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## JUSTIFICATION OF THE ITER BLANKET ELECTRICAL STRAP SERVICEABILITY <sup>\*)</sup>

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First As part of the arrangement to supply the ITER blanket first wall enhanced heat flux (EHF) panels and the blanket module connectors (BMC) for the International Thermonuclear Experimental Reactor (ITER) currently under construction in France, NIKIET JSC is responsible for the development and delivery to the ITER site of more than 2000 electrical strap (ES) sets.

ECs of different standard sizes are used in the ITER blanket design for the electrical connection of the blanket module (BM) surface to the vacuum vessel (VV) to protect the coolant inlet and outlet pipes against ohmic heating, as well as to reduce the electromagnetic loads in the event of potential. Plasma disruptions on the BM. Two ESs are installed on the “first wall panel (FWP) — shielded block (SB)” interface, and two more are installed on the “SB — VV” interface.

Each EC is designed as a rectangular-shaped one-piece structure with 1.2 mm thick wave-like electric conducting lamellas. There are two ES designs depending on the location. Ten lamellas for the modules installed in the outboard blanket area, which allows the passage of a current with an intensity of up to 41.4 kA. The overall dimensions are 168x80x47 mm. Fourteen lamellas installed on the VV top rows and in the inboard blanket area, in which the passage of a current with an intensity of up to 137 kA is possible. The overall dimensions are 168x100x47 mm.

Prior to the series fabrication, in accordance with the ITER IO requirements, the EC manufacturing process needs to be qualified, and the EC structural robustness needs to be confirmed in the ITER specific conditions. The ES qualification program includes both manufacturing and mechanical cyclic tests at an elevated temperature. There were 14 ESs manufactured as part of the qualification program. The mechanical cyclic tests were conducted in three stages.

Stage 1 corresponds to the inductive operating mode (I), stages 2 and 3 corresponds to the plasma disruptions. Following test stages 1 and 2, there are no failures or cracks in any lamellas which satisfies the acceptance criteria. It was shown after stage 3 that the minimum safety margin was equal to 2, and the maximum safety margin was equal to 5.25, while there were not more than 2 failed lamellas and the required number of cycles was 400, which satisfies the acceptance criteria. Adjustments have been made based on the qualification results. Three more ITER blanket ESs were made of CuCrZr bronze and mechanical cyclic tests were conducted. There were no observations made with respect to the connectors as the result of test stages 1 and 2, and no cracks or failures were recorded in the lamellas, which satisfies the EC acceptance criteria. After test stage 3 was completed, cracks were recorded in all lamellas, still the minimum safety margin was 10.5 with the required number of cycles being 400, which satisfies the acceptance criteria.

NIKIET JSC’s experts have completed the ITER blanket module EC qualification process. It has been confirmed based on the qualification results that it is possible to manufacture the ECs, and they are serviceable in conditions of the loads representative of the ITER operating modes.

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<sup>\*)</sup> [abstracts of this report in Russian](#)