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C1Or1A-01: Performance Characteristics Comparison of Major Types of Mechanical Cryocoolers for Aerospace Applications

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The three major types of mechanical cryocoolers in aerospace applications, namely reverse-Brayton cryocoolers, Stirling/pulse tube cryocoolers and Joule-Thomson cryocoolers, have significantly different performance characteristics. Some of these differences are due to the nature of their thermodynamic cycles; others come from their drastically differences in mean operating pressures and pressure ratios. This paper first discusses the key control parameters affecting the sizes and mass of the compressors and heat exchanges in each type of cryocoolers; then compares the performance characteristics of these three types of cryocoolers in several cooling temperature ranges and cooling capacities of interest to the aerospace community; and finally summarizes the performance benefits and associated main applications of each type of cryocoolers.

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