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Recommendations for installation of cooling systems

The purpose for this information is to provide a better understanding of the HVAC equipment, components, designs, and installations, of HVAC system equipment in the Houston area and to apprise you of conditions that may allow a system to operate more efficiently. This information is not intended to be an exhaustive in-depth design of HVAC systems, nor is it intended to be a total list of equipment, components, designs, or installation procedures. Since more in-depth information is desired and may be required for the HVAC system, it is recommended that a reputable, qualified, and State of Texas licensed HVAC contractor be contacted. Opinions related to compliance with specification, legal, and/or code requirements or restrictions of any kind are specifically excluded as being covered in this information. The opinions and comments stated in this information are based on the knowledge gained through experience and professional studies of Ronald I. Givens as of the date this information was prepared and should not be considered conclusive. The information listed below is an opinion of Ronald I. Givens who is not licensed by the State of Texas in the field of HVAC equipment installation and may differ from the opinions and conclusions of other professionals.

If you are in the market for new or replacement heating and cooling equipment, you should examine all of your options carefully. Don't stop with the purchase or installed cost. Look at the operating and maintenance costs. Comparing the value of various systems should be very important to anyone who is about to spend several thousand dollars on a new HVAC system. There are many factors involved in analyzing a return on your investment. You should take into account the expected rate increases now being considered by your power company. The higher the power rates, the more you will save by installing a higher SEER rated system. If you plan on staying in the house for four, five, or more years, the investment in a higher SEER rated system will be a wise one. The minimum SEER rated system you should install is a 13. Most systems run approximately 2500 to 3000 hours per year. In addition to saving on your power bill, you should consider the fact that the new system will greatly improve the comfort level of your home.

A properly installed quality HVAC system will give you the homeowner the most value for your dollar spent. An energy-efficient system may cost more initially, but payback will occur within a year or two in most cases and over the life of the system, the cost of operation is much lower.

The humidity is very high most days in the Houston area. You will feel much more comfortable, no matter what the temperature, if the HVAC system removes the moisture from the air inside your home. If the HVAC system removes as much moisture as is possible from the air inside the home, you will be able to set your thermostat to a higher setting and have the same comfort level, the system will run less, and your power bill will be less. Therefore, moisture removal may be more important than heat removal from the conditioned air in an area of high humidity like Houston.

Correct sizing of your home's HVAC equipment is critical for maximum operating efficiency. An improperly sized system will result in inefficient operation, reduced comfort and decreased reliability of the system. In the cooling mode, a system that is oversized will run in short cycles as the thermostat senses the desired temperature has been reached. This short cycling of the system allows less time for moisture removal, resulting in higher indoor relative humidity which sacrifices comfort. Conversely, a system sized too small will not be able to properly cool the home adequately during the heat of the day and will run for long periods of time without cycling off. Your HVAC firm must determine the proper size HVAC system for your needs in your home. The "rule of thumb" method of tons per square foot is obsolete and should not be used in determining your conditioned air requirements. Make sure your HVAC contractor uses the most accurate method to determine the size of your system. The most accurate method is called the Manual J load calculation, developed by the Air Conditioning Contractors of America. This in-depth analysis measures heat gain and heat loss and takes into consideration the size of your home, insulation level, type of windows and many other factors to find the right HVAC system for your home. Your HVAC firm should determine the heat load of your home. Further, you should inform the HVAC firm if someone will be in the home most of the twenty-four hours of a day and if you have lots of dinner parties, since additional equipment may be required. You should think in terms of ten people sitting requires approximately one ton of cooling to properly condition the air.

The parameters for good temperature control, comfort, and lower electric bills require quality components and proper installation.

Thermostat

The thermostat must be correctly installed or the system will not operate accurately or regularly. The thermostat must be installed near the return air grill to monitor the return air temperature.

An accurate thermostat can save you money and reduce your electric bills. A quality setback thermostat can automatically raise or lower the temperature based on your life style. The thermostat should be easy to program and easily changed.

The reason you change the thermostat setting is to control the enthalpy of the environment. Enthalpy is the total heat content of the air, which is a combination of temperature and humidity levels. When the humidity is high in your home in the summer, you lower the thermostat. This lowers the temperature and removes some of the humidity. In the winter, you raise the temperature higher to compensate for the low humidity in your home.

A thermostat is not an accelerator, it is a brake. Setting a thermostat too low only changes the braking point. It does not speed up the process. The thermostat cannot control a system that is not working properly. It will shut the system off only when satisfied.

Condensing Unit (outside unit)

A condenser with easy starting, quiet operation, accessible cleaning, and efficient design should be considered.

1. SEER rating of 13, and consider 14 or higher.
2. factory installed hard start kit for easy starting.
3. insulated compressor for quiet operation
4. two speed compressor if you want more efficiency, since the compressor will run at about half speed at night and when the temperature drops seasonally, when not as much heat must be removed from your home.

