



How to Select an HVAC System?

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The HVAC system is a critical part of your building's operation and health. We say it is the heart and lungs of your building. When it performs correctly, it often goes unnoticed because you are comfortable with the desired temperature, humidity, airflow, fresh air, sound level, and aesthetics. However, we all have experienced at one time or another how an HVAC system can affect everything and everyone in the building; uncomfortable temperatures, hard to open doors, loud whistling, protruding ductwork, unending maintenance, and worst of all moisture. At Hodge Engineering, we are here to design and care for your heart and lungs. We strive to design your Mechanical systems to perform so effectively and comfortably that they go unnoticed, working efficiently behind the scenes.

So, what goes into selecting an HVAC system? First, code and safety requirements for your building. These are the things that must be included, like fresh air and fire safety provisions. Secondly, your bigger goals will help direct this; like the building use and occupancy, size of the building, up-front cost, operating cost, geography, and building construction



types. Then it comes down to selecting the remaining systems that can meet those requirements and goals. It is best to involve the engineer early in the project to discuss feasibility and design approach. The flow diagram below provides an overview to get started.

Owner Goals & Building Requirements

- Building Use:
 - Office, Retail, Multi-family, Healthcare, Restaurant, Event Space, Etc
- Building Size, Appearance, and Limitations:
 - Square footage, # of stories, high ceilings, lots of glass, outdoor space, indoor space, roof type, etc
- Budget & Schedule
 - First Cost, Operating Cost, Maintenance Cost, Tax Credits
 - Open for business, phasing, allowable shut down time, etc

System Requirements

- Temperature / Humidity Setpoints
- Comfort Zoning - Every room has a thermostat or rooms share one thermostat
- Air Quality & Ventilation
- Control System
- Special Equipment / Conditions
- Equipment locations
- Centralized or Decentralized
- Energy Efficiency
- Available Utilities
- Redundacy
- Future Expansion

System / Equipment Types

- Window / Through Wall Units
- Split Systems / Mini Splits
- Ground or Roof Mounted Packaged Units
- Variable Air Volume (VAV)
- Water Source Heat Pumps
- Variable Refrigerant Flow (VRF)
- Chilled Water / Boiler Water
- Geothermal
- Kitchen or Laboratory Exhaust
- Process Cooling / Heating
- Make Up Air / DOAS
- Exhaust / Supply Fans

There are many types/combinations of systems and equipment. The below matrix provides a high-level overview of the general characteristics for the most common system types that can be used for comparison.

HVAC System Matrix Considerations							
System Type	Window / Through Wall Units	Residential / Light Commercial Split Systems	Packaged Ground or Roof Top Unit	VAV Systems	Water-Source Heat Pump	VRF	Central Chiller Water / Boiler Water
Application	Hotel room, classroom, office, apartments	Residential, office, apartments, retail, low-rise buildings, etc	All low-rise buildings or top floors	Individual zone control - Connect to RTU, SS, WSHP	Small or large buildings - All types	Small or large buildings - All types	Large buildings, high rises, campus energy plant, industrial process cooling, Steam
Temperature Control	May experience temperature swings	All zones must be in cooling or heating	All zones must be in cooling or heating	Zones can be cooling/heating at same time	Zones can be Cooling/heating at same time	Zones can be Cooling/heating at same time	Zones can be Cooling/heating at same time
Dehumidification	Limited	Good	Good	Good	Direct - Good, Indirect (DOAS) - Great	Direct - Good, Indirect - Great	Based on secondary equipment
Outdoor Air Capacity	Low	Good to Low	Good - Easily available	Good	Direct - Good, Indirect (DOAS) - Great	Direct - Low, DOAS - Great	Based on secondary equipment
First Cost	Lowest	Low	Low	Moderate	Moderate to Highest	High	Highest
Efficiency	Standard	Standard	Standard	Good	High Geothermal - Highest	High	High
Maintenance	Simple, but possibly many units in occupied space	Standard - May be in occupied space	Standard - Roof Access	Depends on central system, may have many VAV boxes, units above occupied space	Moderate to High - Cooling tower, pumps, indoor locations may be in/above occupied space	Moderate - May have many indoor units, units above or on wall in occupied space	High - Cooling tower, boilers, pumps, piping indoor units
Life Span	10 to 15 years	10 to 15 years	About 15 years	About 15 years	~15 yrs for AHUs, ~20 yrs for CT	15 to 20 yrs	~20+ yrs
Installation	Simple	Simple	Moderate (Roof access)	Moderate to High	High - (Outdoor space, pump/boiler room, AHU space)	High - May have many indoor units, critical refrigerant piping	High - (Outdoor space, pump/boiler room, AHU space)
Air Distribution	Ductless	Ducted or Ductless	Ducted	Ducted	Ducted	Ducted or Ductless	Based on secondary equipment
Additional Equipment	None	Outdoor unit	None	VAV boxes, possibly a Boiler	Closed Circuit Cooling Tower or geothermal source, Pumps, boiler, Water Piping, DOAS	One outdoor unit serves many indoor units, Branch controller boxes, DOAS	Cooling Towers, Chillers, Boilers, Pumps, Tanks, Piping, complex controls

The cooling tonnage for your type of building can be estimated using the table on the right. It will provide a good starting point during your feasibility and budgeting stages prior to engineering design. These sizes are rules of thumb, so it's important to keep in mind that every building is custom, and requirements will vary. This variation is related to a variety of factors that include location, number of people, insulation values, number + size of windows, and the like.

HVAC LOAD ESTIMATES	
Application	ft ² / ton
Apartments	500
Commercial Kitchen	150
Dining	400
Healthcare	330
Hotel	350
Industrial/Manufacturing	250
Laboratory	150
Office	450
Residential	500
Retail	400
Education	350
Storage Unit	1200

If you have any questions about selecting an HVAC system or would like to hire us for engineering design, please don't hesitate to contact us!