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Fermilab's Horizontal Test Stand Cryogenic System Upgrade and Commissioning

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The Fermilab horizontal test stand previously used for testing the LHC inner triplet quadrupoles has been upgraded to test cryo-assemblies for the HL-LHC upgrade. The test requirements of these new cryo-assemblies required additional capabilities of the test stand cryogenic system, including controlled cool-down and warm-up, helium recovery after a quench, and operation at higher pressures. Most of these upgrades were completed to support a zero-magnet test in late 2020, with the remainder of the upgrades completed to support the first pre-series cryo-assembly test in mid-2021. An overview of the design and initial operating experience of the upgraded test stand cryogenic system and associated process controls system are presented in this paper.

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