

# Efficient Central Air Conditioning Design Steps

**(1) Central Air Handler** is the first and most important step in central air conditioning design. The central air handler location will minimize the amount of duct required, reduce the Manual J duct heat gain and heat losses, will lower the duct total pressure the air handler must overcome thus lowering the air handler motor watts used, and aides in the air flow test and balance now required on all duct systems. Energy efficient HVAC designs always contain a centrally located air handler with ducts mounted inside the building envelope when possible. Duct heat gain and loss calculation results are among the largest Manual J demands, dislocated air handlers and ducts mounted outside the buildings thermal layer will result in a less efficient hvac system.

**(2) Mechanical Systems Mount Inside the Building Envelope** is also important if you expect to maximize the home's energy efficiency. Avoid mounting ducts and air handlers in the worst possible location, the garage is by far the most dangerous location due to the contamination present, the high moisture content can cause cool ducts and air handler water damage, and the garage is never a "central air handler location". A centrally located air handler in an attic space is a better choice than mounting an air handler in a dislocated garage, and of course a central air handler mounted inside the building is the best-case scenario. If a builder must locate the air handler in a garage, surround the air handler in an insulated air-tight closet or enclosure so that the garage air will not contact the cool duct and air handler cabinet. The Air handler cabinet will leak about 2% of total air flow, enough to condition the air-tight air handler closet. Avoid installing an air handler high near the ceiling of a garage, this upper air column is full of moisture with dew point temperatures as high as 80 degrees most of the year, likely to cause water damage.

**(3) Best Practice Duct Designs** using intelligent CAD3D graphic Manual D ensures the duct system modeled exactly matches the Manual J "computer method preferred" approach adopted by codes as the reference standard. Since the mid 1990's duct designs are computer generated and the "smart duct data" links the duct model info to the Manual J, Manual T, and Manual S design guides for a precise calculation of demands, pressures, and equipment selection. Outdated 1980's duct design methods like guessing, approximating, or simplified methods similar to ASHRAE 52 duct estimate should be avoided. Modern duct modeling software programs quantify the only math solution for the many items that make up the Graphic Manual D duct design. Avoid outdated duct design approaches that feature a single low wall return grille used in conjunction with transfer air grilles from enclosable rooms as this practice would not reflect a modern best practice design. Modern duct designs will contain multiple ducted return air grilles that capture the stratified air in the critical enclosable rooms, mechanical ventilation air duct, air volume control dampers for precise room air flow adjustments, centrally located air handlers, and optional HVAC upgrades to enhance comfort.

## Professional Advice:

Hire an independent HVAC designer capable of performing all ACCA design guides and an accurate energy code form. Use the independently designed HVAC permit documents to form a contract with the HVAC installer. ACCA design guides quantify the only HVAC math solution for the building and the Graphic Manual D duct design shows this math in a drawing format easily read by everyone. Avoid use of permit documents that are missing any of the ACCA design guides and required duct design because the permit documents would be based on too many guesses of the most critical items like ducts, ventilation air, volume control dampers, and correct equipment sizing.

References / HVAC Manuals J,D,S,T,ZR for USA.

Home Energy Modeling for this study courtesy of ⇨ HVAC Designs Inc. ⇨ "Precise, Calculating, and Cool"