

Measuring CO₂ in Refrigeration Applications



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Many factors promote the use of CO₂ as a refrigerant; it is inexpensive, energy-efficient, in addition, it has good heat transfer properties and it is compatible with most materials. The challenges related to process design, high operating pressures and safety issues can be overcome with modern technology. From an environmental point of view, CO₂ does not cause ozone depletion and has lower global warming potential than the traditional refrigerants.

As a result, CO₂ refrigeration has found numerous applications in food and industrial processing, cold storages, food retail and transfer, and sports facilities, such as ice rinks. It is also emerging in car and residential airconditioning.

Detecting CO₂

CO₂ is a non-toxic and non-flammable gas. However, CO₂ does not support life and exposure to elevated concentrations of CO₂ can induce a risk to life. The effects of various concentrations of CO₂ on human health are summarized in the table below.

Concentration effect	
350-450ppm	Typical atmosphere
600-800 ppm	Acceptable indoor air quality
5000 ppm	Average exposure limit over 8 hours
3 - 8%	Increased respiration and headache
above 10%	Nausea, vomiting, unconsciousness
above 20%	Rapid unconsciousness, death

Unlike ammonia, it is impossible to detect leakage of the colorless and odorless CO₂ from the refrigeration

system without proper sensors. To ensure the safety of personnel in a CO₂ refrigerated facility, CO₂ transmitters should be installed in every human occupied space and as close to potential leakage points as possible. The number of transmitters should be based on risk assessment. Ventilation and air flow should be considered when planning transmitter installations. Carbon dioxide is twice as heavy as air and sinks and pools low to the ground, displacing oxygen in the air. Therefore, appropriate installation locations for the transmitters are at floor level.

The Vaisala CARBOCAP® Carbon Dioxide Probes GMP251 and GMP252 are intelligent, stand-alone probes, especially designed for harsh and humid environments. The operating temperature range of the probes is specified as -40 ... +60 °C. The GMP251 has a measurement range of 0 ... 20 %CO₂ while the GMP252 is intended for ppm ranges and has a measurement range of 0 ... 10 000 ppmCO₂.

The probes are easy to mount outside the refrigerated rooms. The Vaisala CARBOCAP® sensors are accurate and durable. They have excellent long-term stability which will reduce maintenance costs over the years. The Vaisala sensors enable reliable carbon dioxide detection for the wellbeing of people working in CO₂ refrigerated spaces or people enjoying an exciting ice hockey game in a CO₂ refrigerated ice stadium.

