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**CERTIFIED HVAC DESIGNER**

**CHD OVERVIEW**

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**ONLINE TRAINING BY KRISHNAJI PAWAR**

LEED AP(BD+C), GSAS CGP, GCP, ISO 14001

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MODULE

**5**

# HVAC Systems Design

KRISHNAJI PAWAR - CEO & FOUNDER

LEED AP(BD+C),GSAS CGP,GCP,ISO 14001

[WWW.BEYONDSMARTCITIES.IN](http://WWW.BEYONDSMARTCITIES.IN)



# CERTIFIED HVAC DESIGNER CHD OVERVIEW

The design of an efficient air-conditioning system involves understanding the owner's criteria, performance requirements, constraints, functional requirements, and sustainability requirements like LEED, to ensure a sustainable solution.

# 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



# INTRODUCTION

## Understanding Owner's Criteria and Performance Requirements

- Identify owner's criteria and performance requirements.
- Determine design constraints like limited budget or owner's ability to understand and maintain HVAC systems.
- Identify functional requirements for each area of the building.
- Consider limitations imposed by building codes and regulatory agencies.

## Evaluating Alternative System Concepts

- Identify and evaluate alternative system concepts to meet project requirements.
- Use Building Information Modeling (BIM) for easier comparison and evaluation of life-cycle costs.

# DESIGNING AN EFFECTIVE AIR-CONDITIONING SYSTEM

## Defining Control Zones and Compiling Heating and Cooling Loads

- Determine heating and cooling criteria, operational criteria, and ventilation criteria for each control zone.
- Spaces can form a single control zone if they meet similar criteria in all categories.

## Locating and Allocating Mechanical Equipment Elements

- Allocate space for air-conditioning systems at four specific locations: primary equipment, support equipment, and maintenance.
- Design air distribution systems to ensure effective air diffusion.

## Piping Design

- Determine configuration and routing of various piping systems.
- Define equipment performance criteria.
- Design system operating controls.



# COMPLIANCE WITH BUILDING CODES AND STANDARDS

## International Mechanical Code (IMC)

- Provides regulations for the design, installation, maintenance, and inspection of mechanical systems in buildings.
- Mandates sufficient ventilation to ensure indoor air quality.
- Specifies performance standards for HVAC equipment, including efficiency ratings.
- Outlines duct design parameters, including sizing and insulation requirements.
- Non-compliance can lead to costly retrofits or revocation of occupancy permits.

## International Energy Conservation Code (IECC)

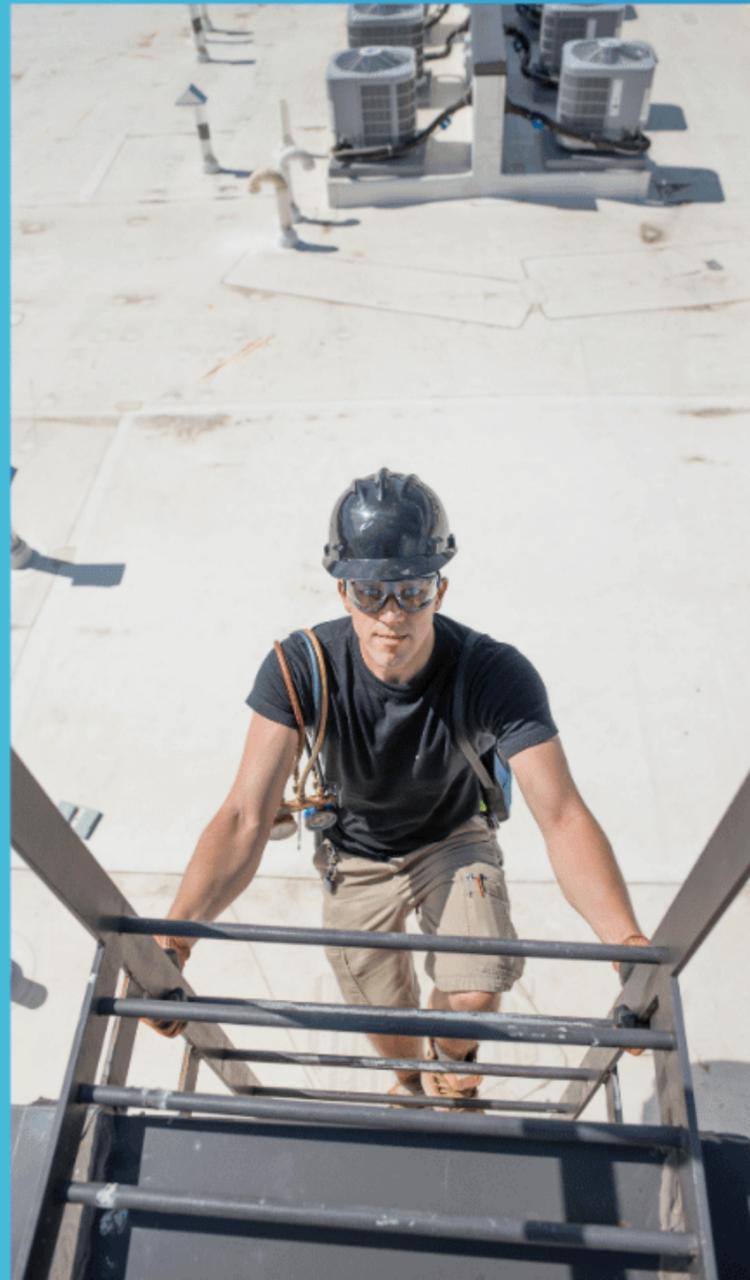
- Promotes energy efficiency in residential and commercial buildings.
- Outlines insulation levels for walls, roofs, and foundations.
- Requires energy-efficient lighting methods, such as LED fixtures.
- Mandates efficiency ratings for HVAC systems.
- Non-compliance can result in financial benefits through reduced utility bills and incentives or rebates for exceeding energy efficiency standards.





