

An Update on Low-GWP Refrigerants

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Abstract

Within the last 50 years the refrigeration sector, including air conditioning, experienced an extraordinary growth driven by the economic and population growth, particularly in developing countries. Great technological advances were achieved over the years driven by competitive market forces (equipment is more reliable, more efficient and smarter). However, a very extensive R&D effort has been also expended to respond to global environmental requirement to use refrigerants that would not damage the ozone layer and have a low global warming potential (GWP). The presentation provides a historical perspective and a summary of the screening process for medium- and high-pressure fluids indicating that the probability of finding new low-GWP fluids is minimal. A review of available low-GWP single-compound refrigerants and blends for different applications follows. Rather limited options for unitary air conditioning (using R-410A) and commercial refrigeration (using R-404A) are highlighted as several identified hydrofluoroolefins (HFOs), successfully used in low- and medium-pressure systems, do not have a normal boiling point low enough for high-pressure applications. This precludes their use unless they are blended with low-temperature boiling fluids, which have a much higher GWP (except hydrocarbons). The discussed merits include coefficient of performance, volumetric capacity, GWP, flammability, and two-phase temperature glide. The presentation also discusses the trade-off between GWP and flammability, and the latest fluids under consideration. Due to trade-offs between different refrigerant attributes the product offerings will undergo increasing fragmentation with multiple refrigerants used depending on regional preferences or equipment size.

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