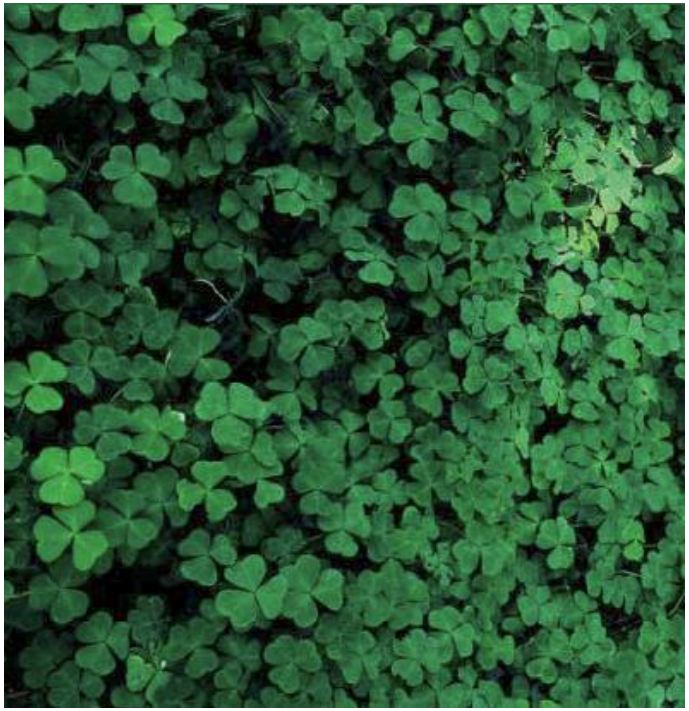
Chilled Beams

ENERGY
ECONOMY
ENVIRONMENT

Why Chilled Beams?

Why Chilled Beams?

Driver 1: ENERGY



- Energy Performance of Buildings

Following the Kyoto protocol the **European Union** has set a target to reduce energy consumption.

For buildings the target is set at a 22% reduction by 2010.

The **160 million buildings in the EU use over 40% of Europe's energy** and create over 40% of its carbon dioxide emissions. And unfortunately that proportion is increasing.

Therefore the Commission of the European Union has issued the **Energy Performance of Buildings Directive (EPBD).**

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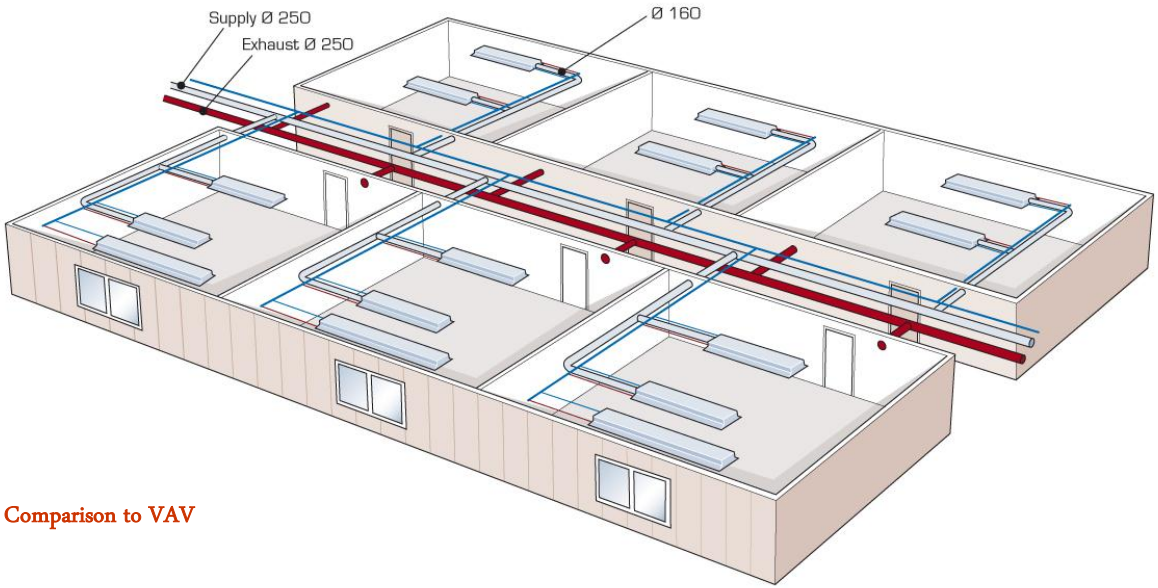
Driver 2 – LESS BUILDING SKIN IS NEEDED

Goal: Minimize supply air required to deliver comfort and minimize energy cost



Comparison to VAV

Driver 3: LESS NOISE

Typically around 10 dB(A) less noise!

Comparsion to VAV and FanCoils

The library of Jönköping University

Driver 4: LESS MAINTENANCE

Experience shows that the cleaning interval may be as much as 5-10 years. The base plate and duct of the covered beam are easily taken down. The **coil** is then accessible for cleaning.

Comparison to VAV and FanCoils

Why Chilled Beams?

Driver: SUMMARY

Energy savings

- First costs are similar for VAV and Chilled Beam solutions
- Reduced air requirements results in smaller AHU and related motor operating costs
- Chiller energy costs can be reduced 15% with Chilled Beams vs. VAV due to higher operating water temps with beams.
- Free cooling is possible, like Jönköping University

Less Building skin is needed

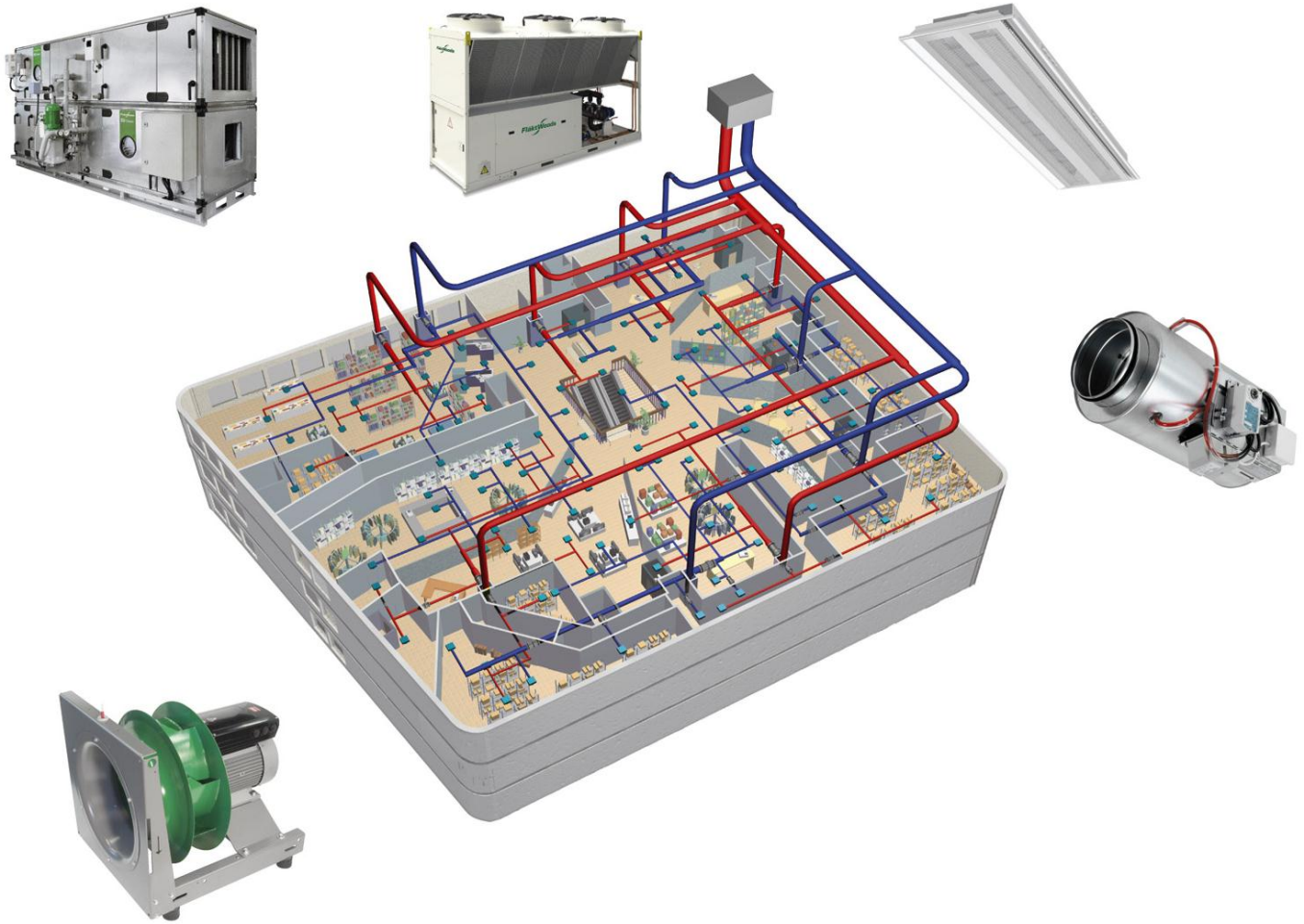
- Saving of 150 – 460 mm per floor (6 to 18 inch)

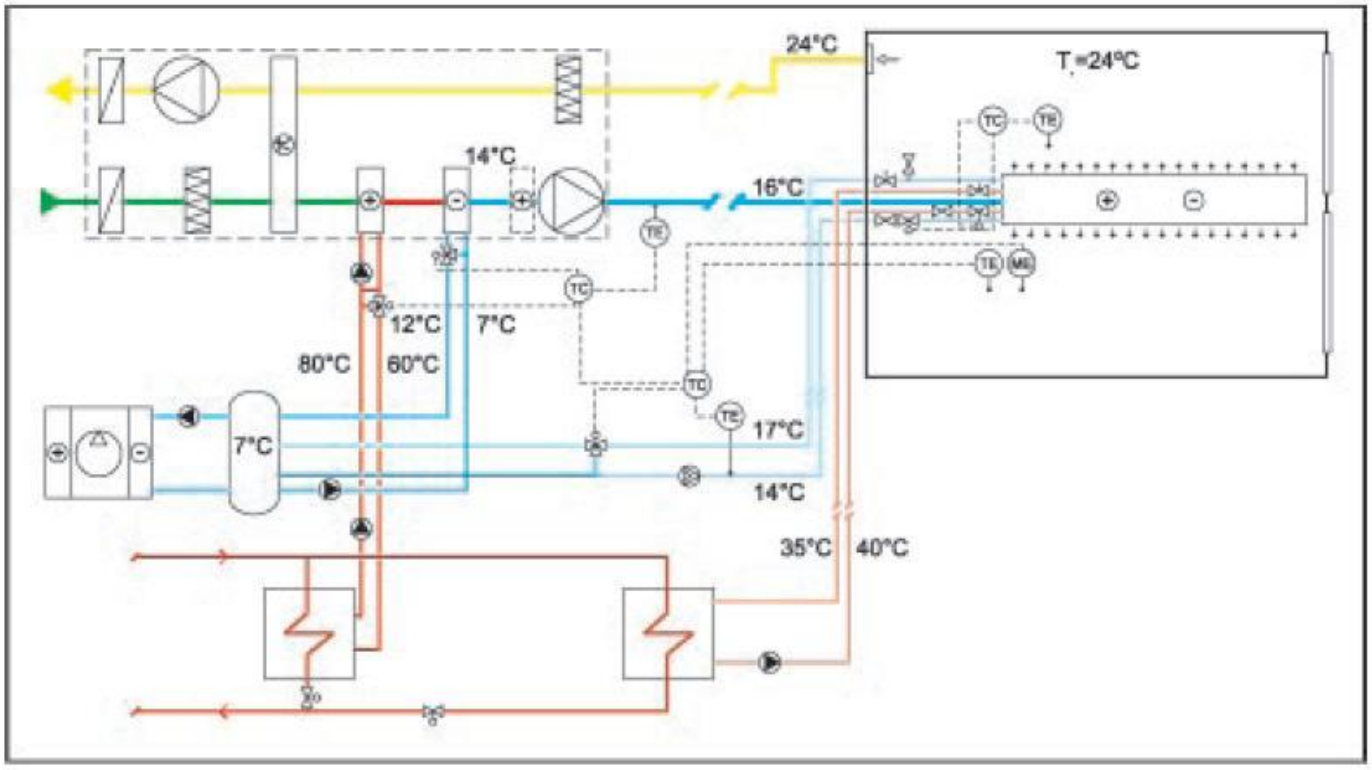
Less noise

- In Europe the maximum noise level for offices is 30-35 dB(A)

