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Transverse pressure dependence of the critical current in Nb₃Sn Rutherford cables up to 200 MPa

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The transverse pressure dependence of the critical current in various Nb₃Sn Rutherford cables is reported. CERN has prepared for the 11 T so-called Dispersion Suppression (DS) dipole magnets constructed in the frame of the LHC luminosity upgrade, cables from different types of strand either with or without AC-loss suppressing central core. Since Nb₃Sn is a brittle material and the Lorentz forces in dipole magnets lead to sizeable transverse pressures in their winding pack, it is essential that the cyclic transverse stress response of the cables and especially their irreversible stress limit are well characterized under magnet-relevant conditions.

Three DS cables, one prepared with RRP-type strands and two with PIT-type strands and the latter two with and without steel core, were impregnated on a U-shaped holder and mounted in a superconducting transformer set-up equipped with a cryogenic press. The transverse pressure dependence of the critical current was measured at 4.2 K in a magnetic field up to 11 T and a maximum applied force of 240 kN, equivalent to some 200 MPa mean transverse stress on the cable. Additionally, RRR-values and critical current of witness- and extracted strands were investigated in order to understand the influence of cabling process on the critical current.

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