



Contribution ID: 630

Type: **Poster Presentation**

C2Po1A-02 [23]: Failure modes, effects and criticality analysis of a 3kW@4.5K helium refrigerator

Tuesday 23 July 2019 09:00 (2 hours)

The comprehensive research facility for key systems of fusion reactors was included in the “13th Five-Year Plan” priority project in China. In order to meet the requirements of cryogenic testing of the large superconducting magnets, it is proposed to build a 3kW@4.5K refrigerator and carry out research on 3kW@4.5K helium cryogenic system. To evaluate the reliability of the 3kW refrigerator, the failure modes, effects and criticality analysis (FMECA) was performed on the helium refrigerator. The refrigerator system is divided into three subsystems: the compressor system, the oil-removal system and the cold box, to identify the failure modes and the impact on the refrigerator system related functions. Calculating the critical value based on the product of the severity and the occurrence and plotting the risk matrix to find the components with high risk and medium risk. In the end, the corresponding risk mitigation action will be proposed to reduce the high-risk components in the refrigerator.

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Session Classification: C2Po1A - Applications: Safety and Instrumentation II