Less maintenance

- Lower life cycle costs/maintenance costs



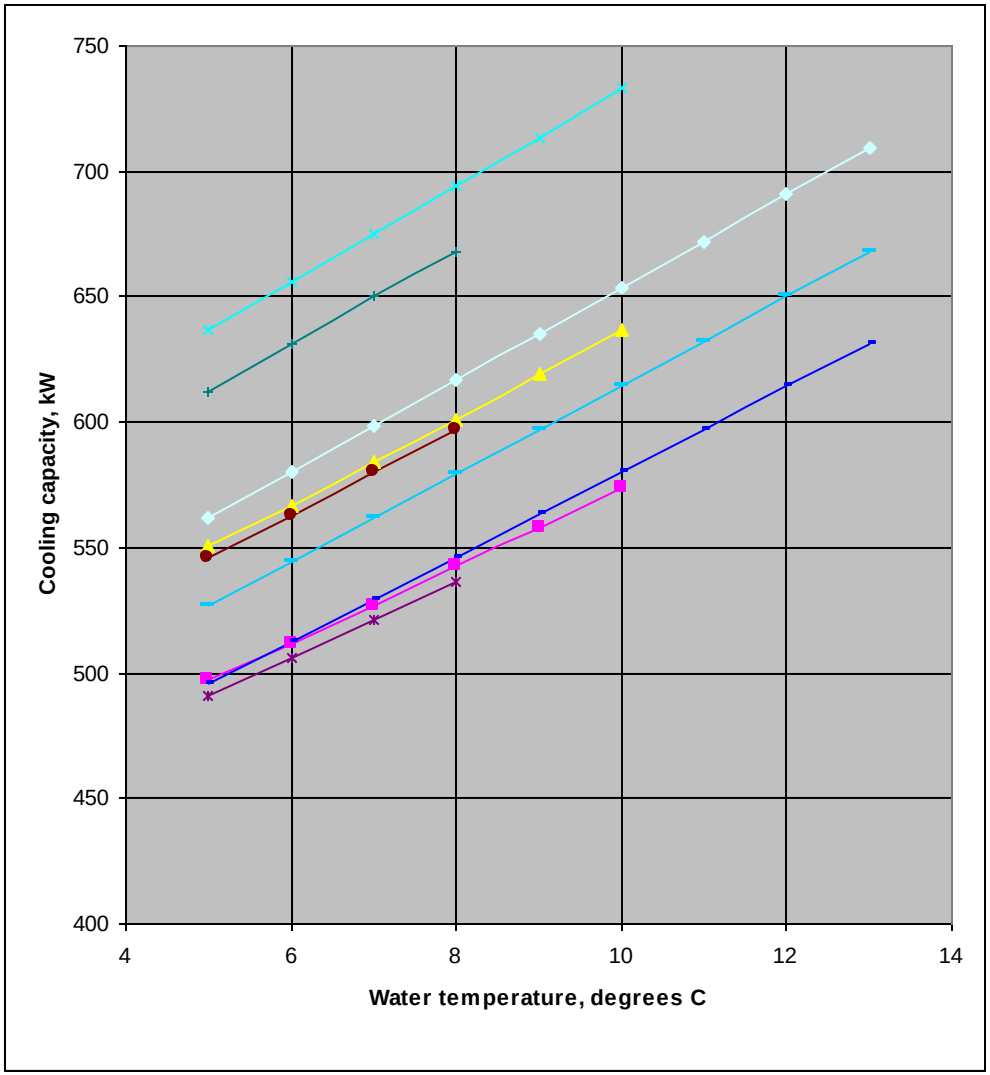


Schematic diagram of a ventilated cooled beam system with both cooling and heating functions

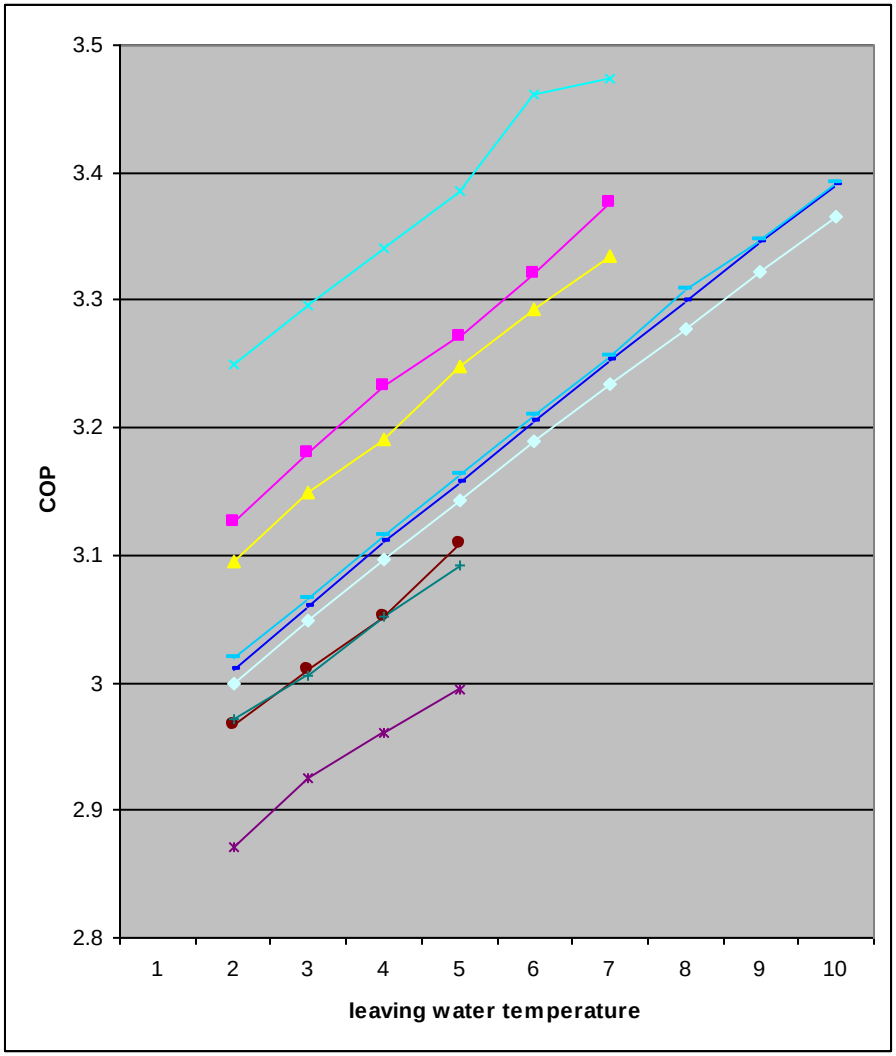
It all starts with a Chiller

Cooling capacity as a function of chiller supply water temperature at constant water temperature difference for some cooled chillers of different type and size.

By raising the water temperature from 6 degrees to 12 degrees we increase the chiller capacity by about 20%

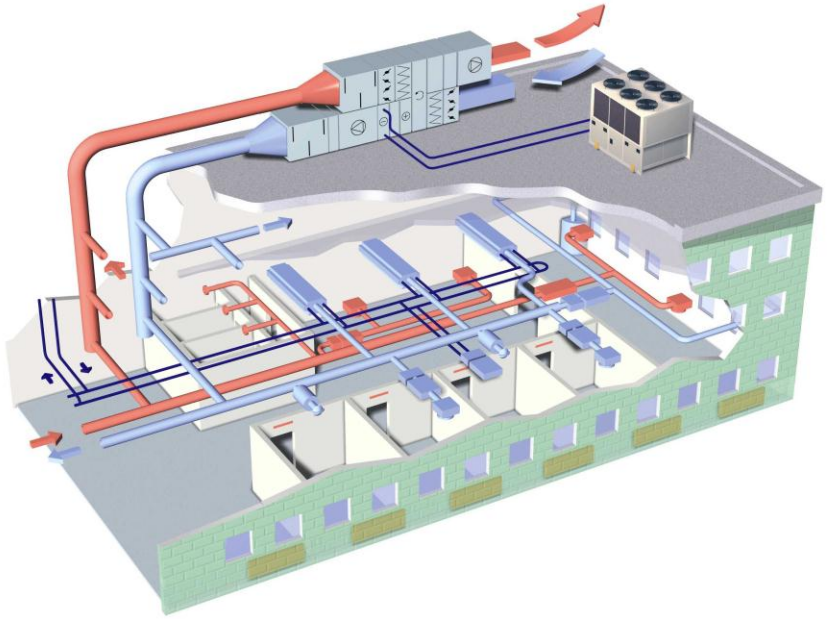


Chiller



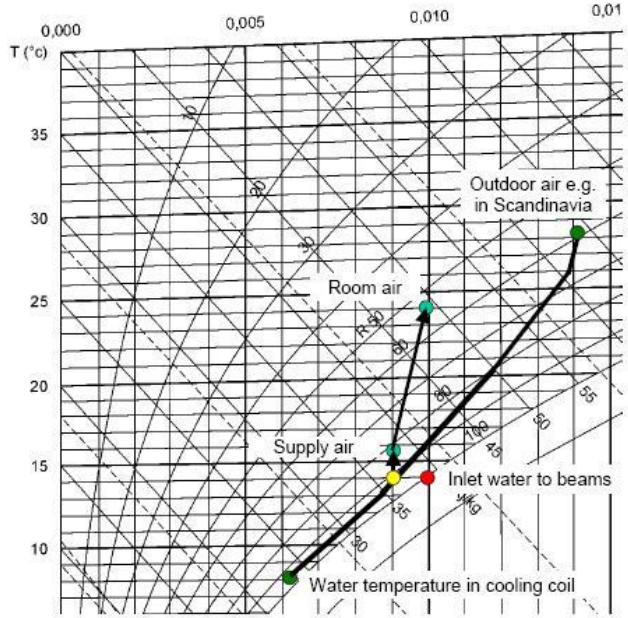
With the rise in water temperature we also get an improvement in the COP, which means reduced energy consumption.

Approx **15% less Energy is needed** for a Chilled Beam solution compared to a VAV solution.

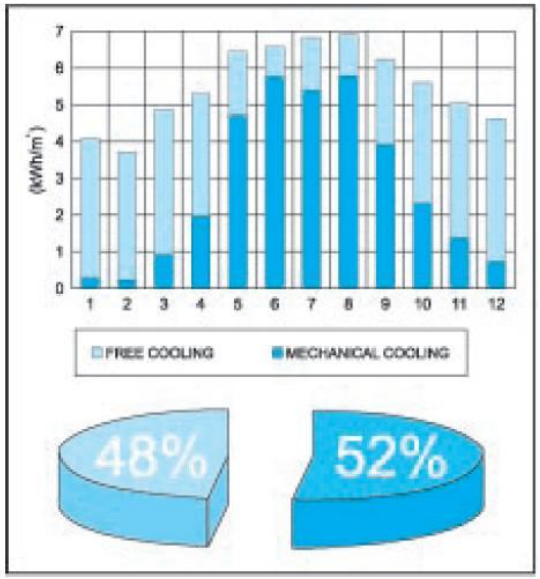


Air Handling Unit

The **air needs to be supercooled during the warmest days** of the summer when we use Chilled Beams.
The best thing to do this might be to use a twin-wheel solution.



Dehumidification process of primary air presented in psychometric chart



The yearly usage of free cooling and saving benefit of cooling energy in one test building

Air Handling Unit

When we use Chilled Beams, 60 – 75 % of the total cooling comes from water instead of air

- Choose the **right size** of the air handling unit
  - Calculate and optimize by LCC
- Choose the right **heat recovery system** for your application
  - Calculate and optimize by LCC
  - Use cheap or free heat available
  - Use free cooling and cooling recovery if possible
- Choose the **right fan** for Your application
  - Efficient fan
  - Efficient motor
- **Optimize the airflows** of the system (fresh air due to the demand)
- A **continuous optimization** and follow up of the system has a huge impact of cutting your running costs.

Water pump

This is a pump from "**Grundfos**" TPE/150/130/4 that can typically be used in a water based system. Since it is a **closed system** the energy consumption is very low, approx. 0.03 kWh per beam.

Building Management System

A good Building Management System that controls the system, is very important!

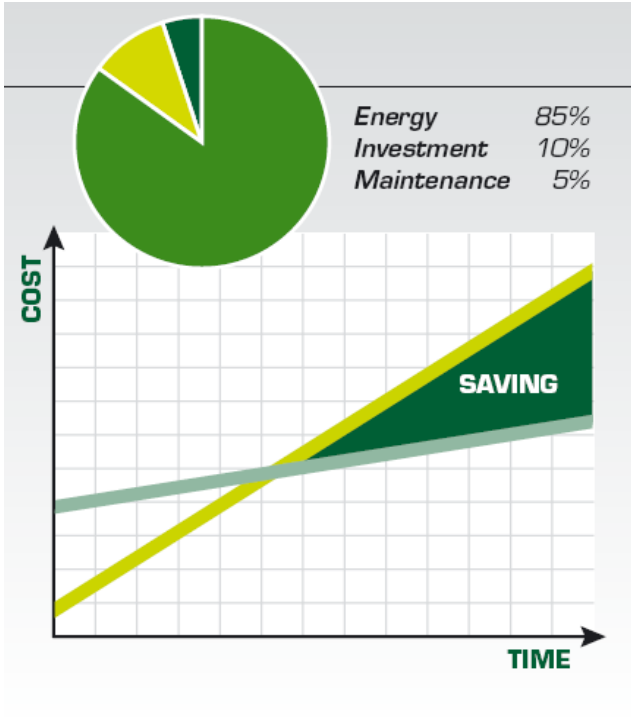


LCC sums it all up

Within the industry we use an analysis approach called “Life Cycle Cost“ when designing ventilation systems.

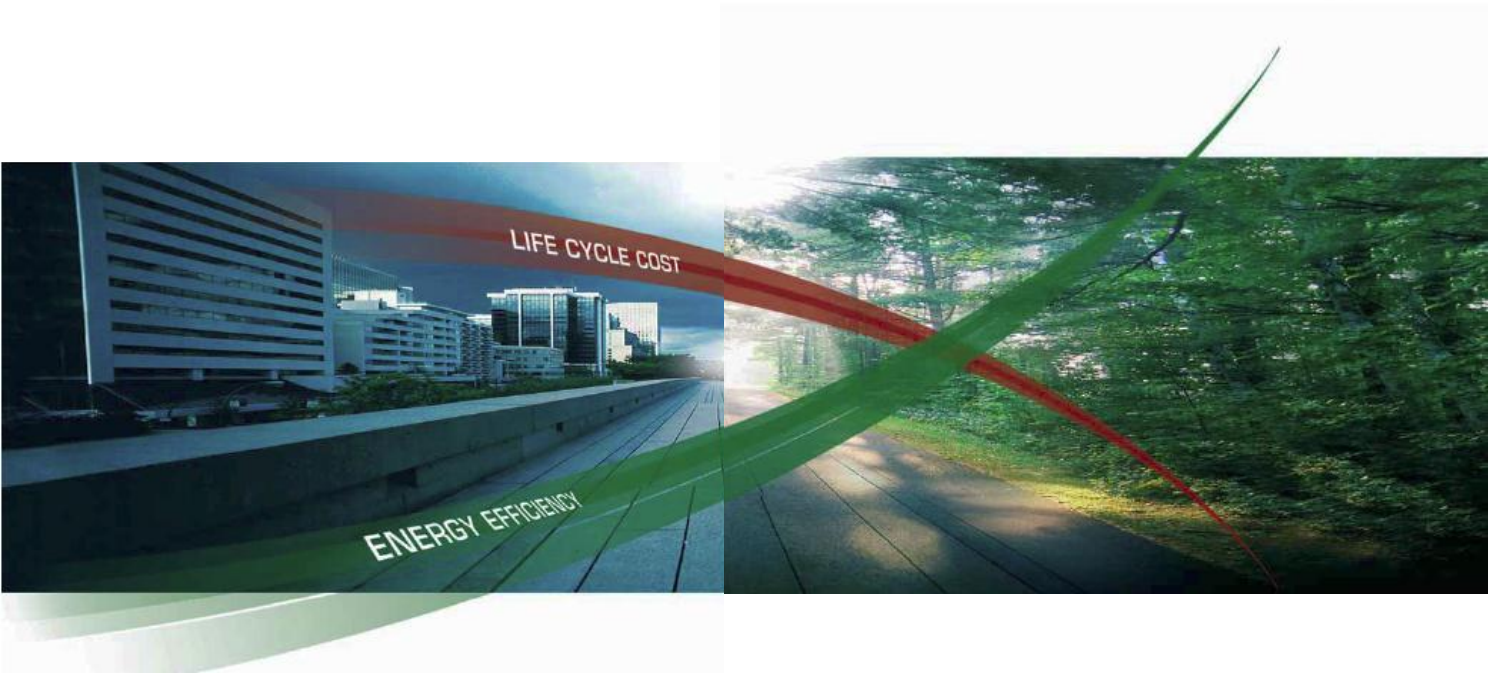
It balances the cost of better components and smarter system control with savings in maintenance and energy costs over the systems life time.

