



TRANSPORT REFRIGERATION

SOCIETAL IMPORTANCE

Transport refrigeration is essential in today's society to preserve and protect food, pharmaceuticals and medical supplies for people worldwide. It includes transport of refrigerated products with reefer ships, intermodal refrigerated containers, refrigerated railcars and road transport including trailers, diesel trucks and small trucks. While the use of transport refrigeration is fairly mature in developed countries, it remains at the early stages of use in many developing countries and is a necessary part of a solution to the problem of high food spoilage rates. Spoilage rates of 25% and higher are found in a number of developing countries and improvement is not anticipated without introduction of a strong "cold chain" of commercial and transport refrigeration of products from the "farm to the table."

Critical Application Considerations

To achieve accurate, cost-effective temperature control of commodities and maximum product quality under all operating conditions, the refrigerant selection, foam blowing agent, refrigeration system design, materials and operating methods are critical. Transport refrigeration equipment is extremely complex and must be capable of operating efficiently in exterior temperatures that range from -40°C to 55°C while maintaining precise internal temperatures that range from -40°C to 30°C. Under extreme ambient operating conditions, it is especially important that the refrigerant discharge pressures and temperatures remain within safe operating limits. HFC foam blowing agents are effective at maintaining these conditions and are currently 10% to 100% more efficient than compared to other materials at the same mass and thickness.

Refrigerants such as HFCs, and CO₂ in some applications, satisfy these conditions and stringent safety requirements, while simultaneously meeting customer control requirements. Refrigerants for this sector must have proven levels of reliability and a trained service network, which most effectively manages a strong "cold chain"

ensuring that food, drugs and other products that require refrigeration reach their destination without deterioration, and do not endanger public health.

There are important safety considerations that affect refrigerant selection. Transport refrigeration equipment must be serviced worldwide. Flammable refrigerant introduction presents significant problems for the service technicians who are accustomed to working with non-flammable refrigerants, and may be a particular problem in developing countries. Extensive training in safe handling practices for both the equipment and use of flammable refrigerants is required. In addition, container units may be placed inside a ship's hull where a potentially concentrated refrigerant leak could lead to a significant increase in the risk of a fire if that refrigerant is flammable. It would be very difficult to eliminate all ignition sources from all areas where these refrigeration systems are used.

Power for transport refrigeration units typically comes from dedicated diesel units or from electricity generated from the primary diesel engine of the truck.

Environmental Considerations

While a refrigerant can impact the environment directly through its ozone depletion potential and its direct global warming potential, it can also impact the environment indirectly through its ability to deliver energy efficiency, which can increase or reduce fuel (typically diesel in transport refrigeration). The direct environmental impact of the refrigerant

occurs only upon release to the atmosphere, so leak reduction is important. **From a Life Cycle Climate Performance perspective, the majority of climate change impact will come from the indirect effect (energy efficiency) so this element must remain a major focus for any transition toward a lower GWP fluid.**

Technology Trends

HFCs remain the primary solution in today's applications when all factors are considered, along with recent technology introductions for carbon dioxide in marine container

applications and in certain trailer and truck applications in some regions. Ammonia and hydrocarbons are being used to a lesser extent.



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The Alliance is an industry coalition that was organized in 1980 to address the issue of stratospheric ozone depletion. It is presently composed of about 100 manufacturers and businesses which rely on HCFCs and HFCs.

Today, the Alliance is a leading industry voice that coordinates industry participation in the development of international and U.S. government policies regarding ozone protection and climate change.