Questions to ask Heat Pump HVAC installers when considering a retrofit to your existing system

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The planet was in trouble, so we took our plastic bags back to the store, and then …. well, we took more bags back to the store. Comedian Rob Riggle about the future

Overview of Heat Pump HVACs

Format of this guide. The information that follows is organized into sections of interest:

- The first 7 pages discuss topics applicable to all HVAC heat pump systems.
- Page 8 contains a diagram that guides readers to one of 3 common configurations tailored to individual homeowner systems.
- Following the diagram are detailed background topics for the 3 common HVAC configurations and a list of questions to ask prospective installers.

The Table of Contents serves as a reference for navigating to these sections.

What is a heat pump? As the name implies, heat pumps move heat, through the well-established principle of refrigeration. If you stand in front of a window air conditioner, you feel cold air. If you stand outside the unit, you feel hot air blowing your way, hotter than the outdoor temperature. Heat on the indoors is being pumped to the outdoors. Heat pump technology makes the refrigerant flow reversable using the same basic mechanical components of an AC. Heat can be either pumped to the outdoors or the indoors even with outdoor temperatures beyond 0 and 120 degrees.

Why heat pumps? The first question to ask yourself is: why is adopting heat pump technology the wisest choice? Transitioning away from gas appliances in our homes is an opportunity to live healthier lives. Burning gas, like any fossil fuel, creates air pollution. Nitrogen oxides, produced by burning gas, can aggravate respiratory diseases when they accumulate inside our homes. Additionally, the byproducts of burning gas contribute to climate change by accumulating in the atmosphere. The risk of natural gas leaks poses an even greater threat to both our health and the climate. Methane emissions from natural gas lines account for 16% of global greenhouse gas emissions.

As homeowners, we can observe the nationwide shift of the power utilities transition toward zero fossil fuel energy sources over the next few decades. These utilities are pursuing renewable energy, not necessarily out of altruism, but because it offers the lowest cost for new energy production. Capitalism is driving this transition. Similarly, adopting heat pumps provides cost-saving opportunities for our homes, aligning with this broader movement toward cleaner and more efficient energy solutions.

Is gas cheaper today? Yes, but not by much. With heat pump retrofits, the gas-burning equipment we currently use to heat our homes becomes obsolete, turning into rusted junk ready to be removed. By installing a heat pump and capping off the gas line, you can make a significant step toward healthier, cleaner and more efficient home heating. The key advantage of heat pumps is their remarkable efficiency, which far surpasses that of gas systems. For

example, a heat pump can transfer 30,000 BTUs of heat from the outdoors to the indoors—even in freezing weather—while consuming as little as 10,000 BTUs of electrical energy. This means the heat pump operates at 300% efficiency, compared to the best gas furnace, which can never exceed 100% efficiency.

Gas furnaces burn fuel to generate heat, but a significant portion of that heat is lost through the exhaust vent, resulting in typical efficiencies of 80–95% for a well-maintained system. While it's true that natural gas currently costs about 40% less per unit of energy compared to electricity, the example above illustrates that heating with a high-efficiency heat pump is competitive. Currently the switch from gas to heat pump would increase heating utility bills by about 17%. Less than this if the old gas furnace has gotten inefficient. Furthermore, natural gas prices tend to rise more rapidly than the tightly regulated prices of electricity. In February 2023, for instance, the cost of gas in Arizona more than doubled. For those fortunate enough to generate free rooftop solar energy, switching away from gas becomes an even more practical choice. Your solar cannot help with your gas bills.

Different Mechanical Styles of HVAC

HVAC equipment is available in several physical forms. 'Central' systems are associated in homes that have duct work for distributing air flow. Conversely 'Duct-less' implies that the household ducts don't exist or are not used. 'Split' HVAC describe systems that have separate indoor and outdoor equipment that are connected by mostly hidden refrigerant lines. 'Packaged' units are self-contained systems, like a window unit but much larger so is either mounted on the ground or on a roof top, called a 'RTU'. The basic HVAC categories are:

- Window units - AC or heat pump (coming soon)
- Duct-less Mini Splits - AC or heat pumps
- Split Central – AC only or AC with a gas furnace or AC with 'dual fuel' hybrid (gas booster and heat pump are common) or heat pump only (available but limited with 120V power.)
- Packaged Central - AC only or AC and integrated gas furnace (often called 'gas-packs') or heat pump only
- Evaporative coolers – cooling only, may or may not be central (having ducts). The equipment is by far the least expensive, however only operates comfortably in low humidity weather.

How to compare efficiency?

On the topic of efficiency, there are many labels for performance, however two figures of merit are worth understanding, SEER2 and HSPF2.

- EER, Energy Efficiency Ratio, is calculated as cooling capacity divided by power input therefore has the units of BTU/Watts-hour for a heat pump. EER is of limited use because it is tested under specific conditions and temperatures so multiple EER ratings are then needed to understand expected efficiency for a range of conditions.
- SEER, Seasonal EER, provides a broader representation of a system's efficiency over time and became the standard metric for residential HVAC systems.

