DEW POINT COOLING

WITH THE ICECUBE®

- 80% less energy than conventional air conditioning
- Larger cooling capacity on hot days
- Always provides fresh air
- No greenhouse gases

Evaporative cooling
The most energy-efficient and environmentally friendly way of cooling is by the natural process of the evaporation of water, so called *evaporative cooling*. The evaporation of water provides cooling energy very efficiently: one cubic meter of water provides more than 500 kWh cooling energy.

Dew point cooling
There are multiple types of evaporative cooling. The **ICECUBE** from Dutch Climate Systems uses the most advanced form of evaporative cooling, called dew point cooling. Dew point cooling is the most effective and energy-efficient way to cool down hot air.

COOLING BY THE EVAPORATION OF WATER

Dew point cooling works differently from a conventional air conditioner

- dew point cooling only consumes a fraction of the energy of a conventional air conditioner
- a dew point cooler does not use harmful refrigerants, but uses the natural harmless refrigerant water
- a dew point cooler supplies fresh air in addition to cooling
- the warmer the air, the more cooling power a dew point cooler has
- the drier the air, the deeper a dew point cooler can cool
- if the air is more humid, a dew point cooler will cool less deep
- a dew point cooler does not dry the air, but will also not increase the humidity
- a dew point cooler is easier to install because it doesn't use harmful refrigerants
- a dew point cooler has lower maintenance costs, because there are less moving parts and no harmful refrigerants

Dew point cooling in combination with air drying

A dew point cooler is perfectly capable of cooling down hot air. If however you want to cool deeper, also on humid days, you have to dry the intake air of the ICECUBE. In the Dry to Cool Multisplit climate system, the **ICECUBE** is combined with energy-efficient air drying. This ensures that, even on humid days, the desired inlet temperature is achieved. For an explanation, see our brochure Dry to Cool Multisplit. The dryer the air, the lower the supply air temperature of the **ICECUBE** is.

Supply air temperature of the ICECUBE

The supply air temperature of the ICECUBE depends on the characteristics of the air that the ICECUBE takes in. The table below shows the supply air temperature at different intake air conditions (temperature and absolute humidity).

	25 °C	30 °C	35 °C	40 °C
8 g/kg	16	17	19	20
10 g/kg	18	19	20	21
12 g/kg	19	20	21	22
14 g/kg	21	22	22	23
16 g/kg	23	23	24	24

* Temperatures may vary based on the chosen configuration.

Energy consumption

Dew point cooling uses only a minimum amount of electrical energy, to power the fans. The energy consumption for dew point cooling in the **ICECUBE** is between 75-150 W. The **ICECUBE** provides a cooling capacity up to 2,000 W with a 400 m³/h air flow. The **ICECUBE** also provides fresh outdoor air at the same time, without any additional energy consumption.

Water consumption

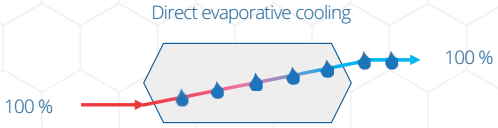
Dew point cooling provides more than 500 kWh of cooling per m³ of water. The **ICECUBE** therefore does not use much water. In fact, more water is used for a traditional air conditioner, due to the water being wasted by the power plant to generate the electricity. The **ICECUBE** has some overflow. In this situation more water is supplied than is evaporated. This water from the overflow can be reused.

(Indirect) evaporative cooling is sometimes referred to as (indirect) adiabatic cooling

DEW POINT COOLING IS THE MOST ADVANCED TYPE OF INDIRECT EVAPORATION COOLING

Here an explanation is provided of the different types of evaporative cooling. See also the Mollier diagram on the next page.

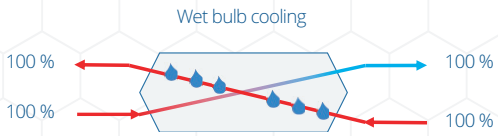
Direct evaporative cooling (direct adiabatic cooling)



Outside air is brought into contact with a wet surface, and then supplied into the room. The maximum cooling temperature is the wet bulb temperature of the intake air.

- DISADAVANTAGE: It is not possible to cool deeper than the wet bulb temperature.
- DISADVANTAGE: Extra moisture enters the room.

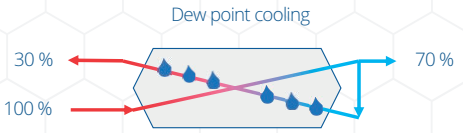
Indirect evaporative cooling / indirect adiabatic cooling / wet bulb cooling



In an air-to-air heat exchanger the indoor air is used as secondary evaporation air to cool down the primary supply air. There is no contact between the two air streams.

- ADVANTAGE: No extra moisture enters the room.
- DISADVANTAGE: It is not possible to cool deeper than the wet bulb temperature of the indoor air.
- DISADVANTAGE: If the indoor air warms up, the system loses cooling capacity, making the indoor air even warmer, causing even more loss of cooling capacity, etc. Thus creating a downward spiral of the cooling capacity.

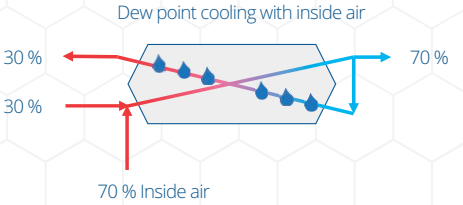
Dew point cooling



Dew point cooling also takes place in an air-to-air heat exchanger. The unique element is that part of the cooled air is used as evaporation air. This smart step allows the system to cool down to the dewpoint of the intake air.

