TESTS ON SINGLEPHASEINDUCTIONMOTOR

Similar to a three phase induction motor, the various tests can be performed on single phase induction motor. The results of these tests can be used to obtain the equivalent circuit parameters of a single phase induction motor. The tests usually conducted are :

1. No load test or open circuit test
2. Blocked rotor test or short circuit test

No load test

The test is conducted by rotating the motor without load. The input current, voltage and power are measured by connecting the ammeter, voltmeter and wattmeter in the circuit. These readings are denoted as V_o , I_o and W_o .

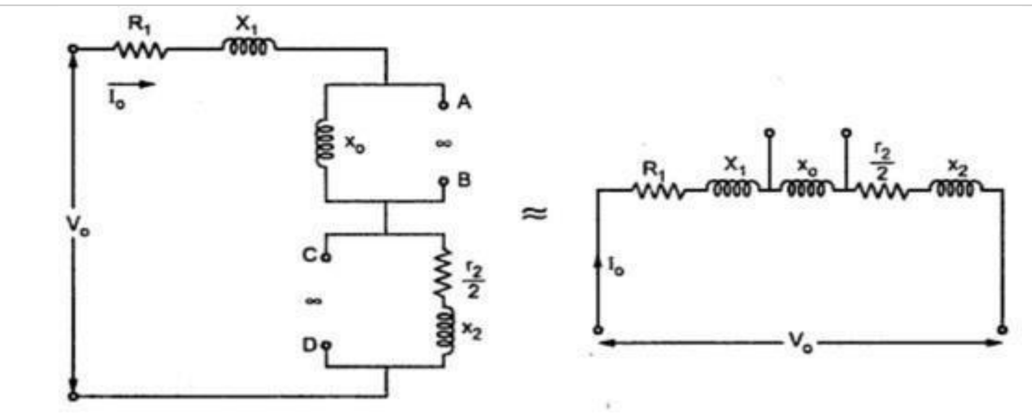
Now $W_o = V_o I_o \cos\Phi$

$$\therefore \quad \boxed{\cos\phi_0 = \frac{W_o}{V_o I_o} = \text{no load power factor}}$$

The motor speed on no load is almost equal to its synchronous speed hence for practical purposes, the slip can be assumed zero. Hence r_2/s becomes ∞ and acts as open circuit in the equivalent circuit. Hence for forward rotor circuit, the branch $r_2/s + j\,x_2$ gets eliminated.

While for a backward rotor circuit, the term $r_2/(2 - s)$ tends to $r_2/2$. Thus x_o is much higher then the impedance $r_2/2 + j\,x_2$. Hence it can be assumed that no current can flow through and that branch can be eliminated.

So circuit reduces to as shown in the Fig.1.



Now the voltage across x_o is V_{AB}

$$\therefore \qquad \bar{V}_{AB} = \bar{V}_o - \bar{I}_o \times \left[\left(R_1 + \frac{r_2}{2}\right) + j(x_1 + x_2)\right]$$

But $\qquad V_{AB} = I_o\, x_o$

$\therefore \qquad x_o = V_{AB} / I_o$

But $\qquad x_o = X_o / 2$

$$\therefore \qquad \boxed{X_o = 2x_o = \frac{2\,V_{AB}}{I_o}}$$

Thus magnetising reactance X_o can be determined.

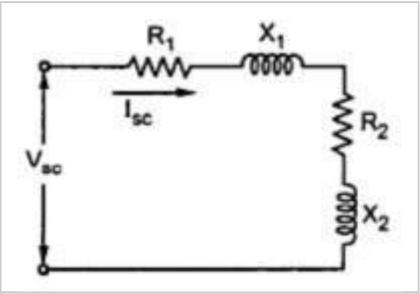
The no load power W_o is nothing but the rotational losses.

Blocked Rotor Test

In balanced rotor test, the rotor is held fixed so that it will not rotate. A reduced voltage is applied to limit the short circuit current. This voltage is adjusted with the help of autotransformer so that the rated current flows through

main winding. The input voltage, current and power are measured by connecting voltmeter, ammeter and wattmeter respectively. These readings are denoted as V_{sc} , $I_{sc}$and W_{sc}.

Now as rotor is blocked, the slip s = 1 hence the magnetising reactance x_o is much higher than the rotor impedance and hence it can be neglected as connected in parallel with the rotor. Thus the equivalent circuit for blocked rotor test is as shown in the Fig.2.



$$W_{sc} = V_{sc}\, I_{sc} \cos \Phi sc$$

$$\cos \Phi sc = W_{sc} / V_{sc}\, I_{sc} = \text{blocked rotor power factor}$$

Now $Z_{eq} = V_{sc}/ Isc$

$R_{eq} = W_{sc} /(Isc)^2$

But $R_{eq} = R_1 + R_2$

$\therefore$ $R_2 = R_{eq} - R_1$

= rotor resistance referred to stator $X_{eq} = \sqrt{(Z_{eq}^2 - R_{eq}^2)}$

$X_1 = X_2$ we get,

$$X_2 = \frac{X_{eq}}{2} = \text{rotor reactance referred to stator}$$

The stator resistance is measured by voltmeter-ammeter method, by disconnecting the auxiliary winding and capacitors present if any. Due to skin effect, the a.c. resistance is 1.2 to 1.5 times more than the d.c. resistance.