

Determination of efficiency, plotting of torque slip characteristics of three phase induction motor by brake test

Title: Determination of Efficiency and Plotting of Torque Slip Characteristics of Three-Phase Induction Motor by Brake Test

Introduction: The three-phase induction motor is one of the most widely used electric motors in various industrial applications. It is essential to determine the efficiency and understand the torque-slip characteristics of an induction motor to assess its performance accurately. The brake test is a commonly used method to evaluate these parameters. In this report, we will discuss the procedure for conducting a brake test, calculating the efficiency, and plotting the torque-slip characteristics of a three-phase induction motor.

Procedure:

1. Setting up the Test Rig:
 - Mount the induction motor on a sturdy platform or bench.
 - Connect the motor to a three-phase power supply.
 - Ensure proper grounding and electrical safety measures.
 - Connect a brake mechanism to the motor shaft.
2. Brake Test Setup:
 - Apply the brake to the motor shaft, gradually increasing the load.
 - Measure the weight applied to the brake mechanism.
 - Record the corresponding speed of the motor shaft using a tachometer.
 - Repeat the measurements for different load values.
3. Calculating Input Power:
 - Measure the input voltage and current to the motor using suitable instruments.
 - Calculate the total input power using the formula: $P_{in} = \sqrt{3} * V * I * \cos(\theta)$, where V is the line voltage, I is the line current, and θ is the power factor angle.

4. Calculating Output Power:

- Determine the mechanical power output by multiplying the weight applied to the brake by the distance from the center of the motor shaft to the point of application.
- Calculate the output power using the formula: $P_{out} = 2\pi * N * T / 60$, where N is the motor speed in RPM and T is the torque developed.

5. Determining Efficiency:

- Calculate the electrical input power by subtracting the losses (core losses and friction losses) from the total input power.
- Efficiency (η) is given by the formula: $\eta = P_{out} / P_{in} * 100\%$.

6. Plotting Torque-Slip Characteristics:

- Determine the slip (S) using the formula: $S = (N_{sync} - N) / N_{sync} * 100\%$, where N_{sync} is the synchronous speed of the motor.
- Calculate the torque (T) using the formula: $T = (2\pi * P_{out}) / (N * 60)$.
- Plot the torque-slip characteristics on a graph, with slip on the x-axis and torque on the y-axis.

Results and Discussion:

- Tabulate the measured data, including input power, output power, torque, slip, and efficiency values for each load.
- Calculate the average efficiency and torque at different slip points.
- Plot the torque-slip characteristics graph using the obtained data points.
- Analyze the graph to understand the motor's performance at various operating conditions.
- Discuss the efficiency variations and torque characteristics observed.

Conclusion: The brake test provides valuable insights into the performance of a three-phase induction motor. By conducting this test, we determined the efficiency and plotted the torque-slip characteristics. The efficiency values helped evaluate the motor's energy conversion efficiency, while the torque-slip characteristics graph provided information on its operating characteristics. Understanding these parameters is crucial for motor

selection and optimization in industrial applications. Further research and analysis can be conducted to explore the impact of different load conditions on the motor's performance and efficiency.