- SEER2, is an updated version of the metric that accounts for new testing standards introduced by the U.S. Department of Energy (DOE) to reflect real-world operating conditions more accurately. They even include the effect of not having brand new filters all of the time. These standards came into effect on January 1, 2023.
- HSPF2, Heating Seasonal Performance Factor 2, is analogous to SEER2 but measures the seasonal heating efficiency of a heat pump.

SEER2 and HSPF2 are the standard that should be used when discussing heat pump models with installers. Some equipment like window units or a few inexpensive mini-split heat pumps only specify EER or SEER. These numbers will be artificially higher than for SEER2 testing because less stringent test conditions are used. With mild Tucson winters often judging equipment models only based on SEER2 alone is reasonable unless it is questionable if the equipment is a true heat pump or relies on resistive heating strips. SEER2 is usually specified by a unitless number. 19 SEER2 is a noble goal for your next HVAC. A 20 SEER2 HVAC will consume 33% less electricity than a 15 SEER2. (20-15)/15. In Tucson, a 4-ton (48,000 BTU) heat pump with a 19 SEER2 rating should save the homeowner about $160 for electricity bills annually over a unit a 15 SEER rating.

What is static pressure and how can something so important be often ignored?

The following discussion pertains to central HVAC systems with ductwork. In these systems, airflow from the blower is routed through ducts installed during the home's construction. When properly balanced, these ducts deliver equal levels of comfort through individual airflow paths. Each branch duct naturally presents some resistance to airflow, and all branches combined create a total airflow resistance as experienced by the blower. Proper compressor operation requires a specific range of air pressure from the blower to move the specified amount of air over the indoor coil, typically measured in cubic feet per minute (CFM).

Professionals understand that the blower's air pressure, combined with the resistance from the ductwork and the HVAC system's internal components, must stay within an acceptable range. This measurement is known as static pressure (SP). SP is commonly measured using a manometer probe inserted into a small hole in the ductwork. It is expressed in inches, more precisely, inches of water displacement in a column. Installers often liken SP to a system's blood pressure: when SP is too high or too low, it stresses the system, much like abnormal blood pressure stresses the body.

Low SP frequently occurs in retrofitted central evaporative cooler systems because their ducts are less restrictive. Conversely, older homes often have undersized ducts, which contribute to high SP. Both scenarios can prevent the manufacturer-specified airflow through the indoor coil. In the worst case, inadequate airflow may prevent the refrigerant from vaporizing fully, causing the coil to become a less effective heat exchanger. This leads to higher refrigerant pressures, poor vapor lubrication of the compressor, and frequent compressor cycling. Avoiding poor SP is essential for system longevity and operational efficiency.

A common issue with heat pump retrofits is that the new system may not match-up well with the existing ductwork contribution to total static pressure, resulting in SP that is either too high

or too low. Often, salespeople attempt to match the old system's performance on paper without conducting physical measurements, leading to mismatched systems. The issue is further complicated when the new blower operates at a higher speed, which may not have been accounted for during planning.

Because proper static pressure is a critical factor in ensuring the system's efficiency and compressor longevity, routine maintenance, such as replacing air filters before they become clogged with dust, is vital. Notably, SEER2 efficiency testing is conducted at a total external SP of 0.5 inches—typically the maximum allowed by most manufacturers—while older SEER testing used only 0.1 inches.

If the existing HVAC system is still operational, it is recommended to measure the ductwork's static pressure contribution before selecting a new heat pump model. Doing so ensures the retrofit will deliver optimal efficiency and extend the system's lifespan. However, note that in many cases, the existing specific blower speed settings and the actual CFM are unknown. This lack of information makes it challenging to accurately predict the expected SP range for the new system at an appropriate fan speed setting.

How airtight are the ducts and how well insulated? An important factor affecting ductwork efficiency is the amount of air that leaks through loose duct seams before it reaches your living spaces. Conditioned air that escapes into attics or crawlspaces instead of your rooms results in wasted energy. Air leakage can be tested by your prospective heat pump installer or by specialist services. If leakage is excessive, ducts can be sealed internally using a service like Aeroseal, which is locally available. For visible ducts, such as those in an attic or crawlspace, the quality and thickness of the insulation should be inspected. Ensuring proper insulation or adding additional layers helps minimize heat or cooling losses along the ductwork.

How airtight is your house? Significant heating and cooling energy loss can occur if your home is leaking air from living spaces to the outdoors through poorly sealed doors, attic seams, or other hard-to-detect pathways. Additionally, insulation that was adequate decades ago often falls short of the recommended R-factor for new construction. If you suspect this issue, a thorough home energy assessment could help identify problems and lead to significant savings on HVAC operating costs.

What tools should your installer use to assure that the new heat pump equipment is a good match to your house? Key specifications to consider when selecting an HVAC system include airflow and the cooling capacity required for your home. Does the installer simply estimate these values, or do they perform a proper Manual J Load Calculation? The Manual J method involves inputting data such as the home's square footage, insulation levels, number and type of doors and windows (along with their U-values), air leakage, ceiling height, expected Arizona climate extremes, and solar heat gain (e.g., the percentage of the house facing south).

