7. Heating and air conditioning systems

7a. Proper sizing – Bigger is not better

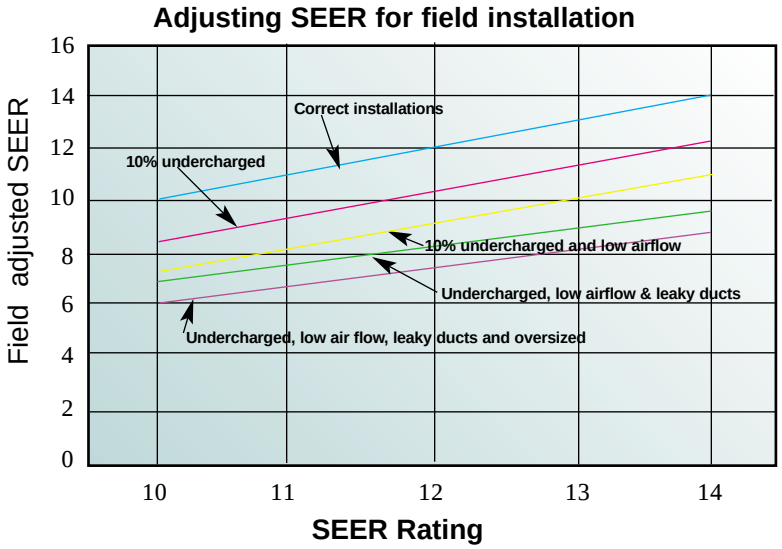
Oversizing found in survey and effects of oversizing

The survey found that oversizing of heating and especially cooling systems is a consistent problem. When houses used to be under-insulated and leaky, a commonly used industry formula was "One ton of cooling for each 500 square feet of floor area." The study found that this outdated formula is no longer appropriate. A correctly sized system delivers more comfort at less initial cost.

An oversized A/C will quickly cycle off and on in short bursts. Since it is oversized, it will rapidly deliver cool air to the space, and the thermostat will think that a level of comfort has quickly been reached. Unfortunately, most thermostats do not measure humidity, and removing moisture is one of the main functions of an air conditioner. An oversized system is not only more expensive, it is shorter lived, noisier and more prone to maintenance problems. A properly sized A/C that operates for a prolonged period of time during the hottest days of summer is actually more efficient and less costly than a rapidly cycling, oversized system.

Builders pay the price for oversized systems. The survey found that the excess sizes of cooling systems ranged from 1/2 to 3 tons. The unnecessary extra expense for this over-sizing ranged from $200 to $1,700 with an average of about $600 – and that was just for the cooling system.

Oversizing a furnace by more than 1.4 times can lead to loss in seasonal efficiency, higher equipment cost, comfort sacrifices due to short cycling, and premature degradation of the furnace and/or vent system. Source: **See page 84** under HVAC.



Air conditioner efficiency (SEER is the Seasonal Energy Efficiency Ratio) is measured in the laboratory, not in the field. With correct installation, a system will deliver close to its measured efficiency (top line this graph). When the system is undercharged and oversized with low air flow (often caused by a restrictive return duct) and leaky ducts, a 14 SEER might actually only deliver the efficiency of a 9 SEER. Careful sizing and installation will help deliver the expected efficiency.

Source: *National Energy Savings Potential from Addressing Residential HVAC Installation Problems* by Chris Neme, John Proctor and Steve Nadel

Balancing the air flow

After the boots have been sealed and supply and return grills have been installed (and after almost all but the final finishing touches have been done), ask the HVAC company to balance the flow of air to all rooms. This final installation step will ensure an even distribution of conditioned air and prevent unnecessary callbacks.

Request a Manual-J analysis

Manual-J is an industry-wide standard that is used to size heating and cooling systems. Local weather conditions and information on insulation, window orientation and efficiency, and duct leakage are processed to recommend peak summer and winter cooling and heating loads. These loads are used to select appropriate equipment to meet these peak conditions.

The Air Conditioning Contractors of America developed Manual-J to size heating and cooling systems. By supplying the builder with the results of a Manual-J analysis, the HVAC contractor can validate the selection of units and avoid potential callback problems.

Going beyond the minimum

If a custom home is being built, encourage the future homeowner to explore the operating costs of HVAC equipment with efficiencies that are higher than the minimum. For a gas heater, 80 percent AFUE (Annual Fuel Utilization Efficiency) is hard to beat for being cost-effective; however, a 12 SEER (or even higher) air conditioner, when properly sized and installed, is usually quite cost-effective and should be seriously considered. Any heat and air system will deliver expected results only if it is carefully assembled and installed. **See page 71** – Adjusting SEER for field installation.

Protect the HVAC equipment during construction

Keep grills, boots, and especially floor boots taped and covered during the building process to keep dust and construction materials from getting into the duct system. The area in the return should be clean and free of debris. Keep the home's breathing passages clean.

Rent temporary conditioning equipment *– do not use the new HVAC system for temporary conditioning*. The use of the home's heating or cooling system during construction permanently contaminates the entire system with dust, paint and other building materials. A recent revision to the Arkansas Mechanical Code (Section 601.5) indicates that the "air distribution system, including equipment shall be protected during construction to be maintained free of debris or other foreign material." Suggestion: Require subcontractors to provide their own safe, auxiliary conditioning equipment.

One-inch thick filters catch some dust, but much of the fine dust passes through. Even with a filter in place, the new heat exchanger coil on the left is clogged with drywall and sawdust construction debris. On the right, the HVAC technician uses an acid/water wash that will dislodge most of the baked-on material. The ductwork, blower motor and all the other hard-to-clean components will continue to blow construction dust back into the house long after this emergency work is done.