MT25

25th International Conference on Magnet Technology

RAI - Amsterdam
August 27 - September 1, 2017

Contribution ID: **696**   Type: **Regular 15 minutes Oral Presentation**

Analyses of the ITER Poloidal Coil joints cold test results.

Wednesday 30 August 2017 18:15 (15 minutes)

The design of ITER Poloidal Coils contains 88 joints connecting individual conductors. Satisfying restrictions from operating condition, manufacturability and serviceability, these joints were designed as twin-box "shaking hands"concept. To ensure the manufacturing process consistently produces acceptable components, joint qualification tests have been defined for AC losses, DC resistance, heat exchange, critical temperature, etc. Data from each test is aggregated to PASS/FAIL result which qualifies manufacturing process. In present work we attempt to dissect the test data in order to reveal constituents of the final acceptance value. The outcome does not change the qualification results, but could steer us towards more robust manufacturing process by highlighting critical steps. We have studied the data from one failed and 3 passed joint samples with regard to DC resistance tests. In our analysis we consider data from all voltage taps and focus on DC resistance components that constitute the joint acceptance criteria. Measurements were conducted at 0T–5T external magnetic field and 0kA–55kA operating current with voltage taps distributed at various distances from the joint. Joint resistance and cable resistance results have allowed us to study current re-distribution between the superconducting strands and the impact of multiple resistive interfaces on overall joint performance. We have dissected the data into inductive, joint-resistive, and cross-strands-resistive components. Study under reverse current polarity has indicated non-symmetric behavior, most likely originating from mechanical movement of the strands. Cyclic load tests, targeted at joint-resistive component degradation study, have also shown improvement (up to factor of 10 reduction) on the cross-strands-resistive component (outside of the joint).
Acknowledgement: Joints have been provided by F4E and ASIPP through EU and CN Domestic Agencies. Special thanks to SPC SULTAN facility for raw data records.
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Session Classification: Wed-Af-Or26

Track Classification: B1 - Superconducting Magnets for Fusion