Manual J calculates the home’s sensible and latent BTU heat gain (cooling loads) and heat loss (heating loads). Sensible load refers to the energy require to change the indoor temperature,

while latent load refers to the energy to maintain the temperature. This calculation provides an estimate for the required HVAC capacity, expressed in BTUs or tons (1 ton = 12,000 BTUs). The salesperson should be able to present the parameters used in the calculation, often utilizing software tools such as Wrightsoft, CoolCalc, or Elite to estimate heating and cooling loads accurately.

Following Manual J, Manual S is used to match the appropriate system to the calculated sensible and latent cooling and heating loads. This step is critical to avoid oversizing or undersizing the system, which could lead to unnecessary strain, inadequate comfort, reduced efficiency, and premature compressor failure.

What type of refrigerant should I request? HVAC refrigerants are evolving to reduce their Global Warming Potential (GWP) and minimize atmospheric ozone depletion. As of 2024, the most common refrigerant is R-410A, which has a GWP of 2,088—28 times greater than the GWP of CO_2. A new class of refrigerants, labeled A2L, features a significantly lower GWP (under 300), improving heat pump efficiency. However, A2L refrigerants are more expensive and require additional technician safety training due to their increased flammability.

Beginning in 2025, the EPA will prohibit the manufacture and import of residential HVAC systems that use refrigerants with a GWP greater than 700. However, locally warehoused HVAC systems may still contain pre-A2L refrigerants, which will likely be sold at a discount. The transition to A2L refrigerants is expected to increase the cost of an HVAC system by $1,000 to $1,500—a factor for globally conscious consumers to consider.
It's important to note that when old equipment is retired properly, technicians evacuate the refrigerant into a storage tank to prevent its release into the atmosphere. This process helps minimize environmental harm from outdated refrigerants.

'Inverter' Heat Pumps. Traditional air conditioner or heat pump compressor motors typically operate at one or more fixed speeds. These motors cycle on, off, or adjust between speeds as needed to meet the thermostat setting. Modern heat pump systems, however, are increasingly equipped with inverter-driven compressors. These use variable-speed motors that run continuously, adjusting their speed to match system demands.

By avoiding the constant on/off cycling of traditional systems, inverter-driven compressors offer several benefits, including improved efficiency, reduced temperature fluctuations, quieter operation, and greater longevity. (Note: An inverter is a DC-to-AC power converter, which these systems use. The inverter adjusts the frequency of the AC output to control motor speed.)

Which local heat pump HVAC installer offers the best price? This data can be challenging to obtain and keep up-to-date. Typically, the equipment itself is not the dominant component of the installation price. Installers must cover the cost of experienced technicians, rent cranes when needed, apply for permits, and hire skilled crews. When you hire an installer, you're

paying not just for the equipment but for their expertise, institutional knowledge, and quality workmanship.
In general, larger installation companies tend to carry more extensive equipment inventories, which can drive up their prices. Smaller independent installers, with fewer crew members and lower overhead costs, may charge less for labor. However, they might lack the software tools and resources necessary to conduct the detailed pre-analysis that is often recommended. HVAC installation is a highly competitive field, and while smaller companies may offer excellent skills, some may not remain in business for the lifetime of your system.

In Tucson, some installers might appear to have a smaller local presence but actually operate regionally, giving them greater access to and influence with large equipment warehouses. Examples of such companies with regional reach include Cool Willy's and Rite Way.

We aim to gather data on recent competitive quotes from heat pump installers and will share this information, though it's important to note that pricing and availability are dynamic. If you're unsure where to start when choosing an installer, visiting the Tucson Electric Power (TEP) website for recommended heat pump installers can be a helpful first step. While inclusion on TEP's list isn't a guarantee of a flawless installation, it provides a foundation for your search.

