Engineering News from Data Aire

R-410a or R-407c – Know the Facts

We are all aware that R22 refrigerant was phased out due to the Montreal Protocol which took effect in January 2010 and alternative refrigerants are now available. In the data center industry for computer room air conditioners, the two most common refrigerants are R407C and R410A. These refrigerants are readily available and are not really new technology, as they have been used in chillers and residential air conditioning for a number of years.

We are nearly three years past this conversion deadline and Data Aire is still offering both of these refrigerants. But which one is the best or right one for your client applications? This discussion will try to answer this question and explain why Data Aire prefers R410A.

What are R407C and R410A Refrigerants?

R407C is non-ozone depleting, ternary mixture of hydrofluorocarbons (HFCs) HFC-32, HFC-125, and HFC-134A in the ratio of 23/25/52 by percentage of weight and has the same global warming potential as R22. In a typical air-conditioner, R407C performs comparably to R22 in positive displacement, direct expansion systems because it was specially designed to closely match R22 in pressure and performance characteristics.

R410A is a non-ozone depleting binary blend of two HFC refrigerants, comprising 50% of R32 and 50% of R125 by percentage of weight, it has no chlorine content, and only a modest global warming potential. It was designed to provide benefits in efficiency and system size by increasing system pressure and taking advantage of thermodynamic and transport properties. R410A exhibits higher pressures and refrigeration capacity than R22.

What are the Advantages and Disadvantages of R407C?

The advantages of R407C are: it is less harmful to the environment than R22 and the values of global warming of R407C is similar to that of R22 but the ozone depletion potential is zero; charging values of a R407C system is similar to R22 and the components used in a R407C system are many times the exact same components.

The primary disadvantage of R407C is the large temperature glide due to the blend of the specific refrigerants. Refrigerant temperature glide is the temperature difference between the starting and ending temperatures of a refrigerant phase change within a system at any constant pressure. The glide associated with R407C (approximately 8° to 11° F) can be large enough to have an effect on the refrigeration cycle and the charge of the compressor.

Another disadvantage of R407C is based on overall system performance. R407C is not as efficient as the performance of a R410A system. In some applications, R407C systems may need a liquid receive to keep the sub-cooling stable.

Recharging a system after a leak of R407C refrigerant usually results in minimal impact on system performance, even under worst-case, multiple-leak/recharge scenarios. However, if the unit is not operating and there is a vapor leak from a static two-phase region, the composition of the refrigerant that remains in the unit will change, which could have a minor impact on energy efficiency and heat transfer conditions.

What are the Advantages and Disadvantages of R410A?

The common advantage of R410A is it is less harmful influence on the environment than R22. The value of global warming potential of R410A is higher than that of R22 but the ozone depletion potential is zero. The characteristics of R410A allow using a smaller displacement compressor, less coil and reduced refrigerant capacity while maintaining system efficiencies comparable to R22 equipment. Due to the fact that R410A has very little refrigerant temperature glide the dew condensing temperature is lower than with R407C, which leads to higher system efficiency. The sub-cooling effect plays an important role. R410A with near zero glide characteristics is able to maintain a constant sub-cooling without a liquid receiver.

When viewing the disadvantages of R410A, the operating pressures of R410A is more than 50 percent higher than R22 and R407C, this higher pressure requires the use of high pressure compressors and of other components capable of withstanding the higher pressures. A R407C system uses few, if any of the same components as a R410A system. A complete redesign is required to use R410A.

Summary

Similarly R407C and R410A refrigerants are less harmful to the environment than R22, they offer similar performance and higher capacities than R22, and they are both readily available therefore they appear to be equal alternatives to R22. There are practical advantages and minimal disadvantages of each alternative refrigerant so why prefer one over the other?

Based on testing in Data Aire' psychometric test facility, we have seen improved overall system efficiency and straightforward system charging when using R410A. Standardizing on one refrigerant reduces inventory and ultimately will reduce operating costs. R410A is currently used for most new, small residential air cooled systems therefore most service technicians are familiar with R410A which means they have the proper tools and are skilled at charging and maintaining R410A systems. In general, service technicians are less familiar with R407C systems and the charging difficulties related to the large refrigerant temperature glide.

Based on the above considerations, R410A is the refrigerant if choice by Data Aire in lieu of R407C for data center computer room air conditioners applications. So when the refrigerant type is not specified or required by specification, please indicate R410A. Even if R407C is specified, many end users are open to listening to the rational for using R410A.