

13. RESIDENTIAL HEATING & COOLING

The architect recommends an in-floor radiant heating system. Why was that recommendation made? That question is often asked by our clients and many times a lively discussion occurs over the pros and cons of the different systems that are available today. I'd like to discuss the pros and cons in this month's article.

In today's residential construction owners have upwards of seven directions they could take. I'll start with one of the most commonly used systems in the Santa Fe area. This is the in-floor radiant heating system. This system consists of a remote boiler to heat the water which circulates through "pipes" placed inside a concrete slab. This makes for "warm" floors and a very even heat distribution. The pipes in the slab are either copper or a synthetic polypropylene fiber reinforced tube. They are placed in the slab about every twelve inches, but by exterior glass doors or windows they are typically spaced at nine inches apart. Different heating zones within the residence are achieved by valves which control the amount of hot water flowing into the different zones. Probably the most important point to inform you of is that with a radiant system you have no real air circulation, you must rely on fans (which I recommend installing in all main rooms including bedrooms with a radiant system) and the ability to have cross ventilation from windows in every room. This cross ventilation is important to keep in mind in the preliminary design of any residence no matter what heating system is chosen. One other consideration in a radiant heating system is to spend the extra money to put rigid insulation under the slab which maximizes the efficiency of the radiant system.

Another common heat distribution system is baseboard heating which can either be electric or hot water. Electric baseboard is the least efficient of the heating systems and I would only use it in accessory structures such as storage areas or maybe even a free standing studio where the distance from the main residence precludes tying into it's mechanical system. Hot water baseboard utilizes the same type boiler as a radiant system but it's heating elements are exposed and located usually under windows or along cold walls (those facing North and East) where heat loss occurs. This is an economical choice for radiant systems and provides the same nice comfortable heat. Sometimes in two story applications, in-floor radiant is used on the first floor and baseboard is utilized upstairs where

there are no concrete slabs to conceal the radiant pipes. The one main disadvantage to all three of these systems is that between the time you adjust the thermostat and the time the radiant or baseboard heaters adjust themselves to the new temperature setting be hours. Many clients do not use these systems for this one reason.

One of the cheapest and commonly used systems in remodels or additions is wall or freestanding heating units. These are typically gas fired and installed either recessed in the wall or freestanding in a corner of a room. Many times these are used as a back up system for active or passive solar systems where the need for heating may happen only on the coldest, cloudiest days of the year. Installation requires only a gas line to the proposed location and a vent to the exterior.

HVAC systems (Heating Ventilating and Air Conditioning) are gas fired (they can also be electric) heating units that heat outside air and distribute it through the residence by ductwork either under the floor or in the ceiling above, or exposed on the roof. A condenser and humidifier can be added to this system to provide either air conditioning or increase the humidity in a house. The advantages of this system are instant on-demand heating and cooling, the ability to circulate outside unheated and uncooled air throughout the house and for many people with antiques and important art collections humidity control is required. This humidity control is required because in our dry climate with so little humidity wood furniture can literally dry up and crack, by introducing humidity you can prevent this kind of damage. The disadvantages to this system are uneven heat/cooling distribution because the air comes through at single points, no warm floors and it's higher initial cost with (air conditioning and humidifiers) than radiant heating to install.

For locations with moderate heating and cooling needs, heat pumps are an energy efficient alternative to conventional HVAC systems. Using electricity, the system moves heat rather than generates heat. By taking advantage of the season and moving or removing heat from one space to another, less energy is used. The most common heat pump system is an air-source heat pump, which needs monthly filter maintenance. A neglected heat pump can significantly affect the energy efficiency. Geothermal heat pumps use ground-source or water-source heat and a portion of your lot is designated as your

geothermal source. This system has a high up front cost, but general low operating cost. Use of geothermal depends on lot, subsoil, and landscape.

The other cooling option used and usually used only in radiant or wall heater applications is evaporative cooling. Evaporative cooling is typically a square enclosure with filters on four sides and a fan inside. Air is pulled from the outside through the filters (which cools the air by moving the air over the wet filters). Many times we will locate evaporative cooling in the kitchen (where a lot of heat is generated by appliances) and possibly in the Master Bedroom. Evaporative cooling is a low technology and cost effective alternative instead of a central air conditioning system and should be considered.

The most cost effective way to heat a house is still passive solar. This option requires no electricity or gas usage but by simply orientating your house correctly and supplying enough glazing to the South, heat gain is achieved and the spaces are heated naturally. A caution with passive solar is that any standard home mortgage also requires a back up heating system and overhangs over the windows must be provided to shade the house from the hot summer sun. Window treatment can also help control the amount of solar gain and once again ceiling fans are important for air distribution.

Active solar systems are typically done with exterior panels on the roof which run water through them, heat up the water (which is stored in a insulated tank in the house) and a pump to distribute the hot water through the house for both heating and also for domestic hot water needs when the system is set up properly.

All these systems have advantages and disadvantages and each must be discussed with any potential client to determine which system will best serve them. Certainly on larger residential and commercial jobs a Mechanical Engineer should be hired to do preliminary evaluation and drawings to describe the proposed new mechanical system.