Determination of Supply Air Relative Humidity to Control Internal Latent Gains

Internal Latent Gains Taken from CIBSE Guide A Table 6.2:

Offices General / City Centre based on Moderate Office Work Latent Heat Gain: 55W / Person

The primary equation used is:-

$$gs = groom – (\Theta L / X * hfg)$$

Where:

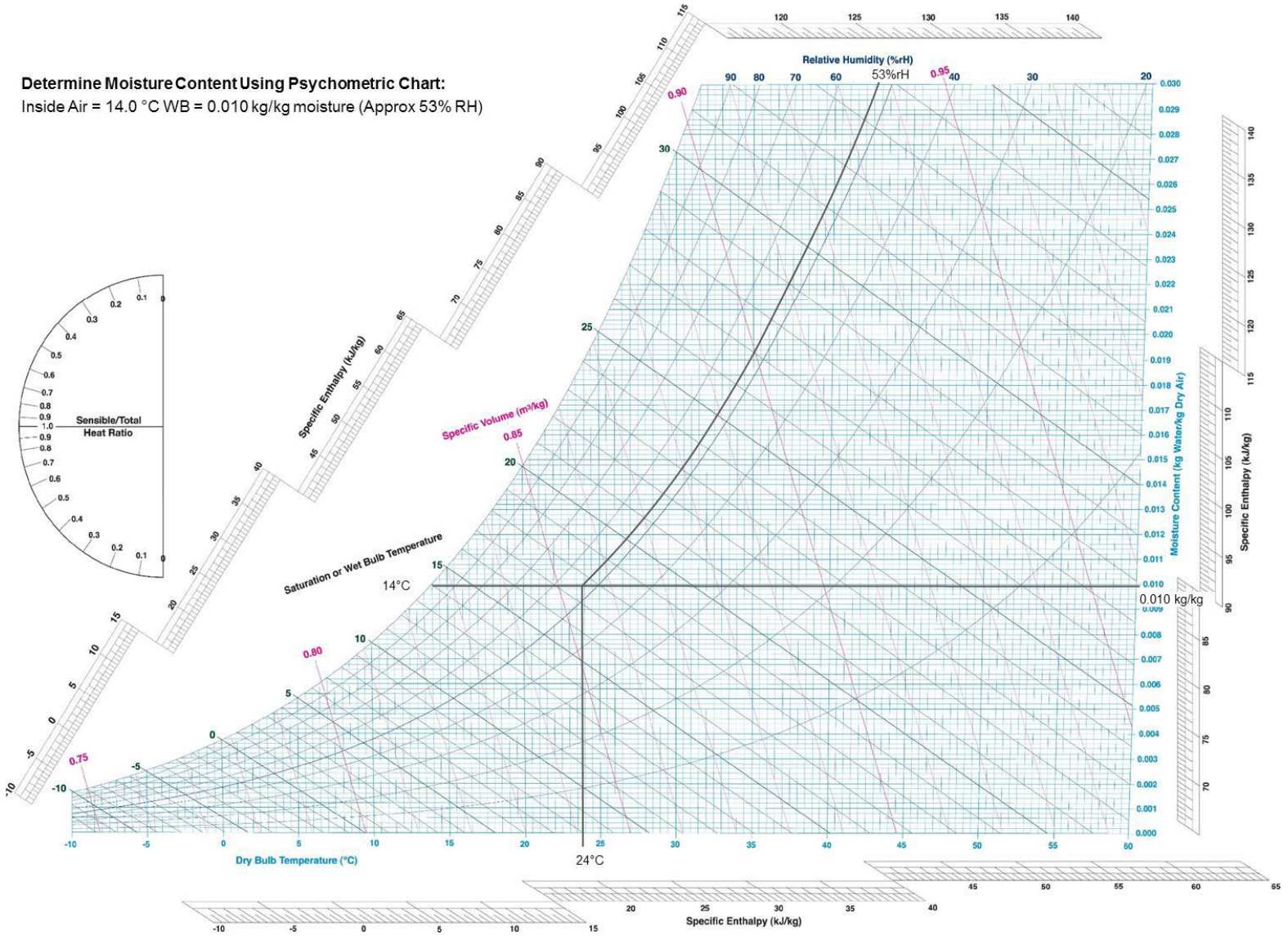
gs = Moisture Content Supply Air (kg/kg)
groom = Moisture Content Room (kg/kg)
ΘL = Total Spatial Latent Gains (kW)
X = Fresh Air Supply Volume (kg/s) = Fresh Air Supply Volume (m3/s) * 1.177 (kg/m3).
hfg = Latent Heat of Evaporation (approx 2450 kJ/kg)

Worked Example:

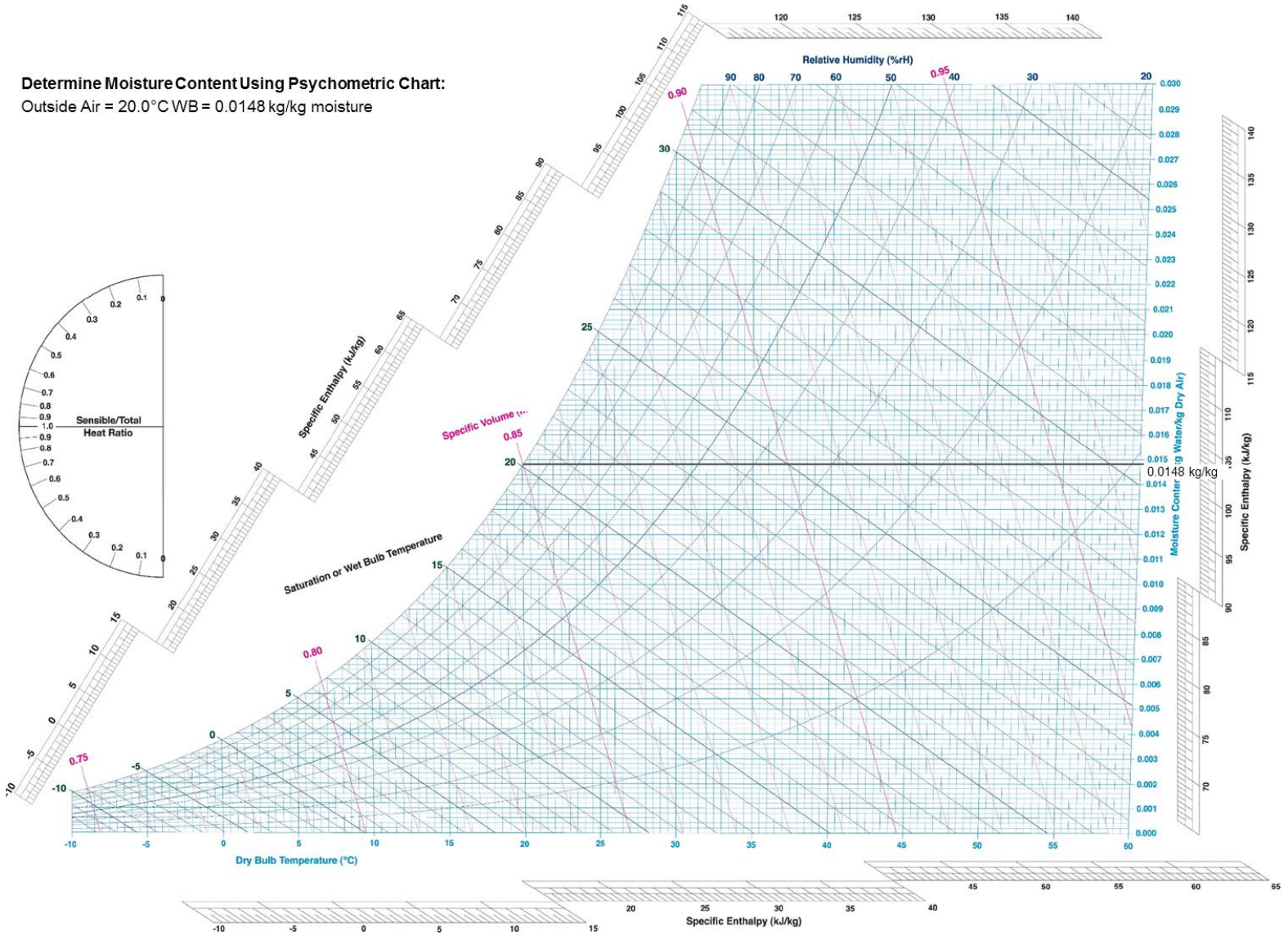
Determine the required AHU air supply humidity for an active chilled beam system based on the following design parameters:

Open Plan Room Size: 15 x 5m (75m2) x 3.0m high.
Indoor Average Room Temperature: 24°C
Maximum Dew Point: 14°C
Outdoor Air Design Condition: 20.0°C WB
Occupancy: 30 people
Infiltration: 0.15 ACH
Air Supply Volume: 8 l/s/person
Air Supply Temperature: 16°C after re-heat.

