TUTORIAL – SINGLE PHASE IMPEDANCE AND POWER

EXERCISE 1: FLUORESCENT TUBE

Philips Lighting
Master TL5 HE Eco 32=35W/840 UNP/40

P = 31,7 W - I = 0,17 A - V = 230 V
A fluorescent tube is a capacitive load

1) **Calculate** :
   - the apparent power required by the tube
   - the tube power factor and the phase angle between the line current I and the supply voltage
   - the reactive power required by the tube
2) **Draw** the power triangle.

Equivalent "parallel" tube model

3) **Draw** a diagram of the equivalent "parallel" model of the tube as a resistor and a reactance connected in parallel. **Indicate** the supply voltage V, the line current I, the active current I_P and the reactive current I_Q on the diagram
4) **Plot** the Fresnel diagram by taking the supply voltage V as a reference
5) **Calculate**:
   - the active current flowing through the tube
   - the reactive current flowing through the tube
   - the equivalent tube ilmpedance
   - the equivalent tube resistance
   - the equivalent tube reactance
   - the capacitance of the tube equivalent capacitor.

Equivalent "series" tube model

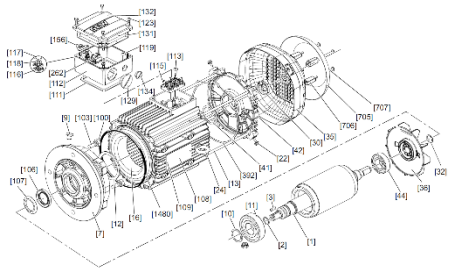
6) **Draw** a diagram of the equivalent "series" model of the tube as a resistor and a reactance connected in series. On the diagram, indicate the supply voltage V, the line current I, the voltage across the resistor V_R and the voltage across the reactor V_C
7) **Plot** the Fresnel diagram by using the line current I as a reference
8) **Calculate**:
   - the voltage across the resistor
   - the voltage across the reactance
   - the equivalent tube impedance
   - the equivalent tube resistance
   - the equivalent tube reactance
   - the capacitance of the tube equivalent capacitor

Additional documentation: GIE 2017 p N38

EXERCISE 2: SINGLE-PHASE MOTOR

Motor SEW - DRK 71 M4 - 0,25 kW

P_U = 0,250 kW - I = 2,05 A - V = 230 V
η = 66.3%
A single-phase motor is an inductive load



9) **Calculate**:
   - the apparent power required by the motor
   - the motor power factor and the phase angle between the line current I and the supply voltage V
   - the reactive power required by the motor

10) **Draw** the power triangle.

Equivalent "parallel" motor model

11) **Draw** a diagram of the equivalent "parallel" model of the motor as a resistor and a reactance connected in parallel. **Indicate** the supply voltage V, the line current I, the active current I_P and the reactive current I_Q on the diagram.

12) **Plot** the Fresnel diagram by taking the supply voltage V as a reference.

13) **Calculate**:
   - the active current flowing through the motor,
   - the reactive current flowing through the motor,
   - the equivalent motor impedance,
   - the equivalent motor resistance,
   - the equivalent motor reactance,
   - the equivalent motor inductance.