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MODULE 4B

HVAC System Concepts and Process

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CERTIFIED HVAC DESIGNER CHD OVERVIEW

One of the primary objectives for the heating, ventilating, and air-conditioning (HVAC) system designer, after having determined the net heating and cooling requirements, is to determine how these requirements will be satisfied. Based on a number of criteria, The designer will select one or more systems for the building.

Learning Objectives

- Introduction
- HVAC Fundamentals
- The Air-Conditioning Process
- HVAC System Concepts and Process
- HVAC Systems Design
- Engineering, Economics, and Design Decision-Making
- Certified HVAC Designer (CHD) Specialty Certification
- Summary and Resources
- Certified HVAC Designer - CHD Practice Test V.4.1

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INTRODUCTION

All-Air Systems

- Utilize air as primary medium for heating and cooling.
- Components include air handling units (AHUs), fans, ductwork, and diffusers.
- Function like a central nervous system pumping conditioned air through ductwork.

Single-Zone Systems

- Focus on one specific area within a building.
- Advantages include simplicity in design and installation, good indoor air quality, flexibility in temperature settings, and potential for uneven temperature distribution.

AIR DISTRIBUTION SYSTEMS IN HVAC SYSTEMS +

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Variant Air Volume (VAV) Systems

- Allow for control of air volume delivered to different zones based on demand.
- Advantages include enhanced energy efficiency, greater comfort levels in occupied spaces, but disadvantages include more complex control mechanisms and system design, higher initial costs, and increased installation complexity.

Dual-Duty Systems

- Comprise two separate duct systems for heated and cooled air.
- Advantages include excellent control over temperature and humidity levels, flexibility to meet varying needs across different zones, but disadvantages include high energy consumption and increased installation complexity and costs.

Multizone Systems

- Serve multiple zones with distinct temperature control requirements.
- Advantages include customizable comfort for diverse spaces, efficient use of a central air handling unit, and potential for inconsistent temperatures if not properly balanced.

AIR-WATER SECONDARY SYSTEMS

- Air-water secondary systems are crucial in modern HVAC design, particularly in commercial and institutional buildings.
- These systems use both air and water for thermal energy transfer, enhancing energy efficiency and providing superior comfort.
- Key components include active chilled beams, passive chilled beams, fan coil units (FCUs), unit ventilators, and active and passive chilled beam systems.
- Active chilled beams use a combination of chilled water and air to provide cooling, allowing for precise control over air distribution and temperature.
- Passive chilled beams rely on natural convection to circulate air, making them effective in buildings with steady occupancy levels and noise reduction.

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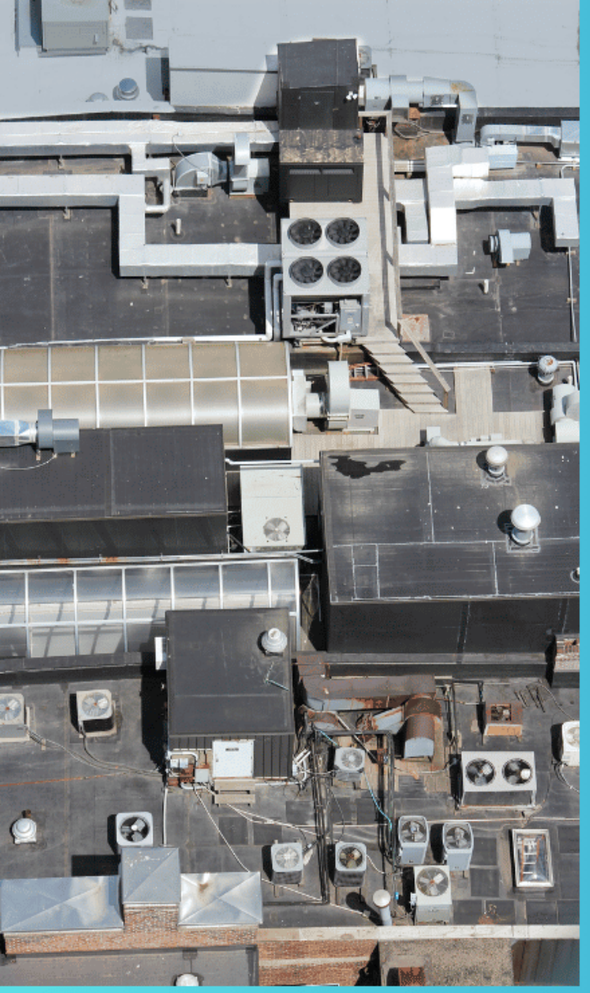
- Fan Coil Units (FCUs) provide both heating and cooling, allowing for localized temperature control.
- Unit ventilators combine ventilation with air conditioning, ensuring a steady supply of fresh air while controlling the indoor climate.
- Advantages of air-water systems include energy efficiency, improved comfort, reduced noise levels, and flexibility in design.
- Understanding these systems is essential for engineers and designers aiming to create comfortable, energy-efficient indoor environments.



UNIT AIR CONDITIONING SYSTEMS

Incremental Units

- Self-contained systems providing localized cooling or heating.
- Typically designed for single-room applications.
- Operates on a refrigeration cycle including a compressor, evaporator, and condenser.
- Available in various capacities, ranging from 5,000 to 30,000 BTUs.
- Cost-effective and energy-efficient solution for small to medium-sized spaces.

Packaged Units

- Self-contained HVAC systems that house all essential components.
- Designed for commercial and industrial applications.
- Can serve larger spaces than incremental units.
- Energy efficient and easy to install and maintain.
- Can be used in retail stores with large open floor plans.

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Split Systems

- Composed of an indoor unit and an outdoor unit, connected by refrigerant lines.
- Allows for more flexibility in placement.
- Can be configured to allow for multiple indoor units serving different zones.
- Can be compared to a two-part puzzle: each piece serves a specific purpose but requires connection to form a complete picture.

Variable Refrigerant Flow (VRF) Systems

- Advanced category of HVAC technology that utilizes refrigerant as the heat transfer medium.
- Can simultaneously heat and cool different areas of a building.
- Can connect multiple indoor units to a single outdoor unit.
- Can recover heat from one zone and transfer it to another, further optimizing energy use.
- Can be installed in large office complexes to accommodate different departments with varying temperature preferences.
- Manages multiple indoor units, adjusting their cooling or heating output to create a balanced and comfortable environment throughout the building.

HEAT PUMPS

- Heat pumps are mechanical devices that transfer thermal energy from one location to another, typically from a lower-temperature source to a higher-temperature destination.
- They operate on thermodynamic principles, utilizing the refrigeration cycle.
- Heat pumps can function in two primary modes: heating mode and cooling mode.
- There are three main types of heat pumps: Air-source Heat Pumps (ASHP), Ground-source Heat Pumps (Geothermal), and Water-source Heat Pumps.
- Efficiency of heat pumps is measured using the Coefficient of Performance (COP) for heating and the Energy Efficiency Ratio (EER) for cooling.

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- Advantages of heat pumps include energy efficiency greater than 100%, versatility, and reduced environmental impact.
- Disadvantages include high initial costs, temperature limitations, and significant land area requirements for ground-source systems.
- Understanding the operational principles, types, and performance metrics of heat pumps is critical for professionals in the HVAC field and informed decision-making by consumers and policymakers.

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