levels in charts 8.4 to 8.7 apply only when the air adjustment valves are fully open (100%).

**Air resistance, Sound pressure level**

*Pressure drop [Pa], sound pressure level dB(A)*

**Power level 7, 9 and 12 (100% open)**

The sound pressure level [dB(A)] refers to an effective room area of 10m² Sabine and a reverberation period of 0.5 seconds.
Design features for model ACBLQ

The cassette chilled beam model ACBLQ is an active chilled beam. Its design and operation combines a ceiling air discharge with a decentralized cooling unit. This means that none of the usual additional air discharge points are required which in turn helps to optimize both the investment and the energy costs. The design allows for trouble-free installation in standard panelled ceilings which makes the unit suitable for a whole host of applications. The units can be installed flush in panelled ceilings.

Air cooler

The air cooler is made of copper pipes covered with aluminium fins. To ensure a continuous heat transfer the fins and the pipes are bonded together.
- The water quality of the coolant must meet the requirements of the German Standard VDI 2035
- Maximum operating pressure 6 bar*
- Maximum operating temperature 90°C*
*Further installation options on request

Connections

The connecting pipes projects horizontally «H» from the casing. The copper connection pipes have a diameter of 15 mm. The connections are suitable for soldered joints, clamping joints and crimped connections.

Casing

The casing is made of coated steel plate (the colour is white, similar to RAL 9010). The cover can be removed for maintenance purposes. For dimensions see Fig. 8.2. A ø 125 mm air inlet connector is located at the top of the casing. Upon request the unit can also be supplied with this connector located at the side. An air adjustment to individually control the supply air volume flows on each air discharge side comes as standard.

Options

- ø 125 mm air inlet connector located at the side of the unit

Applications

Offices, open plan offices, administrative buildings, restaurants, showrooms, galleries, supermarkets, department stores, etc.

Flush installation in panelled ceiling | Central recirculating air inlet

Water-sided pressure drop* [∆p_w]

Water volume flow \( m_w \) [kg/h]

* Note!

You can calculate the water-sided pressure difference [kPa] of the panelled chilled beam, model ACBLQ, using the water volume flow (Formula 4) in Fig. 9.2. Further pressure optimization on request.

Formula 1 to calculate the average temperature difference \( \Delta t_w \)

\[
\Delta t_w[K] = \frac{t_{w1}[^{\circ}C] + t_{w2}[^{\circ}C]}{2}
\]

Formula 4 to roughly estimate the water volume flow \( m_w \)

\[
m_w[kg/h] = 860 \cdot \frac{Q_{tot}[kW]}{t_{w2} - t_{w1}[K]}\]
Chilled Beam ACBLZ (active)

Specification | Capacity Charts

**Dimensions**

Water-sided 1 pipe division

**Technical data | Weights**

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<th>Type</th>
<th>$L_{(tot)}$ [mm]</th>
<th>$L_{(finned)}$ [mm]</th>
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**Water-sided pressure difference ($\Delta p_w$)**

**Air resistance | Sound pressure level**

Subject to technical changes - Issued 10/2010
Design features for model ACBLZ

The panelled chilled beam model ACBLZ is an active air conditioning unit. As it requires a supply air flow to operate it automatically meets the requirements regarding the ventilation of a room. An air adjustment valve to control the air flow volume comes as standard. Installation of the unit is in panelled ceilings. An additional air passage grill is not required. The structural design of the units will be explained in the following.

Air cooler

The air cooler is made of copper pipes covered with aluminium fins. To ensure a continuous heat transfer the fins and the pipes are bonded together.

- The water quality of the coolant must meet the requirements of the German Standard VDI 2035
- Maximum operating pressure 6 bar
- Maximum operating temperature 90°C

Connections

The chilled beams will be supplied with ‘H’ (horizontal) connection pipes only. The connection pipes average diameter is

- ø 15 mm with one pipe division
- ø 22 mm with two or more pipe divisions.

The supply air connection (ø 100 mm) is located at the end or alternatively at the top of the unit.

Casing

The casing is made of coated steel plate (the colour is white, similar to RAL 9010). The perforated recirculating air inlet cover can be removed for maintenance purposes. For dimensions see Fig. 10.2.

Two mounting rails run along the top of the whole unit. The mounting brackets which are included in the delivery are attached to these rails.

Options

- Integrated light fixture

Installation notes

If the chilled beams are to be arranged in parallel the installation requirements illustrated in Fig. 11.2 must be complied with to ensure a trouble-free operation.

Applications

Offices, open plan offices, administrative buildings, restaurants, showrooms, sound and TV studios, supermarkets, department stores, etc.

Flush installation in panelled ceiling

Model ACBLZ chilled beams are installed in panelled ceilings only. An additional air passage grill is not required.

If a number of chilled beams are needed to meet the cooling requirements of the room the minimum installation distances given in Fig. 11.2 must be observed.

11.2

[B] Width of the chilled beam, see Fig. 10.2
[Almin] Minimum distance between two chilled beams or a chilled beam and a wall, in line with the air volume flow, see Fig. 5.4

Note!

You can calculate the water-sided pressure difference [kPa] of the panelled chilled beam, model ACBLZ, using the water volume flow (Formula 4) in Fig. 10.4.

