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STRUCTURAL DESIGN OF ITER CRYO-PLANT TERMINATION COLD BOX UNDER EXTREME CONDITIONS

Content :

The ITER Cryodistribution system distributes cryogenic cold power, 75 kW at 4 K and 1200 kW at 80 K, from the cryoplant system to the superconducting magnets and cryopumps. The Cryoplant Termination Cold Box (CTCB) connects three liquid helium (LHe) plants, two 80 K helium plants and one LHe tank at one end, and five auxiliary cold boxes and thermal shield cooling system at the other. The main function of the CTCB is to provide interconnection between the cryogenic sources and applications, and thus plays pivotal role in distributing the cold helium fluid with huge mass flow rates up to 4 kg/s per plant. The connection between different systems is made through total nine large cryolines having diameter ranging from ~0.5 m to ~1.0 m. The ITER project being recognized in the category of Basic Nuclear Installation requires stringent qualification of each system and equipment under various loads and the combination of loads. The CTCB has been designed and analyzed considering the fulfilment of its process, thermal and structural requirements under various load conditions and operating scenarios. Among the various loads, the loads from the cryolines during nominal condition and during loss of insulation vacuum event pose a great challenge for bearing and transmitting these loads via the CTCB to the civil structure. This paper will describe the major requirements of the CTCB, load specification, design methodology, finite element analysis and final outcome and results complying with all requirements.

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