"Fluorocarbons: Balanced Solutions For Society"

Commercial Refrigeration…*A Working Example*

A Worldwide Perspective

Commercial refrigeration is essential in today's society, to preserve and protect food for people around the world. A variety of systems are currently used in supermarkets and retail food stores. These include central refrigeration systems (multi-compressor or conventional single compressor units), connected to remote food display cases, walk-in refrigerators and freezers, and self- contained display cases. New designs, known as distributed systems, are also being used that place refrigeration compressors and associated components near the display cases or walk-in refrigerator/freezer coils that are being refrigerated. There are also indirect systems in which a primary refrigeration system cools a secondary fluid, which then circulates through a secondary loop to the display cases or coils. In each case, the choice of refrigerant will depend on the specific requirements of the application.

Environmental Considerations for Commercial Refrigeration

Since the mid-1980s, commercial refrigeration systems have undergone a transition from using ozone depleting refrigerant compounds, including chlorofluorocarbons (CFCs), to low or non-ozone depleting compounds, such as hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs). Ammonia, hydrocarbons and carbon dioxide are being used to a lesser extent. Several of these compounds, while non-ozone depleting, do have global warming potential (GWP). There are two aspects to global warming that must be considered when selecting a refrigerant. One is the GWP of the refrigerant compound itself if emitted, the "direct effect." Another concerns the amount of energy consumed to operate the equipment, the "indirect effect." The two aspects considered together represent the most significant portions of Life Cycle Climate Performance, or LCCP. Significant additional considerations include the cost of the system and the safety of the users, service technicians and the public.

Life Cycle Climate Performance (LCCP)

Fluorocarbon replacements for CFC-502 and CFC-12 include HCFC-22, HCFC-22 based blends, HFC-134a, -404A and -507. Other replacements can also be used although significant system modifications may be required to manage properly the fire/explosion and pressure hazard potential, greatly increasing the cost.

An analysis of four configurations was performed using LCCP for a typical U.S. supermarket constructed in 1999 of 5,680 sq. M (60,000 sq. ft.). The results show:

Life Cycle Climate Performance (Million Kg CO_2)

Configuration	Refrigerant	Indirect[1]	Direct[2]	Total
Central Refrigeration Systems	R-404A/R-507	11.7	12.1	23.8
Distributed System	R-404A/R-507	10.7	0.8	11.5
Secondary Loop	R-404A/R-507	13.6	0.18	13.8
	Ammonia	13.6	0.0001	13.6

[1]15 years of energy consumption, 0.65 Kg CO_2 per kWh.
[2]15 years of refrigerant emissions.

The distributed systems with HFCs are clearly the right choice based on LCCP. The HFC-404A or -507 distributed system had an LCCP less than half the direct expansion system and was at least 15% better than either

secondary loop system. The secondary loop system with ammonia has an LCCP similar to that of the secondary loop HFC system. A 1999 report by A. D. Little estimates that using ammonia would add costs of $660 million per year in the U.S. alone due to additional safety equipment, hardware and increased energy consumption.

HFCs – The Balanced Solution

When all factors are considered, HFCs offer the best solution for meeting the requirements of the commercial refrigeration industry. Commercially available throughout the world, HFCs are energy efficient, low in toxicity, cost-effective, can be used safely and are reusable. When used in energy efficient applications, their excellent LCCP reduces fossil fuel consumption and with it emissions of carbon dioxide, the most prevalent greenhouse gas.

Industry Principles

The environmental and cost superiority of HFCs in commercial refrigeration systems must be complemented with responsible HFC use. The commercial refrigeration industry is committed to providing products that provide the best LCCP that technology, availability and financial assessment will allow. This will differ across the various products and applications, and will continuously be evaluated as technology develops. In addition to significant operating efficiency improvements, the industry has already taken significant steps to reduce emissions of refrigerants by designing leak tight equipment, minimizing system charge and promoting refrigerant recycling.

The industry actively promotes the following general principles that should be followed for all refrigerants:

- Use in tight systems that are leak tested and then frequently monitored after installation to eliminate direct refrigerant emissions;
- Recovery, recycling and reclaiming of all refrigerants;
- Training of all personnel involved in the refrigerant handling process;
- Compliance with standards, that govern proper refrigeration installation and maintenance of machinery spaces (e.g. ASHRAE 15, ISO 5149);
- Equipment sizing to match the specific need, thereby minimizing the refrigerant amount; and
- Design and installation and operation to optimize energy efficiency.

Balanced Solutions for Society...Commercial Refrigeration is a Perfect Example of The Concept. Energy Efficiency, Reduced CO_2 Emissions, Availability, Affordability. HFCs – the RIGHT Choice for Commercial Refrigeration.

The Alliance for Responsible Atmospheric Policy is a leading industry voice that coordinates industry participation in the development of reasonable international and U.S. government policies regarding ozone protection and global climate change.

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