Formula 1 to calculate the average temperature difference $\Delta T_{\text{in}}$

$$\Delta T_{\text{in}}[K] = t_r - \frac{t_{w1}[\text{°C}] + t_{w2}[\text{°C}]}{2}$$

Formula 4 to roughly estimate the water volume flow $m_w$

$$m_w[\text{kg/h}] = 860 \cdot \frac{Q_{\text{inlet}}[\text{kW}]}{t_{w2} - t_{w1}[\text{°C}]}$$
### Dimensions

![Dimensions Diagram]

12.2

### Technical data | Weights

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12.3

### Water-sided pressure difference [\(\Delta p_w\)]

![Water-sided Pressure Difference Graph]

12.4

### Capacity Charts 2-sided air discharge

**Specific cooling capacity \([q_{K(spez)}]\) ACBLA __36**

#### Power level 7

![Capacity Chart 7]

#### Power level 8

![Capacity Chart 8]

#### Power level 9

![Capacity Chart 9]

#### Power level 12

![Capacity Chart 12]

12.5

12.6

12.7

12.8
Chilled Beam ACBLA (active)

Design Features | Installation Example

Design features for model ACBLA

Model ACBLA panelled chilled beams are active air conditioning units. As they require a supply air flow to operate they automatically meet the requirements regarding the ventilation of a room. Installation of the units is underneath ceilings only. An additional air passage grill is not required. The structural design of the units will be explained in the following.

Air cooler
The air cooler is made of copper pipes covered with aluminium fins. To ensure a continuous heat transfer the fins and the pipes are bonded together.
- The water quality of the coolant must meet the requirements of the German Standard VDI 2035
- Maximum operating pressure 6 bar
- Maximum operating temperature 90°C

Connections
The chilled beams will be supplied with “H” (horizontal) connection pipes only. The connection pipes average diameter is
- ø 15 mm with one pipe division
- ø 22 mm with two or more pipe divisions. The supply air connection (ø 100 mm) is located at the end or alternatively at the top of the unit.

Casing
The casing is made of coated steel plate (the colour is white, similar to RAL 9010). The perforated recirculating air inlet cover can be removed for maintenance purposes. For dimensions see Fig. 11.2.
Two mounting rails run along the top of the whole unit. The mounting brackets which are included in the delivery are attached to these rails.

Options
- Available unit lengths: 12–36 dm in 6 dm increments

Installation notes
Model ACBLA chilled beams are always installed directly underneath the ceiling. If the chilled beams are to be arranged in parallel the installation requirements illustrated in Fig. 13.2 must be complied with to ensure a trouble-free operation.

Applications
Offices, open plan offices, administrative buildings, restaurants, showrooms, sound and TV studios, supermarkets, department stores, etc.

Installation underneath a ceiling

Model ACBLA chilled beams are always installed underneath a ceiling. An additional air passage grill is not required.

If a number of chilled beams are needed to meet the cooling requirements of the room the minimum installation distances given in Fig. 13.2 must be observed.

Minimum distances between chilled beams arranged in parallel

2-sided air discharge

Note!
You can calculate the water-sided pressure difference [kPa] of the panelled chilled beam, model ACBLZ, using the water volume flow (Formula 4) in Fig. 12.4; please use Fig. 17.1–17.4 to calculate the sound pressure level.
Chilled Beam ACBLE (active)
Specification | Capacity Charts

Dimensions

Technical data | Weights

<table>
<thead>
<tr>
<th>Type</th>
<th>L_{tot} [mm]</th>
<th>L_{finned} [mm]</th>
<th>Weight [kg]</th>
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<tbody>
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<td>1000</td>
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<td>ACBLE 1860</td>
<td>1793</td>
<td>1600</td>
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<td>ACBLE 2460</td>
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<tr>
<td>ACBLE 3060</td>
<td>2993</td>
<td>2800</td>
<td>100</td>
</tr>
</tbody>
</table>

Water-sided pressure difference [Δp_w]

Capacity Charts 2-sided air discharge
Specif. cooling capacity \([q_{k(spez)}]\) ACBLE __60

Power level 7

Power level 8

Power level 9

Power level 12

Subject to technical changes · Issued 10/2010
Chilled Beam ACBLE (active)
Design Features | Installation Example

Design features for model ACBLE

Model ACBLE panelled chilled beams are active air conditioning units. As they require a supply air flow to operate they automatically meet the requirements regarding the ventilation of a room. Installation of the units is in panelled ceilings. An additional air passage grill is not required. The structural design of the units will be explained in the following.

Air cooler
The air cooler is made of copper pipes covered with aluminium fins. To ensure a continuous heat transfer the fins and the pipes are bonded together.

- The water quality of the coolant must meet the requirements of the German Standard VDI 2035
- Maximum operating pressure 6 bar
- Maximum operating temperature 90°C

Connections
The chilled beams can be ordered with »H« (horizontal) or »V« (vertical) connection pipes only. The connection pipes average diameter is

- ø 15 mm with one pipe division
- ø 22 mm with two or more pipe divisions.

The supply air connection (ø 100 mm) is located at the end or alternatively at the top of the unit.

