

Coaxial Superconducting Power Cables

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COAXIAL SUPERCONDUCTING CABLE DESIGN

On 6-January 2000 Southwire energized the first superconducting cable system to supply power to a live load. Since that date, the system has been powering the manufacturing complex at the company headquarters in Carrollton, GA. Southwire designed and built three 30-m, single-phase HTS cables rated 12.4 kV, 1,250 Amps. During the three-plus years the system has operated, the cables have provided 100% reliability and service. Southwire used the cold dielectric, co-axial conductor design shown below.

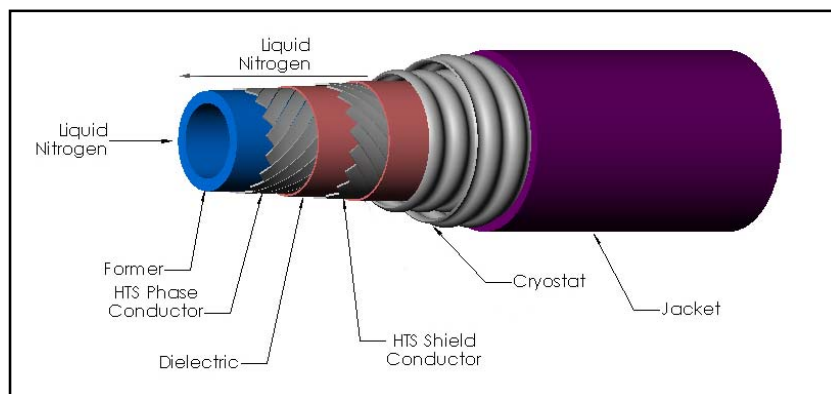


Figure 1 - Cold Dielectric Superconducting Cable

The cable is built around a central core that serves as a flow path for the liquid nitrogen (LN) coolant. Superconducting tapes are wrapped around the core and make up the phase conductor, replacing copper or aluminum in conventional cables. The superconducting tapes are then covered with a polymer dielectric tape called Cryoflex™. This is proprietary material developed specifically for HTS cable applications. Cryoflex operates at the temperature of LN, -200°C, and provides the needed electrical insulation. A second layer of HTS tapes is wound on top of the dielectric to form the outer shield conductor. The outer layer of HTS captures all electro-magnetic fields (EMF) emitted from the phase conductor, resulting in a fully shielded cable design. The final cable construction is inserted into a thermal envelope consisting of a double-walled stainless steel pipe. This pipe maintains the -200°C operating temperature.

The HTS cables and components are tested to standard industry qualification requirements for their respective voltage ratings. The system has passed all test requirements including AC withstand, BIL and fault current.