



# TOROIDAL FIELD COIL CONDUCTOR

*Close-up view of niobium-tin superconducting wire. Photo: Luvata Waterbury, Inc.*

## U.S. CONTRIBUTION

US ITER fabricated 8% of the toroidal field coil conductor for the international ITER fusion project. The ITER Organization was responsible for the conductor design released for fabrication. Japan, the European Union, the Russian Federation, Korea, and China also contributed conductor.

## OVERVIEW

The 18 toroidal field coils produce a magnetic field of 5.3 tesla around the ITER tokamak torus to confine the plasma particles. The coils have a total magnetic energy of 41 gigajoules and a maximum magnetic field of 11.8 tesla. The United States is responsible for enough conductor to wind slightly over one coil, which is equivalent to more than 4 miles of conductor constructed from 40 tons and over 4,000 miles of niobium-tin superconducting strand. The coils are made of cable-in-conduit superconductors, which are composed of superconducting strands cabled together, compacted into a stainless steel conduit, and cooled by supercritical helium. The United States' toroidal field contribution includes nine active double-pancake lengths (about 765 meters each), with three using Oxford Superconductor Technology (OST) strand and six using Luvata strand; one dummy length of 765 meters for winding trials; and two active lengths of 100 meters each for qualification.

## STATUS

The United States completed delivery of conductor in 2017.

*A completed spool of conductor  
at Criotec in Chivasso, Italy.  
Photo: US ITER*



U.S. DEPARTMENT  
of ENERGY

OAK RIDGE  
National Laboratory

PPPL  
PRINCETON  
PLASMA PHYSICS  
LABORATORY



Savannah River  
National Laboratory®



Jacketing material at the conductor integrator at the High Performance Magnetics facility. Photo: US ITER



A close-up view of conductor shows the density of compacted strand around a helium cooling channel. Photo: US ITER



Cabled conductor at New England Wire Technologies. Photo: NEWT

## TECHNICAL DESCRIPTION

**Toroidal field (TF) coil height:** 16.5 m

**TF coil width:** 9 m

**Single TF coil weight:** 310 t

**Total TF coil weight:** 6,540 t

**Number of coils:** 18

**Peak field strength:** 11.8 T

**Operating voltage:** 7 kV

**Operating current:** 68 kA

**Operating temperature:** 5 K

**Current per TF coil:** 9.11 MA

**Maximum magnetic field:** 11.8 T

**Total magnetic energy of all TF coils:** 41 GJ

**Number of turns per coil:** 134

## CONTRIBUTORS INCLUDE

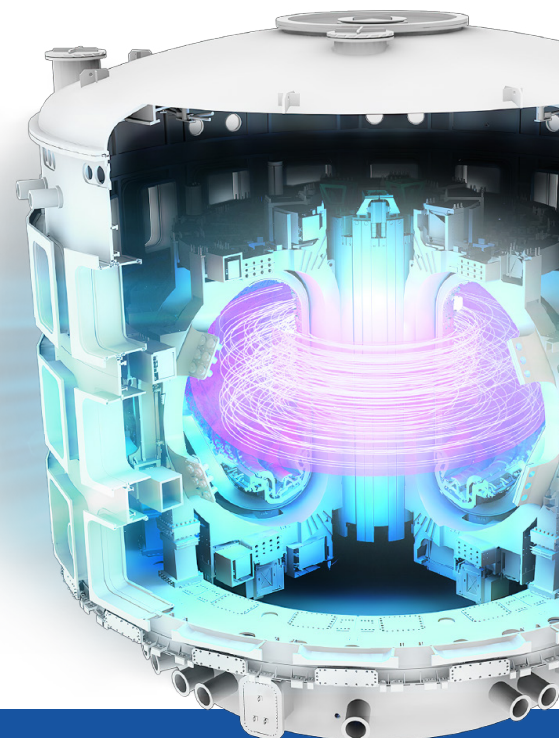
Luvata Waterbury, Inc. (Waterbury, CT)

Oxford Superconducting Technologies (Carteret, NJ)

New England Wire Technologies (Lisbon, NH)

High Performance Magnetics (Tallahassee, FL)

Criotec (Chivasso, Italy)



May 2026  
ORNL 2026-G00142/IA2

US ITER is managed by Oak Ridge National Laboratory in Tennessee, with partner labs Princeton Plasma Physics Laboratory in New Jersey and Savannah River National Laboratory in South Carolina.