Casing
The casing is made of coated steel plate (the colour is white, similar to RAL 9010). The perforated recirculating air inlet cover can be removed for maintenance purposes. For dimensions see Fig. 14.2.

Two mounting rails run along the top of the whole unit. The mounting brackets which are included in the delivery are attached to these rails.

Options
- Available unit lengths: 12 – 36 dm in 6 dm increments

Installation notes
If the chilled beams are to be arranged in parallel the installation requirements illustrated in Fig. 15.2 must be complied with to ensure a trouble-free operation.

Applications
Offices, open plan offices, administrative buildings, restaurants, showrooms, sound and TV studios, supermarkets, department stores, etc.

Installation in panelled ceiling

Model ACBLE chilled beams are always installed flush in panelled ceilings. An additional air passage grill is not required.

If a number of chilled beams are needed to meet the cooling requirements of the room the minimum installation distances given in Fig. 15.2 must be observed.

Note!
Other installation options on request.

Minimum distance between two chilled beams arranged in parallel

2-sided air discharge

Note!
You can calculate the water-sided pressure difference [kPa] of the panelled chilled beam, model ACBLE, using the water volume flow (Formula 4) in Fig. 14.4; please use Fig. 16.4–16.7 and 17.1–17.4 to calculate the sound pressure level.

Formula 4 to roughly estimate the water volume flow $\dot{m}_w$

$$\dot{m}_w[\text{kg/h}] = 860 \cdot \frac{q_{\text{spec}}[\text{kW/m}] \cdot l_{\text{finned}}[\text{m}]}{(t_{W2} - t_{W1})[\text{K}]}$$
Specif. cooling capacity \( q_{\text{specif.}} \) | 1-sided air discharge

### Power level 8

16.1

### Power level 9

16.2

### Power level 12

16.3

**Note!**

*) The sound pressure level [dB(A)] refers to an effective room area of 10 m² Sabine and a reverbation period of 0.5 seconds. Other power levels on request.
Chilled Beam ACBLA/ACBLE (active)
Air Resistance and Sound Pressure Level for 2-sided Air Discharge

**Formulas for calculation**

**Formula 1**
Calculating the average temperature difference $\Delta \vartheta_\text{m}$

$$\Delta \vartheta_\text{m}[K] = t_\text{R} - \frac{t_\text{W1}[\degree C] + t_\text{W2}[\degree C]}{2}$$

**Formula 3**
Calculating the total cooling capacity $\dot{Q}_\text{tot}$ (1 unit)

$$\dot{Q}_\text{tot}[kW] = q_\text{specif}[W/m] \cdot L_{\text{finned}}[m]$$

**Formula 4**
Estimating roughly the water volume flow $\dot{m}_\text{w}$

$$\dot{m}_\text{w}[kg/h] = 860 \cdot \frac{q_\text{specif}[kW/m] \cdot L_{\text{finned}}[m]}{t_\text{W2} - t_\text{W1}[K]}$$

**Formula 5**
Calculating the total water-sided pressure drop (1 unit)

$$\Delta p_{\text{w,tot}}[kPa] = \Delta q_\text{w,specif}[W/m] \cdot L_{\text{finned}}[m]$$

**Note!**

*) The sound pressure level [dB(A)] refers to an effective room area of 10 m² Sabine and a reverbation period of 0,5 seconds. Other power levels on request.
Chilled Beam ACBLO (active)

Specification | Capacity Charts

---

**18.1**

**Dimensions**

---

**18.2**

**Technical data | Weights**

<table>
<thead>
<tr>
<th>Type</th>
<th>L(_{\text{tot}})</th>
<th>L(_{\text{finned}})</th>
<th>Weight</th>
<th>min. distance to the ceiling</th>
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</thead>
<tbody>
<tr>
<td>ACBLO 1260</td>
<td>1193</td>
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<tr>
<td>ACBLO 1860</td>
<td>1793</td>
<td>1600</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>ACBLO 2460</td>
<td>2393</td>
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<tr>
<td>ACBLO 3060</td>
<td>2993</td>
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<td>100</td>
</tr>
</tbody>
</table>

---

**18.3**

**Capacity Charts 2-sided air discharge**

**Power level 7**

---

**18.4**

**Power level 9**

---

**18.5**

**Power level 12**

---

**18.6**
**Chilled Beam ACBLO (active)**

**Design Features | Installation Example**

**Design features for model ACBLO**

Model ACBLO chilled beams are active air conditioning units. As they require a supply air flow to operate, they automatically meet the requirements regarding the ventilation of a room. Installation is flush to a panelled ceiling. The structural design of the units will be explained in the following.

**Air cooler**

The air cooler is made of copper pipes covered with aluminium fins. To ensure a continuous heat transfer, the fins and the pipes are bonded together.
- The water quality of the coolant must meet the requirements of the German Standard VDI 2035
- Maximum operating pressure 6 bar*
- Maximum operating temperature 90°C*

*Other installation options on request.

**Connections**

The chilled beams can be ordered with »H« (horizontal) or »V« (vertical) connection pipes only. The connection pipes average diameter is:
- ø 15 mm with one pipe division
- ø 22 mm with two or more pipe divisions.

The supply air connection (ø 100 mm) is located at the end of the unit. (see page 18).

