Heaven's light is our guide

Rajshahi University of Engineering & Technology

(RUET), Rajshahi

Department

Of

Electrical and Computer Engineering

LAB REPORT-5

Course No: ECE-2208

Course Title: Electrical Machines – I Sessional

Date of Experiment: 6/12/2023

Date of Experiment: 20/12/2023

Submitted To:

Md. Omaer Faruq Goni

Lecturer

Department of Electrical & Computer Engineering

Rajshahi University of Engineering & Technology,

(RUET)

Submitted By:

Mohammad Mahin Ahsan

Roll: 2010003

Semester: 2nd Year Even

5.1. Name of the Experiment:

Determination of circuit parameters of 3-phase induction motor from no load test and blocked rotor test.

5.2. Objectives:

- To know about the equivalent circuit of induction motor.
- To know about all the parameters of equivalent circuit of induction motor.

5.3. Theory:

5.3.1. Blocked Rotor Test:

This is also known as locked rotor or short circuit test. This test is used to find

- Short-circuit current with normal voltage applied to stator
- Power factor on short-circuit
- Total leakage reactance X_1, of the motor as referred to primary *(i.e.,* stator)
- Total resistance of the motor R_1 as referred to primary.

In this test, the rotor is locked (or allowed very slow rotation) and the rotor windings are short-circuited at slip-rings, if the motor has a wound rotor. Just as in the case of a short-circuit test on a transformer, a reduced voltage (up to 15 or 20 per cent of normal value) is applied to the stator terminals and is so adjusted that full-load current flows in the stator. As in this case s=1, the equivalent circuit of the motor is actually like a transformer, having a short-circuited secondary. The values of current, voltage and power input on short circuit are measured by the ammeter, voltmeter and wattmeter connected in the circuits.

W = total power input on short circuit
V_S = line voltage on short circuit
I_S = line current on short circuit

Now, the motor input on short-circuit consists of mainly stator and rotor Cu losses. Core-loss, which is small due to the fact that applied voltage is only a small percentage of the normal voltage. [1]

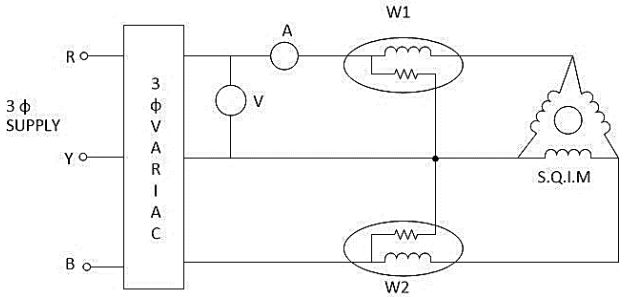

Fig 5.1: Blocked Rotor Test and No-load Test of a Three-φ Induction Motor

5.3.2. No-Load Test:

No Load Test is an indirect method used for determining the efficiency and also to determine the circuit parameters of the equivalent circuit of the three-phase induction motors. The open-circuit test is performed on the transformer. The no-load test is the same as the open-circuit test performed on the transformer.

In this method, the motor is uncoupled from its load and the rated voltage at the rated frequency is applied to the stator to run the motor without the load. With the help of the two watt-meter, the input power of the motor is measured.

An ammeter measures the no-load current, and a voltmeter gives the normal rated supply voltage. The I^2R losses on the primary side are neglected as they vary with the square of the current, as we know that the no-load current is **20-30%** of the full load current,

As the motor is running at no load, the total input power is equal to the constant iron loss, friction, and windage losses of the motor.

$$P_{constant} = P_i = P_1 + P_2 = \text{Sum of the two wattmeter readings}$$

Since the power factor of the induction motor under no-load condition is generally less than 0.5, thus the Wattmeter reading of one of the Wattmeter will show a negative reading. Therefore, it is necessary to reverse the direction of the current coil terminals to take the readings. [2]

5.4. Required Apparatus:

- Three- φ AC supply (220V)
- Variac (1 piece, 0-250V)
- Three- φ induction motor
- Voltmeter (1 piece, 0-450V)
- Ammeter (0-5A)
- Wattmeter (2.5A-150V)