Not surprisingly a smarter system comes out on top. About 85% of the life time cost is typically energy costs, 10% initial investment and 5% maintenance.

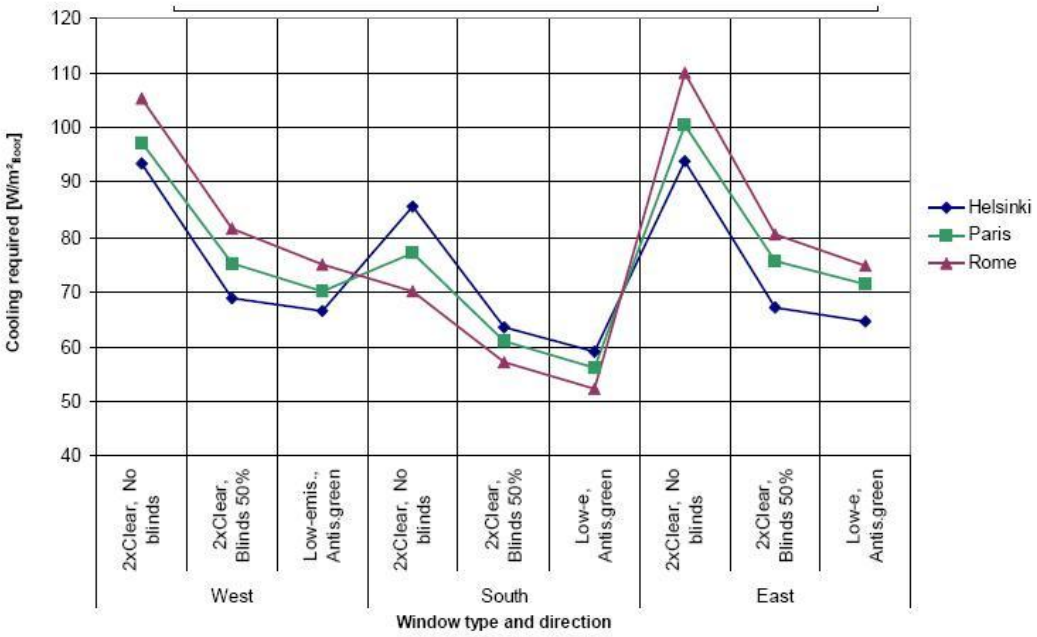


Conclusion: Life Cycle Cost

The **initial cost** for a Chilled Beam solution is typically more expensive then a VAV or FanCoil solution. But the **running cost** (energy, maintenance, and so on) is **much lower** for a **Chilled Beam System**



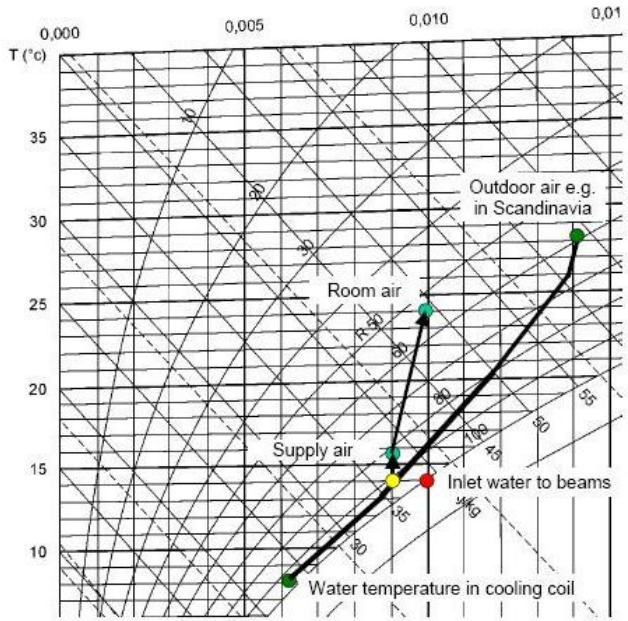
Obstacle



A study shows the cooling load using different window types and directions in three different geographical areas in Europe. According to this study the difference in the cooling load in different areas is 10-18 % depending on the case and the maximum cooling load is 110 $W/m^{2.}$

- Too high cooling loads
- The Contractors of the building is not the same as the owner and he does not care about a lower **Life Cycle Cost**
- All good architects wants to create something new

Condensation?



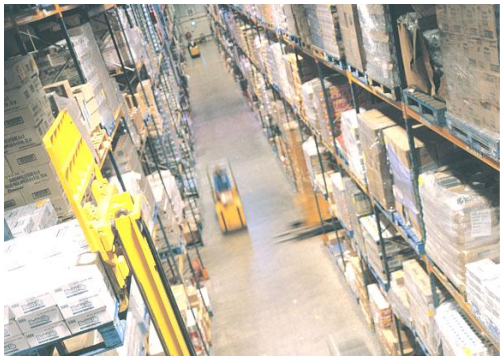
Dehumidification process of primary air presented in psychometric chart

- **Supercooling** of air might be needed
- **Over pressure** in some buildings
- **Only air during start-up** time on mornings.
- Possibility to **increase the cold water temperature** via the BMS
- **Sensors at Windows**, if open => NO water
- **Sensors** at the **worst places** in the building, or at the **Chilled Beam**.
- **Dimension with Common Sense**, NO Chilled Beams at IN/OUT area

Why Chilled Beams?

All buildings are special





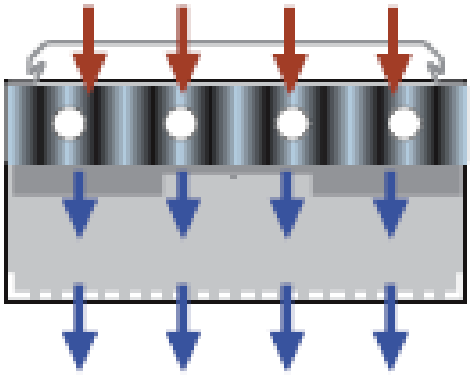


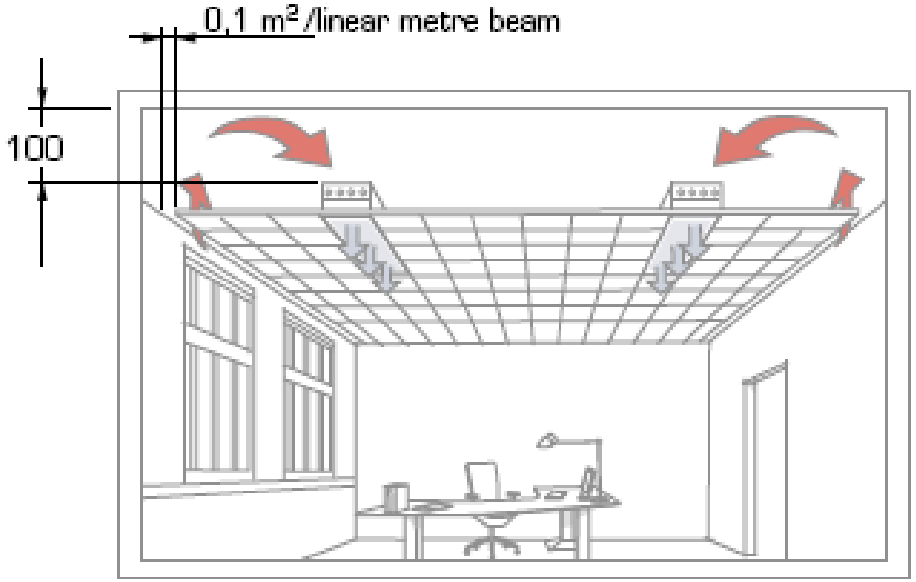


Convection Beams

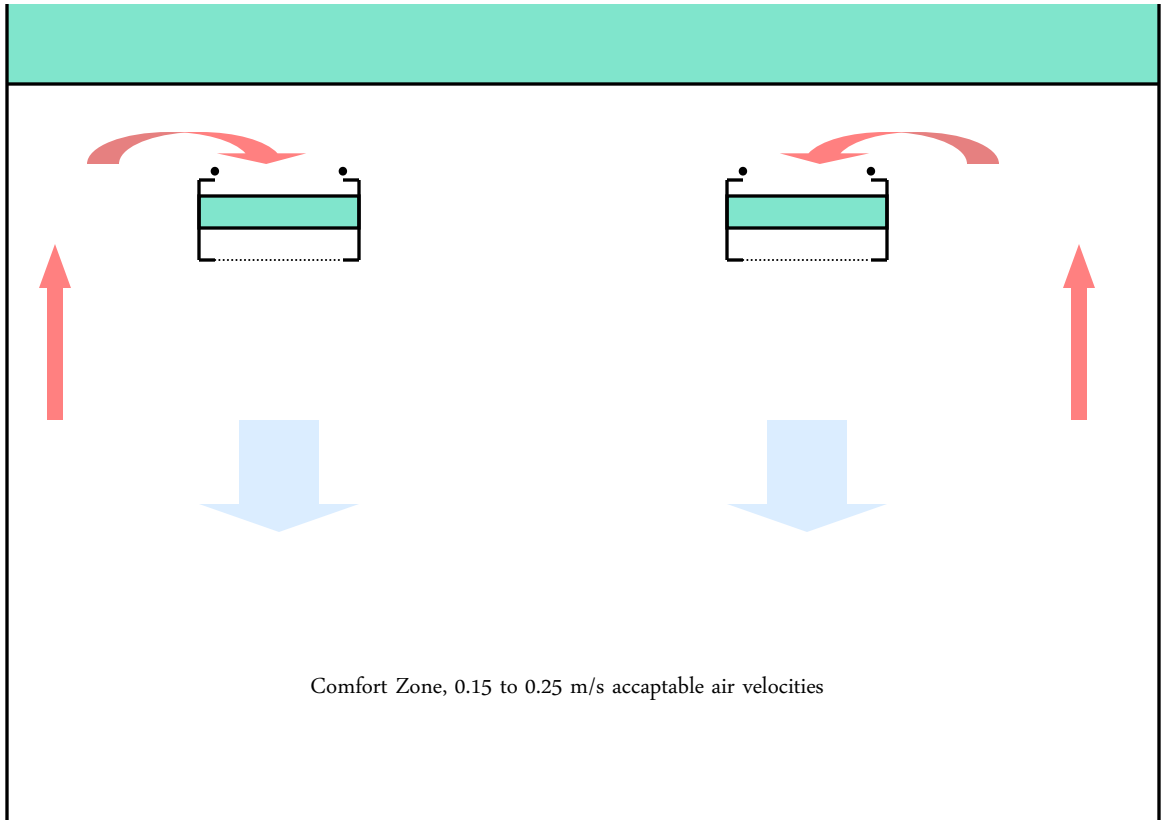
A passive chilled beam (convection beam) is based on the circulation of air due to natural convection through the cooling coil.

The air flow through the chilled beam is determined by the temperature difference (actually density difference) in- and outside the beam, together with beam height.