**Casing**

The casing is made of coated steel plate (the colour is white, similar to RAL 9010). The recirculating air inlet cover can be removed for maintenance purposes. For dimensions see Fig. 18.2.

Two mounting rails run along the top of the whole unit. The mounting brackets which are included in the delivery are attached to these rails.

**Options**

- Available unit lengths: 12–36 dm in 6 dm increments
- 1- and 2-sided air discharge

**Installation notes**

The installation requirements for chilled beams illustrated in Fig. 18.3 in respect of the distances to the ceiling must be complied with as the stated cooling rates will not be achieved otherwise.

**Applications**

Offices, open plan offices, administrative buildings, restaurants, showrooms, sound and TV studios, supermarkets, department stores, etc.

---

**Installation in a panelled ceiling**

Model ACBLO chilled beams are always installed flush in panelled ceilings. If a number of chilled beams are needed to meet the cooling requirements of the room, the minimum installation distances given in Fig. 19.2 must be observed. The edge gaps »Sb« must be at least 70% of the free area of the chilled beam's face view.

**Note!**

Other installation options available on request.

---

**19.1 Installation example and function**

*AL* Centrally conditioned outside air

*U* Warm recirculating air entering the ch. b.

*Z* Cooled recirculating and supply air leaving the ch. b.

*SL* Recirculating air induced by the supply air flow

---

**19.2**

[B] Width of the chilled beam, see Fig. 18.2

[A_{min}] Minimum distance between two chilled beams or between a chilled beam and a wall, in line with the air volume flow, see Fig. 5.4

[D_{min}] Minimum distance between the top edge of the chilled beam and the prefabricated or the room's ceiling, see Fig. 18.3
Chilled Beam AECAK (passive)
Specification | Capacity Charts

Dimensions

Mounting brackets
Up to 2,4 m 2 off from 2,5 m 3 off
Connections
1 pipe division ø 15; 150 mm long

Technical data | Weights

<table>
<thead>
<tr>
<th>L_{(tot)}</th>
<th>L_{(finned)}</th>
<th>Chilled beam width B</th>
<th>Distance to the ceiling</th>
<th>Water content</th>
<th>Weight</th>
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<td>[mm]</td>
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</table>

Formulas for calculation

Formula 1
Calculating the average temperature difference \( \Delta \theta_w \)
\[
\Delta \theta_w[K] = t_R - \frac{t_{W1}[^°C] + t_{W2}[^°C]}{2}
\]

Formula 3
Calculating the total cooling capacity \( \dot{Q}_{tot} \) (1 unit)
\[
\dot{Q}_{tot}[kW] = \dot{q}_{K(spezif)}[W/m] \cdot L_{(finned)}[m]
\]

Formula 4
Estimating roughly the water volume flow \( \dot{m}_w \)
\[
\dot{m}_w[kg/h] = 860 \cdot \dot{q}_{K(spezif)}[W/m] \cdot L_{(finned)}[m] \cdot \left( t_{W2} - t_{W1}[^°C] \right)
\]

Formula 5
Calculating the total water-sided pressure drop (1 unit)
\[
\Delta p_{Wtot}[kPa] = \Delta \dot{q}_{W(spezif)}[W/m] \cdot L_{(finned)}[m]
\]

\( \Delta \theta_w[K] \) = Average temperature difference between two different media
\( t_R[^°C] \) = Room temperature
\( t_{W1}[°C] \) = Water inlet temperature
\( t_{W2}[°C] \) = Water outlet temperature
\( \dot{m}_w[kg/h] \) = Water volume flow
\( \dot{q}_{tot}[W/m] \) = Total cooling capacity of a hilled beam
\( \dot{q}_{K(spezif)}[W/m] \) = Cooling power per metre of finned chilled beam length \( L_{(finned)} \)
\( \Delta \theta_w[K] \) = Calculating the average temperature difference
\( \Delta p_{Wtot}[kPa] \) = Specific pressure drop of 1 m finned chilled beam length \( L_{(finned)} \) see Fig. 20.5
Design features for model AECAK

Model AECAK chilled beams are designed to be seen. They can be used in areas with high cooling loads such as department stores with high thermal loads, etc. The units can be tailor-made to complement the architectural design of the room. The structural design of the units will be explained in the following.

Air cooler
The air cooler is made of copper pipes covered with aluminium fins. To ensure a continuous heat transfer the fins and the pipes are bonded together.
- The water quality of the coolant must meet the requirements of the German Standard VDI 2035
- Finned length of the chilled beam $L_{\text{finned}}$ see Fig. 20.3
- Maximum operating pressure 6 bar
- Maximum operating temperature 90°C

Connections
The chilled beams can be ordered with »H« (horizontal) or »V« (vertical) connection pipes only. The connection pipes average diameter is
- ø 15 mm with one pipe division

Casing
The casing is made of coated steel plate (the colour is white, similar to RAL 9010). For dimensions see Fig. 20.2; unit length $L_{\text{ges}}$ and finned length of chilled beam $L_{\text{finned}}$ see Fig. 20.3.
Mounting rails run along the top of the whole unit. The mounting brackets which are included in the delivery are attached to these rails.
White special fins protect the interior of the chilled beam.

