Q.1) A 10KVA, 200/400V, 50Hz, 1-phase, transformer gave the following results:

OC tests (HV open): 200V 1·3A 120Ω

SC test (LV short): 22V 30A 200Ω

Determine Shunt and series branch parameters referred to Low voltage side and hence draw equivalent circuit diagram also

⇒ Soln -

We have given,

$S = 10KVA$

$V_1 = 200V \quad V_2 = 400V \quad K = \frac{V_2}{V_1} = \frac{400}{200} = 2$

From oc test, we have (referred to L.V side)

$V_1 = 200V \quad I_0 = 1·3A \quad W_0 = 120W$

$W_0 = V_1 I_0 \cos\phi_0$

$\cos\phi_0 = \frac{W_0}{V_1 I_0} = \frac{120}{200 \times 1·3} = 0·461$

$R_0 = \frac{V_1}{I_0 \cos\phi_0} = \frac{200}{1·3 \times 0·461} = 333·72\,\Omega$

$X_0 = \frac{V_1}{I_0 \sin\phi_0} = \frac{200}{1·3 \times \sqrt{1-(0·461)^2}} = 173·36\,\Omega$

From short test, (referred to H.V side)

$V_{SC} = 22V \quad I_{SC} = 30A \quad W_{SC} = 200W$

$Z_{02} = \frac{V_{SC}}{I_{SC}} = \frac{22}{30} = 0·733\,\Omega$

$R_{02} = \frac{W_{SC}}{I_{SC}^2} = \frac{200}{30^2} = 0·22\,\Omega$

$X_{02} = \sqrt{Z_{02}^2 - R_{02}^2} = \sqrt{0·733^2 - 0·22^2} = 0·699\,\Omega$

Equivalent resistance and reactance (R_{02} and X_{02}) referred to L.V side,

$R_{01} = \frac{R_{02}}{K^2} = \frac{0·22}{2^2} = 0·055\,\Omega$

$X_{01} = \frac{X_{02}}{K^2} = \frac{0·699}{2^2} = 0·174\,\Omega$

The equivalent circuit diagram referred to LV side is,

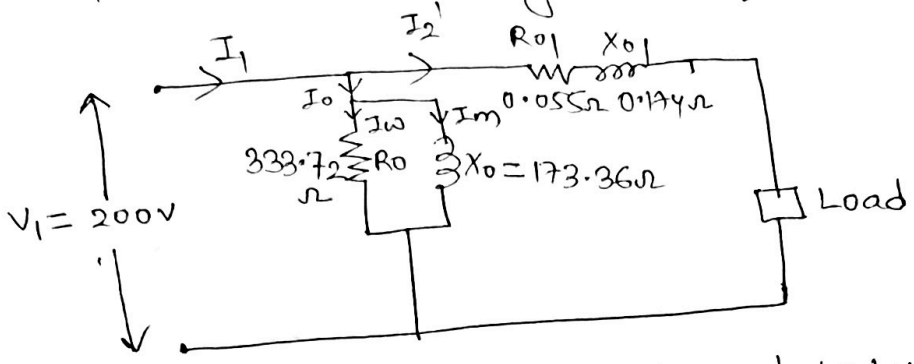


Fig. eq. ckt diagram referred to LV side

Q.2) The following test results were obtained on a 20KVA, 2200/220V, 50Hz single phase transformer:

open ckt test (LV side): 220V 1.1A 125 W

short ckt test (HV side): 52.7V 8.4A 287 W

Calculate the equivalent ckt referred to LV side and draw the equivalent ckt.

⇒ Soln -

We have given,

$S = 20KVA$

$V_1 = 2200V \qquad V_2 = 220V$

From open ckt test, (referred to LV side)

$V_2 = 220V \quad I_0' = 1.1A \quad W_0' = 125\,W$

$$W_0' = V_2 I_0' \cos\phi_0$$

$$\cos\phi_0 = \frac{125}{220 \times 1.1} = 0.516$$

$$R_0' = \frac{V_2}{I_0' \cos\phi_0} = \frac{220}{1.1 \times 0.516} = 387.59\,\Omega$$

$$X_0' = \frac{V_2}{I_0' \sin\phi_0} = \frac{220}{1.1 \times \sqrt{1 - 0.516^2}} = 233.48\,\Omega$$

From Short ckt test, (referred to H.V side)

$V_{SC} = 52.7V \quad I_{SC} = 8.4A \quad W_{SC} = 287W$

$$R_{01} = \frac{W_{SC}}{I_{SC}^2} = \frac{287}{8.4^2} = 4.067$$

$$Z_{01} = \frac{V_{SC}}{I_{SC}} = \frac{52.7}{8.4} = 6.27\ \Omega$$

$$X_{01} = \sqrt{Z_{01}^2 - R_{01}^2} = \sqrt{6.27^2 - 4.067^2} = 4.77\ \Omega$$

Equivalent series resistance and reactance (R_{01} and X_{01}) referred to L.V side (Secondary side)

$$R_{02} = K^2 R_{01} = \left(\frac{220}{2200}\right)^2 \times 4.067 = 0.04067\ \Omega$$

$$X_{02} = K^2 X_{01} = (0.1)^2 \times 4.77 = 0.0477\ \Omega$$

The equivalent ckt diagram referred to L.V side,

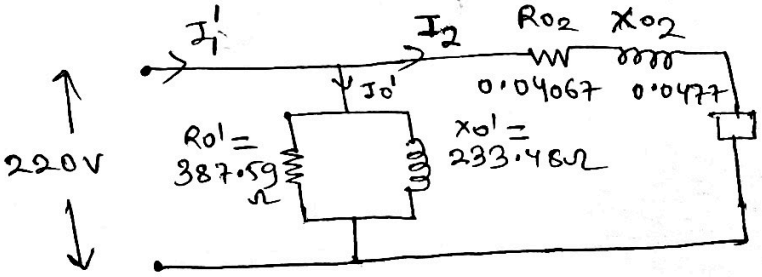
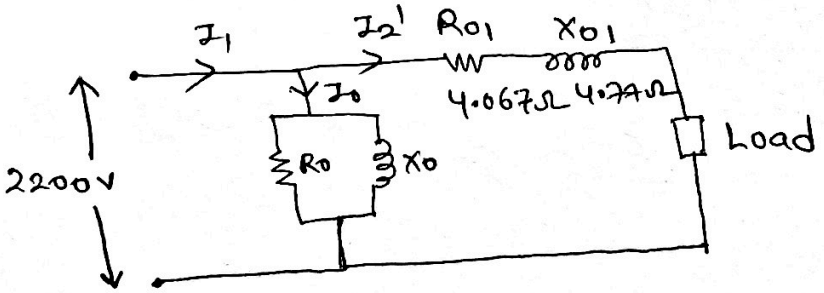


Fig Equivalent ckt diagram referred to L.V side



Equivalent ckt diagram referred to H.V side

$$R_o = \frac{R_o'}{K^2} = \frac{387.59}{(0.1)^2}$$

$$X_o = \frac{X_o'}{K^2} = \frac{233.48}{(0.1)^2}$$