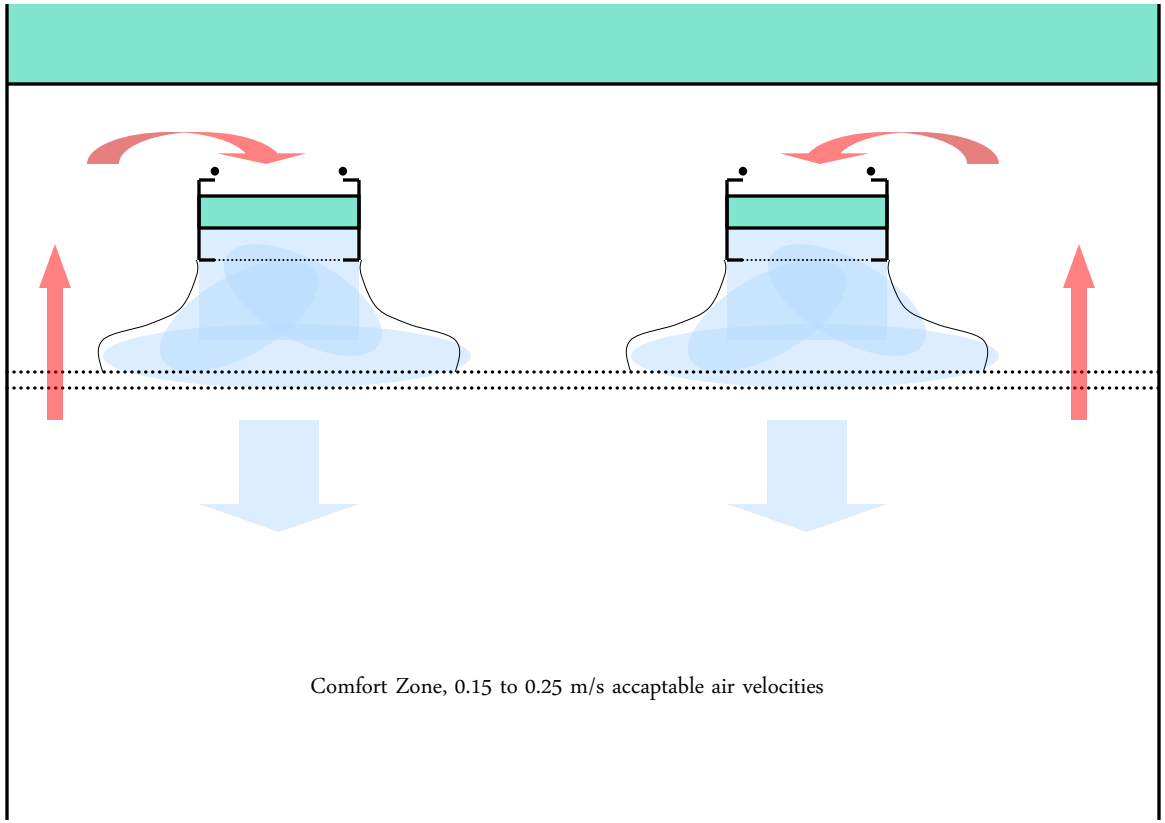




Convection Beams



Convection Beams



Comfort Zone, 0.15 to 0.25 m/s accaptable air velocities

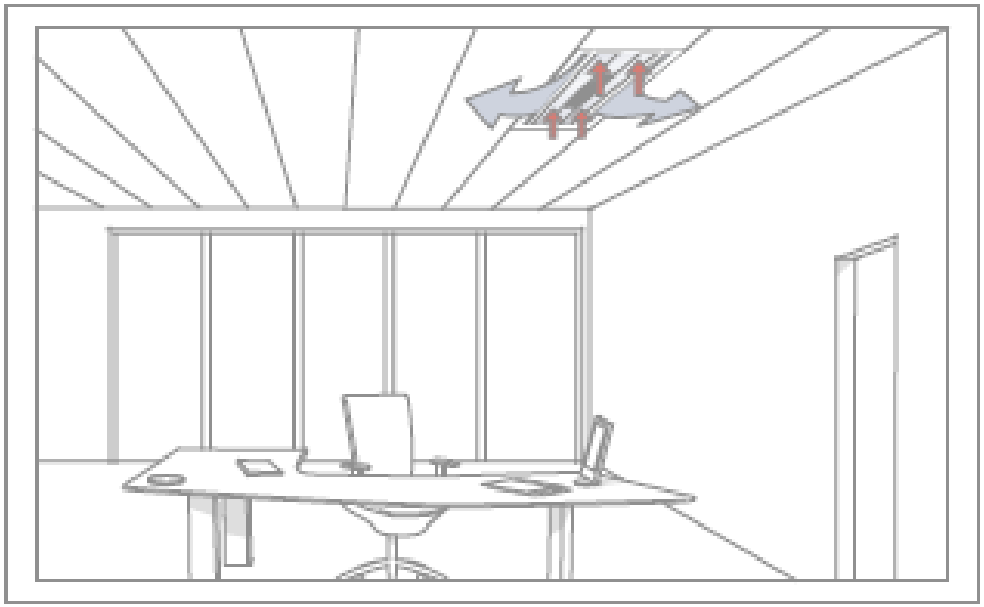
Convection Beams

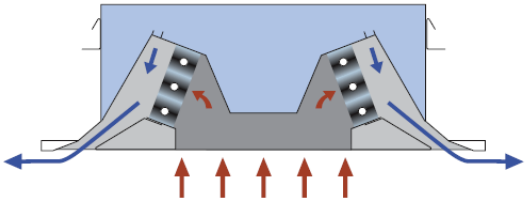
Induction Beams

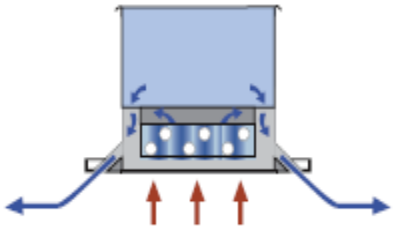
When covered supply air beams are used, the circulation air is not allowed to come into contact with the upper side of the suspended ceiling.

The air is taken in from the bottom of the device to ensure easy check-up and service.

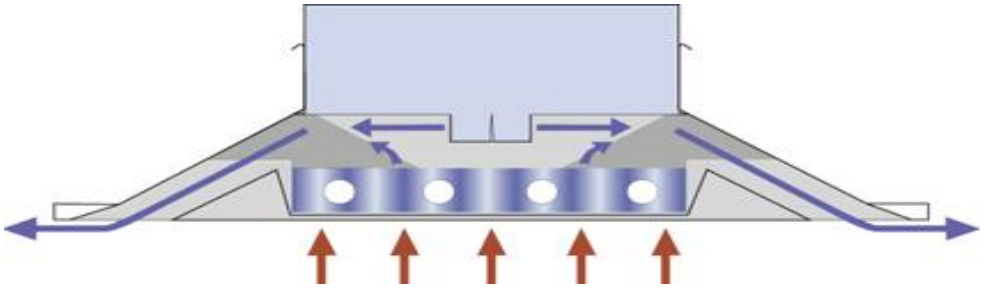
A great advantage of this supply air beam is that the air is directed straight up towards the ceiling, in which way best possible air circulation and smallest possible disturbance of air flow into the device can be achieved.

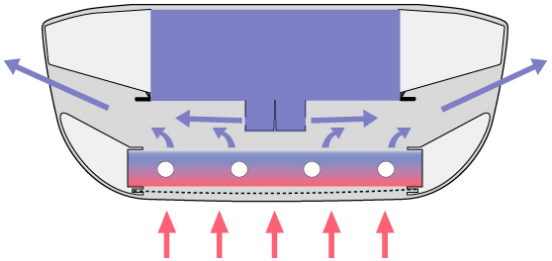






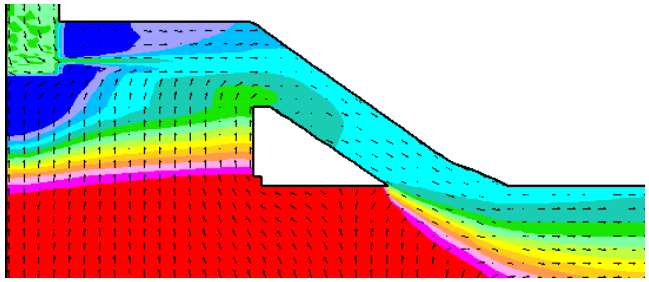
The function of active induction beam

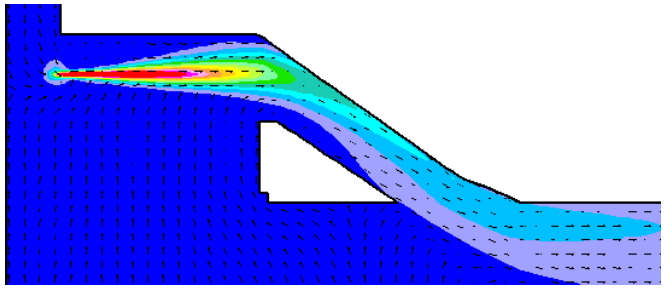




Temperature profile

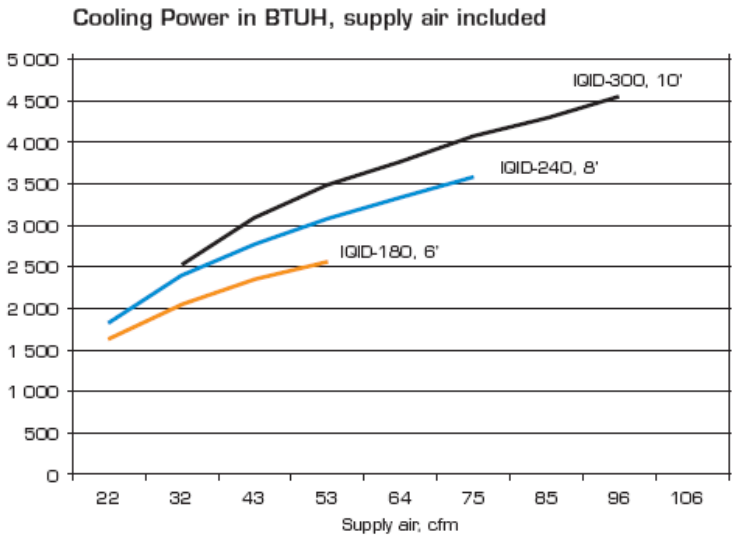
Velocity profile





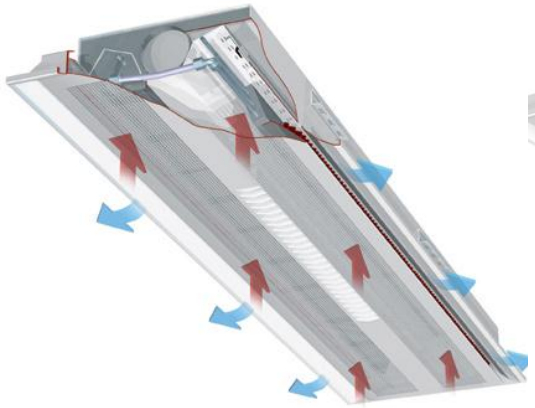
Induction Beam IQIB

- Induction beam
- Available also with 152mm height
- Comfort Control and FPC
- 2 and 4-pipe coils



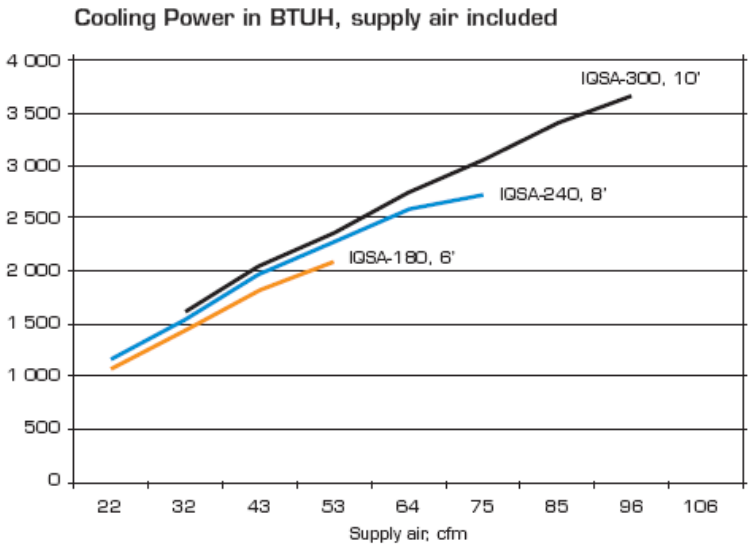
Induction Beam IQID

- Connection of both air and water inside the beam
- KSO exhaust valve inside the beam (not standard)



