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Tue-Af-Po2.19-07 [48]: A Theoretical Investigation on the AC Loss Estimation Method for Fusion Magnet

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During operation, AC loss of central solenoid (CS) coils can be quite significant. From cryogenic point of view, CS coils, made of cable-in-conduit conductors (CICC's), can be regarded as porous pipes. A common way to estimate the heat generated by AC loss is from a difference in the enthalpy flow between the inlet and outlet. In actual cases, offsets in the enthalpy flow difference commonly observed, which does not seem to stay constant during operation. For a simplified cryogenic circuit, which contains key ingredients of actual system, we investigate this background enthalpy flow in detail, by using FLOWER code. The circuit contains a by-pass line and a pressure-relief valve. The work done passing through the porous media, CICC, has been carefully removed. It was shown that for the semi-closed test circuit, the enthalpy flow is accumulated in the outlet side in the form of cryogen density increase. The accumulated enthalpy only can be removed by pressure relief and due to overall mass imbalance, offsets in the enthalpy flow difference vary significantly. A way to minimize AC loss estimation error is further discussed.

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