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Reel-To-Reel Contact Critical Current Measurement System for Superconductor Tape Testing SREYA VANGARA, Massachusetts Institute of Technology — The Plasma Science and Fusion Center at MIT is developing high-field superconducting magnets for the compact tokamak SPARC, for which the rapid qualification at large volumes of high temperature superconductors (HTS) is vital. To determine the critical current, or the maximum current the HTS is able to conduct without resistance, either small sections of HTS can be removed from larger reels and contact-tested with an input current, or entire reels can be run through an external field, inducing an internal current. The former process is time-consuming and ignores inconsistencies throughout the reel, but the latter does not directly pass current into the HTS. My project unites these methods with a novel reel-to-reel contact critical current testing system to rapidly conduct essential large-scale measurements. Three primary designs were explored for a testing rig. The first system utilizes a screw linear actuator to clamp each subsection of HTS onto two copper current leads, between which voltage is measured. The second system instead harnesses a pneumatic air cylinder and piston to apply a clamping force. The third system, in contrast, tensions the tape across the current leads. All three systems are designed to function in temperatures from 55-80K and ambient fields of 0-3T.

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