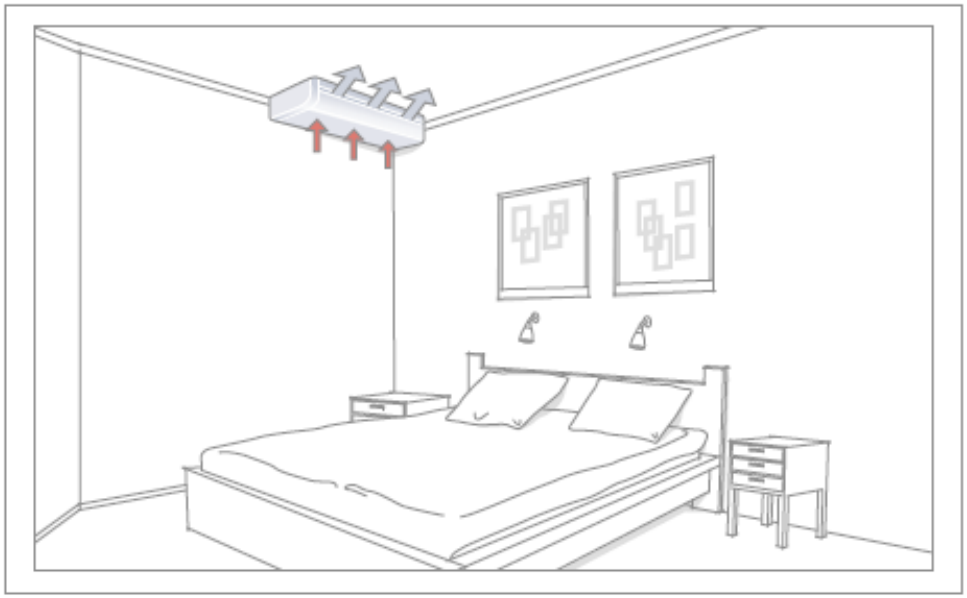
Induction Beam IQSA

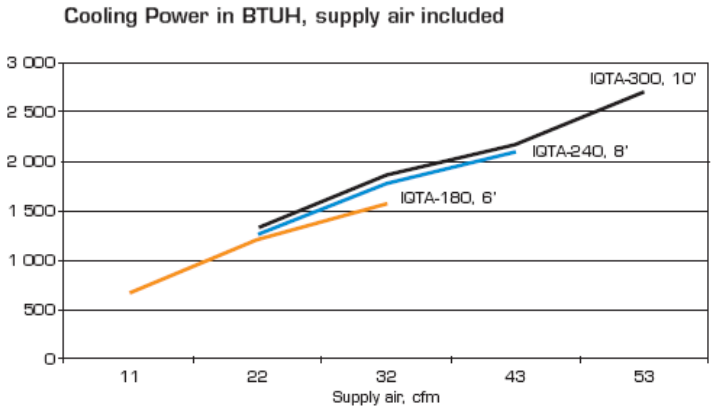
- Different connection possibilities



Induction Corner Beam IQTA

- Cornerbeam
- Air distribution with Coanda effect

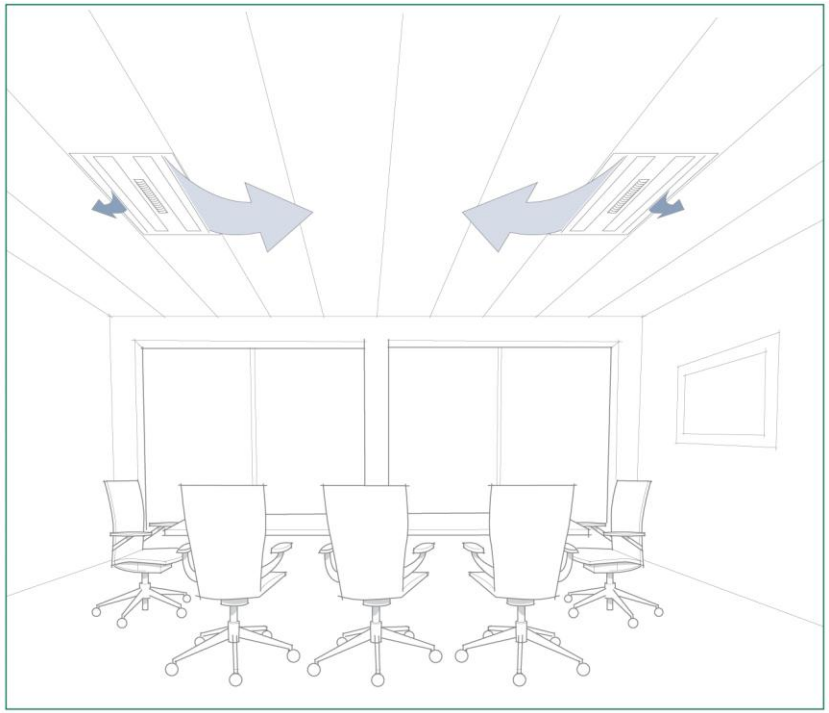


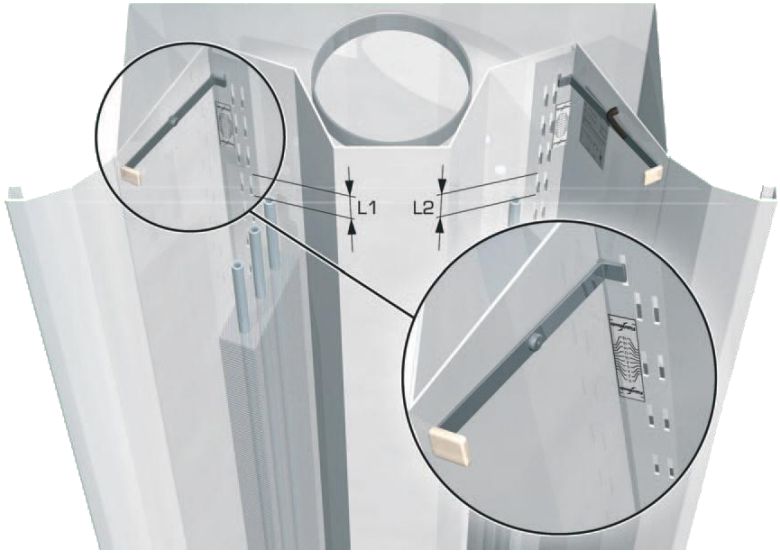


Comfort Control

Available for:

- IQID
- IQFC
- IQSA
- IQTA

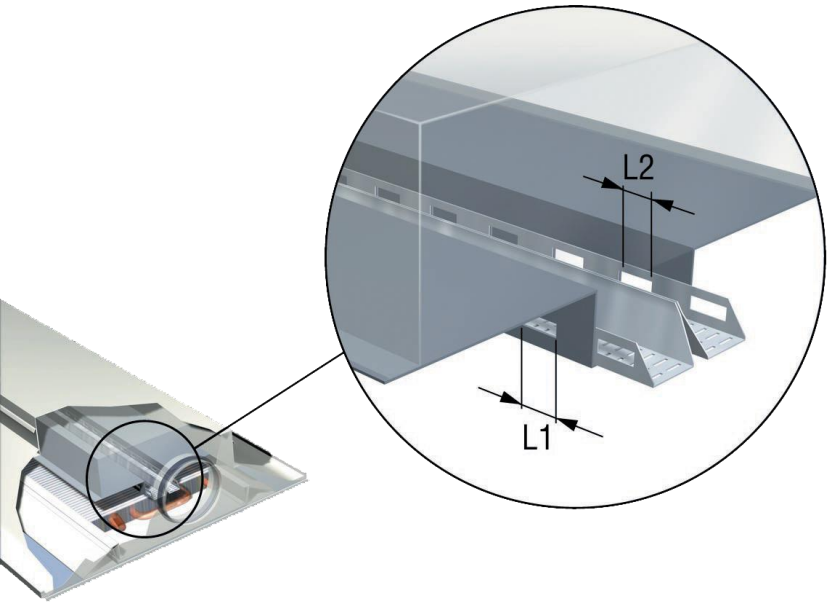


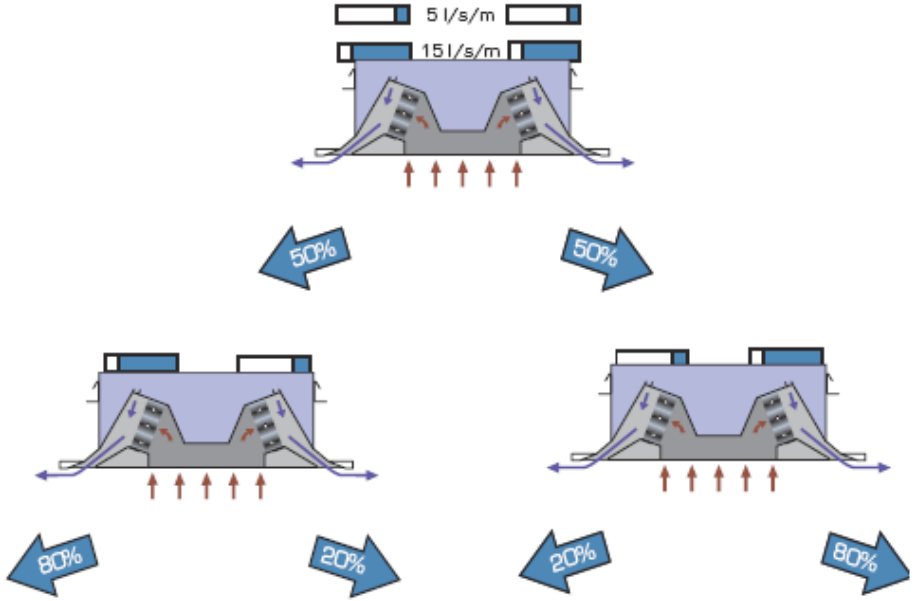


Safeguard against variations in site conditions

Comfort Control

- One/two way distribution
- Easy to change / adopt

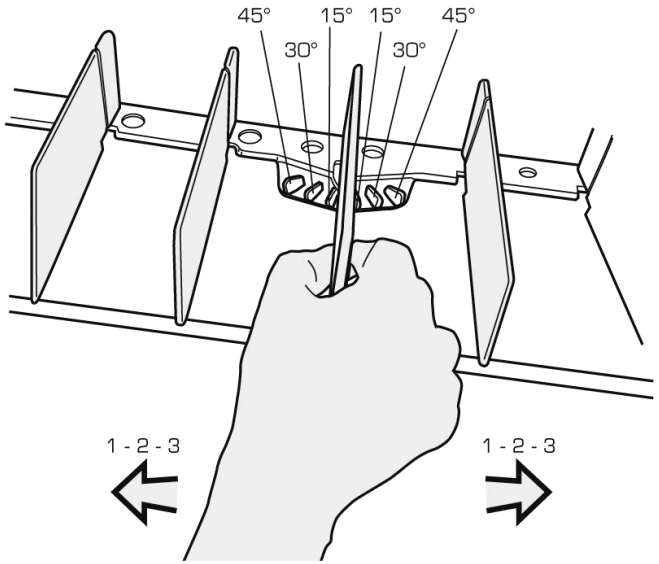




Flow Pattern Control (FPC)

Available for:

- IQID
- IQFC
- IQTA

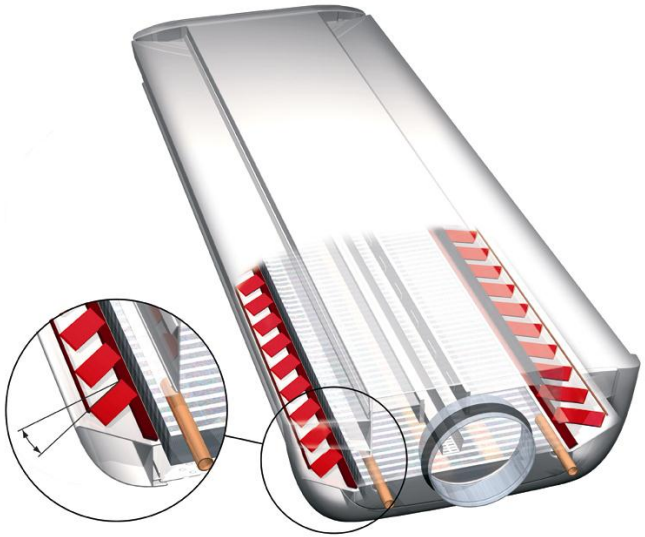


Safeguard against variations in site conditions

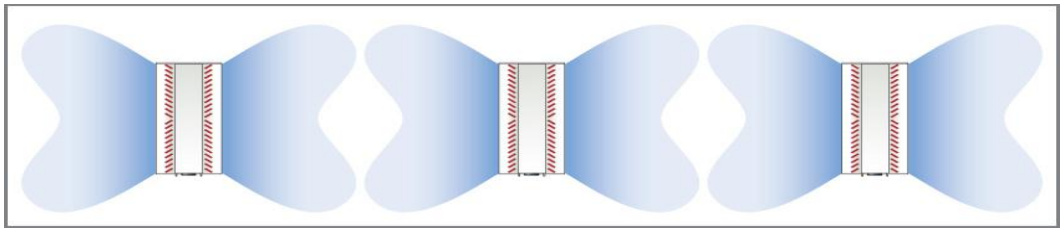
Possible Functions of Induction Chilled Beams

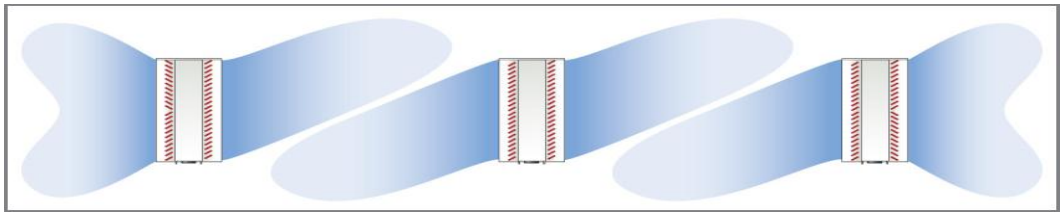
Flow Pattern Control (FPC)

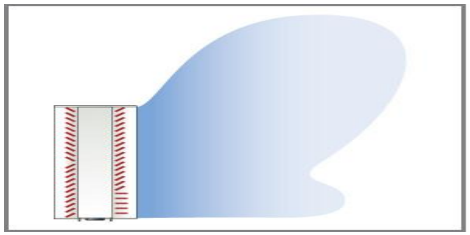
- Vanes adjustable in 4 steps of 0 - 15 – 30 – 45°
- Unique combination of Comfort Control and FPC

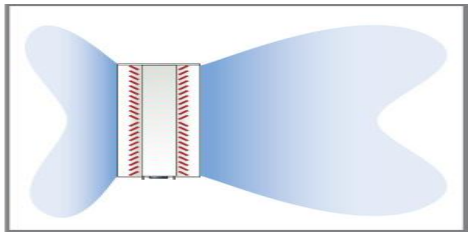


0 -15-30-45°





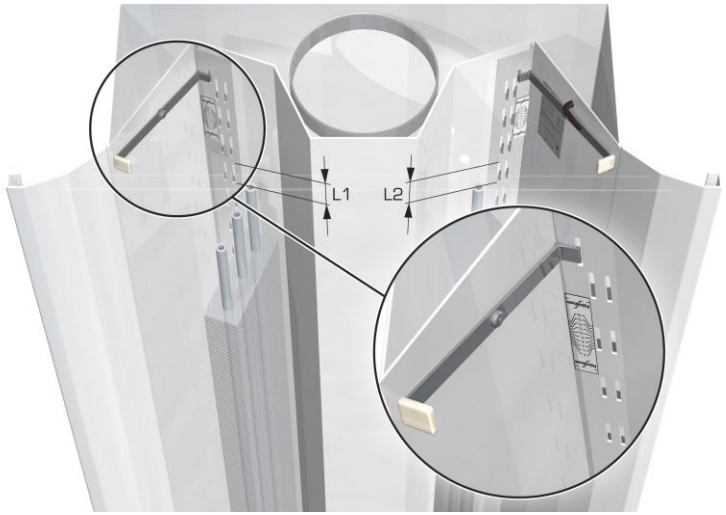




High Air Flow

Available for:

- IQID
- IQFC
- IQTA
- IQSA

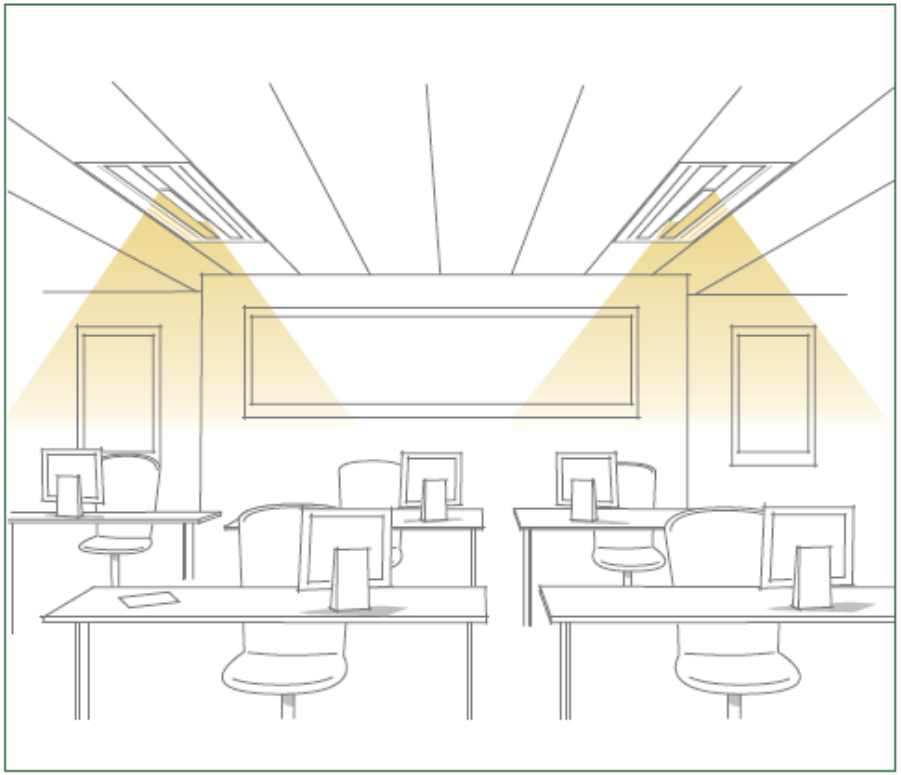


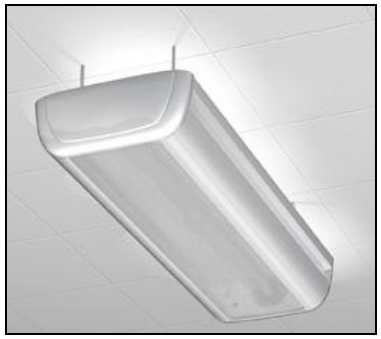
Possible Functions of Induction Chilled Beams

