IT Cooling: Applicable European Standards for Performance Testing

Mr Julio Conde Blanco

Project Manager, Energy Department

CEIS

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HVACR Leadership Workshops

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IT Cooling
Abbreviations

- Information Technology Cooling Equipment or IT Cooling abbreviations:
  - **CRAC**
    - Computer Room Air Conditioner
  - **CRAH**
    - Computer Room Air Handler

IT Cooling
Available Standards

- There are no ad hoc EN testing standards for measuring the cooling capacity and energy efficiency on IT cooling appliances
- Do we need to develop an ad hoc testing standard for Information Technology cooling equipment?

IT Cooling
Available Standards

- **EN 14511:2018 Series**

Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors

- **EN 1397:2015**

Heat exchangers - Hydronic room fan coil units - Test procedures for establishing the performance

Test Conditions & Methods

EN 14511-2 defines test conditions for Close Control units (CRAC)

EUROVENT completes and extends these test conditons

Class	CRAC Condenser dry bulb	CRAC Condenser wet bulb	CRAC-W Condenser entering water(brine)	CRAC-W Condenser entering water(brine)	Indoor air entering dry bulb	Indoor entering relative humidity*
1	35	24	30	35	24ºC	50%
2					30ºC	35%
3					35ºC	27%
4					40ºC	20%

*The relative humidity corresponds with an absolute humidity of 9.3g/kg

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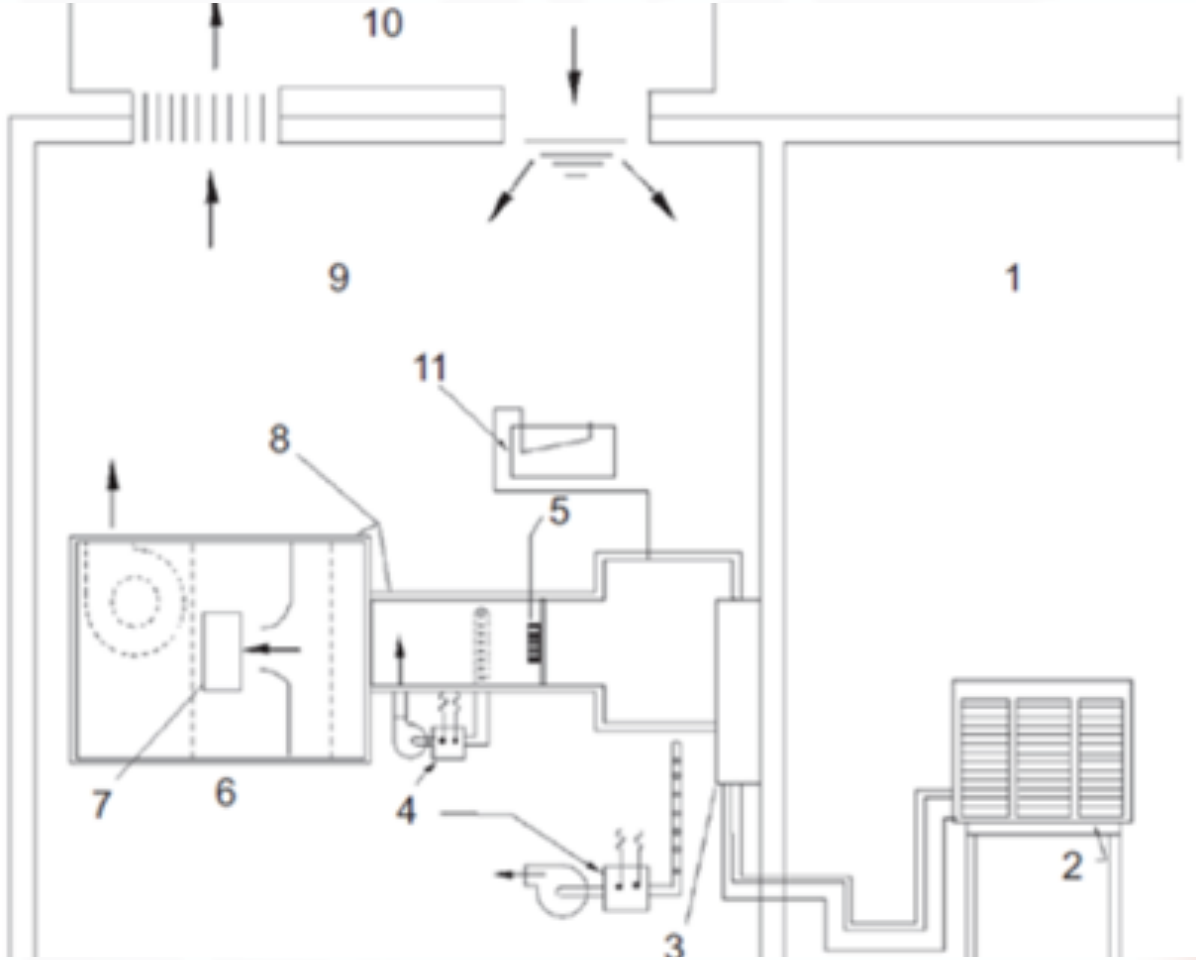
Eurovent test conditions for CRAH unit

Class	Evaporator Entering/Leaving water(brine) temperatures	Indoor coil air entering conditions	
		Dry bulb temperature	RH*
1	10ºC / 16ºC	24ºC	50%
2	10ºC / 16ºC	30ºC	35%
3	15ºC / 21ºC	35ºC	27%
4	18ºC / 24 ºC	40ºC	20%

