With power electronic converters in the distribution grid, parameters such as voltage, current, active and reactive power can be adjusted. For hybrid transformers (cf. figure), one DC/AC converter of the back-to-back system is connected in series to the low voltage (LV) transformer winding. To protect the converter from grid faults like short circuits as well as the grid from converter faults, a bidirectional bypass switch with a closing time below 500μs is required to provide an alternative current path.

In this thesis, two different bypass concepts are investigated. At first, a thyristor bypass including a gate drive circuit and the clamping mechanism is designed taking into account the heating of the bypass during a short circuit. In addition, a hybrid solution consisting of a thyristor switch and a Thomson coil actuator is analyzed. From designs for medium voltage switches presented in the literature, a LV switch is deduced and design limitations are outlined. The scalability of switching times and component volume with respect to the voltage level is analyzed with COMSOL and verified by a LV prototype.

**Work Description:**
- 20% Theory
- 30% Simulation (FEM)
- 50% Hardware design and tests

**Prerequisites:**
- Experience with FEM simulation preferable

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