Lightning

Available for:

- IQID
- IQFC
- QPDA
- Customized solutions, e.g. for IQSA



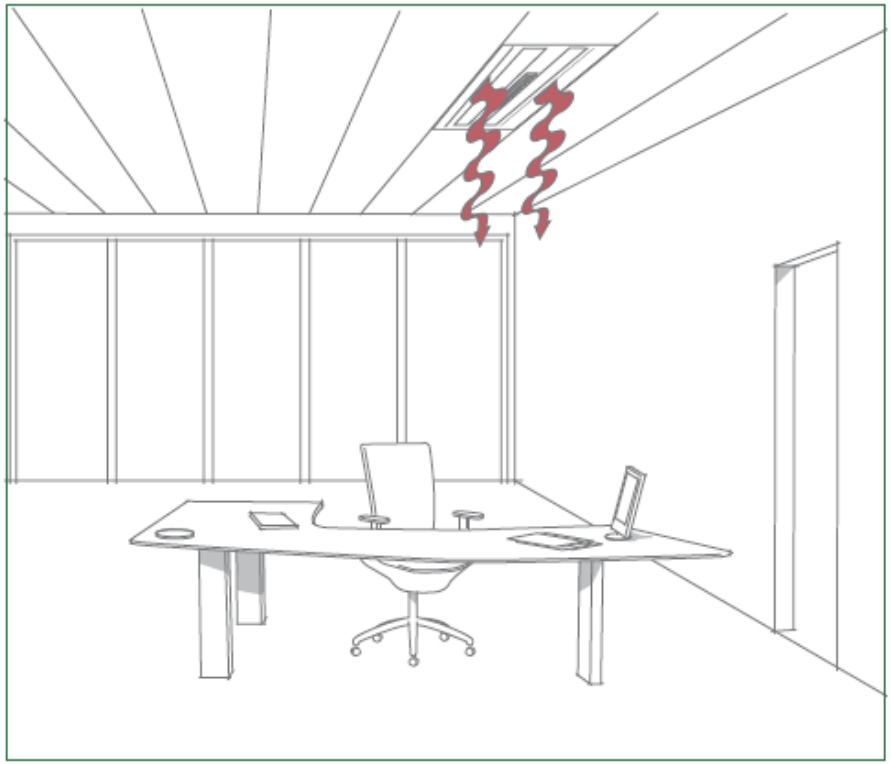


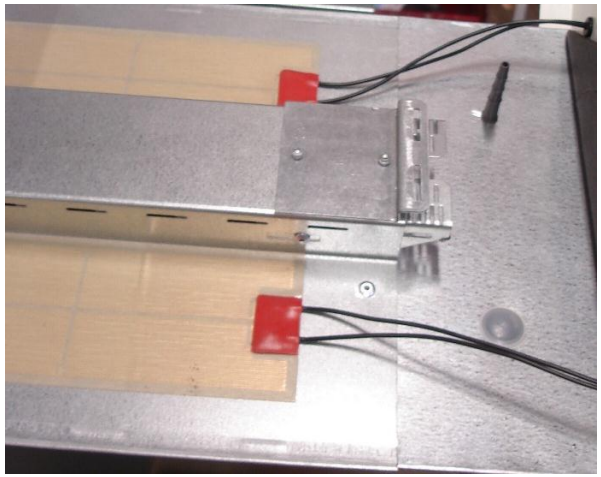
Possible Functions of Induction Chilled Beams

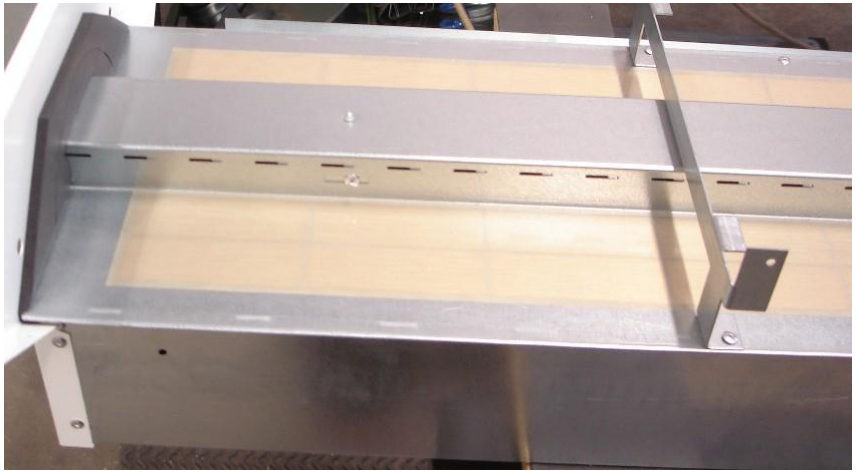
Heating

Available for:

- IQID
- IQFC
- IQSA
- IQTA





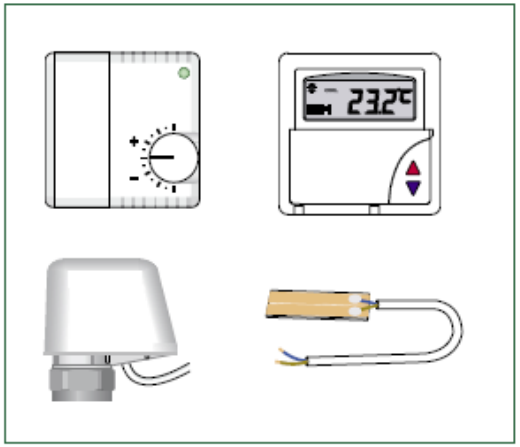


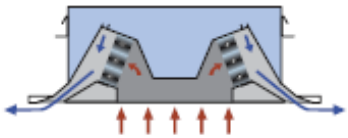
Possible Functions of Induction Chilled Beams

Controls

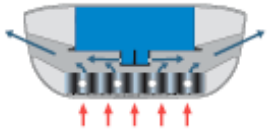
Available for:

- IQID
- IQFC
- IQTA
- IQSA
- QP(B,S,D)A

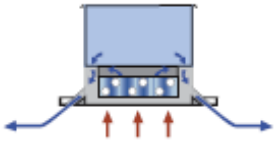




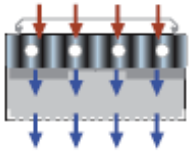
IQID



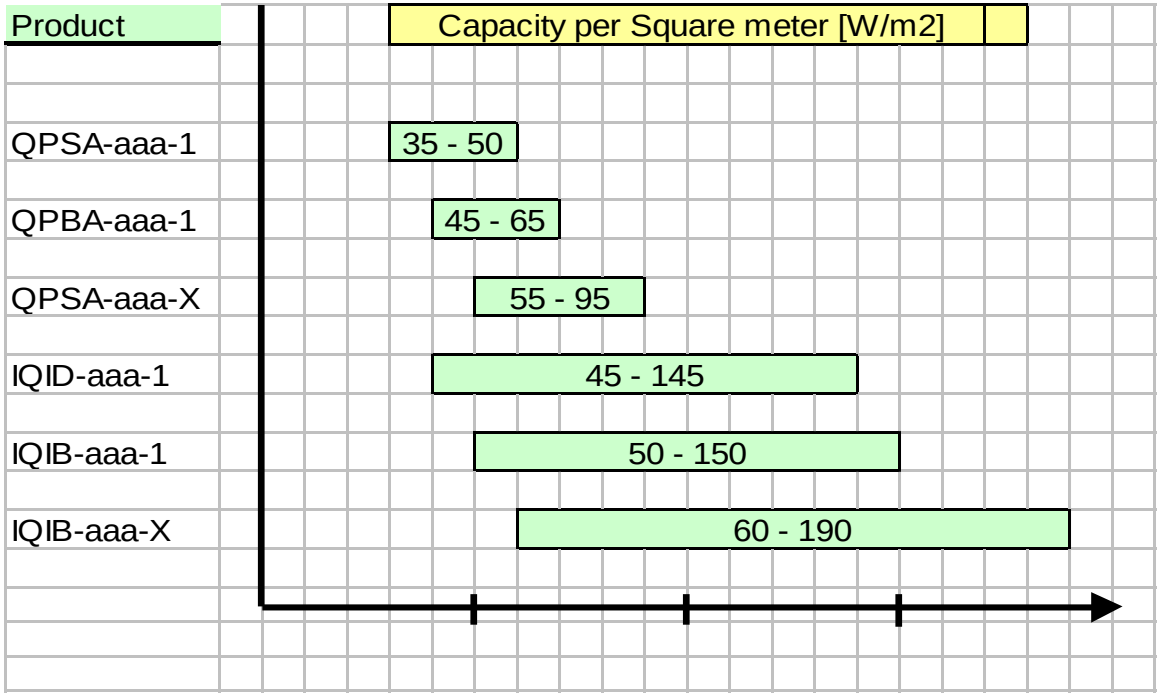
IQFC



IQSA

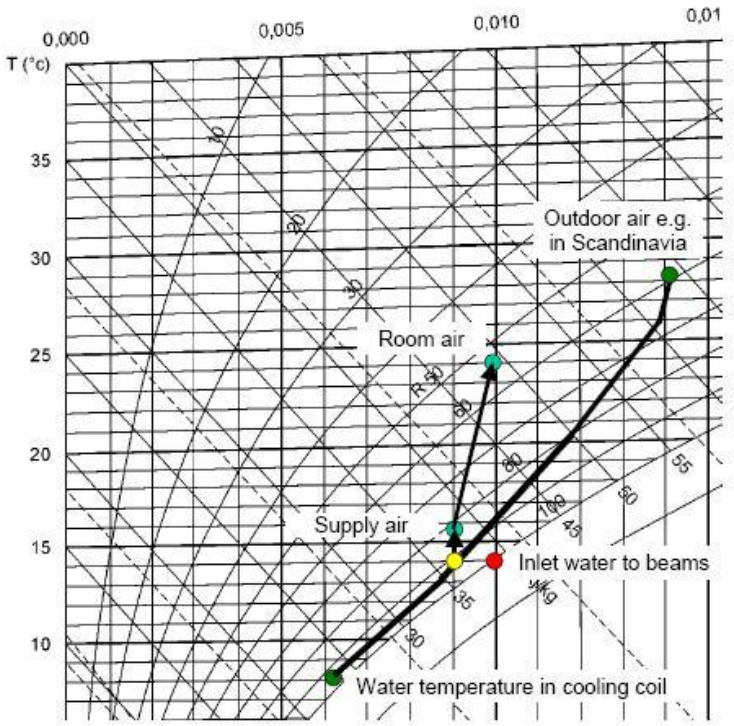


QP(S,B,D)A



Condensation

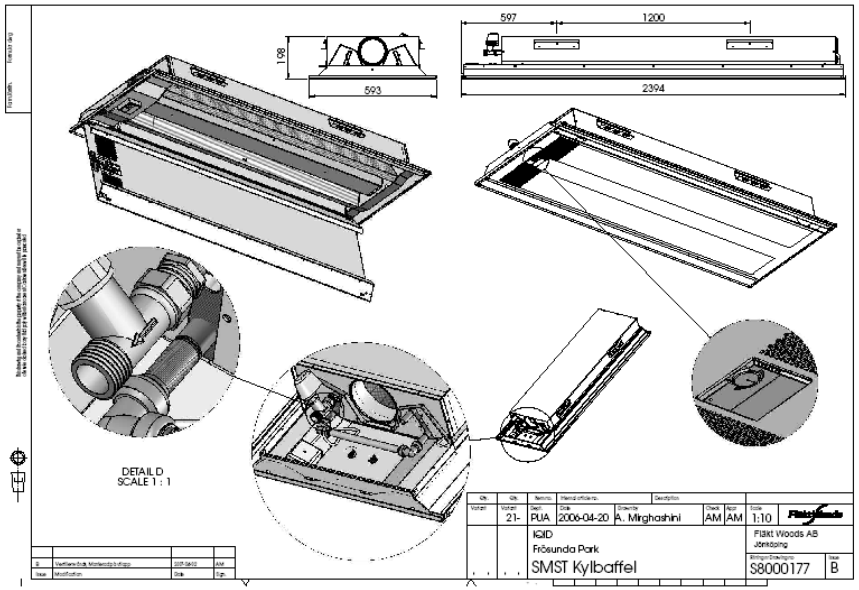
- **Supercooling** of air might be needed!
- **Over pressure** in some buildings
- **Only air during start-up** time on mornings.
- Possibility to **increase the cold water temperature** via the BMS
- **Sensors at Windows**, if open => NO water
- **Sensors** at the **worst places** in the building, or at the **Chilled Beam**.
- **Dimension with Common Sense**, NO Chilled Beams at IN/OUT area

