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Design and construction of the first full-length prototype of the 11T dipole magnet for the High Luminosity LHC Project at CERN

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The luminosity upgrade of the Large Hadron Collider at CERN requires the installation of additional collimators in the dispersion suppressor regions of the accelerator. Amongst other things, the upgrade foresees the installation of one additional collimator on either side of IP 7 at the location of existing main dipoles that will be replaced by shorter and more powerful dipoles, and of one additional collimator on either side of IP2 at the location of existing empty cryostats. This paper describes the design and the construction status of the first full-length prototype of the 11T dipole magnet, which is needed for IP7. This magnet features a two-in-one structure, like the LHC main dipole, impregnated coils made of Nb3Sn conductor, an inner bore of 60 mm and a magnetic length of about 5.3 m. Two 11 T magnets are needed to replace a 15-m long MB. A by-pass cryostat placed in between the two magnets allows creating a room temperature space for the additional collimators. The magnet is designed to provide the same integrated field as the MB at nominal field. However, due to the difference in transfer function at lower field, a correction by means of a trim current as been considered. A full length prototype is currently under construction at CERN with the goal of developing the manufacturing and inspection procedures prior to launch the series production. For this, new tooling has been developed and optimized during the fabrication of fully representative practice coils. This paper describes the main manufacturing steps and corresponding quality indicators which will be used to monitor the series production. Finally, the production and installation schedule will be presented.

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