Options
- integrated lighting fixtures
- integrated smoke detectors

Installation notes
The installation requirements for chilled beams illustrated in Fig. 20.3 in respect of the distances to the ceiling must be complied with as the stated cooling rates will not be achieved otherwise.

Applications
Offices, open plan offices, administrative buildings, restaurants, showrooms, sound and TV studios, supermarkets, department stores, etc.

Note!
Please refer to the Order Key on page 4.
Chilled Beam AECBK (passive)
Specification | Capacity Charts

22.1

Dimensions

Mounting brackets
Up to 2.4 m 2 off from 2.5 m 3 off
Connections
1 pipe division ø 15; 150 mm long

22.2

Technical data | Weights

<table>
<thead>
<tr>
<th>L_{tot} [mm]</th>
<th>L_{finned} [mm]</th>
<th>Chilled beam width B [mm]</th>
<th>Distance to the ceiling D_{min} [mm]</th>
<th>Water content [l]</th>
<th>Weight [≈kg]</th>
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<td>600</td>
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<td>4,40</td>
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</tr>
</tbody>
</table>

Formulas for calculation

Formula 1
Calculating the average temperature difference \( \Delta \theta_m \)
\[
\Delta \theta_m [K] = \frac{t_R - \left( t_{W1} [°C] + t_{W2} [°C] \right)}{2}
\]

Formula 3
Calculating the total cooling capacity \( \dot{Q}_{tot} \) (1 unit)
\[
\dot{Q}_{tot} [kW] = \frac{\dot{q}_{K(spezif)} [W/m] \cdot L_{(finned)} [m]}{1000}
\]

Formula 4
Estimating roughly the water volume flow \( \dot{m}_w \)
\[
\dot{m}_w [kg/h] = 860 \cdot \frac{\dot{q}_{K(spezif)} [W/m] \cdot L_{(finned)} [m]}{t_{W2} - t_{W1} [°C]}
\]

Formula 5
Calculating the total water-sided pressure drop (1 unit)
\[
\dot{p}_{Wtot} [kPa] = \dot{p}_{W(spezif)} [kPa/m] \cdot L_{(finned)} [m]
\]

22.3

Note! Design example for passive chilled beams page 28.
Chilled Beam AECBK (passive)
Design Features | Installation Example

Design features for model AECBK
Model AECBK chilled beams are designed to be seen. They can be used in areas with high cooling loads such as department stores with high thermal loads, etc. The units can be tailor-made to complement the architectural design of the room. The structural design of the units will be explained in the following.

Air cooler
The air cooler is made of copper pipes covered with aluminium fins. To ensure a continuous heat transfer the fins and the pipes are bonded together.
- The water quality of the coolant must meet the requirements of the German Standard VDI 2035
- Finned length of the chilled beam \( L_{\text{finned}} \) see Fig. 20.3
- Maximum operating pressure 6 bar
- Maximum operating temperature 90°C

Connections
The chilled beams can be ordered with »H« (horizontal) or »V« (vertical) connection pipes only. The connection pipes average diameter is
- \( \varnothing 15 \text{ mm} \) with one pipe division

Casing
The casing is made of coated steel plate (the colour is white, similar to RAL 9010). For dimensions see Fig. 22.2; unit length \( L_{\text{gas}} \) and finned length of chilled beam \( L_{\text{finned}} \) see Fig. 22.3.
Mounting rails run along the top of the whole unit. The mounting brackets which are included in the delivery are attached to these rails.
White special fins protect the interior of the chilled beam.

Options
- integrated lighting fixtures
- integrated smoke detectors

Installation notes
The installation requirements for chilled beams illustrated in Fig. 22.3 in respect of the distances to the ceiling must be complied with as the stated cooling rates will not be achieved otherwise.

Applications
Offices, open plan offices, administrative buildings, restaurants, showrooms, sound and TV studios, supermarkets, department stores, etc.

Note!
Please refer to the Order Key on page 4.
Chilled Beam AECBU (passive)
Specification | Capacity Charts

24.1 Chilled Beam AECBU (passive)

Dimensions

Mounting brackets
Up to 2.4 m 2 off from 2.5 m 3 off
Connections
1 pipe division
a 15; 150 mm long

24.2 Technical data | Weights

<table>
<thead>
<tr>
<th>$L_{\text{tot}}$</th>
<th>$L_{(\text{finned})}$</th>
<th>Chilled beam width $B$</th>
<th>Distance to the ceiling $D_{\text{min}}$</th>
<th>Water content $[\text{L}]$</th>
<th>Weight $[\approx \text{kg}]$</th>
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</thead>
<tbody>
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</table>

24.3 Note! Design example for passive chilled beams page 28.

Formulas for calculation

Formula 1
Calculating the average temperature difference $\Delta \theta_m$

$$\Delta \theta_m [\text{K}] = \frac{t_R - \frac{t_{W1} [\text{°C]} + t_{W2} [\text{°C}]}{2}}{2}$$

Formula 3
Calculating the total cooling capacity $Q_{K\text{tot}}$ (1 unit)

$$Q_{K\text{tot}} [\text{kW}] = q_{K\text{specif}} [\text{W/m}] \cdot L_{(\text{tot})} [\text{m}]$$

