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C4Or1B-07: Experiences during design, fabrication, assembly and factory acceptance test of ITER Cryoplant Termination Cold Box

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The ITER Cryodistribution (CD) system distributes cryogenic cold power equivalent to 75 kW at 4.5 K and 1300 kW at 80 K, from the cryoplant to the applications, namely superconducting magnets, cryopumps etc. The Cryoplant Termination Cold Box (CTCB), which is the largest CD cold box, interconnects 3 liquid helium (LHe) plants, two 80 K helium plants, 1 LHe tank at one end, and 5 auxiliary cold boxes, thermal shield cooling system at the other end. CTCB plays a pivotal role in distributing cold helium fluid with highest mass flow rates of 4 kg/s coming from one of the 80 K plant. The physical connection between CTCB and different applications is made through total 9 cryolines having outer diameters ranging from 0.45m to 1.0m. The CTCB, with ˜20 m length, 3.5 m diameter and 70 tons of weight, has been designed to operate for various temperature levels i.e. 4K, 50K and 80K, manufactured and assembled with various large size components such as electrical heater of 600 kW capacity, cryogenic control valves of DN200, bubble panel stainless steel thermal shield etc. The CTCB has been designed, analyzed considering the fulfilment of its functional, thermo-structural requirements under various load conditions i.e. Seismic, loss of insulation vacuum, having interface loads of ˜100 tons which is about 1.4 times of overall weight itself. The CTCB components & subsystems have been manufactured and factory tested individually in various locations in Europe as well as in India and then assembled at one place. It has been also integrally tested, which majorly includes helium leak & pressure test, all functionality checks of instruments etc. The factory test also included functional test of mini CODAC & complete PLC program. This paper describes challenges involved in design, fabrication, assembly and factory acceptance test (FAT) and how they were resolved. The status of CTCB and experiences gained during design, fabrication, assembly & FAT with final outcome and results complying with all requirements are also reported.

Author: Mr PATEL, Pratik (ITER-India, Institute for Plasma Research)

Co-authors: Mr VAGHELA, Hitensinh (ITER-India, Institute for Plasma Research); Mr MURALIDHARA, Srinivasa (ITER-India, Institute for Plasma Research); Mr SHUKLA, Vinit (ITER-India, Institute for Plasma Research); Mr GARG, Anuj (ITER-India, Institute for Plasma Research); Mr DAS, Jotirmoy (ITER-India, Institute for Plasma Research); Mr DASH, Bikas (ITER-India, Institute for Plasma Research); Mr MADEENAVALI, shk (ITER-India, Institute for Plasma Research); Dr CHANG, Hyun-Sik (ITER Organization); Mr GRILLOT, David (ITER organization); Dr SARKAR, Biswanath (ITER Organization); Ms CURSAN, Marie (ITER Organization); Ms OPPOLZER, Kerstin (Linde Kryotechnik AG); Dr SANDER, Frank (Linde Kryotechnik AG); Mr ADLER, Ernst (Linde Kryotechnik AG)

Presenter: Mr PATEL, Pratik (ITER-India, Institute for Plasma Research)

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