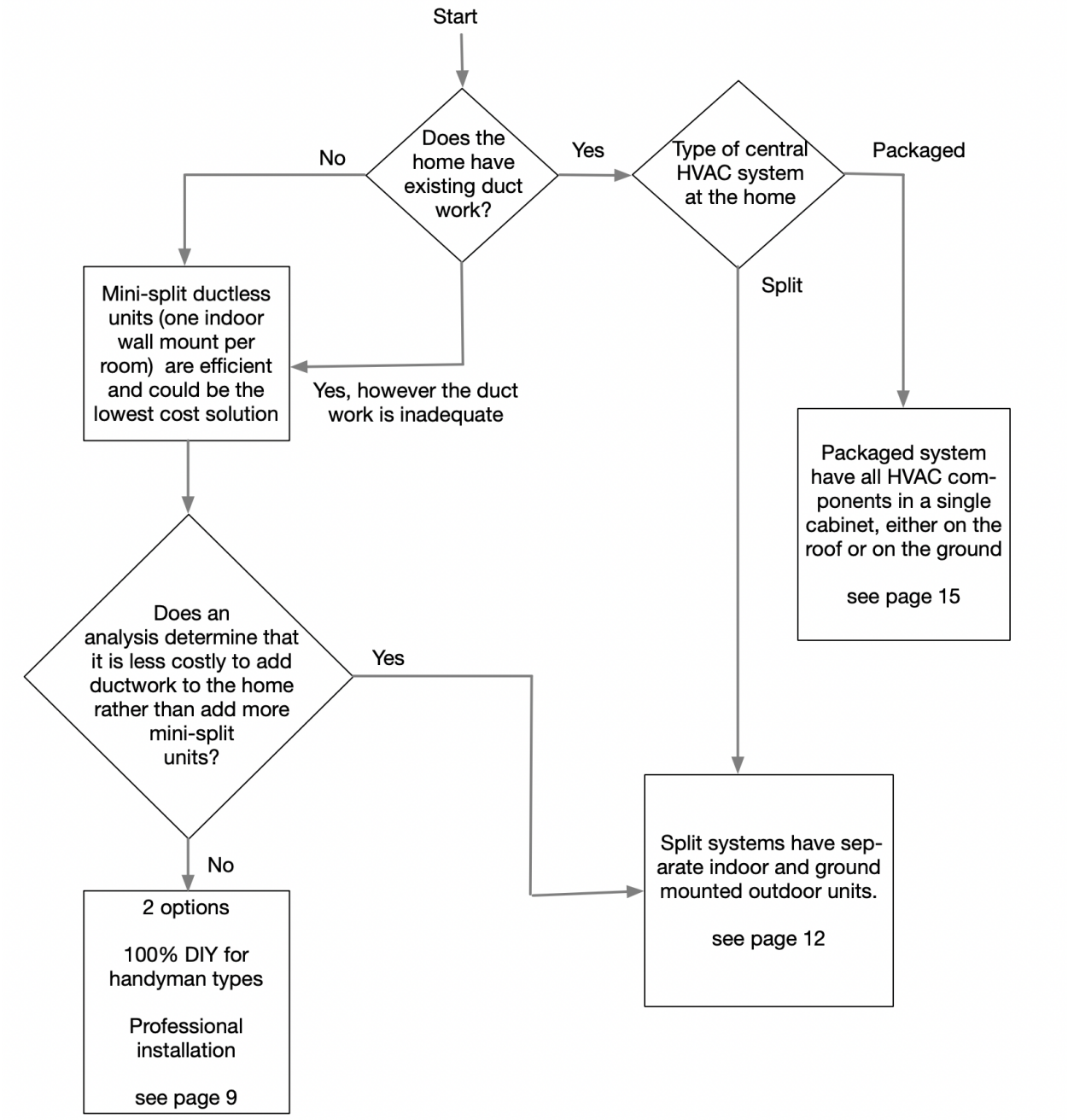
As for heat pump manufacturers, key players include Bryant, Carrier, Daikin (Goodman), Day & Night, Heil, Johnson Controls, Lennox, Trane, Mitsubishi, Rheem/Ruud, and Tempstar. Many of these brands share manufacturing facilities, meaning the underlying equipment may be identical with differences only in branding. All of these manufacturers have well-established reputations for producing high-quality residential heat pumps.

What type of HVAC equipment fits my home's existing construction?

HVAC systems come in several configurations, often determined by your existing home setup.

The diagram on the next page helps direct to the suggested lists of questions to ask candidate installers for each of the three main types of heat pump HVAC systems.

Types of HVAC Systems



Decision tree for what type of retrofit heat pump is best suited to the existing home construction

Not shown on the decision tree is the option for **window-mounted heat pumps**. For this option to be practical, the window must be a casement style (where the windowpane slides open vertically), and the heat pump model must be compatible with a standard 115V outlet. Two companies, Midea and Gradient, offer heat pumps with the efficiency required to operate from 115V outlets for moderate-sized rooms. However, these models are not yet widely available in Arizona or online. We will continue to monitor their future availability.

Portable heat pumps are also advertised. These units sit on the floor of a room and include flexible air and condensate hoses that attach to an adjustable adapter plate designed to fill the opening of a sliding-pane-style window. While portable heat pumps can provide a minimalist solution for cooling or heating a single small room, they are generally not very efficient and may not provide adequate comfort levels.

Ductless Mini Split Heat Pumps.

Mini-split heat pumps offer some of the highest energy efficiencies among all heat pump options. Each room is equipped with a wall-mounted or, in some cases, a ceiling-mounted unit that delivers cooled or heated air to the adjacent living space. Multiple mini-split units are required to cover all of a home's living areas.
An advantage of mini-splits is their ability to provide individual temperature control for each "zone" in the house, enhancing energy efficiency. Mini-splits do not rely on electric resistive heat strips in the indoor unit. However, the outdoor unit typically includes an electric compressor crankcase heater to maintain the refrigerant and oil at a minimum temperature. In defrost mode, these systems temporally reverse the refrigerant flow and stop the fan motor.

