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Choice of 2G HTS tape for magnet design according to quench protection requirements.

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Use of 2G HTS superconductors in magnet applications allows creating compact magnets with large magnetic fields due to many times higher current density of superconductors in comparison with traditional metal wires. At the same time, 2G HTS tapes make the design of magnet special and require choosing 2G HTS tape parameters suitable to each magnet design. The unique properties of 2G HTS tapes are possible current transport in parallel in the superconducting and normal conducting layers, non-uniform critical current distribution by length of 2G HTS tape, strong correlation of heating of the tape with the thickness of the thin stabilizer layers and the non-linear behavior in external magnetic field. All factors have an impact on the quench detection of magnets and have to be taken into consideration to prevent overheating of local hot-spots. This paper describes a method for selecting the 2G HTS tape geometry for magnet design by calculation of quench protection properties in accordance with current sharing between layers of 2G HTS tapes in the external magnetic field and with deviation of critical current values by length. Analysis of quench in 2G HTS tape with realistic critical current distribution by length allows predicting behavior of temperature and voltage in each point of tape and provides specifications for creating an effective quench protection system.

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