

Dipole Arc Magnet Cold Masses

ASG in 2007 completed the supply of one third (416 units + 30 spare parts) of the cold masses for the arc dipole magnets composing the Large Hadron Collider ring (overall 1232 units). Each dipole, designed as a twin-aperture structure, has length 15 m, outer diameter 0.57 m and weight 30 t. The individual stored energy is 7.1 MJ at 7 TeV.

The magnet uses NbTi superconducting cable and produces a field of 8.33 T in superfluid helium at 1.9 K. The “dipole cold mass”, which contains all the cooled components, consists in two s.c. dipoles, each of them composed of two poles made of two layers (Kapton insulation system), the collars (coils pre-stressing system, made by austenitic steel laminations), the laminated iron yoke (split in two halves) and the outer austenitic shrinking cylinder (obtained by automatically TIG welding of two cylindrical half-shells in 316LN; the weld length covers the whole length of the magnet surrounding the yoke assembly).

Geometrical controls over the dipole geometry have been carried out using laser tracker repeatedly during the assembly. X-ray examinations have been performed both longitudinally over the stainless steel shell and circumferentially on the end covers welding. Production rate was of 3.6 cold masses per week, this meant implementing in parallel four winding lines, one collaring station, two curing stations.

The coil geometry of each component and assembly must be accurate, reproducible and symmetric within few hundredths of mm, in order to prevent any systematic coil movement causing quenches and to give high quality of the magnetic field. The ASG Superconductors’ production of 30 pre-series dipoles used special high-tech tools and had qualified special processes developed during the prototypes phase.



Winding line



Collared coils completed