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The pressure drop measurement of JT-60SA superconducting magnets

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JT-60SA is a tokamak magnetic confinement device for plasma experiments. This is one of a joint international research and development projects involving Japan and Europe. JT-60SA adopts superconducting magnets consist of cable-in-conduit conductors. The magnet system consists of 18 Toroidal Field (TF) coils and 4 Central Solenoid (CS) modules, and 6 Equilibrium Field (EF) coils. Poloidal field (PF) coils (including the EF coils and CS modules) are cooled in the same circuit. The number of flow paths of PF coils is 190, and all of them are cooled in parallel.

The construction of JT-60SA was completed in March 2020. The cool-down operation was started on 10 October, and the temperature of the superconducting magnet reached 4.5K on 27 November.

Supercritical helium at 4.4K was provided to PF coils with a cold circulator. The design flow of PF windings is 926 g/s without the flow for the feeders. In this work, the mass flow of PF windings was controlled within a range of 572 g/s to 1,162 g/s. We measured mass flow rate, pressure, and temperature at inlet and outlet of PF coils while changing the speed of the cold circulator. Based on the measurement, the formulas of PF coils friction factors at around nominal operating temperature were derived.

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