

THE PRODUCTION PHASE FOR THE NCSX MODULAR COIL WINDING FORMS*

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The National Compact Stellarator Experiment (NCSX) is being constructed at the Princeton Plasma Physics Laboratory (PPPL) in partnership with the Oak Ridge National Laboratory (ORNL). A key element of the core is the modular coil system which is principally responsible for the generation of the 3-D stellarator field. This system is comprised of six each of three distinct types of coils. The coils consist of LN₂ cooled cable supported on cast stainless steel winding forms; this paper will describe their production. This requires a closely coordinated team: the NCSX engineering and physics groups, a pattern shop, a foundry, a machine shop, and a management group which coordinates the industrial team member's efforts. The process begins with NCSX's issuance of specifications and CAD files which describe the forms and their requirements. Next, the pattern shop prepares a casting model from the supplied CAD file which must be dimensionally adjusted for the casting temperatures and for overcasting allowances. The foundry performs flow-solidification analyses which are necessary to develop the mold design details and pouring parameters required to produce high quality castings. Following this, the pattern shop and foundry jointly determine the segmentation of the pattern (replica of the part) and mold details. Using this design, a mahogany pattern is constructed, which is then sent to the foundry where the two groups work together to produce a sand mold from the patterns. Following mold assembly and verification, the foundry pours the casting, performs a number of clean-up operations, inspections (visual, liquid penetrant, permeability, dimensional inspections, radiography), and weld upgrading operations. Finally, the casting is sent to the machine shop, where machining operations are performed on multi-axis computer driven milling machines and final inspections are performed. Manufacturing is expected to be completed by the Fall of 2006.

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