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Experimental study of a helical coil operating mechanism for future switchgear applications

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The replacement of the strong greenhouse gas sulphur hexafluoride and the emerging installation of multi-terminal HVDC grids also lead to significantly changing requirements for future switching devices. On the one hand, the application of alternative insulating and arc quenching gases requires higher opening velocities of the contacts to compensate the reduced dielectric strength of these gases. On the other hand, fast switching devices are needed due to the fast increase of the fault current in DC grids. In this contribution a compact helical coil operating mechanism is set up for replacing conventional mechanical spring drives in circuit breaker and switching applications. The total stroke is selected to match typical contact distances in state-of-the-art gas-insulated switchgear. Nevertheless the operating principle can be easily extended to higher moving distances. In order to achieve an intrinsic breaking effect, the winding direction of the stator is reversed after half of the moving distance. In a first approach, the operating mechanism is tested in the high current part of a synthetic test circuit with a sinusoidal current. The initial position of the sliding anchor on the stator is varied to experimentally determine the acceleration and breaking performance of the operating mechanism. Furthermore, the amplitude of the sinusoidal test current is varied up to values of several kilo-amperes. The movement of the anchor is observed by measurements of the travel curve and video camera recordings. In addition the wear of the stator windings as well as the sliding contacts of the anchor are investigated yielding a statement with regard to the durability of the operating mechanism. The results also indicate the applicability of the mechanism for future DC switching devices.

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