# Fan Coil Units Statement on Entering Air Temperature

Issue 2
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Entering Air Temperature is the temperature of the air when it comes into contact with either the cooling or heating coil within the fan coil unit. For cooling this needs to be expressed in °C dry bulb (db) and °C wet bulb (wb) [or %Rh]. For heating it needs only to be expressed in °C dry bulb (db) as there is no moisture phase change. Choosing the correct 'air-on' temperature can have a significant effect on the thermal output of the unit. For a typical UK fan coil installation a change of entering air conditions from 23°C db / 50% Rh to 24°C db / 50% Rh can increase the sensible cooling by approximately 10% with no additional capital outlay.

For many selections a predetermined 'air-on' dry bulb and wet bulb temperature is used and 23°C db / 16.4°C wb (50% Rh) is often chosen for UK installations, although there are indications that 24°C db is more realistic. A rule of thumb for ceiling void installations is to add 1.5°C to the design room air temperature. For exactness, however, the dry bulb and wet bulb temperatures of the air entering the fan coil unit should be calculated, see Jones WP, Air Conditioning Engineering[1]. For a ceiling void installation in cooling mode the following air temperatures need to be considered:

- the return air from the room, say 23°C
- heat pick up from high level lighting and within the ceiling void, say 1.5°C
- the primary fresh air from the central station AHU controlled at a particular air-off temperature

The volume ratio of return air from the room to primary fresh air is decided by the cooling load and the fresh air requirements of the occupants respectively. A mass ratio calculation of these two air streams will give the entering air temperature to the fan coil unit, i.e. the coil air-on temperature. The moisture content of the mixed air stream also needs to be calculated to determine the wet bulb temperature. Most selection software will have the capability to calculate the 'mixed' condition, providing that the volume proportions, temperatures and psychrometrics of the two air stream components are known. On the psychrometric chart a typical 'wet-coil' ceiling void fan coil unit installation might appear as shown in Figure 1 for the summer cooling cycle.

For cased or vertical fan coil units drawing all of their air from the conditioned space, the entering air condition will more closely reflect that of the room itself and this condition can be calculated and used for the selection. Fresh air in these situations is fed into the room elsewhere and is mixed with the room air before entering the fan coil unit.

For ceiling void and cased fan coil units in heating mode the same logic applies as for cooling except in reverse and the calculation is simpler as latent effects and moisture content is not considered. A rule of thumb is to subtract 1.5°C from the design room air temperature and a dry bulb temperature of 21°C is often chosen for UK installations.

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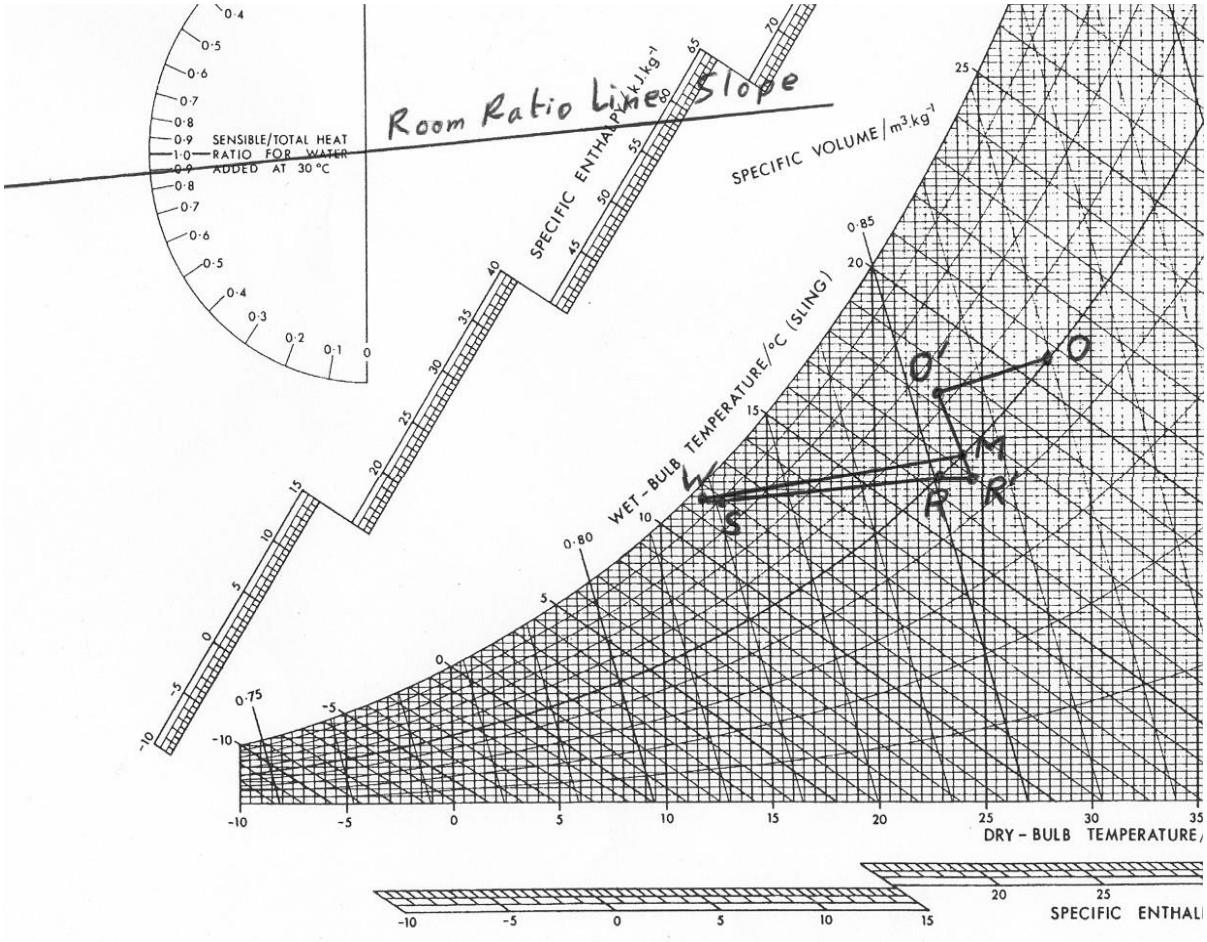


**Figure 1 – Psychrometric Diagram of Fan Coil Unit, Summer Cooling Cycle**

Explanation of Figure 1:

- O = Outdoor air temperature, (design day - 28°Cdb/50%)
- O' = Fresh air supply from AHU to inlet of FCU, (AHU could do more or less cooling than this example)
- R = Return air from room (23°Cdb/50%)
- R' = Return air entering inlet of FCU [dew point = 12.2°C]
- M = Mixed air condition (return air plus fresh air) [dew point = 13.2°C]
- W = FCU off coil condition [dew point = 11.2°C]
- S = Supply air diffuser condition (including heat pick-up from duct).

1. JONES WP Air Conditioning Engineering (5th edition) (Oxford: Butterworth-Heinemann) (2000)