The world-wide globalization of electric energy delivery enhances the problem of DC-bias of power transformer cores. This is due to several reasons:

(i) High voltage (HV) lines over extreme distances favour the short-time influx of strong, solar-wind caused, geomagnetically induced currents (GICs) into HV-AC systems [1].
(ii) Long distance HV-DC lines may produce long-term DC-currents in local HV-AC mains.
(iii) Inter-connections between HV-AC systems and HV-DC systems - or HV-AC systems of deviating frequency, respectively - create an increasing demand for thyristor/transistor equipments which may produce long-term DC-currents of weak intensity.
(iv) Extremely large 3-phase power transformers tend to be replaced by sets of three 1-phase transformers which show strongly increased susceptibility to DC-bias.

Influx of DC-current into a power transformer which is part of a rigid HV-system tends to remain without effect on the global AC-magnetization of the magnetic core. This is true for both alternating magnetization (AM) of limbs and rotational magnetization (RM) of T-joints and yokes. However, even small DC-magnetization components in rolling direction favor half-cycle saturation processes. The latter are characterized by the annihilation of bar-domain Bloch walls [2,3] with consequences on the most important characteristics of material.

This yields significant effects as summarized in the following:

(a) The permeability shows distinct decreases linked with high half-cycle increases of field.
(b) The losses for AM tend to increase due to rising hysteresis losses as a result of affected bar domains.
(c) The relative impact of RM on losses sinks due to a priori high hysteresis losses [3].
(d) For AM, magnetostriction-caused strains increase strongly due to enhanced annihilation / nucleation of oblique domains.
(e) For RM, the relative increase of MS-caused strains decreases due to a priori pronounced oblique domain structures [4].

As industrially relevant consequences, DC-bias tends to cause strong increases of excitation currents and stray fields, as well as increases of no-load losses and audible noise.

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