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C1Or4B-06: Design, fabrication and installation of the refurbished K500 cyclotron cryogenic distribution system for MSU chip testing facility

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Michigan State University (MSU) has refurbished the superconducting K500 cyclotron and installed it as the heart of a new semiconductor / electronic chip testing facility at the Facility for Rare Isotope Beams (FRIB). The K500 cyclotron used to be a part of the Coupled Cyclotron Facility (CCF) at MSU but was decommissioned in 2020 following the reconfiguration of the beamlines for the FRIB LINAC. The K500 cyclotron consists of a superconducting solenoid and several cryo-panels (independently maintained at 4.5 K and 80 K). The refurbishment of this cyclotron required a completely new cryogenic distribution system incorporating several different modes of operation for the solenoid and the cryo-panels to satisfy the testing requirements. The cryogenic distribution has been designed using the same operational concept used for the FRIB experimental system cryogenic distribution system –which has separate lines for cool-down and 4.5 K operation. This provides flexibility for commissioning, different modes of operation, and maintenance of the K500 cyclotron without affecting other cryogenic loads on the refrigerator. The refurbishment, associated additions and modifications of a legacy system to fit new requirements presented several design challenges which were resolved during the concept design phase. Design, fabrication, and installation of all the elements of the cryogenic distribution system were carried out in-house at FRIB. This paper presents an overview of the process design, analysis, fabrication, and installation of the refurbished K500 cyclotron cryogenic distribution system.

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