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C1Po1E-02: Assessment of the existing cryogenic central plant for the Electron Ion Collider cryogenic loads at Brookhaven National Laboratory

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The Electron Ion Collider (EIC) at Brookhaven National Laboratory consists of one existing hadron ring and new electron accelerator. The EIC incorporates beamline and detector elements that require superconductivity, which is achieved by cooling these elements to cryogenic temperatures. The EIC cryogenic systems are designed to provide cooling for various components, including heat shield circuits, current leads, power couplers, thermal intercepts, and superconducting devices operating at or below 4.5 K. The existing central plant used for cooling Relativistic Heavy Ion Collider (RHIC)'s magnet rings will also be used for EIC. There are Superconducting magnets that require operation at 1.92 K, and Superconducting Radio Frequency (SRF) cavities that require operation at 2.0 K. These are located at distinct locations around the Collider ring. Satellite systems located locally will be installed to produce the 1.92K and the 2.0K cooling capability. These systems will not be fully independent standalone plants, rather they will use the existing central plant for capacity assistance. The existing cryogenic distribution in the hadron magnet ring will also be used to supply the satellite systems.

This paper examines the different types of loads imposed on the existing central plant and evaluates where the plant is expected to operate. Due to modifications made to the plant for the RHIC program, the existing equipment will be evaluated to assess whether changes are needed to the cold end of the plant: expander(s), exchangers and return piping configuration to return the satellite return streams. The finding will provide valuable insights into upgrade/modification requirements, optimizing the cryogenic plant, and ensuring reliable support for EIC's advanced scientific objectives.

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