Progress of mock-up trials for ITER TF coil procurement in Japan

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The magnet system for ITER comprises 18 Toroidal Field (TF) Coils using Nb₃Sn cable-in-conduit superconductor, which operate at 4.5 K in supercritical helium. Japan Atomic Energy Agency (JAEA) is responsible for the procurement of 9 TF coils as Japanese Domestic Agency (JADA). Before launching the procurement of these coils, reduced and full-scale trials will be performed to determine and optimize the manufacturing process of a TF coil. During the manufacture of the TF coil, heat-treated superconducting cable-in-conduit conductor, whose length may vary during heat treatment, shall be inserted in the grooves of the radial plate (RP), which is part of the mechanical structure supporting the large electromagnetic forces that are of the order of 800 kN/m. The RP also enhance reliability of the electrical insulation that will be tested up to 19kV DC and 2.5kV AC for the winding pack to ground. Very accurate tolerances, of the order of 0.01% on the length of the RP grooves and of the wound conductor, are required to enable the insertion of the conductor. Therefore, the development of suitable manufacturing techniques for the RP and for the winding operation is essential to achieve this requirement. JAEA has contracted companies for fabrication trials of a full-scale RP and winding trials of a one-third scale double pancake to verify feasibility of the required tolerances from an industrial view point. Prior to these trials, JAEA developed a preliminary manufacturing plan and then, industry will carry out small-scale trials to demonstrate applicability of the preliminary manufacturing plan before making the reduced and full-scale trials. The small scale trials will include the cover plate welding with the laser welding, the impregnation using the acryl and metal models, and, the mechanical test and the trail bending of the TF conductor. The results of the small-scale trials and progress on the reduced and full-scale trials are presented in this paper.