STUDY ON THE USE OF STARTER FOR SQUIRRREL CAGE INDUCTION MOTOR

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" I hereby declare that this report is a result of my own work except for the excerpts that have been cited clearly in the references."

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Date : 5 NOV 2008

"I hereby declare that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Industrial Power)"

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Untuk ayah dan ibu tersayang

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ABSTRACT

This project is a study on the use of starter for single-phase squirrel-cage induction motor. This project will discuss about the different between motor that used starter and motor that does not used it. The objective of this project is to study and analyze the characteristic of the motor, to compare between motor that use starter with those that do not use it and also to learn about the functions of the squirrel-cage motor starter circuit (concept).

ABSTRAK

Tujuan projek ini dilaksanakan adalah untuk mengkaji kegunaan pemula bagi motor induksi sefasa sangkar tupai. Dalam projek ini, kami akan mebincangkan mengenai perberzaan diantara motor yang mengguan pemula dan juga motor yang tidak menggunakan pemula. Objektif projek ini adala untuk mempelajari dan juga menganalisa sifat-sifat motor tersebut, membandingkan diantara motor yang menggunakan pemula dan juga yang tidak menggunakannya disamping mempelajri dan memahami fungsi litar motor induksi sefasa sangkar tupai (konsepnya).

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LIST OF ABBREVIATION

AC	-	Alternating current
emf	-	Electromotive force
PSM	-	Projek Sarjana Muda
PSC	-	Permanent Split Capacitor
uF	-	micro Farad
Vac	-	Voltage alternating current
Nm	-	Newton meter
RPM	-	Reverence per minute
V	-	Volt
A	-	Ampere
Hz	-	Heinz
HP	-	Horse Power
W	-	Watts
LED	-	Light Emitting Diode

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CHAPTER 1

INTRODUCTION

1.1 Overview

An electric motor converts electrical energy into mechanical energy. The reverse process that is converting mechanical energy into electrical energy is accomplished by a generator or dynamo. Electric motors are found in household appliances such as fans, refrigerators, washing machines, pool pumps and fan-forced ovens.

Most electric motors work by electromagnetism. The fundamental principle upon which electromagnetic motors are based is that there is a mechanical force on any current-carrying wire contained within a magnetic field. Most magnetic motors are rotary, but linear motors also exist. In a rotary motor, the rotating part (usually on the inside) is called the rotor, and the stationary part is called the stator. The rotor rotates because the wires and magnetic field are arranged so that a torque is developed about the rotor's axis. The motor contains electromagnets that are wound on a frame. This frame is known as armature. The armature is a part of the motor across which the input voltage is supplied. Depending upon the design of the machine, either the rotor or the stator can serve as the armature. But to make a motor start rotating, there must be at least 2 phase winding placed in quadrature and excited by two-phase source. The motor cannot rotate if there just only one phase so a starter is use to develop another phase in so that it can move the rotor. There are several types of motor and there are:

- AC induction motor also known as squirrel-cage motor
- AC Synchronous Motor
- DC motor

1.2 Project Importance

There are two type of motor which is self-starting and which is cannot self-start. Self-starting motor is the type of motor that start rotating by itself after power is supply to it. In order to make a motor to self-starting, it must be at least two windings placed in space quadrature and excited by a two phase source. But, the single-phase squirrel cage induction motor only have a single-phase winding to keep the motor running but the motor cannot self-starting. So, how to make a single-phase motor self start?

1.3 Project Objective

Before conducting or doing the project, the objectives of the project are the main focus in this project. At the last of this report from the conclusion the objective are stated where it succeed or not. Below are the objectives of this project.

- To study the methods used in starting the motor.
- To compare the starting current and torque-speed characteristic between:
    1. Single-phase and 3-phase squirrel-cage induction motor.
    2. Single-phase capacitor-start squirrel-cage induction motor and single-phase capacitor-run squirrel-cage induction motor
- To study the relationship between the number of pole and the speed of squirrel-cage induction motor.

1.4 Scope

The project background is to start a single-phase squirrel cage induction motor, there must be providing by some external means. In order to do so there are some method recommended that are use to start a motor and those type of method that going to be study are single-phase capacitor-start squirrel-cage induction motor and single-phase capacitor-run squirrel-cage induction motor. There also going to be comparison between 2-pole motor and 4-pole motor, torque speed characteristic and also starting current characteristic.

CHAPTER 2

LITERATURE REVIEW

2.1 Squirrel-Cage Induction Motor

The reason the motor is call squirrel-cage induction motor is because it has a rotor that have a similarity between this rings-and-bars winding and a hamster wheel (presumably similar wheels exist for pet squirrels) shown in Figure 2.1. Induction machines with squirrel-cage rotors are most utilized type of electrical machine. Its special design is simpler, more robust and apart from that also cheaper than slip-ring rotors. A squirrel cage rotor is the rotating part commonly used in an AC induction motor. Internally it contains longitudinal conductive bars of aluminums or copper set into grooves and connected together at both ends by shorting rings forming a cage-like shape. The core of the rotor is built of a stack of iron laminations.

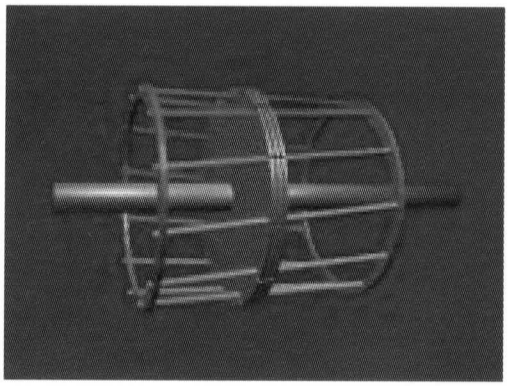

Figure 2.1: Squirrel-cage rotor

The same basic design is used for both single-phase and three-phase motors over a wide range of sizes. Rotors for three-phase will have variations in the depth and shape of bars to suit the design classification.

For a three-phase induction motor employs an ingenious scheme of placing three identical phase windings 120 degrees electrical in space with respect to each other. When these windings are excited by a balanced three-phase power source, they create a uniform magnetic field around the rotor boundary at synchronous speed shown in Figure 2.2. The rotor will cut the flux and induces an electromotive force (emf) and thereby a current in the rotor conductors. The interaction between the rotor current and the revolving magnetic field cause the rotor to rotate. The rotor rotates at a speed that lowers than the synchronous speed of the motor shown in Figure 2.3.

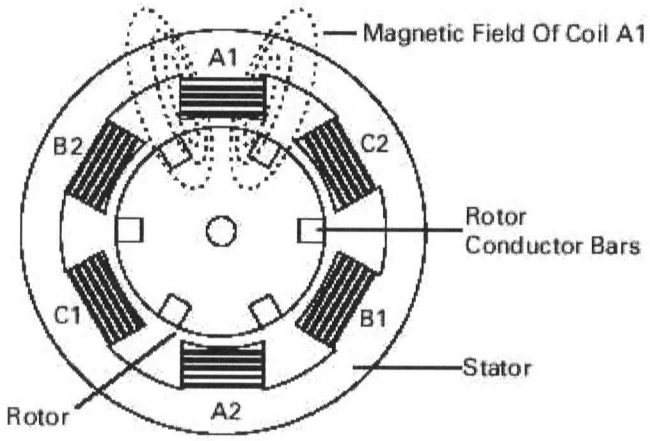

Figure 2.2: Rotor cut the flux