- ADVANTAGE: No extra moisture.
- ADVANTAGE: Cools deeper.
- ADVANTAGE: There is no downward spiral of the cooling capacity.

Dew point cooling with extra indoor air

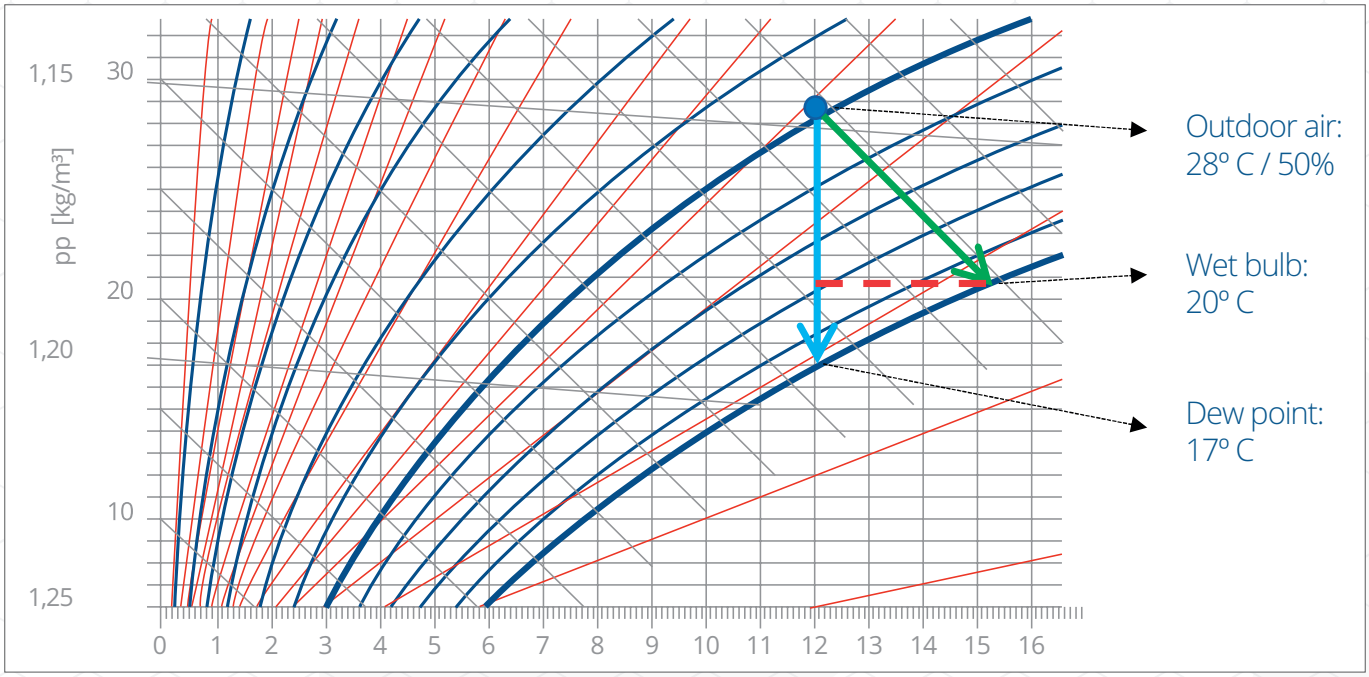


It is possible to use part of the indoor air as input air into the dew point cooler. This provides an advantage in two situations:

1. If the ICECUBE is combined with air drying (as in the Dry to Cool Multisplit system), because then only 30% of the supplied air needs to be dried in instead of 100%.

2. When the indoor air is cooler than the outdoor air. The total mixed input air is then cooler, allowing for a slightly deeper supply air temperature.

- ADDITIONAL ADVANTAGE: Lower supply air temperature.
- ADDITIONAL ADVANTAGE: Less air needs to be dried.
- ADDITIONAL ADVANTAGE: Less outside air filtering is required.
- DISADVANTAGE: The system provides a smaller amount of ventilation air.



Please notice that the efficiency of the heat exchanger determines to which degree the lowest possible temperature (dew point or wet bulb) is achieved. A more efficient heat exchanger will bring the supply air closer to the ultimately possible temperature. In the **ICECUBE**, the evaporation process takes place on the surface of the exchanger, with an ideal distribution of the water over the exchanger surface. This is one of the reasons that the **ICECUBE** reaches the highest efficiency.

Difference between supply air temperature and indoor temperature

There is a difference between the supply air temperature which the ICECUBE brings into the room, and the resulting indoor air temperature, of the room itself. Especially on a hot day, there are several sources that add heat to the room. For example the sun shining through a window, the penetration of warm outside air through the walls and chinks in the building, and also the equipment and the people in the room itself that give off heat. The indoor air temperature is a result of all these heat sources in combination with the supply of air from the ICECUBE. All these heat sources are the reason that the indoor air temperature is always above the supply air temperature delivered by the ICECUBE. So it is important to ensure that as little as possible heat is added to the room. One of the most important ways to do this is by using blinds.

No risk of legionella: 5 reasons

1. The water in the ICECUBE flows over the surface of the heat exchanger, and is not sprayed into the air. No aerosols are created when water flows over the surface.

2. The water is on the secondary side of the heat exchanger. The air that comes into contact with the water is discharged outside and does not enter the conditioned space.
The ICECUBE is 100% airtight and watertight.

3. There is no stagnant water in the ICECUBE. Overflow of water from the process is removed using a condensate pump.

4. Legionella grows at temperatures above 25 °C. The water in the ICECUBE rarely exceeds 25 °C.

5. The water in the ICECUBE is treated by means of oscillation. This will reduce growth from legionella. This also prevents limescale build-up.

Cooling the Planet
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