# NFPA STANDARDS AND GUIDELINES +

- Develops codes and standards aimed at preventing fire hazards and ensuring life safety in buildings.
- Includes fire safety systems, egress requirements, and electrical safety.
- Non-compliance can result in severe penalties, including legal liability in the event of a fire.



## ASHRAE Standards and Guidelines

- Establishes standards for HVAC systems, indoor air quality, and energy efficiency.
- Outlines ventilation requirements for acceptable indoor air quality.
- Provides guidelines for energy-efficient design in buildings.
- Emphasizes thermal comfort, ensuring buildings maintain appropriate temperature and humidity levels for occupants.
- Compliance can enhance a building's marketability and qualify for green building certifications.

# DESIGNING FOR MAINTAINABILITY IN HVAC SYSTEMS

- HVAC Equipment Location and Access: Strategic location of HVAC equipment is crucial for maintaining system longevity.
- General Considerations for Equipment Location: Location near utility connections minimizes installation and maintenance costs.
- Clearance and Space Requirements: Each piece of equipment has specific clearance requirements as stipulated by manufacturers.
- Structural Considerations: Heavy equipment like boilers and chillers require reinforced structural support.



# MECHANICAL EQUIPMENT ROOMS FOR AIR-HANDLING EQUIPMENT +



- **Layout and Flow:** The layout should facilitate a logical flow, allowing maintenance personnel to move freely between equipment.
- **Ventilation and Environmental Control:** MERs should be adequately ventilated to prevent overheating of equipment.
- **Access Points:** Doors should be wide enough to accommodate the largest equipment and should swing outward to avoid obstructing pathways.
- **An Exemplary MER Design:** A dedicated room with a layout that includes a central AHU flanked by two smaller units.



# MECHANICAL EQUIPMENT ROOMS FOR BOILERS AND CHILLERS +

- Special Requirements: Clearance Zones, Sound Isolation, and Safety Measures: Boilers require significant clearance for combustion air intake and exhaust.
- Safety Measures: Strict adherence to safety codes and regulations is mandatory due to potential hazards associated with boiler operation.



## Ceiling Cavity Space:

- Access Panels: Strategically placed access panels in ceiling cavities allow maintenance personnel to reach ductwork and piping without removing ceiling tiles or panels.
- Load Considerations: The weight of ductwork and associated components must be accounted for in the ceiling design to prevent sagging.
- Thermal Insulation: Proper insulation within ceiling cavities can enhance energy efficiency and maintain desired indoor temperatures.

# DESIGNING FOR SUSTAINABILITY: HIGH-PERFORMANCE BUILDING ELEMENTS

## Overview of Sustainable Building Design

- Sustainable building design integrates environmental, economic, and social considerations.
- The primary objective is to minimize environmental impacts while maximizing resource efficiency.
- High-performance buildings are defined by their ability to consume fewer resources, generate renewable energy, and promote occupant health and productivity.

## ASHRAE Standard 189.1: A Framework for Sustainable Buildings

- The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 189.1 is a comprehensive guideline for high-performance green buildings.
- Key definitions include Net Zero Energy Building (NZEB) and Sum Zero Energy Building (SZEB).



# HIGH-PERFORMANCE BUILDING ELEMENTS +



- Building Envelope Design: High-performance insulation materials, air tightness, and strategic placement of windows and shading devices.
- Energy Systems Integration: Combination of renewable energy technologies and energy-efficient systems.
- Water Efficiency Measures: Low-flow fixtures, rainwater harvesting, and greywater recycling.
- Indoor Environmental Quality (IEQ): Natural ventilation, daylighting strategies, and low-VOC materials.

# GREEN BUILDING RATING SYSTEMS - BENEFITS

- Reduce energy consumption
- Reduce water consumption
- Reduce materials waste
- Reduce heat island effect
- Improve indoor air quality
- Reduce absenteeism
- Reduce Toxins in environment
- Improve productivity
- Preserve open space
- Preserve species habitat
- Improve asset value
- Increase infrastructure vitality



**B E Y O N D**  
S M A R T C I T I E S

**CONTACT US**



+91 6363032722



info@beyondsmartcities.in



learn.beyondsmartcities.in



#55,HMR Layout ,Bengaluru ,India



# THANK YOU