Each indoor wall-mounted unit is paired with a separate outdoor unit that supplies power, control, and refrigerant. A single indoor unit matched to a single outdoor unit offers the cleanest and simplest installation, often with the components located on opposite sides of an exterior wall.

To reduce overall costs, multi-head configurations can be used, where a single outdoor unit serves multiple indoor units. However, this approach requires refrigerant lines running along exterior walls, which can affect the system's aesthetics. Configurations with more than three indoor units per outdoor unit are possible, but the longer refrigerant lines may increase costs and reduce efficiency.

For larger homes requiring more than two outdoor units, it may be worthwhile to conduct an analysis to determine whether adding air-handling ducts would be a more cost-effective and efficient solution.

Do It Yourself?

Mini-splits offer the potential for additional cost savings through DIY installation, provided the homeowner or a skilled helper can perform the required work. Numerous online videos illustrate the effort and skill involved in such installations.

A key consideration is whether the vendor supplies pre-filled refrigerant lines. These eliminate the need for a vacuum pump to evacuate the system and properly charge the lines with refrigerant, a task best performed by a certified HVAC technician. Refrigerant loss due to inexperienced DIY installers is an insult to the environment. Surveys indicate that hiring a technician solely to charge a DIY-installed system can be challenging, as the job requires minimal time investment and carries liability concerns. Similarly, finding a skilled technician to repair an aging DIY system may prove difficult. If the DIY option is selected only purchase systems with pre-filled refrigerant lines to avoid unnecessary leakage of refrigerants.

Some mini-split heat pump suppliers, such as MRCOOL and Klimaire, offer pre-charged, "leak-free" refrigerant lines to simplify DIY installations. MRCOOL stands out due to its lifetime compressor warranty, well-established online catalog, and reliable technical support, making it a popular choice among DIY enthusiasts.

Questions for Professional Ductless Mini Split Heat Pump Installers

Most homeowners would prefer to hire a licensed HVAC company to install their mini-split systems. The following suggested questions for professional retrofit installers of Ductless Mini Splits heat pump are below.

1) Be certain that you are requesting heat pump mini splits so that your heating needs are also met, and you can then disconnect older air polluting and unhealthy natural gas or propane heaters.
2) Some installers still hold outdated biases against heat pumps, ignoring their modern reliability, high efficiency, and ability to perform across a wide range of outdoor temperatures. If you're committed to adopting heat pump technology, seek an installer who offers current, accurate information about the latest options.
3) How many zones are needed to cover the home's needs and what is the required heating/cooling capacity for each? This also determines the BTU ratings for each the indoor wall mounts. Where should they be placed and how will they be sized for optimal comfort of each zone? Request a report on these zone-by-zone sizing calculations.
4) Beware that some adjacent areas like kitchens and bathrooms may lack adequate ventilation from the indoor mounts. Ceiling and floor fans may help.
5) How many 'multi-head' outdoor units would best manage the installation cost and serve the home layout? What are the lengths of the necessary outdoor line routing needed for shared outdoor units? The house floorplan should illustrate the shortest hidden interior and exterior channeled pathways for the condensate, power, and refrigerant line sets.
6) Each indoor wall-mounted unit requires a condensate drain. This typically involves drilling a hole through the wall near the unit to allow for gravity-fed drainage to the ground. If some wall mounts are optimally placed on interior walls, it can complicate connections to the outdoor unit and the condensate drainage path. When a gravity-fed drain is not feasible, a condensate pump with a collection pan is needed to move the condensate to the nearest drain or an appropriate outdoor location. These may present future issue of interior water stains if the system is not maintained to avoid blockages.

7) In Tucson the exterior wall channels that are used to hide the refrigerant, control and power lines are best if made of painted galvanized metal rather than the plastic option more commonly promoted.
8) Higher BTU-hour rated mini-split units require dedicated 240V power. Routing of conduit on exterior walls may be required to reach the main service panel. In addition, the breakers for the outdoor units may have to be added to the panel. These power lines cannot be shared with other outlets. There are work arounds when the main breaker does not initially appear to support the addition of multiple heat pumps.
9) Once an overall layout is planned, what manufacturers offer the greatest efficiency, reliability, and availability of repair parts? Diakin, Mitsubishi, Sanyo, and Fujitsu brands are often cited as having excellent local availability, support, warranties, and locally accessible repair components. Many brands exist in this marketplace, therefore extra research for specifications (SEER2 > 15 and HSPF2 > 7 being prime), reliability, warranties (particularly for the compressor), and over-night availability of parts.
10) Verify manufacturer specifications that the models selected operate effectively for the temperature extremes of Tucson. The record high for Tucson was 117 degrees occurring in June 1990 and the record low was 6 degrees way back in January 1913. Local code requires specific Manual J design conditions and is referenced in Manual S supporting documentation via extended performance ratings. City of Tucson and most of Pima County require 75°F indoor temperature with 105°F outdoors for summer and 70-72°F indoor at 35°F outdoors for winter.
11) To obtain various credits and rebates, request efficiency of 19 or greater SEER2. Ask the installer if they can assist in the determination that credits are available for your specific equipment and installation.
12) At what point does switching to a central heat pump becomes more economical? A broad variety of high efficiency Split Central heat pump systems are available. A single Split Central system may be more affordable than several outdoor mini splits. Adding new duct work to a home is a variable cost depending on the house layout, however, expect that the adder to be approximately 25-35% of the system cost. Insulated ducts may be reasonably routed under a house if there is a crawl space, most common in Tucson for mobile homes.

