

Manufacturing of the Coil Support Structure for W7-X

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Equipos Nucleares S.A. (hereinafter referred to as ENSA) as a Contractor in the Wendelstein 7-X Stellarator project, nowadays being erected at the Max Planck Institut in Greifswald, is currently manufacturing the Coil Support Structure (CSS), which is a stainless steel ring-shaped structure formed by five equal sectors (modules), each of them made up from 2 symmetric half-modules. Both, modules and half-modules are joined together by way of bolts and super-bolts. Special assembly pins keep two half-module in their right position to form a module every time it needs to be disassembled. This CSS works as the central support of both planar and non-planar coils of the Stellarator and hence is part of the Magnet system. Those coils are bolted to the CSS by means of one hundred and forty casted extension legs welded to the structure, each coil bolted to a couple of legs. In order to achieve an exact location of the coils in reference to the centre of the experiment, those legs have severe tolerances to be reached during the welding of the extensions and moreover afterwards an accurate machining is necessary to obtain the holes on a precise position so that the bolts will fit perfectly between the coils and the CSS.

Besides, the complicate shape of the CSS allows the ports to pass through the structure and reach their place into the vacuum vessel. Furthermore, all the structure is cooled down by way of a cooling system based on a copper coated stainless steel long tube going through the entire structure which it is attached to it via copper strips. Liquid helium at 4 K will circulate throughout this cooling system to refrigerate the entire structure so that the heat doesn't pass from the CSS to the coils and then maintain the mechanical properties as well as the superconductive behaviour.

On top of all this, temperature and stresses on the materials will be controlled at several locations on each half-module by means of advanced temperature sensors and strain gauges glued to the structure.

ENSA collaborates both in the design and the manufacturing of the CSS with the highest and newest technologies such as 3D CAD systems, laser trackers for dimensional controls, tools, machines, non destructives tests, etc.