1. **Determine internal moisture content using psychometric chart:**



2. Determine outside moisture content using psychometric chart:



3. Determine Infiltration Gain:

Infiltration (Xi) @ 0.15 ACH = 0.15*15m x 5m x 3m = 33.75 m3/hr
= 0.00938 m3/s
= 0.00938 * 1.177 = **0.01103 kg/s**

Using: **Θli = (gintroduced – groom) *X * hfg**
= (0.0148 – 0.010)*0.01103*2450
= 0.130 kW

4. Determine Spatial Latent Gains:

Occupancy Latent = (Latent Heat Gain per Person * Occupancy)

Occupancy Latent = (55 * 30) = 1650 W = 1.65kW

Total Spatial Latent Gains (ΘL) = 0.130 + 1.65 = **1.78 kW**

Total Fresh Air Supply = 30 x 8 = 240l/s = 0.24 m3/s
= 0.24 * 1.177 = **0.2825 kg/s**

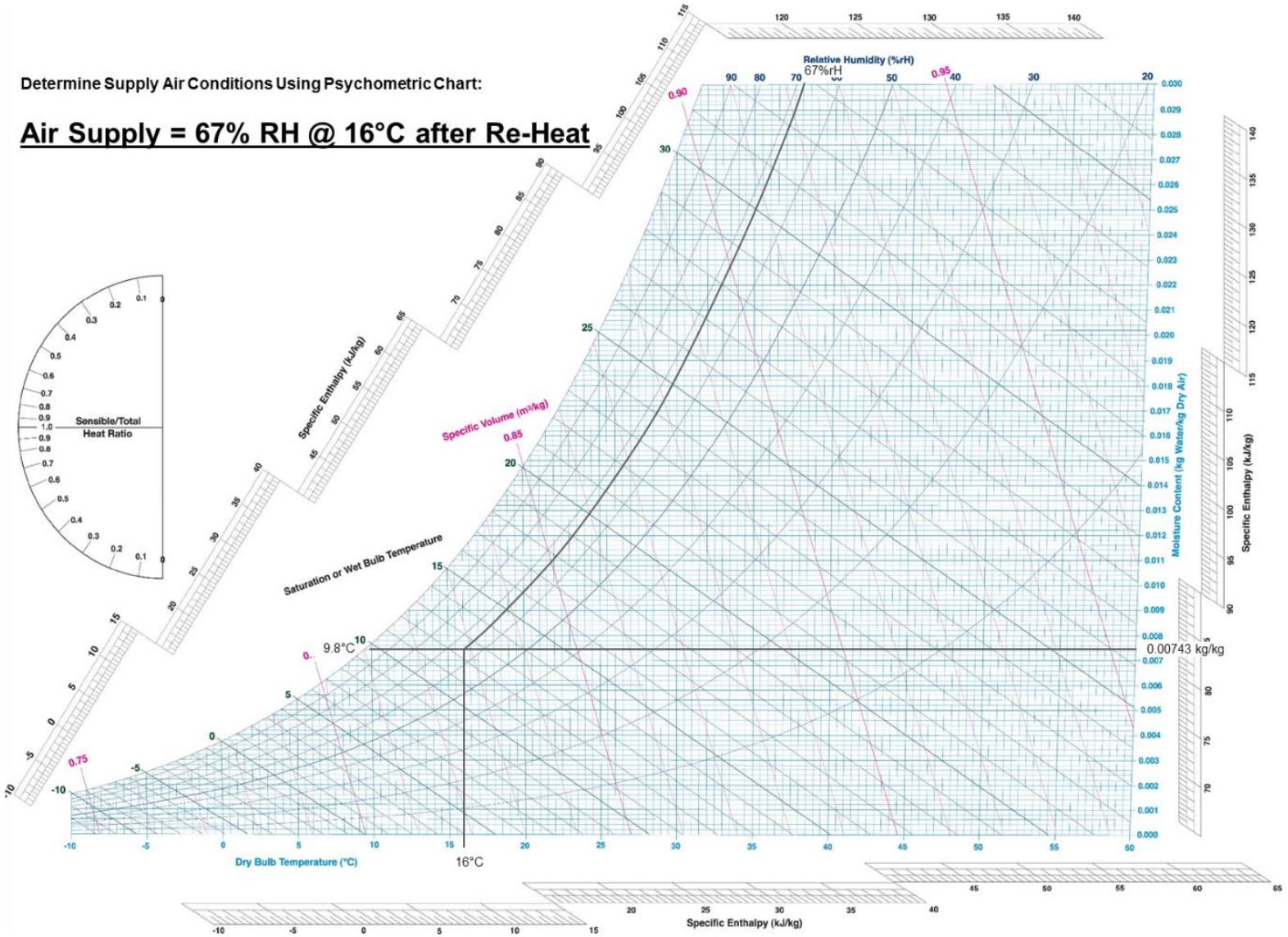
Using: **gs = groom – (ΘL / X * hfg)**

gs = 0.010 – (1.78 / 0.2825*2450)

gs = 0.010 – 0.00257

gs = 0.00743 kg/kg

5. **Determine required supply air conditions using psychometric chart:**



Result: <u>Fresh air supply to be dehumidified to 9.8°C WB (approx. 67% RH after reheat to 16.0°C.</u>