Formula 4
Estimating roughly the water volume flow $m_w$

$$m_w [\text{kg/h}] = 860 \cdot \frac{Q_{K\text{specif}} [\text{W/m}] \cdot L_{(\text{finned})} [\text{m}]}{t_{W2} - t_{W1} [\text{K}]}$$

Formula 5
Calculating the total water-sided pressure drop (1 unit)

$$\Delta p_{\text{Wtot}} [\text{kPa}] = \frac{\Delta q_{W\text{specif}} [\text{W/m}] \cdot L_{(\text{finned})} [\text{m}]}{t_{W2} - t_{W1} [\text{K}]} + \Delta q_{W\text{specif}} [\text{W/m}] \cdot L_{(\text{finned})} [\text{m}]$$

$\theta_m$ = Average temperature difference between two different media
$t_R$ = Room temperature
$t_{W1}$ = Water inlet temperature
$t_{W2}$ = Water outlet temperature
$m_w$ = Water volume flow
$q_{K\text{specif}}$ = Cooling power per metre of finned chilled beam length $L_{(\text{finned})}$
$T_{\text{tot}}$ = Total cooling capacity of a hilled beam
$T_{\text{Wtot}}$ = Total pressure drop of a chilled beam
$\Delta q_{W\text{specif}}$ = Specific pressure drop of 1 m finned chilled beam length $L_{(\text{finned})}$ see Fig. 20.5
Design features for model AECBU

Model AECBU chilled beams are preferably used in panelled ceilings or specially designed panelling systems. The units can be tailor-made to complement the architectural design of the room. An air passage grill [2] is required on the side that is visible from the room for optical reasons. The structural design of the units will be explained in the following.

Air cooler
The air cooler is made of copper pipes covered with aluminium fins. To ensure a continuous heat transfer the fins and the pipes are bonded together.
- The water quality of the coolant must meet the requirements of the German Standard VDI 2035
- Finned length of the chilled beam L_{fined} see Fig. 20.3
- Maximum operating pressure 6 bar
- Maximum operating temperature 90°C

Connections
The chilled beams can be ordered with »H« (horizontal) or »V« (vertical) connection pipes only. The connection pipes average diameter is
- ø 15 mm with one pipe division

Casing
The casing is made of coated steel plate. For dimensions see Fig. 24.2.
Mounting rails run along the top of the whole unit. The mounting brackets which are included in the delivery are attached to these rails.

Installation notes
The installation requirements for chilled beams illustrated in Fig. 24.3 in respect of the distances to the ceiling must be complied with as the stated cooling rates will not be achieved otherwise.

Applications
Offices, open plan offices, administrative buildings, restaurants, showrooms, sound and TV studios, supermarkets, department stores, etc.

Note!
Please refer to the Order Key on page 4.
Chilled Beam AECEU (passive)

Specification | Capacity Charts

26.1

Dimensions

Mounting brackets
Up to 2.4 m 2 off
from 2.5 m 3 off

Connections
1 pipe division
a 15; 150 mm long

26.2

Technical data | Weights

<table>
<thead>
<tr>
<th>L_{tot} [mm]</th>
<th>L_{finned} [mm]</th>
<th>Chilled beam width B [mm]</th>
<th>Distance to the ceiling D_{min} [mm]</th>
<th>Water content [l]</th>
<th>Weight [≈kg]</th>
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</table>

Formulas for calculation

**Formula 1**
Calculating the average temperature difference \(\Delta \theta_m\)
\[
\Delta \theta_m [K] = t_k - \frac{t_w_1 [°C] + t_w_2 [°C]}{2}
\]

**Formula 3**
Calculating the total cooling capacity \(Q_{tot}\) (1 unit)
\[
Q_{tot} [kW] = q_\text{K(spezif)} [W/m] \cdot L_{\text{finned}} [m]
\]

**Formula 4**
Estimating roughly the water volume flow \(m_w\)
\[
m_w [kg/h] = \frac{860 \cdot \frac{q_\text{K(spezif)}}{[W/m]} \cdot L_{\text{finned}} [m]}{t_{w_2} - t_{w_1} [K]}
\]

**Formula 5**
Calculating the total water-sided pressure drop (1 unit)
\[
\Delta p_{Wtot} [kPa] = \Delta q_{W(spezif)} [W/m] \cdot L_{\text{finned}} [m]
\]

Notes:
- \(\Delta \theta_m\) = Average temperature difference between two different media
- \(t_k\) = Room temperature
- \(t_w_1\) = Water inlet temperature
- \(t_w_2\) = Water outlet temperature
- \(m_w\) = Water volume flow
- \(Q_{tot}\) = Total cooling capacity of a chilled beam
- \(q_\text{K(spezif)}\) = Cooling power per metre of finned chilled beam length \(L_{\text{finned}}\)
- \(L_{\text{tot}}\) = Total length of the chilled beam
- \(\Delta p_{W(spezif)}\) = Specific pressure drop of 1 m finned chilled beam length \(L_{\text{finned}}\)

Note! Design example for passive chilled beams page 28.
Design features for model AECEU

Model AECEU chilled beams are high performance units. It’s the unit of choice for locations with very high sensible cooling loads such as sound and TV studios, department stores with high thermal loads due to the lighting, computer rooms, etc. Installation is in panelled ceiling, behind decorative panels to protect them from view or in plain view if being able to see the technology is not a problem. Due to the high cooling power it is not recommended for people to occupy an area directly below the chilled beam for long periods (air flow rate > 0,25 m/s). TTC can supply suitable solutions for such an application.

