Electronic Coolants for Liquid Chillers and Direct Refrigerant Chillers for Electronic Systems

Speaker: Randy Owen - K-O Concepts Inc., Titusville, FL 32796 USA

Email: rowen@k-oconcepts.com

Abstract

Use of liquid chillers and direct refrigerant cooling for electronic systems will be discussed in this presentation, with a focus on the range of electronic coolants available and in use across military, aerospace, laser, medical, semiconductor test, and other market segment applications.

Electronic coolants include the use of water in various forms (deionized, water/glycol, and other additives), a range of dielectric liquids, certain refrigerants, and some developing so-called nanofluids. A set of tables will be presented to outline the various characteristics of these fluids, including boiling point, freezing point, GWP value, flashpoint, dielectric constant, vapor pressure, and similar. The purpose is to illustrate the options available and some of the primary advantages and disadvantages of certain fluids for use as a coolant in single-phase and two-phase liquid cooling systems for electronics thermal management.

Liquid chillers and direct refrigerant cooling systems will also be discussed, illustrating principal components of each type of system, coolants used, types of pumps and compressors, and physical dimensions and capacities for different types of rackmount and standalone cooling systems. Comparison of efficiencies achieved with different chiller system designs will also be included.

Chillers and direct refrigerant cooling systems have significant design and performance differences and understanding these differences is important in evaluating and selecting such systems for use in electronic systems. Chillers can be either rackmount, for insertion directly into an industry-standard test system or other electronics enclosure, or floor-standing. A well-designed chiller can occupy as little as forty percent of the volume of a competing chiller; electrical efficiency is an additional noticeable difference between types of chillers. The ability to closely control system temperature variation to a given temperature set point is a feature which can be critical within certain types of laser diode and electro-optical systems, to maintain laser or imaging system performance, for example.