

Exercise Session 11: Transformers

EX 1 rated currents

A 3-phase transformer is needed for service purpose. The transformer nameplate shows (30 kVA, 3,81 kV (Y)/0.381 kV (Y), 50 Hz). For tuning the protection relays, some information about the currents is needed

- a) Calculate the rated line current of the primary and secondary, in Y/Y connection.

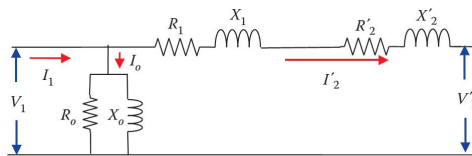
EX 2 Different connection

The transformer of exercise 1 is now used to connect the load to a grid with lower voltage level (2,2 kV). For this purpose, the primary winding is connected in Delta.

- a) Calculate the rated line current of the primary and the current flowing in one coil.
- b) What is the rated current of the secondary?

EX 3 open- and short-circuit tests

Before installing the above transformer, tests are made to determine its equivalent circuit parameters according to the figure below. The connection is the original Y/Y.



Equivalent circuit of the transformer reduced to the high voltage side (primary side)

The open-circuit test is made so that the high voltage side (primary) is open and the transformer is fed from the low voltage side (secondary). Test results are: $V_{oL}=0,381$ kV, $I_{oL}=2,5$ A, $P_{oL}=300$ W. The short-circuit test is made so that the low voltage side is short-circuited and the transformer is fed from the high-voltage side (primary). The test results are: $V_{sc}=260$ V, $I_{sc}=4,55$ A, $P_{sc}=645$ W.

- a) From the open-circuit test, calculate the magnetizing reactance X_0 and the iron core resistance R_0 .
- b) From the short circuit test, calculate the equivalent resistance ($R_1+R'_2$) and the equivalent reactance ($X_1+X'_2$).

EX 4 Equivalent circuit

The calculated equivalent resistance and reactance from the previous short-circuit test are referred to the secondary side, whereas the magnetizing reactance and iron resistance are referred to the primary side. In an equivalent circuit, they need to be referred to the same side.

- a) Calculate the equivalent resistance and reactance as referred to the high voltage side (primary).
- b) Draw the equivalent circuit with all its parameters in numerical values.