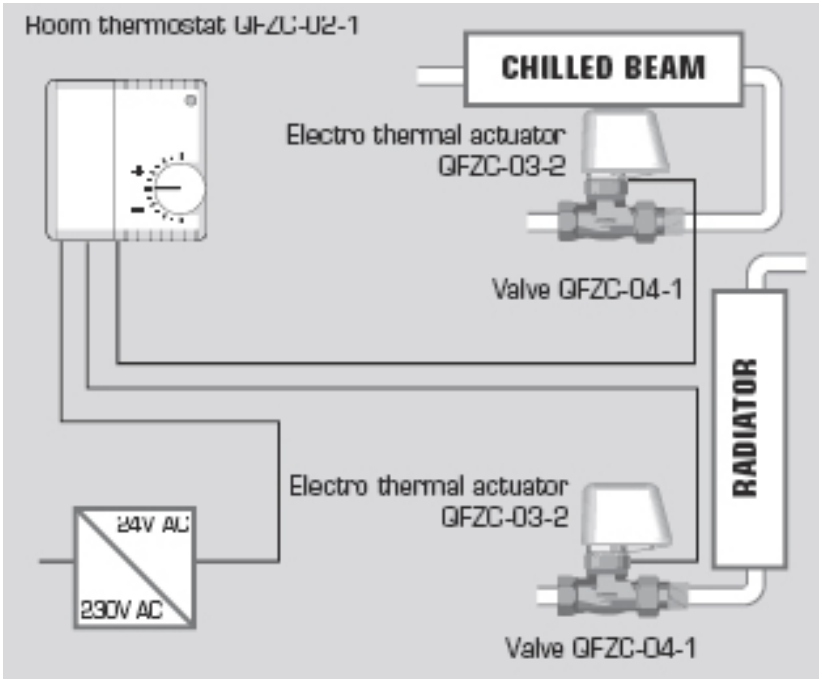


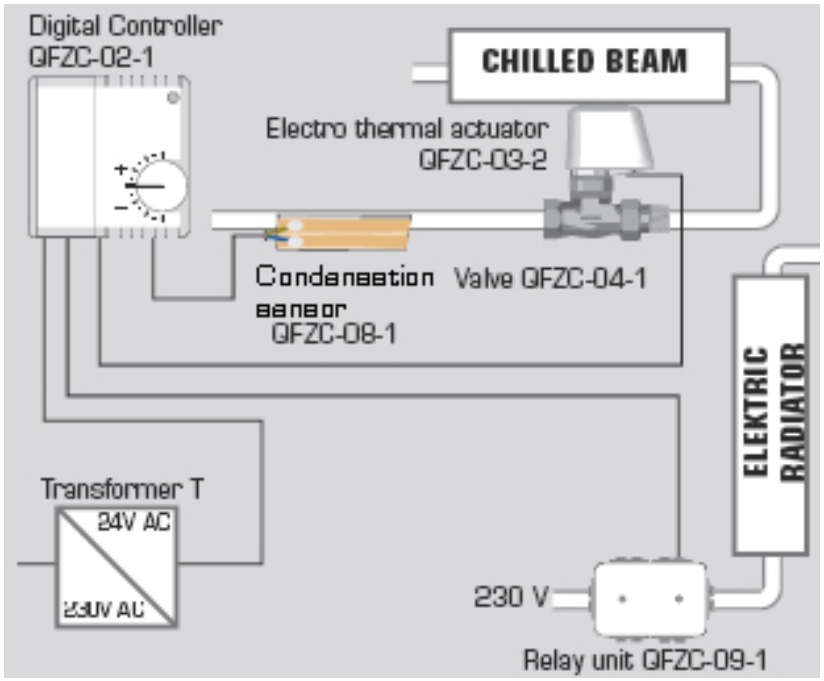
Dehumidification process of primary air presented in psychometric chart

Condensation

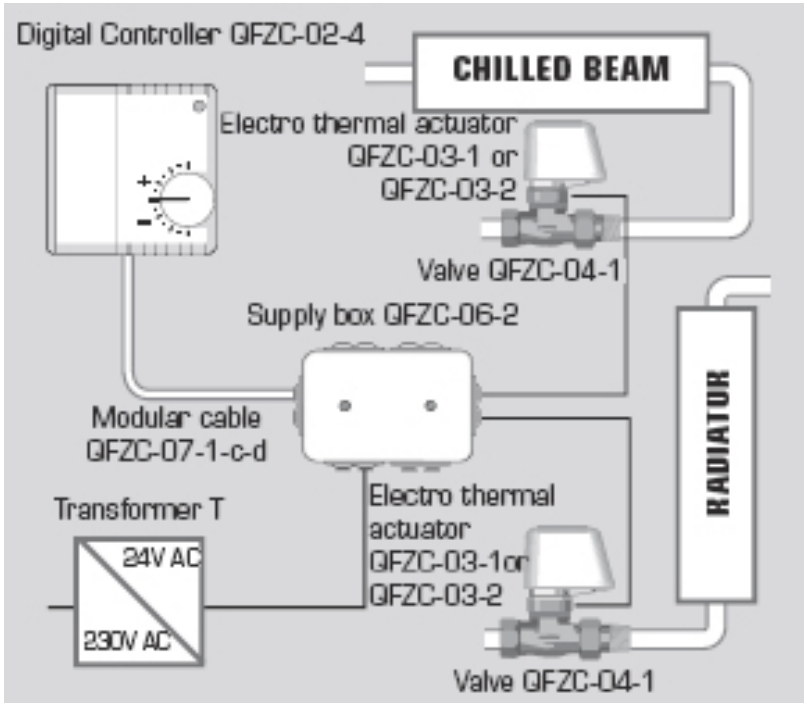
Cooling with condensation sensor

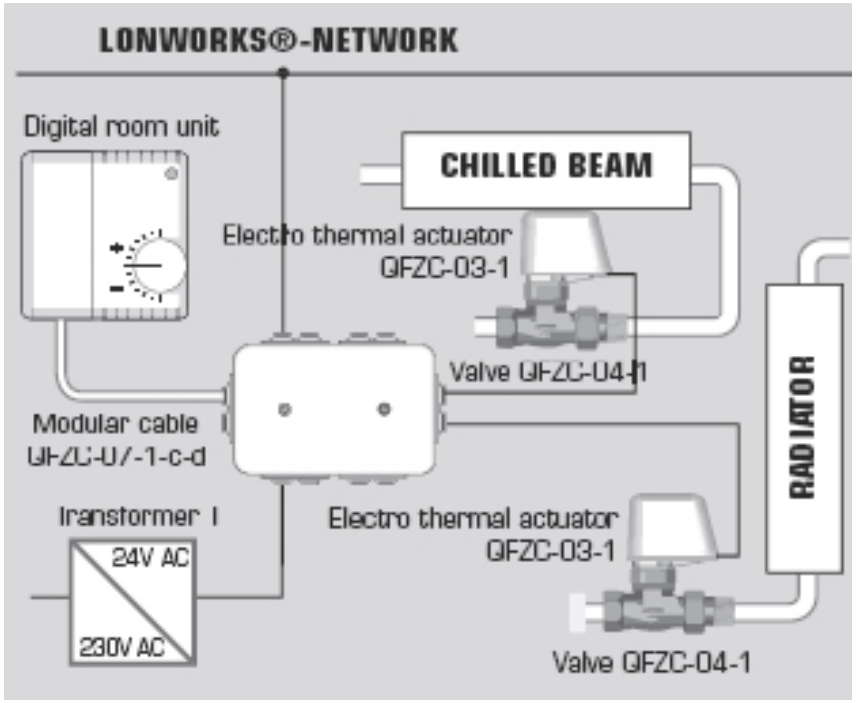



Room thermostat QFZC-02-1
CHILLED BEAM
Electro thermal actuator
QFZC-03-2
Valve QFZC-04-1
RADIATOR
Electro thermal actuator
QFZC-03-2
24V AC
230V AC
Valve QFZC-04-1

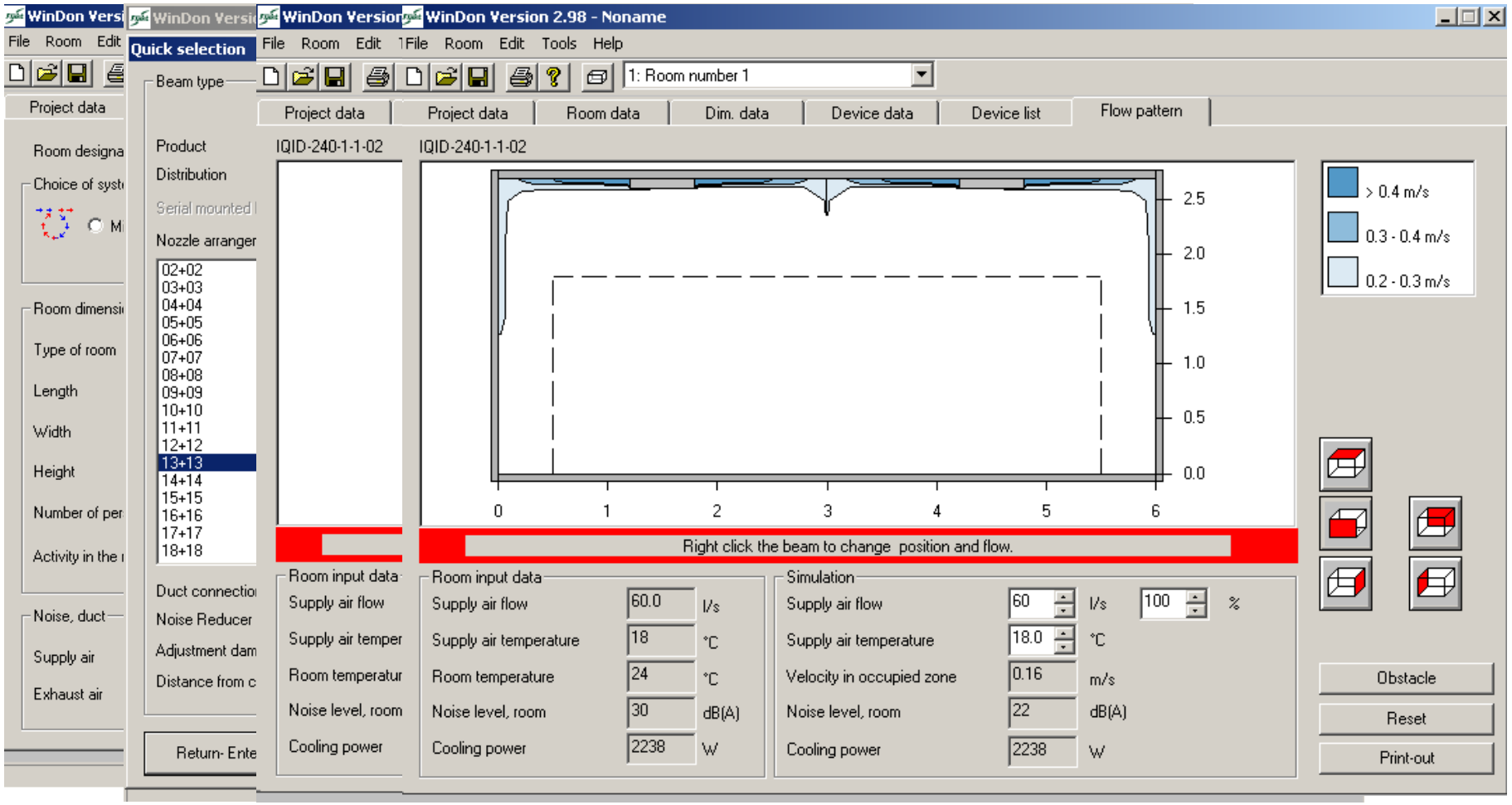

Digital Controller
QFZC-02-1
CHILLED BEAM
Electro thermal actuator
QFZC-03-2
Condensation sensor
QFZC-08-1
Valve QFZC-04-1
ELEKTRIC RADIATOR
Transformer T
24V AC
230V AC
230 V
Relay unit QFZC-09-1

