

BEYOND

SMART CITIES

HVAC SYSTEMS - CEM REFRESHER

ONLINE TRAINING COURSE

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ENERGY SPECIALIST CURRICULUM





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TYPES AND FUNCTIONS OF HVAC SYSTEMS

FOR ENERGY PROFESSIONALS

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WHAT SHOULD YOU LEARN



Introduction to HVAC Systems

Functions of HVAC Systems

Environmental Control Factors

Comfort zone psychrometric chart

Temperature control strategies

Relative humidity control

VAV Systems

Secondary Systems





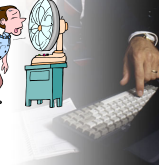
HVAC INTRODUCTION

- ✓ HVAC systems – or Heating, Ventilating and Air-Conditioning systems – control the environment for people and equipment in our facilities.
- ✓ HVAC use in an office building might be as high as 30 – 50% in some climates.
- ✓ HVAC systems and chillers are also significant energy consumers in many manufacturing facilities.



FUNCTIONS OF HVAC SYSTEMS

- ✓ The purpose of a Heating, Ventilating and Air Conditioning (HVAC) system is to provide and maintain a comfortable and safe environment within a building for the occupants or for the process being conducted.
- ✓ Many HVAC systems were not designed with energy efficiency as one of the design factors

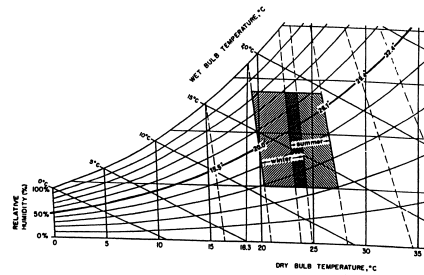


ENVIRONMENTAL CONTROL FACTORS

- ✓ An HVAC system functions to provide an environment in which these three factors are maintained within desired ranges. Typical design conditions are:
- ✓ 23 degrees C temperature (dry bulb)
- ✓ 40 - 60% relative humidity
- ✓ ASHRAE 62 – 2016, 2001 and 62.1 – 2016 Ventilation Standard
 - 10 LPS outside air per person, or
 - CO2 less than 1000 PPM



COMFORT ZONE ON PSYCHROMETRIC CHART



TEMPERATURE CONTROL STRATEGIES

- ✓ Vary the temperature of the supply air to the space while keeping the air flow rate constant. This is the constant volume, variable temperature approach.
- ✓ Vary the air flow rate while keeping the supply air temperature constant. This is the variable volume, constant temperature approach. VAV – variable air volume system.
- ✓ Vary the supply air temperature and the flow rate, as in a variable volume reheat system.

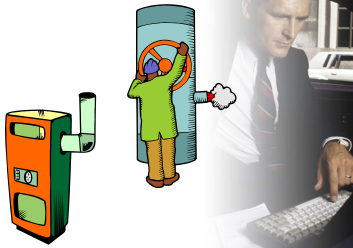


RELATIVE HUMIDITY CONTROL

- ✓ Humidification - The air is too dry and water vapor must be added for comfort.
- ✓ Dehumidification - The air is too wet and water vapor must be removed for comfort.
- ✓ AC systems typically over-cool the air to remove water vapor, and then may have to heat the air back up - this is called reheat, and requires additional energy.
- ✓ Either way, energy required is around 2300 kJ per kg of water.

PRIMARY EQUIPMENT

- ☒ Chillers
- ☒ Direct expansion (DX) systems
- ☒ Boilers
- ☒ Furnaces



SECONDARY SYSTEMS

- ☒ Single duct, single zone system
- ☒ Single duct, terminal reheat system
- ☒ Multizone system
- ☒ Dual duct system
- ☒ Single duct, variable air volume system
 - ➔ This is the most common system going in to large commercial buildings
- ☒ Fan coil system



VAV HVAC SYSTEMS

- ☒ Most common new system going in to large commercial buildings.
- ☒ High efficiency because of use of variable speed drive on the supply air fan. For example, cutting air flow from full rate to 80% of full rate, cuts the fan power almost in half!
- ☒ Fan is controlled most often to keep a constant static pressure in the supply duct. Temperature is controlled by a local terminal box in the zone.



POWER AND ENERGY IN AIR CONDITIONING



☑ One kW of A/C = 3600 kJ/h

A kW is a measure of A/C power, and is used when sizing systems, or when determining electrical demand.

☑ One kWh of A/C = 3600 kJ

A kWh is a measure of A/C energy, and is used when sizing storage tanks for thermal energy storage (TES) systems, or when determining electrical energy consumption.



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THANK YOU

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