Air cooler
The air cooler is made of copper pipes covered with aluminium fins. To ensure a continuous heat transfer the fins and the pipes are bonded together.
- The water quality of the coolant must meet the requirements of the German Standard VDI 2035
- Maximum operating pressure 6 bar
- Maximum operating temperature 90°C

Connections
The chilled beams can be ordered with »H« (horizontal) or »V« (vertical) connection pipes only. The connection pipes average diameter is
- Ø 15 mm with one pipe division

Casing
The casing is made of coated steel plate. For dimensions see Fig. 26.2; unit length $L_{net}$ and finned length of chilled beam $L_{finned}$ see Fig. 26.3. Mounting rails run along the top of the whole unit. The mounting brackets which are included in the delivery are attached to these rails.

Installation notes
The installation requirements for chilled beams illustrated in Fig. 26.3 in respect of the distances to the ceiling must be complied with as the stated cooling rates will not be achieved otherwise.

Applications
Offices, open plan offices, administrative buildings, restaurants, showrooms, sound and TV studios, supermarkets, department stores, etc.

Note!
Please refer to the Order Key on page 4.
The Task

An office with a sensible cooling load of \( Q_{\text{sen}} = 1.200 \text{ W} \) is to be cooled using two passive chilled beams of the type AECBU. In addition, preconditioned primary air will be fed into the room.

The chilled beams are to be installed in a panelled ceiling at a height of 2.7 m.

The required supply air flow will be supplied to the room through a ventilation system.

The room volume is approx. 80 m³.

Cold water temperatures: \( t_{W1} = 17°C \) and \( t_{W2} = 19°C \)

Room temperature: \( t_R = 26°C \)

Supply air temperature: \( t_{LUZ} = 18°C \)

Max. possible installation length \( L_{\text{tot}} = 5.50 \text{ m} \)

The supply air flow \( V_{LUZ} \) shall be 240 m³/h, i.e. the air in the room is to be changed 3 times

Cooling capacity \( Q_{\text{sen}} = 600 \text{ W per chilled beam} \)

The Solution (explained step by step)

1. Use Formula 1 to calculate the average temperature difference \( \Delta \theta_m \)

\[
\Delta \theta_m[K] = t_R - \frac{(t_{W1} + t_{W2})[°C]}{2} = 26 - \frac{17°C + 19°C}{2} = 8 K
\]

2. Fig. 24.4 gives the following specific cooling capacity \( q_{K_{\text{specif}}} \) for unit width of 45 and 60 at \( \Delta \theta_m = 8 K \):

- (Unit width 45) \( q_{K_{\text{specif}}} = 180 \text{ W/m} \)
- (Unit width 60) \( q_{K_{\text{specif}}} = 270 \text{ W/m} \)

3. Calculate the required finned length of the chilled beams

\[
\begin{align*}
\text{Required finned length } L_{\text{finned}} & \quad \text{a) (Unit width 45) } L_{\text{finned}} = \frac{Q_{\text{sen}}[W]}{q_{K_{\text{specif}}}[W/m]} = \frac{600 \text{ W}}{180 \text{ W/m}} = 3.33 \text{ m} \\
\text{Required finned length } L_{\text{finned}} & \quad \text{b) (Unit width 60) } L_{\text{finned}} = \frac{Q_{\text{sen}}[W]}{q_{K_{\text{specif}}}[W/m]} = \frac{600 \text{ W}}{270 \text{ W/m}} = 2.22 \text{ m}
\end{align*}
\]

Deduction in line with Fig. 24.3:

- for a) part no. AECBU3545, unit length \( L_{\text{tot}} = 35 \text{ dm} \) = equivalent to \( L_{\text{finned}} = 3.3 \text{ m} \)
- for b) part no. AECBU2560, unit length \( L_{\text{tot}} = 25 \text{ dm} \) = equivalent to \( L_{\text{finned}} = 2.3 \text{ m} \)

4. Select the chilled beam you require from step 3.

In respect of the installation length you could use both of the chilled beams. For the subsequent calculation we have chosen solution "b" (part no. AECBU2560 _ _ _ OS)

Installed cooling capacity \( Q_{\text{sen}} = 270 \text{ W/m} \cdot 2.3 \text{ m} = 621 \text{ W} \) (required 600 W)

Water-sided pressure drop

5. Rough calculation of the water volume flow using formula 4

\[
\dot{m}_W[kg/h] = 860 \cdot \frac{q_{K_{\text{specif}}}[kW/m] \cdot L_{\text{finned}}[m]}{t_{W2} - t_{W1}} = 860 \cdot \frac{0.27kW/m \cdot 2.3 m}{2K} = 267 kg/h
\]

6. Calculate the total water-sided pressure drop using formula 5

\[
\Delta p_{W_{\text{specif}}}[kPa] = 1.9 kPa/m \text{ for } \dot{m}_W = 267 kg/h
\]

\[
\text{Total water-sided pressure drop} = \Delta p_{W_{\text{specif}}}[kPa] \cdot \dot{m}_W[kg/h] = 1.9 kPa/m \cdot 2.3 m = 4.37 kPa
\]