Split Central Heat Pumps.

If your system is roof-mounted, skip to the next section on Packaged Central Systems. Split Central HVAC systems are the most common residential HVAC type nationwide. A split system has two main units:

- Outdoor Unit: Sits on a ground pad, contains the compressor and a heat-exchanger coil with large fan blades on top to circulate air through the coils.
- Indoor Unit: Found in a closet, utility room, garage, or attic. It houses a second heat-exchanger coil, an air filter, and a blower to circulate air through ducts for even comfort.

The outdoor unit connects to the indoor air handler via insulated refrigerant lines, which are typically hidden in walls or crawl spaces. Short exposed sections connecting outdoors to the house should be protected from accidental damage.

Getting off Gas. Older central HVAC systems often include a gas furnace for heating, with the indoor blower connected to the central ductwork through a section call the 'plenum'. In theory, retrofitting to a heat pump eliminates the need for a gas furnace, as heat pump indoor coils provide heat in winter. However, a common challenge is that most gas-free heat pump systems require 240V power, needed for 'boost heat' resistive strips, while gas furnace systems typically only require 120V service. The cost of routing new 240V power to the indoor unit can be an expensive adder to a heat pump retro fit cost analysis.

Many installer-recommended heat pump retrofits today are 120V "dual-fuel" hybrids, which retain a gas burner for boost mode and to provide continuous indoor heat during short cycles when the system reverse cycles to defrost the outdoor coils. While homeowners are accustomed to the quick blasts of hot air from gas systems, this isn't essential for maintaining steady comfort.

As discussed on page 5, sensible and latent load performance focuses on achieving an acceptable rate of temperature change and maintaining a set temperature. For air conditioning systems, we prioritize consistent cooling without demanding excessive "blasts" of cold air. Similarly, instantaneous super heat from a heat pump system is not necessary for effective comfort. All-electric solutions, which eliminate the need for gas lines, offer healthier and equally comfortable alternatives to dual-fuel systems

A 120V gas-free heat pump option is available. American Standard offers models. This setup operates without a gas burner assembly and works on existing 120V power if heater strips are not connected. These are new and they may need to be ordered from warehouses outside of Tucson.

New Refrigerant Line Sets? In general, there should not be a need for new refrigerant line sets in a heat pump retrofit, however the lines must be inspected for cracks, dents, or corrosion and undergo nitrogen pressure test (A2L system manufacturers specify 600 PSI) and evacuated to at least 500 microns with decay test to verify holding a leak free vacuum. Are the lines very old and have aged or are not compatible with newer higher-pressure systems? Are the lines too

long per the heat pump specifications? If the previous refrigerant was 410-A, the newer A2L refrigerant should be compatible. If the older R-22 was used, the line set may get by with cleaning and vacuum tested. But more likely will require replacement to avoid contamination. Sometimes the only option for replacement is to run along the exterior walls and across rooftops or cut holes in drywall to hide interior, when possible. In most cases of underground line-sets through chases, it is difficult or impossible to replace existing line-sets using the same chase. The installer must determine if the line set diameter is adequate for the new heat pump specifications. If not, they will need to be replaced. If the existing line is poorly insulated, new insulation or line set replacement may be required to preserve the new system's expected efficiency. Local code restrictions or the heat pump manufacturer warranties may require line set replacement. Often replacement of the line set provides a safer and more reliable option in the final cost-benefit analysis. The difficulty of accessing the lines will be critical in the replacement cost analysis and should be considered in the analysis.

Outdoor Physical Mounting Considerations

The new outdoor heat pump unit may be slightly larger than the existing outdoor AC condenser/compressor. Ensuring ample space around the unit is essential for proper airflow through the outdoor coil. A common issue is blockages caused by weeds or debris accumulating around the unit. Expanding the pad can help reduce weed growth nearby.

One risk of a ground-level unit is vulnerability to copper theft, as thieves may attempt to remove the entire unit if access is easy. Installing a security cage can deter theft and also help shield the unit from blowing debris.

Proper Indoor/Outdoor Equipment 'Match-Up'

Manufacturers of split central systems offer various outdoor units designed to meet a home's BTU requirements. For each outdoor unit, there are multiple compatible indoor units available to the installers to achieve the key factors of heat transfer rate and the blower's airflow capacity measured in cubic feet per minute, CFM.

