Recent advances in the development of miniature vapor compression cycle components have created unique opportunities for heating and cooling applications, specifically to human physiological requirements that arise in extreme environments. Diving in very cold water between 1.7 and 5°C requires active heating because passive thermal insulation has proven inadequate for long durations. To maintain diver mobility and cognitive performance, it is desirable to provide 250 to 300 W of heat from an un-tethered power source. The use of a miniature vapor compression cycle reduces the amount of power (batteries or fuel cell) that the diver must carry by 2.5 times over a standard resistive heater. This study develops the compact evaporator used to extract heat from the sea water to provide heat to the diver. The performance is calculated through the application of traditional single-phase and two-phase heat transfer correlations using numerical methods. Fabrication methods were investigated and then a prototype was manufactured. A test stand was developed to fully characterize the evaporator at various conditions. The evaporator is then evaluated for the conditions of interest. Test results suggest the correlations applied under predict performance by 20%. The evaporator tested meets the performance specifications and design criteria and is ready for system integration.

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The public is welcome to attend.