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Current imbalance and AC losses of long distance DC HTS cable

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Despite intensive research in the field of applied superconductivity only now we start to use of this phenomenon for the most obvious application, namely, power transmission. At present, it can be seen an explicit shift from AC to DC HTS cable systems due to the many advantages of the DC ones. However, even at constant current transmission line is subjected to current fluctuations and, consequently, AC losses. One more reason for reducing the efficiency of HTS lines is current imbalance. It is associated with the presence of electrical resistance at the soldered connections of the superconducting tapes. Although these resistances are very low, but against the background of zero resistance of the rest of the superconductor they determine the individual currents in tapes and introduce essential nonlinearity into the dependence of these currents on the total current.

A large national project on DC HTS power transmission was launched in Japan in FY 2013. The system will be used as power supply of the Internet data center in Ishikari, Hokkaido. Within the framework of the project two cables with the lengths of 500 and 2000 m will be laid. Since the novel design of the thermal insulation will be used, it becomes important to carefully consider the contribution of internal heat generation. The frequency characteristics of the ripple currents were calculated taking into account current imbalance in order to estimate AC losses.

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