5.5. Circuit Diagram:

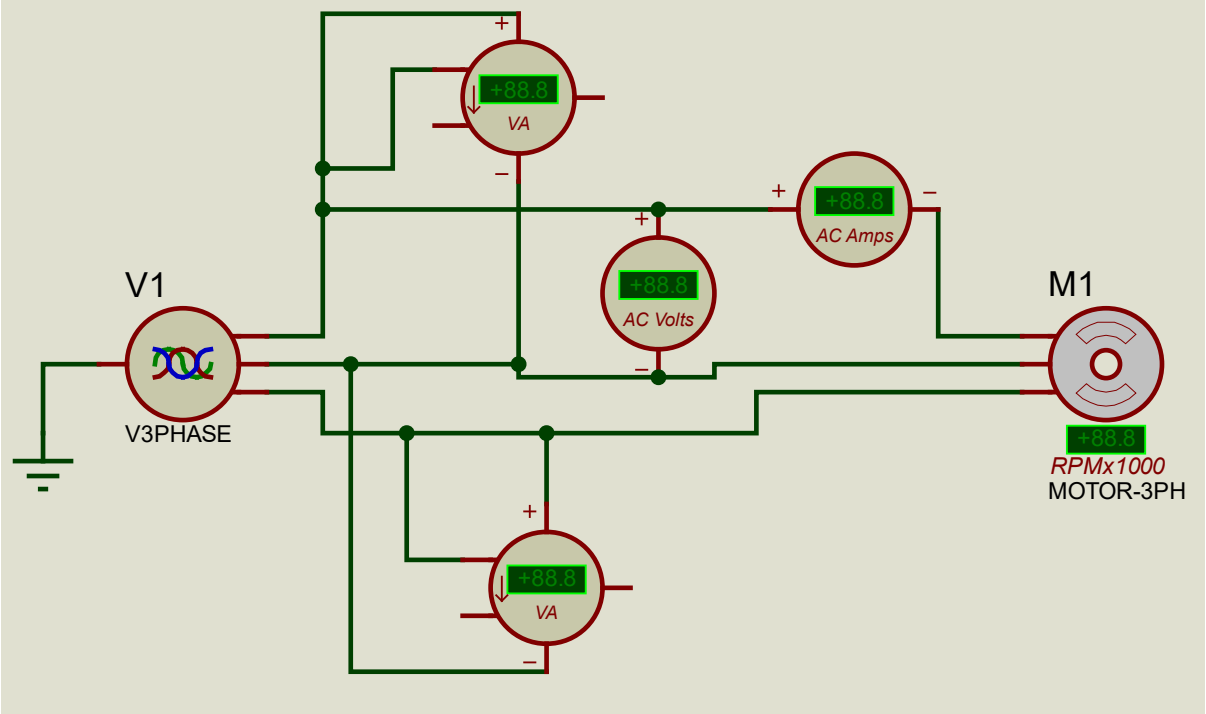

Fig 5.2: Blocked Rotor Test and No-load Test of a Three-φ Induction Motor

5.6. Procedure:

1. Ammeter, voltmeter and two wattmeters were connected as per circuit diagram.
2. Three phase AC supply was given to the through variac.
3. The input was set at 110V using variac.
4. Then the line current, phase voltage and the powers were measured in no-load state and noted down.
5. Then the blocked rotor test was conducted by manually holding the rotor to create the block rotor condition and the same readings were taken.

5.7. Data Table:

5.7.1. Blocked Rotor Test:

V_s	I_s	W_1	W_2	W_T
105	2.28	500	260	760

5.7.2. No-Load Test:

V_0	I_0	W_1	W_2	W_T
438	2.4	860	140	720

5.7. Calculation:

5.7.1. Blocked Rotor Test:

$$R_{01} = \frac{V_s^2}{W_T} = \frac{105^2}{760} = 14.5$$

$$Z_{01} = \frac{V_0}{\sqrt{3} I_s} = \frac{105}{\sqrt{3} \times 2.28} = 26.58$$

$$X_{01} = \sqrt{Z_{01}^2 - R_{01}^2} = \sqrt{26.58^2 - 14.5^2} = 22.27$$

5.7.2. No-load Test:

$$R_0 = \frac{W_T}{I_0^2} = \frac{720}{2.4^2} = 125$$

$$Z_{01} = \frac{V_0}{I_0} = \frac{438}{2.4} = 182.5$$

$$X_0 = \sqrt{Z_0^2 - R_0^2} = \sqrt{182.5^2 - 125^2} = 132.97$$

5.9. Discussion:

The efficiency of small motors can be determined by directly loading them and by measuring the input and output powers. But in case of large motors, it is difficult to arrange that much load for them. The power loss will be large if we directly test the load. That is why, the no load test and blocked rotor test is used to determine the efficiency of 3-phase induction motor. Some problem arose during the experiment as the wattmeter caught fire due to some fault in the connections.

5.10. Conclusion:

The experiment was done with top most precautions as work was done with high voltage. Though an accident occurred, no one was harmed. All connections were given carefully and all the values were taken and calculated carefully.

5.11. References:

[1] "NIT Kurukshetra," [Online]. Available: http://nitkkr.ac.in. [Accessed 8 December 2023].

[2] "Circuit Globe," [Online]. Available: https://circuitglobe.com/no-load-test-of-an-induction-motor.html. [Accessed 8 December 2023].