Current Rotary Coolers Improvements Usable for Next Generation of Rotary Coolers

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Today, many new systems using cryocoolers have a prime requirement to be compact, low weight, and have a low power consumption. These system requirements have a direct impact on the cryocooler technology to be used within these applications. Furthermore, the cooling technology and product definition should be compliant with the required product reliability and the system operational requirements (Robustness, Induced Vibrations, EMI-levels, ROHS, etc.). Improvements and technology developments of cooled IR sensors have had significant impact on the required cryogenic cooling power and temperature to be produced by the cryocooler. Originally, the detectors used to be cooled to a cryogenic temperature of 77K. More recently, depending on detector technology, bandwidth and required performance, the detector operating temperature may vary in a broader range, between 60K to 170K. Furthermore, greater cooler efficiency and power density are required to ease the definition of compact and flexible IR-cores.This paper focuses on next generation cooler characteristics linked to the mentioned system requirements. The latest cooler developed by Thales, the RMs1 is used as case study to illustrate these characteristics leading to a compact and efficient cooler, low induced vibration and noise combined with a high reliability.In the first part of the paper, the definition and the basic cryogenic performance of the RMs1 cooler is presented. In the second part of the paper, the latest improvement is presented such as the impact on overall performance of the newly developed and qualified electronic driver. Based on the results achieved with the RMs1, an approach for future generation compact cryocoolers is presented. The RMs1 cooler and its future spin-offs may be used in different market segments and is surely not restricted to the cooling of IR sensors.