*The relative humidity corresponds with an absolute humidity of 9.3g/kg

Air enthalpy test method

1 outdoor-side test room
2 outdoor unit of equipment under test
3 indoor-side coil section of equipment under test
4 air temperature and humidity measuring instruments
5 mixer
6 airflow measuring apparatus
7 door/window
8 insulation
9 indoor-side test room
10 room conditioning apparatus
11 apparatus for differential pressure measurement



Raised view of an air enthalpy test room

Air enthalpy test method

Total cooling capacity

$$\phi_{tci} = \frac{q_{vi}\left(h_{\alpha 1} - h_{\alpha 2}\right)}{v'_n\left(1 + W_n\right)} 1\,000$$

Sensible capacity

$$\phi_s = \frac{q_{vi}\left(c_{pa1}t_{a1} - c_{pa2}t_{a2}\right)}{v'_n\left(1 + W_n\right)}$$

Latent capacity

For the cooling mode, it is recommended that the latent cooling capacity is determined using the cooling condensate flow rate measurement method.

$$\phi_d = \frac{K_1 q_{vi}\left(W_{i1} - W_{i2}\right)}{v'_n\left(1 + W_n\right)} 1000$$

$$\phi_d = K_1 q_{wc}$$

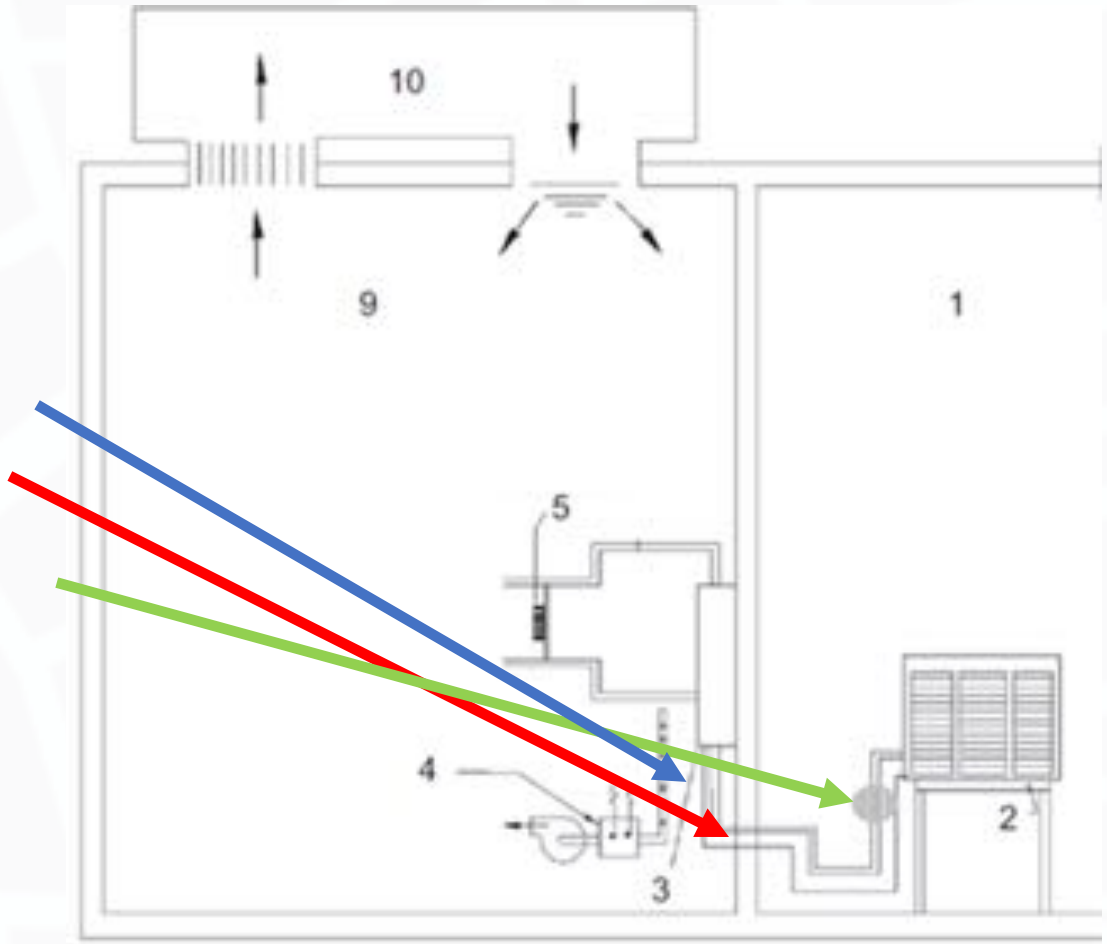
$$\phi_d = \phi_{tci} - \phi_s$$

Water enthalpy test method

1 outdoor-side test room
2 outdoor unit of equipment under test
3 indoor-side coil section of equipment under test
4 air temperature and humidity measuring instruments
5 mixer

6. Entering water temperature sensors
7. Leaving water temperature sensors
8. Water Flow rate measurement device

9 indoor-side test room
10 room conditioning apparatus



Raised view of an water enthalpy test room

Water enthalpy test method

Total cooling capacity

$$\emptyset_{tci} = q_f \cdot (h_l - h_e) - P$$

Latent cooling capacity

$$\phi_d = K_1 q_{wc}$$

Sensible cooling capacity

$$\emptyset_s = \emptyset_{tci} - \emptyset_d$$

Evaluating the peformance of a CRAC unit

- Test method
  - Air enthalpy method following EN 14511-3:2018

- Test results
  - Total Cooling Capacity
  - Sensible cooling capacity
  - Latent cooling capacity
  - Power input
  - Energy Efficiency Ratio
  - Airflow rate and external static pressure

Mr Julio Conde Blanco
Project Manager, Energy Efficient
CEIS
jconde@ceis.com