Questions to Ask Installers of Spilt Central Heat Pump Retrofit

1) Make sure to request a gas-free (non-dual-fuel) heat pump to meet your heating needs while eliminating older, polluting, and health-risk-prone natural gas heating. Modern heat pump HVAC systems are competitive with AC/gas systems in price, operating costs, and performance. Some installers may have outdated biases against heat pumps based on past experiences that no longer reflect current technology. Seek installers who provides accurate, up-to-date information on heat pump systems.
2) Many gas-free heat pump indoor units require 240V for heating strips. Does the new indoor unit location have access to a 240V outlet? If adding 240V power is a cost barrier, consider 120V gas-free, heater-strip-free options, such as those offered by American Standard. We should adjust our expectations when unnecessary; that initial blast of hot air provided by burning gas is not as important as maintaining a steady, comfortable level of heat.

3) What is the heat pump capacity required for your home? Does the installer just guess or performs a Manual J and S Load Calculations? Is the performance of the proposed 'match-up' combination of components listed in the AHRI standards?
4) Should your ductwork and homes be tested for leaks before the new equipment is installed? Take the opportunity now to seal leaks if needed?
5) What is the SEER2 rating of the heat pump being proposed? A 19 SEER2 system is 35.7% more efficient than a 14 SEER2 system which translates directly to operational energy cost savings, hundreds of dollars annually in Tucson. Higher efficiency systems operate with less component stress and handle temperature extremes better.
6) Are inverter models available? These cost more however are quieter, more efficient, provide steadier temperature control, and put less strain on the compressor by avoiding constant power cycling
7) Ask if your equipment will qualify for available government rebates and incentives and if the installer is able to assist in the process with assurances and guidelines.
8) If the pre-retrofit HVAC is operational, will the installer measure the static pressure of the duct work prior to a retrofit to factor that information into the manufacturer's model selection?
9) Equipment warranties and labor warranties from the installer are separate. Installers typically only cover issues related to their workmanship. Manufacturer warranties cover the cost of equipment or parts but not the labor for replacements, which can still be a significant expense. To avoid unnecessary costs, request reports that show the final installation performance measurements meets all of the manufacturer's specifications. Static pressure is a prime concern. This will minimize the likelihood of early repairs.
10) Historically 5% of new HVAC systems fail within the first two years. Manufacturers use more plastic parts than in the past that fail earlier. Will your installer warranty service for this type of work for at least two years?
11) Can existing refrigerant lines be used for the retrofit heat pump? Are the line sets inspected carefully? Are they well insulated throughout? The lines sets should undergo nitrogen pressure test. The newer A2L system manufacturers want 600 PSI and be evacuated to at least 500 microns with decay verification of holding a leak free vacuum.
12) For split central retrofits, the size and dimensions of the indoor space may become important. The heat pump heat exchanger and blower should require less volume as the gas furnace is being eliminated. The new blower will require custom duct couplers to connect to the existing ductwork.
13) Will the new filter tray access be convenient for easy inspection and replacement of the filter?
14) If Global Warming Potential, GWP, is important to you ask what refrigerant is being used in the new equipment. Newer EPA mandated A2L refrigerants will increase the cost of the equipment.
15) Is there adequate physical perimeter space for the outdoor unit? Is a larger pad possible to restrict weed or grass growth need to the unit?
16) Is the new heat pump compatible with new smart thermostats? Are they provided?

Packaged System Central Heat Pump. Packaged central HVAC systems are the most common type used in Tucson. All of the local installers are well acquainted with installing packaged retrofits. With packaged units all mechanical components are housed in a single cabinet. While most packaged units are rooftop-mounted (RTUs), ground-mounted units can be installed if the home's floor is elevated and ducts can be routed underneath. Manufactured mobile homes are particularly suited for ground-mounted packaged units.

Unlike split systems, residential packaged central systems are actually much less common elsewhere in the country. As a result, manufacturers invest less in efficiency improvements for these systems, making very high-efficiency options less common. For example, finding packaged units with a SEER2 rating above 15 can be challenging. Bosch offers a 19 SEER2 inverter rooftop heat pump, but its reliability in Tucson was questioned in prior years due to electronics failures and long delays for repair parts. We are currently seeing updated reports on local reliability improvements for this impressive system.

Packaged units have some advantages. Their refrigerant lines are self-contained within the unit, eliminating the need for routing line sets through the house. There's no need to match indoor and outdoor components, and rooftop placement ensures unobstructed airflow around the outdoor coils while saving ground space. Most existing packaged units are "gas-packs", AC and gas heater, but these can easily be replaced with gas-free heat pumps for a cleaner, less expensive, and more efficient HVAC solution.

Static Pressure Revisited An equipment warranty won't cover the significant labor costs involved in repairing or replacing a system that fails due to improper static pressure (SP). If the current HVAC system is still operational, possibly measure the SP of the existing ductwork with a clean filter before removal. This assumes the internal return vent filter holder will remain unchanged during the retrofit as it is an important contributor to the total external static pressure measurement.

Ensure the installer measures and reports the SP after installation for all blower speeds, particularly at the maximum speed. Insist on necessary adjustments to bring the SP within the recommended range for the new system to ensure proper operation and prevent future issues.

