

Abstract Submitted
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Innovations in Quasi-Poloidal Stellarator Design¹ B.E. NELSON, J.F. LYON, K.D. FREUDENBERG, P.J. FOGARTY, Oak Ridge National Laboratory, R.D. BENSON, M. MADHUKAR, Univ. Tenn. Knoxville — The Quasi-Poloidal Stellarator (QPS) is being developed with very low plasma aspect ratio, 1/2-1/4 that of existing stellarators. Design innovation is driven by both the complex 3-D geometry and the need for reduced cost and risk in fabrication, so QPS differs significantly in design and construction from other toroidal devices. An internally cooled, compacted cable conductor consisting of stranded copper filaments wound around an internal copper cooling tube was developed that can be wound into complex 3-D shapes. This conductor is wound directly onto the complex, highly accurate, stainless steel coil winding forms. Simplified coil winding procedures lead to faster fabrication and reduced technical risk. A full-size prototype of the largest and most complex of the winding forms has been cast using a patternless process (machined sand molds) and a high-temperature pour, which resulted in <1/10 the major weld repairs of similar sand castings using conventional patterns, and machined to high precision. A vacuum-tight cover is welded over each coil pack and a high-temperature cyanate ester resin is used for vacuum pressure impregnation of the coils because it has several important advantages over the usual epoxy. The completed coils are then installed in an external vacuum vessel.

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