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EM analyses on the 55.NE.V0 loom system and attached components

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The ITER vacuum vessel (VV) contains transducers for vessel and blanket instrumentation and for the measurement of plasma performance. The electrical and optical signals to and from these transducers are managed through the electrical services infrastructure project 55.NE.V0. This system is responsible for transmitting electrical signals from the VV inner skin to the outside of the vacuum where they interface to conventional signal transmission and data acquisition systems. Around 1400 sensors/junction boxes/connectors and more than 1700 MI cables are distributed throughout the vacuum vessel inner surface.

This paper concerns EM activities performed as part of the full set of engineering analyses necessary to assess the design configuration feasibility.

Transient electromagnetic analyses were performed for 4 representative looms systems, placed at the inboard and outboard region, and exiting the VV from lower and upper ports. Highly populated looms in the divertor region (named 55.NE.D0) were analysed for the most demanding downward plasma disruptions.

All the cables were modeled using dedicated EM "wire elements", an element type developed by LTCalcoli, suitable to model eddy currents in wire-shaped structures.

The calculated distributed EM loads along the cables and in attachment components allowed the most loaded cable branches, and the worst position and disruption for connecting clamps and junction boxes, to be identified.

Detailed 3D EM models were developed for the most loaded junction boxes and clamps and integrated in the ITER Global Model.

The detailed analyses allowed the Lorentz forces and resultant torques on the different sub-structures, and the force distribution element by element, to be evaluated, ready for subsequent structural assessments.

Since the clamp bosses are welded onto the VV which is a confinement boundary and ESPN equipment, the analyses conducted contribute to demonstrating the absence of impact on the VV. This work is considered to be a Protection Important Activity (PIA).

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