

update

Refrigerant Solutions Dealing with the Phase-Out of HCFC-22

Overview

HCFC-22 is the world's most widely used refrigerant. Introduced nearly 60 years ago, it serves in both residential and commercial applications from small window units to large water chillers, and everything in between. Its particular combination of efficiency, capacity and pressure has made it a popular choice for equipment designers.

Recently, extensive use of HCFC-22 has made it possible to reduce the use of CFC refrigerants, because its Ozone Depletion Potential (ODP) is as much as 95% lower than CFC's. Nevertheless, HCFC-22 does have some ODP, so international law set forth in the Montreal Protocol have put HCFC-22 on a phaseout schedule. In developed countries, production of HCFC-22 will end no later than the year 2030. The production is reduced in a series of specified steps in the intervening years.

In the US, the adoption of the Clean Air Act (CAA) has accelerated the phaseout of HCFC-22 quicker than called for by the Montreal Protocol. The CAA calls for a phase out of HCFC-22 used in new air-conditioning equipment by 2010, and a total production phase out by 2020.

After the phaseout dates, supplies of HCFC-22 should still be plentiful thanks to conservation and recycling techniques developed for CFCs. For instance CFC-11 hasn't been produced since January 1996, but because of recycling, it is still widely available. Recycled HCFC-22 should be even more plentiful, because it is more widely used than CFC-11. It is important to remember that the phaseout affects only production for use as a refrigerant. Production of HCFC-22 for use as a building block for fluoropolymers such as Teflon[®] will continue after the phaseout.

Viable Options

There are several viable options for refrigerant choice in commercial air conditioning equipment.

HFC-134a – is a medium pressure refrigerant having an ODP of zero. As such, it is a long term environmental solution to ozone depletion and is not scheduled for production phaseout. HFC-134a has a lower volumetric capacity than HCFC-22. This means more refrigerant will have to be circulated to keep the same capacity, which necessitates larger or faster compressors.

HFC-407C – is similar to HCFC-22 in working pressure, volumetric capacity, and efficiency. In fact HFC-407C was developed specifically as a drop-in replacement for HCFC-22. It can be retrofitted into most existing HCFC-22 systems. It has zero ODP and is also not scheduled for phase-out. HFC-407C is a zeotropic blend refrigerant consisting of basically HFC-134a and HFC-410A. This gives the refrigerant a unique feature known as “temperature glide” and presents intriguing implications for equipment design. In a new chiller, the temperature glide can be utilized to advantage with the design of a counter-flow evaporator.

HFC-410A – is another zeotropic blend, having a much higher working pressure than HCFC-22, about 50% higher. As a result, heat exchangers and compressors will have to be designed to withstand that pressure. But, HFC-410A also has about 50% more volumetric capacity than HCFC-22. This means lesser amounts of refrigerant will be circulated, which could result in smaller compressors.

YCAS high efficiency air-cooled screw chiller



There is no obvious single refrigerant replacement for HCFC-22. In fact, end users of air-conditioning equipment will have to accept the fact that there won't be a “one refrigerant” solution for their site. Smaller packaged units (PTAC, RAC, residential, etc..) with fixed speed hermetic compressors probably won't use

HFC-134a as the capacity derate would be unacceptable. Larger capacity units may find the higher pressure of HFC-410A to be cost prohibitive, and therefore may find HFC-134a a more practical alternative. Many users and manufacturers will find HFC-407C attractive as it allows the use of existing HCFC-22 components. And some users will still remain with HCFC-22 as a workable and practical solution for the life of the equipment purchased today.

Cost and Availability

All the replacement refrigerants for HCFC-22 have higher unit costs. This is due in part to production quantities, but also due to manufacturing processes. HFC-134a will likely stay higher in price than HCFC-22 due to its two-step manufacturing process. HFC-407C and HFC-410A being blends will also have higher costs. HCFC-22 is not expected to experience a major price increase, due to its long phaseout period and wide availability.

Conclusion

Make equipment evaluations based on many criteria, not just refrigerant. Look for equipment that is economical, considering first cost, installation cost, maintenance cost and operating costs. Consider the acoustical characteristics of the equipment. Noise pollution is becoming more of a concern. Look for equipment that is user friendly and easy to operate.

Don't make refrigerant an issue. There are many approved, viable refrigerant options available. And remember, there will not be a single refrigerant solution that works with all equipment at all job sites.

