What Is HVAC System Design?

Worksheet

HVAC system design is the engineering process of sizing and laying out the equipment, ducts, and controls that heat, cool, and ventilate a building to meet comfort, health, and energy-efficiency requirements.

Questions

1. What is the main goal of HVAC system design?

A) To maximize building height
B) To heat, cool, and ventilate a building for comfort and health
C) To reduce the number of windows
D) To increase structural load

2. Which document typically drives minimum ventilation rates in commercial buildings?

A) ASHRAE 62.1
B) A local zoning ordinance
C) A paint manufacturer's spec sheet
D) The elevator code

3. A VAV system primarily saves energy by:

A) Turning off all lights automatically
B) Adjusting airflow per zone instead of a fixed volume
C) Using larger, less efficient ducts
D) Skipping air filtration

4. As a rough rule of thumb, how many square feet does 1 ton of cooling cover in a moderate-climate home?

A) 100 sq ft
B) 400 sq ft
C) 1,000 sq ft
D) 4,000 sq ft

5. A 2,000 sq ft single-story home in a moderate climate needs a preliminary cooling estimate.

6. A 20-person conference room (400 sq ft) needs its outdoor air rate checked against ASHRAE 62.1.

7. An engineer is placing a rooftop air handling unit (AHU) serving a 3-story office. Where should ducts and the mechanical room go?

8. Define: What does HVAC stand for?

9. Define: What is a Manual J calculation?

10. Define: Why does duct routing affect ceiling height?

Answer Key

1. B) To heat, cool, and ventilate a building for comfort and health - HVAC exists to keep occupants comfortable, healthy, and safe through controlled temperature, humidity, and air quality.

2. A) ASHRAE 62.1 - ASHRAE 62.1 is the standard most codes reference for minimum outdoor-air ventilation rates.

3. B) Adjusting airflow per zone instead of a fixed volume - Variable Air Volume systems reduce fan energy by varying airflow to match each zone's actual demand.

4. B) 400 sq ft - About 400 sq ft per ton is a common preliminary estimate, later refined by a full Manual J load calculation.

5. Use the rule-of-thumb of roughly 400 sq ft of floor area per ton of cooling 2,000 400 = 5 tons of cooling capacity needed A professional Manual J load calculation refines this using insulation, windows, and orientation 5 tons is a solid starting point for sizing the equipment

6. ASHRAE 62.1 suggests about 5 CFM per person plus 0.06 CFM per sq ft for office spaces Occupancy component: 20 people 5 CFM = 100 CFM Floor-area component: 400 sq ft 0.06 = 24 CFM Total required outdoor air 124 CFM, which sizes the fresh-air branch serving the room

7. Place the AHU near the building's vertical shaft to minimize duct runs Route vertical risers through a dedicated mechanical shaft stacked on every floor Keep horizontal duct runs under about 150 ft to limit pressure drop and fan energy Coordinate riser location with the structural grid and vertical circulation core early in design

8. Heating, Ventilation, and Air Conditioning - the systems that control a building's indoor thermal comfort and air quality.

9. An industry-standard method for calculating a building's heating and cooling loads room by room.

10. Ducts need clear space above the ceiling; larger or longer duct runs need deeper plenums, which can raise floor-to-floor height.