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A Pulse Forming Network Power Supply for Quench Protection Heaters

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After completing the 32T all-superconducting user magnet, development of magnets of this class with a noticeably higher field has begun: the NHMFL 40T magnet is the immediate target. The next generation of high temperature superconductor (HTS) high-field user magnets demands the next generation of quench protection systems. Previously, a bank of batteries was employed to power the quench protection heaters, but safety considerations have driven the development of alternatives. One such alternative is a pulse forming network (PFN). A PFN is a specially tuned RLC circuit designed to deliver a pulse of current of a specific shape. It can be designed to deliver a large variety of pulse shapes and can therefore be tuned to the specific needs of the current generation of quench protection systems. A PFN is simpler to maintain and has fewer safety considerations than a battery bank, making them ideal choices for user magnets that will likely see many years of service. We will discuss the development, construction, and testing of the first quench protection system to make use of a PFN. This unique application was realized using the design and manufacturing expertise available at the Mag Lab to construct a test scale system for use in the development of the all-superconducting 40T project.

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