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Thu-Mo-Or16-03: Test Results of the First Two Full-Length Prototype Quadrupole Magnets for the LHC Hi-Lumi Upgrade

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The future high luminosity (Hi-Lumi) upgrade of the Large Hadron Collider (LHC) at CERN will include eight (plus two spares) 8.4 m-long cryostatted cold masses which will be components of the triplets for two LHC insertion regions. Each cold mass will consist of two 4.2 m-long Nb3Sn high gradient quadrupole magnets, designated MQXFA, with aperture 150 mm and operating gradient 132.6 T/m, for a total of twenty magnets. Before assembling and testing the final cold masses at Fermilab, the twenty component quadrupoles will be tested first at the vertical superconducting magnet test facility of the Superconducting Magnet Division (SMD) at Brookhaven National Laboratory (BNL), in superfluid He at 1.9 K and to 18.0 kA, in accordance with operational requirements of the LHC. Following a test of the first long single coil (in a mirror configuration) of the MQXFA design, the first two full-length prototype quadrupole magnets, MQXFAP1 and MQXFAP2, have been tested at BNL. This paper reports on the quench test and training results of these two magnets, and also the retest of the first prototype, rebuilt and designated as MQXFAP1b. The test results of these magnets will be important for validating the MQXFA design.

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