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Cold head maintenance with minimal service interruption

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Turn-key superconducting magnet systems are increasingly conduction-cooled by cryogenerators. Gifford-McMahon systems are reliable and cost effective, but require annual maintenance. The most common maintenance method is to simply replace the cold head of the cryocooler with a reconditioned one. For conduction-cooled magnets, the direct replacement method requires a complicated design with a vacuum chamber separate from the main vacuum of the cryostat, as well as detachable thermal contacts, which add to the thermal resistance of the conduction cooling path and reduce the reliability of the system.

We present a rapid warm-up scheme to bring the cold head body, which remains rigidly affixed to the cold mass, to room temperature, while the cold mass remains at cryogenic temperature. Electric heaters thermally attached to the cold head stations are used to warm them to room temperature. Rapid warm-up of the cold head body permits conventional cold head maintenance with no danger of contaminating the inside of the cold head body. This scheme increases the efficiency of the cooling system, facilitates annual maintenance of the cold head and return of the magnet to service with minimal interruption.

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