Evaporator Coil (inside unit)

The evaporator coil (cooling coil) should be compatibly sized for use with the condensing unit. The evaporator coil does not need to be the same brand as the condensing unit. However, the SEER rating for the condensing unit is based on using the manufacturer's recommended matching evaporator coil.

The evaporator coil should never be oversized in a system for a single family home. However, the evaporator coil can be undersized one half a ton, only if there is proper air flow through the system. Under sizing the evaporator coil can/may cause it to get colder, removing more moisture from the conditioned air, and thereby lowering the humidity in the home. However, if the evaporator coil is undersized too much then the coil will restrict the air flow causing the system to operate longer and raising the power bill.

Refrigerant Lines

Both of the refrigerant lines must be properly sized and installed to make a high efficiency system work effectively.

Ridged Metal Ducts

It is best to use only sheet metal ducts. The best duct to use is an all hard ridged round pipe, externally insulated to provide the best air flow and a longer life. Duct work should be designed and engineered to your homes specific requirements. If your system is in place and you are only getting new equipment, you should have your HVAC contractor inspect the general condition of your home's duct work and check for leaks. Leaking duct work will reduce your systems capacity and efficiency, and result in reduced comfort.

Water Drain Lines

The condensate and safety/drip pan drain lines should be of a heavy duty pipe like 480psi pvc pipe. The drain pipes should be 3/4 or 1 inch diameter pipes. A tee fitting should be installed in the condensate drain line near the evaporator coil so that chemicals can be put into the drain line to clean out any build up. In addition, the drain lines should be properly sloped so that water does not stand in the drain lines causing an algae growth.

Refrigerant Flow Control Devices

Expansion Valve

An expansion valve is to modulate the refrigerant into the evaporator coil. An expansion valve is the best and most efficient way to add refrigerant to the evaporator coil, thereby removing the maximum amount of moisture/humidity from the air inside your home. An expansion valve adds exactly the right amount of refrigerant to the evaporator coil under all conditions, keeping the evaporator coil full of liquid refrigerant when the system is running and thereby keeps the evaporator coil as cold as possible. Colder evaporator coil results in maximum moisture/humidity removal, a more comfortable environment, lower operating cost, and longer system life. The thermostatic expansion valve has a sensing bulb mounted on the refrigerant outlet line of the evaporator. The bulb temperature controls the opening of the expansion valve's thermostat valve needle. Expansion valves can and do fail, however, they do not have a high failure rate and should be used in your system. An expansion valve can be installed on many existing/in place evaporator coils if the manufacturer does not install one.

Capillary Tube

The capillary tube is the most common refrigerant flow control device. The capillary tube is used to put refrigerant into the evaporator coil (inside unit). Approximately eighty per cent of the HVAC systems in the Houston area have capillary tubes. The fundamental function of the capillary tube is based on the pressures in the system and whether the evaporator coil needs it or not, refrigerant flow is based on the pressure differential in the high and low side of the system. Therefore, only during the heat of the day will the system cool efficiently. The capillary tube starves the evaporator coil most of the time, resulting in poor humidity removal and a higher operating cost. An expansion valve is a much better way of putting refrigerant into the evaporator coil in an area that has very high humidity. The capillary tube is used more often because it is cheaper to manufacture the evaporator coils with them than with expansion valves. Further, the compressor life can be shorter if a capillary tube is used in the system.

Sight glass

A sight glass should be installed in the liquid line so that anyone, even the home owner, can monitor the refrigerant level. The amount of refrigerant that should be used varies with the type and design of system. Using the sight glass, the HVAC firm can get an exact refrigerant charge in the system. The appearance of vapor bubbles in the sight glass will indicate a refrigerant shortage. The sight glass may show a few bubbles when the system first starts or just as the system stops and these bubbles are normal equalizing actions and do not indicate a shortage of refrigerant. Many sight glasses have a chemical which will change color when the system has moisture in it. The chemical is green when dry and pink when wet from moisture. The system must not have moisture in it. The sight glass should be installed near the evaporator coil (inside unit) and not at the condensing unit area.

Return Air Duct

The return air grill and duct must be properly sized to provide good air flow through the system. Restricted air flow affects the performance of the system and will cause the system to run longer raising the power bill. If the master suite door is to be closed for long periods of time, say all night, then another smaller return air duct and grill should be installed in the master suite. If the door is closed to the master suite with out a return air duct the suite will build up a static pressure and the air cannot properly circulate back to the HVAC equipment causing the suite to be uncomfortable.

Fresh Air Intake

Most hvac systems do not have fresh air intakes. Every system should have fresh air intake tied into the return air duct before the filter. The fresh air intake should be open to the outside at all times. It is recommend that approximately five to ten percent outside air be taken into the return air duct anytime the system is moving air, in both the heat and cooling modes. The fresh air duct can be a six to eight inch duct run from the outside to the return air duct. The effect of the fresh air intake is to dilute any pollutants that are in your home and allow pollutants to leak out of your home.

Access Door

An access door should be on both sides of the evaporator coil (inside unit) in the plenum and transverse/transition piece (between the furnace and evaporator coil), to allow inspection and easy cleaning of the coil.