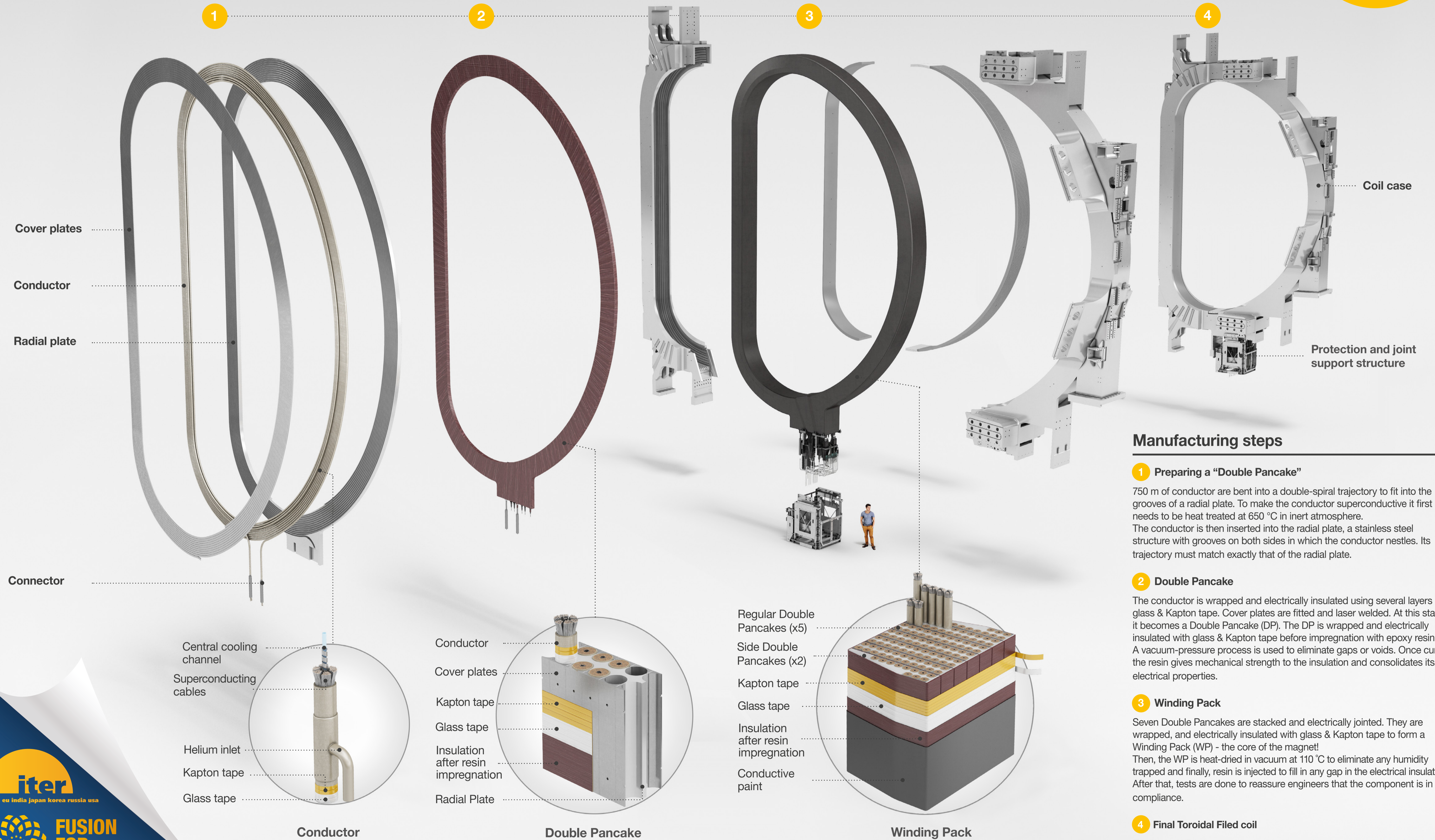


ITER Toroidal Field Coils

18 powerful superconducting magnets will confine the ITER plasma reaching 150 million °C. Powered with 68 000 A they will generate a strong magnetic field of 11.8 Tesla (approximately 1 million times stronger the magnetic fields of the Earth). Europe will manufacture 10 of the TF coils and Japan 8 plus one spare. They will be the biggest Niobium-tin (Nb₃Sn) magnets ever produced. More than 600 people from 26 companies have collaborated to produce the European TF coils.

Each coil is approximately:
14 m high
9 m wide
300 t with its case - the weight of a Boeing 747



Manufacturing steps

1 Preparing a "Double Pancake"

750 m of conductor are bent into a double-spiral trajectory to fit into the grooves of a radial plate. To make the conductor superconductive it first needs to be heat treated at 650 °C in inert atmosphere. The conductor is then inserted into the radial plate, a stainless steel structure with grooves on both sides in which the conductor nestles. Its trajectory must match exactly that of the radial plate.

2 Double Pancake

The conductor is wrapped and electrically insulated using several layers of glass & Kapton tape. Cover plates are fitted and laser welded. At this stage it becomes a Double Pancake (DP). The DP is wrapped and electrically insulated with glass & Kapton tape before impregnation with epoxy resin. A vacuum-pressure process is used to eliminate gaps or voids. Once cured the resin gives mechanical strength to the insulation and consolidates its electrical properties.

3 Winding Pack

Seven Double Pancakes are stacked and electrically joined. They are wrapped, and electrically insulated with glass & Kapton tape to form a Winding Pack (WP) - the core of the magnet! Then, the WP is heat-dried in vacuum at 110 °C to eliminate any humidity trapped and finally, resin is injected to fill in any gap in the electrical insulation. After that, tests are done to reassure engineers that the component is in compliance.

4 Final Toroidal Filed coil

Finally, the WP is inserted into a massive stainless steel case, weighing almost 200 tonnes, strong enough to resist the huge forces generated during operation.