Air-sided cooling capacity

7. The additional cooling capacity provided through the required supply air supply at 240 m³/h is calculated as follows:

\[
Q_{\text{air}}[kW] = \frac{240 \text{ m³/h} \cdot 1.2 (kg/m³) \cdot 1 \text{ (kJ/kg·K)} \cdot 8 \text{ (K)}}{3600} = 0.64 kW
\]

Please note

Note! Corrective factors must be applied to the calculated cooling power if TTC grills are used for air inlet and air discharge (please refer to the TTC Modultherm Planning Documentation)
Mollier h,x-Diagramm

Barometer reading 1013 mb
Dexia Bank, Luxemburg
Architect Claude Vasconi
For the new administrative building of Dexia Bank in Luxemburg, TTC developed an active chilled beam (ACBLE) for heating and/or cooling as well as the corresponding curved ceiling panels (Fig. 30.1–3).

The primary air is supplied via nozzles, using induction to suck in secondary air through the air inlet grating and the heat exchanger, located in the unit. The escaping mixed air attaches itself to the ceiling, due to the Coanda effect, then disperses into the room and thus creates air circulation in the room.

Altstadtpalais Munich
In the Altstadtpalais in Munich, architects Auer + Weber/Munich applied ecological axioms in conjunction with Feng shui rules to install 434 active chilled beams with primary air connection in the ceiling, allowing a high level of flexibility with regard to how the room is used and furnished (Fig. 30.4–5).
In Combination with Multi-function Covers and LEDs

TTC covers are an ideal combinations of design and function. Available in a multitude of shapes and materials they can be integrated into any type of architectural design. (Fig. 31.1–4).

Adding coloured direct or indirect illumination can create different moods and thus increase peoples sense of well-being.

Being to set how much air will be discharged into the room means that a room’s requirements can be met exactly. All covers can of course also be used to remove air from the room. Different functions such as heating/cooling and ventilation can be concentrated in a small space which reduces investment cost.

TTC ceiling covers are particulary suitable for retrofitting in offices, department stores and showrooms. Their design ensures trouble-free installation in most commonly used standard panelled ceilings. Design: www.two-design.com

Wall/Ceiling Installation

Active chilled beams, model ACBLH, can be installed on the wall underneath the ceiling (Fig. 31.5–6).

The primary air is injected via a nozzle system behind the heat exchanger where it uses induction to create a vacuum which sucks the warm room air into the heat exchanger. The room air is then mixed with the primary air in the mixing chamber and blown out again underneath the ceiling. Due to the Coanda effect the air stream attaches itself to the ceiling and thus achieves a high trajectory length and penetration depth. When in cooling mode, all condensate that may accumulate will be collected in a condensate tray from where it can be drained.

Applications:
Offices and administrative buildings
Showrooms
Cafés, Restaurants, Pubs, etc.
Developing innovative solutions
for new buildings and redevelopment projects
in close co-operation with architects and planners

Assisting architects and planners to develop customized solutions during the planning phase is just one of the strengths of TTC Timmler Technology. TTC supplies intelligent buildings technology for contemporary residential and work environments: LED lights, innovative air conditioning systems, design-oriented façade components and gratings for both interior and exterior applications. Our know-how and many years experience let you combine modern design, energy efficiency and economic viability. Whatever your technical requirements, we design customized solutions consisting of standard components or tailor-made components, produced to your specifications.

Kind to the environment and economically viable

People and the environment are at the heart of TTC’s philosophy. We develop natural air conditioning systems that are both energy and cost efficient.

Multi-functionality
Use our know-how to enhance your design

Multi-functionality is a particularly strong point of TTC buildings technology. To name just a few examples:

- **LED Lightdesign** – As with TTC gratings you can also use TTC Lighttools in our maintenance platforms to create a stunning illumination and to put your design into the »limelight«. The options TTC Lightdesign is offering are as versatile as your ideas: From façade space lights, Power LEDs, LED light lines and tiles to wall washers – with individual designs and a wide range of materials we can deliver customized solutions for your projects.

- **TTC Modultherm** is the ideal system to noiseless air condition whole buildings cost efficiently, using the natural force of gravity.

- **TTC Chilled Beams** ensure an air conditioning with high comfort and very low noise in working areas. In arrangement with the architect chilled beams add themselves into the design of the ceiling.

- **TTC Floorunits** with different functionalities of heating, cooling and ventilation provide the free view through space high glass façades. These products combine design with functionality an energy efficiency.

- Homogeneous grating systems allow a seamless transition between the interior and the exterior design of a building. On the inside TTC Under Floor systems provide solutions for all your heating, cooling and ventilation requirements and on the outside they complement the TTC Façade Drainage systems.

- Filigree sun protection systems on the façade provide openness and transparency.

TTC Timmler Technology GmbH

Christian-Schäfer-Str. 8
D-53881 Flamersheim
Tel +49 (0) 2255 921-0
Fax +49 (0) 2255 921-500
info@ttc-technology.eu
www.ttc-technology.eu