Solution for big zones and LON/Modbus



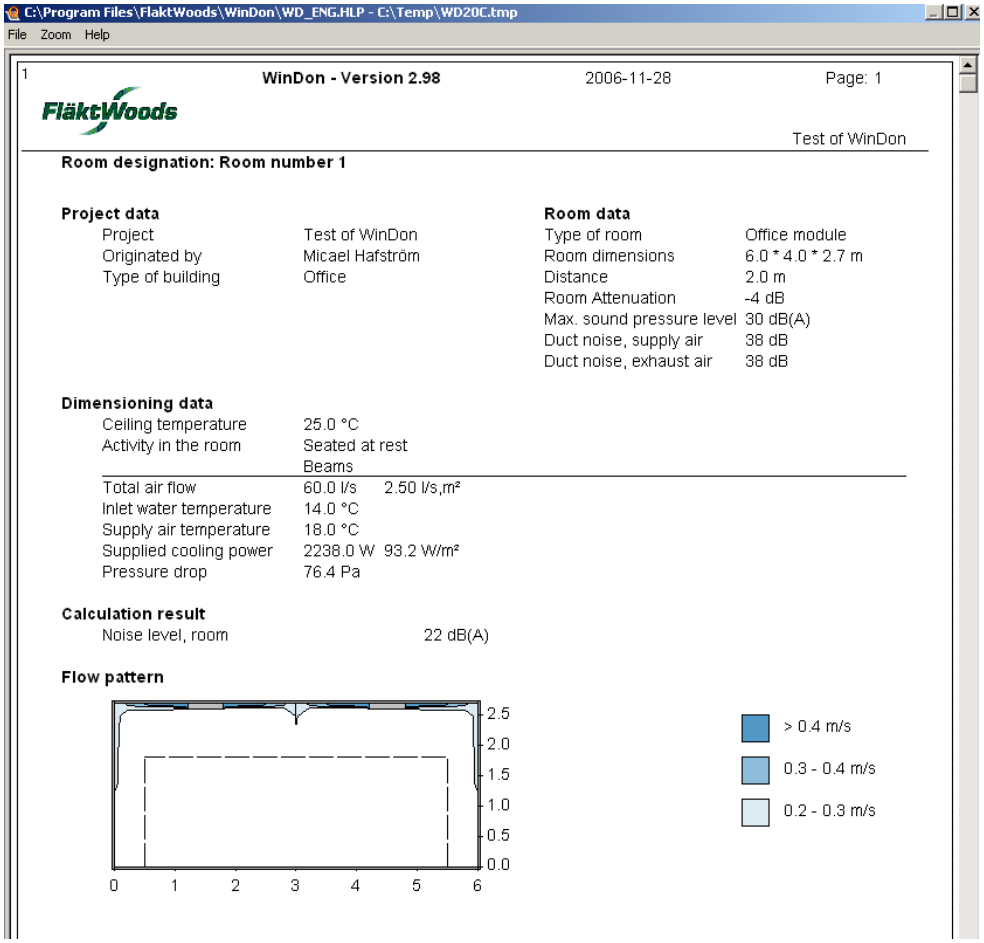


Dimensioning – Air movement



Printout

- Comfort boundaries
- Noise levels
- Air movement
- Ensure Quality



Test facilities

Sound test laboratories

- Toijala FI
- Jönköping SE
- Colchester UK

Comfort laboratory

- Jönköping SE

Fire test laboratories

- Toijala FI
- Colchester UK

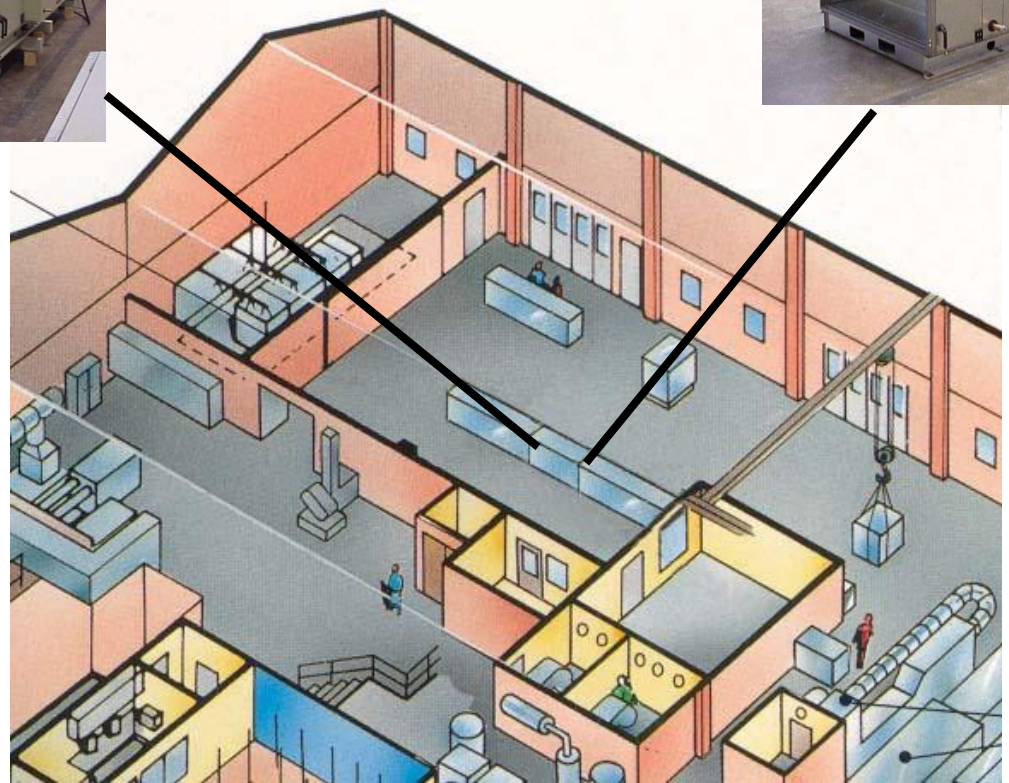
Fan test laboratories

- Colchester UK
- Jönköping SE
- Växjö SE

Air treatment laboratory

- Jönköping SE

- Capacity: air flow and pressure
- Power consumption
- Leakage
- Sound power



Large office room - cooling coil-CAV

- Air flow 20 l/s
- Cooling capacity 1150 W

Office room - VAV

- Air flow 65 l/s
- Cooling capacity 680 W

Conference room - VAV

- Air flow 80 l/s
- Cooling capacity 1200 W

Office room - cooling coil - CAV

- Air flow 15 l/s
- Cooling capacity 700 W

EC air handling unit with controls

- Size 03
- Air flow 0,7 m³/s

EUROVENT certification

The air handling units EU, EC and STING are certified by EUROVENT

- EU - certificate no
  AHU-99-03-008
- EC - certificate no
  AHU-99-03-007
- STING – certificate no
  AHU-04.03.026

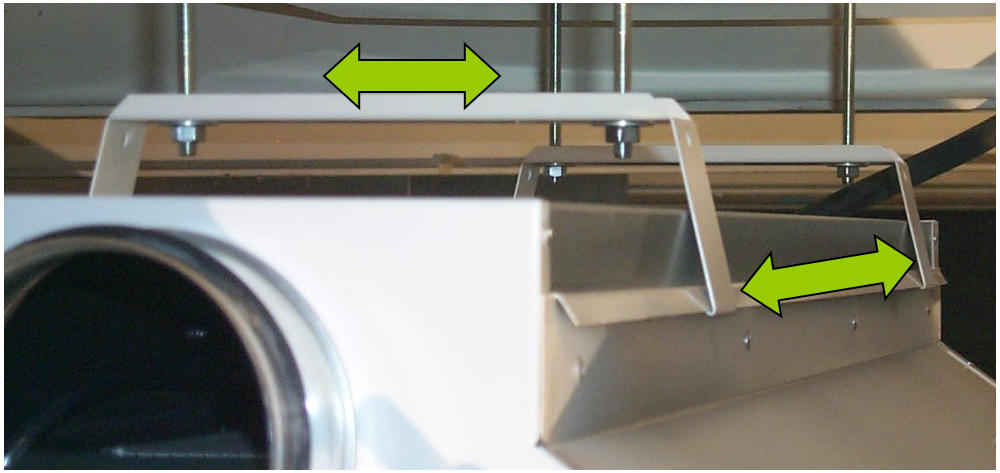
The Eurovent certification guarantees that product data in PC programs and documentation are correct.

Chilled Beams will be Eurovent certified during 2007

Accessories for installation

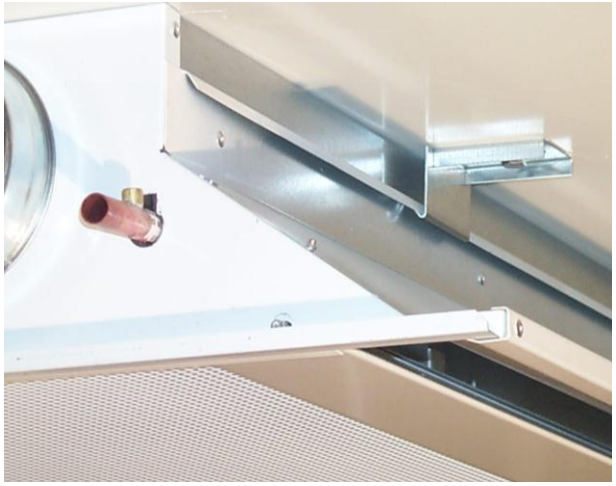
Attachment

QFAZ-18



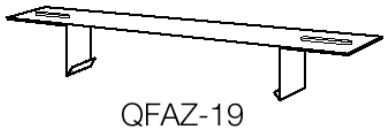
Suspensionbracket

IQAZ-02

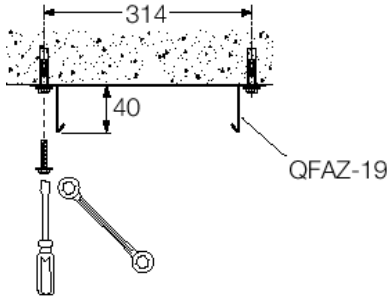


Accessories for installation

- Attachment QFAZ-19 (QFAZ-18)

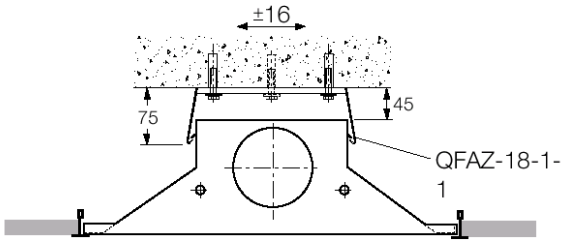


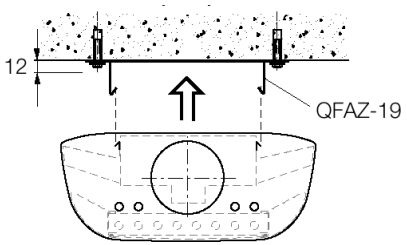
1. Fasten attachment

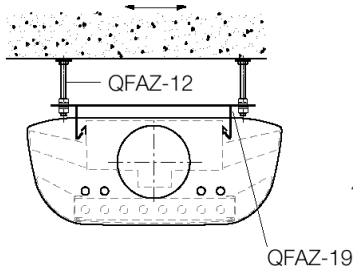


2. Press up the beam into

the attachment





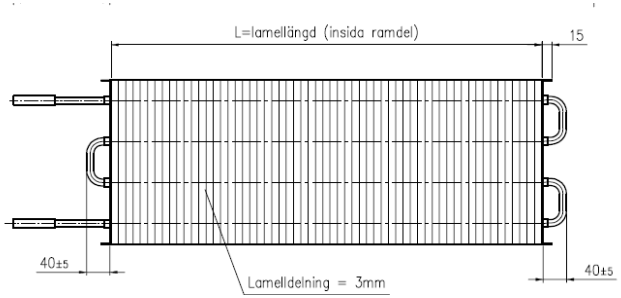


That's it!

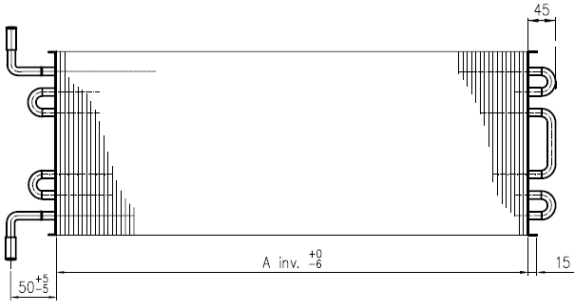
The coil shall be accessible for cleaning. This is particularly applicable to the upper side of the coil. Any false ceiling sheets should be taken down, and the coil vacuum-cleaned. Experience shows that the cleaning interval may be as much as 5-10 years. The base plate and duct of the covered beam are easily taken down. The coil is then accessible for cleaning.

The supply air duct in the beams is simple to dismantle and clean. This is required at intervals of approximately 10 years using a good-quality fine filter in the supply air unit.

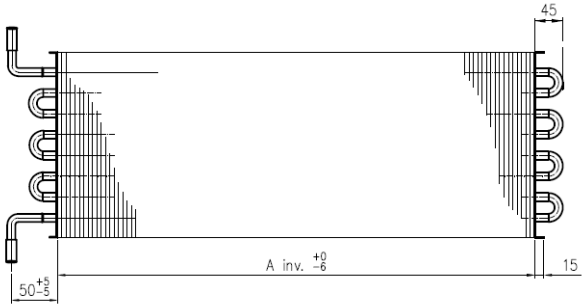
Special Coil for higher capacity



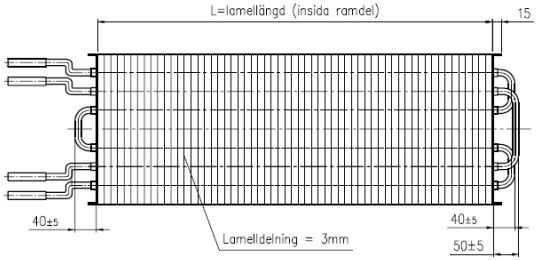
Standard Coil for IQIB/IQIC,
4 rows for cooling



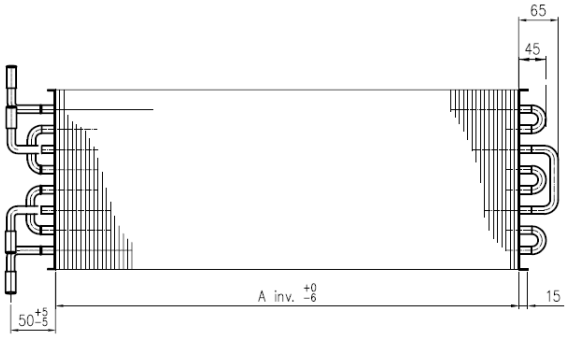
Special Coil for IQIB/IQIC, 6 rows for cooling, **12 % more capacity**, 50 % higher pressure drop over water



Special Coil for IQIB/IQIC, 8 rows for cooling, **25 % more capacity**, 100 % higher pressure drop over water



Standard Coil for IQIB/IQIC 4pipe, 4 rows for cooling and 2 pipes for heating



Special Coil for IQIB/IQIC 4pipe, 6 rows for cooling (**12% more capacity**) and 2 pipes for heating

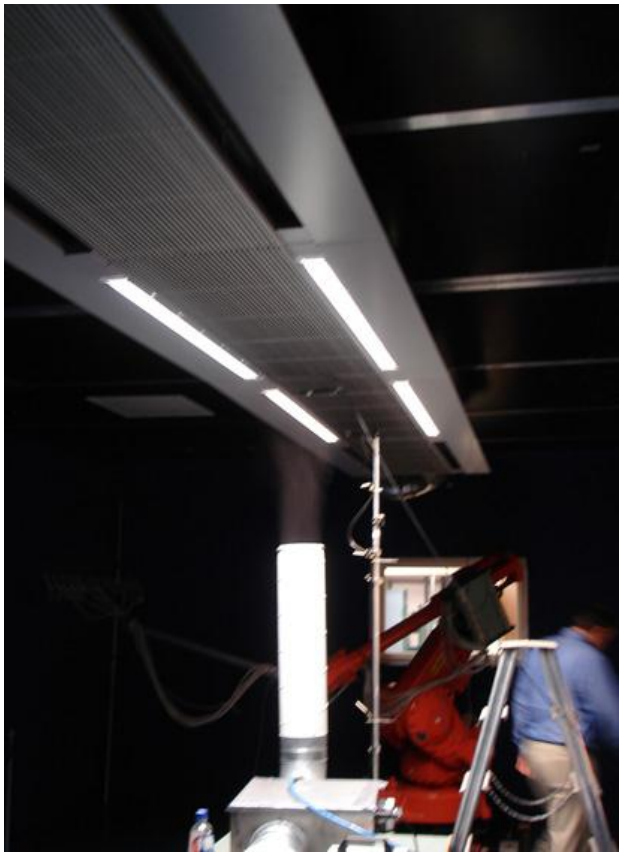
Greenville, Furman University

The consultant Ballinger is placed in Philadelphia

Our factory is in Fairfield, Cincinnati, OH

Greenville, Furman University

Customized Chilled Beams




FläktWoods