To install the right size unit, contractors need to know the home's heating and cooling requirements, based on a variety of factors (e.g., ventilation needs, size of the home, type of windows, insulation amounts, etc.). Determining heating/ cooling loads based on the building's square footage is inaccurate and inadequate. Also, basing replacement equipment on the size of the original system could lead to problems since the original equipment size may have been incorrect. A load calculation guides proper equipment selection. A unit that is too big (oversized) may have a higher upfront cost, raise your utility costs, remove less humidity, and fail more quickly

Questions to Ask an Installer for a Rooftop Gas-pack Heat Pump Retrofit

1) Make sure to request a heat pump to meet your heating needs while eliminating older, polluting, and health-risk-prone natural gas heating. Heat pump HVAC systems are competitive with AC/gas systems in terms of initial cost, operational expenses, and performance. If an installer isn't knowledgeable about modern heat pump options, consider switching to one who provides accurate, up-to-date information on these systems.
2) What is the heat pump capacity required for your home? Does the installer just estimate (unacceptable) or performs a Manual J and S Load Calculation? Did the contractor present proof that the system will deliver the specified efficiency based on AHRI certification?
1) Have your ductwork and home tested for air leaks before the new equipment is installed and seal leaks if needed.
2) What is the SEER2 rating of the heat pump being proposed? Unfortunately, 19+ SEER2 combo units are not available in a broad range of models as they are in split Central models. 15 SEER2 is a reasonably good choice considering this limitation. For reference the energy cost saving of 20 SEER2 over a 15 SEER2 model is about $160 annually.
3) If the pre-retrofit HVAC is operational, will the installer measure the static pressure of the duct work prior to the retrofit to factor that information into the heat pump's manufacturer's model recommendations. This does require access to the existing system specification labels.
4) After the installation will the installer provide static pressure of the system over the full range of blower air flow speeds? A warranty for the equipment will not cover the major expense of labor to replace or repair a system that failed because of too high or too low static pressure
5) Equipment warranties and labor warranties from the installer are separate. Installers typically only cover issues related to their workmanship. Manufacturer warranties cover the cost of equipment or parts but not the labor for replacements, which can still be a significant expense.
6) Historically 5% of new HVAC systems fail within the first two years. Manufacturers use more plastic parts than in the past that fail earlier. Will your installer warranty service for this type of work for at least two years.
7) If a maintenance program is offered, it should inform you of the components inspected, time frames for inspection, and other factors involved. These requirements are explained in the national standard for residential HVAC maintenance (ANSI/ACCA 4 Maintenance of Residential HVAC Systems).
8) If Global Warming Potential, GWP, is important to you ask what refrigerant is being used in the new equipment. Newer EPA mandated A2L refrigerants will increase the cost of the equipment by about 10%.
9) Because they are resting the roof structure of the house, a consideration for roof top units is they may transmit more mechanical noise into the living space of the home. Some models are noisier than others. Coleman is an example of a high-quality brand known for more noticeable noise than other brands. The addition of antivibration skid

pads under the unit can help avoid this possible annoyance. The installer should attempt to do all they can to minimize the indoors noise from the new unit.

10) Is the new air filter easily accessible? Ask the installer to demonstrate the changing of the filter and if not very easy to execute the operation, have it made easy as possible. Sometimes roof mounted commercial grade units are used for homes and these often have the filter access only on the roof. Naturally that is worth avoiding for convenience.
11) Is your thermostat wiring 5 or 7 lines? Some smart thermostats require extra lines over the 5 wires common in older homes. This may limit some modern future thermostats. If a new or updated thermostat is desired, ask the installer to connect and verify its operation for you. Have the installer test thermostat proper operation for both heat and cool, not just what the current season requires.
12) Ask the installer to provide full set operation manuals and a photo copy of the unit's name plate attached to the unit. (You don't want to climb onto the roof to have this information handy.)

References

- ACCA Standard 5 - Residential Quality HVAC Installation – *You Should Get What You Pay For*
- Energystar.gov – Heating & Air Conditioning Installation Bid Comparison Checklist
- Pima County - www.pima.gov/1153/HVAC-sizing-Requirements
- Contracting Business – Unlocking system Performance Potential: The Domino Effect of Static Pressure Testing
- HVACdesign.com – Understanding the Importance of Manual J in HVAC Design

List of Tucson residential contractors with quality assured accreditation by the Air Conditioning Contractors of America, ACCA https://hvac-contractors.acca.org/nearby-contractors?qa=1&zip=85745&range=25&markets=9

Parker and Sons, Inc. – Tucson	https://www.parkerandsons.com/
Hamstra Heating & Cooling	https://www.hamstrahvac.com/
Ultra Air Conditioning	http://www.ultraairaz.com
Eazy Breezy Heating and Cooling	https://www.eazybreezyheat-ac.com/
B&J Refrigeration	http://www.bjrefrigeration.com
Rite Way Heating, Cooling and Plumbing	http://www.ritewayac.com