

Application Note

ICEMAN™ Moisture Detection in New Refrigerants

Potential problems with moisture in refrigerants include reaction with lubricants, corrosion, copper plating, wear, hot spots, and more.

Moisture in refrigerant gases is extremely difficult to measure in the field. Environmentally friendly refrigerants have created measurement problems because their water molecules do not fully separate from their refrigerant molecules at ambient temperatures, thus creating false low-moisture indications. Normally, a liquid sample must be collected and transported to a lab to be heat vaporized, and analyzed. Winner of the prestigious R&D 100 award, the portable IceMan can measure trace moisture content in a wide variety of pure and blended refrigerant gases, combining all these steps into an on-the-spot system. A standard vaporizing valve and an internal battery-powered heated vaporizer can make four to eight measurements before needing to be recharged, enabling samples to be analyzed in 15 to 20 minutes. A microprocessor-based electronics packages is also incorporated, providing flexibility in selecting units of measure, communications and output scale. The device reads in ppm by volume, but it can convert to the standard ppm by weight.

Please review the following information to determine if the ICEMAN is right for your application.

Background

Moisture, a major contaminant in refrigerant gases, can create problems in everything from the manufacturing process to the end-use product. In the manufacturing process, the extreme cold temperatures necessary to produce these gases in a liquid form can cause water molecules to freeze, thereby disrupting the manufacturing process. In refrigeration systems, the constant compression and expansion of the refrigerant generates temperatures that can cause the moisture to create an ice plug in the system, resulting in potential compressor failure. The interaction of the water molecule with the refrigerant material can also create a corrosive mixture, which will lead to higher maintenance costs. The rapid release of these refrigerants, as used in fire extinguishers and aerosol propellants, can create the same extreme cooling effects that lead to ice formation and failure of the product.

Requirements

Original equipment manufacturers such as refrigerant manufacturers, refrigerant reclaimers, installers and others check for moisture in refrigerants in new or existing refrigeration and A/C systems. Moisture analysis is also a part of routine quality assurance for refrigeration product going out the door. The industry specification for moisture contamination is 10 ppmW or less for most single component fluorocarbon refrigerants and for multi-component refrigerants, 400 and 500 Series¹. The 10 ppmW moisture specification also in-

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cludes reclaimed and/or repackaged refrigerants. Some refrigerant manufacturers perform moisture measurements as low as 1 ppmW for either alarming purposes or improved product certification.

Moisture readings can vary widely due to sample handling errors in obtaining a representative liquid sample. Each time a sample is handled, from collection to ultimate analysis, there is the possibility of introducing an error into the measurement. The ICEMAN eliminates any sample collection or handling errors by allowing you to make the measurement directly at the sample point.

Application

Eliminate errors in sampling handling and get real time monitoring and response with the ICEMAN electrolytic analyzer. For improving the reliability of A/C or other refrigerant systems, the ICEMAN offers direct measurement of moisture with high accuracy. The ICEMAN is portable and has a built-in rechargeable lead-acid battery. The ICEMAN is available with an optional, bi-directional RS232 for automatic data collection and communication.

Once the ICEMAN has stabilized on your product stream, you can analyze for moisture without any further adjustments or calibration. A unique heat exchanger flash vaporizes the liquid refrigerant and automatically controls the temperature of the resulting gas sample going into the ICEMAN moisture sensor. The sample flow is also precisely controlled at 100 sccm to the electrolytic cell. All incoming moisture molecules are adsorbed in the cell on a phosphorus pentoxide coating, which is a strong desiccant. By applying a voltage potential across the cell electrodes, the moisture molecules are dissociated into hydrogen and oxygen. From this dissociation, a current is produced which is directly proportional to the amount of water vapor present through Faraday's Law of Electrolysis.

The ICEMAN displays the moisture value directly in either ppmV or ppmW, with a correction for the molecular weight of the sample gas. The ICEMAN's linear dynamic range is 0-1000 ppm with a 0.1 ppm display resolution and a lower detection limit of 1 ppm with an accuracy of $\pm 5\%$ of reading or 0.4 ppm, whichever is greater.

Attached please find a brochure on the ICEMAN. Please feel free to call (1-800-641-6478) or email us at our new website, www.meeco.com, to learn more about this new application.

¹ The 1999 Standard for Fluorocarbon Refrigerants, Standard 700, Air Conditioning and Refrigeration Institute (ARI), Arlington, Virginia.