

## High Performance Liquid Cooling Garment (LCG) Using ThermoCore

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**Abstract :** Modern warfighters experience extreme environmental conditions in many of their operational and training activities. In temperatures exceeding 95°F, the body's temperature regulation can no longer cool through convection and radiation. In this case, the only cooling mechanism is evaporation. However, evaporative cooling is often compromised by excessive humidity. Natural cooling mechanisms can be further compromised by clothing and protective gear, which trap hot air and moisture close to the body. Creating an efficient heat extraction apparel system that is also lightweight without hindering dexterity or mobility of personnel working in extreme temperatures is a difficult technical challenge and one that needs to be addressed to increase the probability for the future success of the US military. To address this challenge, Oceanit Laboratories, Inc. has developed and patented a Liquid Cooled Garment (LCG) more effective than any on the market today. Oceanit's LCG is a form-fitting garment with a network of thermally conductive tubes that extracts body heat and can be worn under all authorized and chemical/biological protective clothing. Oceanit specifically designed and developed ThermoCore®, a thermally conductive polymer, for use in this apparel, optimizing the product for thermal conductivity, mechanical properties, manufacturability, and performance temperatures. Thermal Manikin tests were conducted in accordance with the ASTM test method, ASTM F2371, Standard Test Method for Measuring the Heat Removal Rate of Personal Cooling Systems Using a Sweating Heated Manikin, in an environmental chamber using a 20-zone sweating thermal manikin. Manikin test results have shown that Oceanit's LCG provides significantly higher heat extraction under the same environmental conditions than the currently fielded Environmental Control Vest (ECV) while at the same time reducing the weight. Oceanit's LCG vests performed nearly 30% better in extracting body heat while weighing 15% less than the ECV. There are NO cooling garments in the market that provide the same thermal extraction performance, form-factor, and reduced weight as Oceanit's LCG. The two cooling garments that are commercially available and most commonly used are the Environmental Control Vest (ECV) and the Microclimate Cooling Garment (MCG).

**Keywords :** thermally conductive composite, tubing, garment design, form fitting vest, thermocore

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