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Fault Detection and Protection of Induction Motor

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ABSTRACT

The main object of this panel to provide protection to the 3-Phase Induction Motor against single phasing and overload condition. One of the most common electrical motors used in most applications which is known as induction motor. There are basically two types of induction motor that depend upon the input supply - single phase induction motor and three phase induction motors. Single phase induction motor is not a self starting motor and three phase induction motors is a self-starting motor.

Keywords: Thermister, Relay Driver, Motor Gard Relay, Negative Temperature Coefficient, Positive Temperature Coefficient

I. INTRODUCTION

We think that design is something which help us to overcome our difficulties and makes work more easy and better way with creativity. Design engineering can enable us to think of the problems to perform any task and also enables us to see for alternative solutions for those problems. This will increase the creativity. We analyzed some sectors of work before we started.
So, for proper operation of these motors we required to give protection to the motor during the different types of faults occurs. Based on these conditions we make project on 3-Phase Induction Motor Protection. In this project we provide protection to 3-phase induction motor in different types of fault. The Imposed external condition includes unbalanced supply voltages, Under Voltage, over voltage, under frequency, over frequency, single phasing and reverse phase conditions. The Internal fault includes the bearing failures, Internal Shunt faults, which are commonly earth faults and Over loads. In this project Direct on Line starter is used to reduce the effect of these high starting currents on the electrical distribution network. Motor Guard Relay is used to provide all type of protection to the 3-phase inductionmotor.

II. SYSTEM TOPOLOGY

1.Block diagram

In the figure, system block diagram is given.by studying the system practically it is divided into parts.

1) Transformer
2) Thermistor
3) Relay Driver

Overload Protection: In over load condition we give the mechanical load to motor when it is operated/running by wheel pulley type load arrangements. The effect of an overload is an excessive rise in temperature in the motor windings due to current higher than full load current. Properly sized overload protection disconnects the motor from the power supply when the heat generated in the motor circuit or windings approaches a damaging level for any reason. Overload protection trips when an overload exists for more than a short time. The time it takes for an overload to trip depends on the type of

overload device, length of time the overload exists, and the ambient temperature in which the overloads are located.

Under-voltage protection: Under-voltage protection can be provided by either a no-volt coil or by a control circuit that holds the contactors in for small dips in the voltage but disconnects the motor if the under voltage persists. If the voltage across the no-volt coil drops, the no-volt coil disconnects the supply and operator action is required to restart the motor. If an automatic restart will put the operator in danger, the control circuit that maintains supply for small dips in the supply voltage can be used.

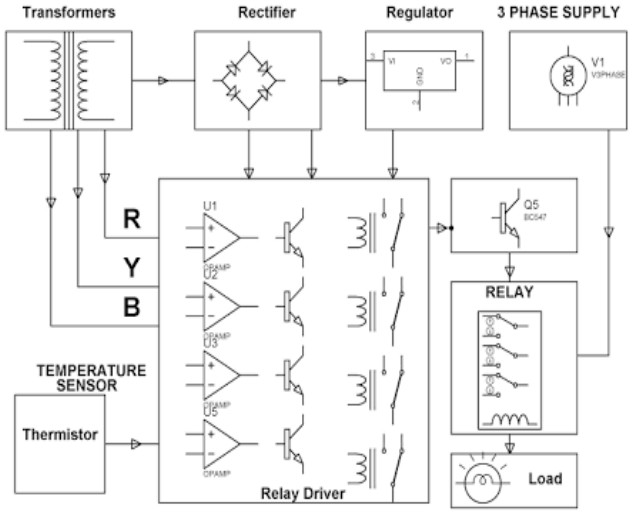

Figure 1: System Block Diagram

2. Material

A. Relay Driver

A relay is an electro-magnetic switch which is useful if you want to use a low voltage circuit to switch on and off a light bulb (or anything else) connected to the 220v mains supply. The diagram below shows a typical relay (with "normally-open" contacts).

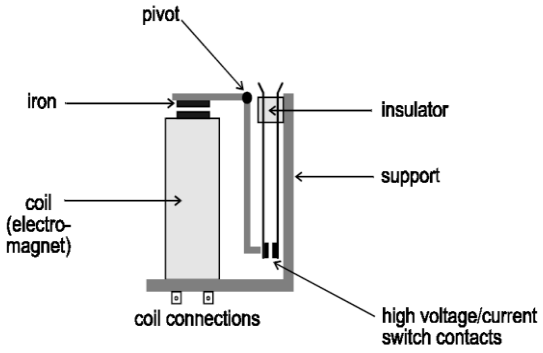

Figure 2: Relay Driver

The current needed to operate the relay coil is more than can be supplied by most chips (op. amps etc), so a transistor is usually needed, as shown in the diagram below.

B. Thermister

Thermistor thermally sensitive resistors whose prime function is to exhibit a large, predictable and precise change in electrical resistance when subjected to a corresponding change in body temperature.

Figure 3: Thermister

Negative Temperature Coefficient (NTC) thermistors exhibit a decrease in electrical resistance when subjected to an increase in body temperature and Positive Temperature Coefficient (PTC) thermistors exhibit an increase in electrical resistance when subjected to an increase in body temperature.

C. Voltage Regulator

A regulator is a device which has the function of maintaining a designated characteristic. It performs the activity of managing or maintaining a range of values in a machine. The measurable property of a device is managed closely by specified conditions or an advance set value; or it can be a variable according to a predetermined arrangement scheme.

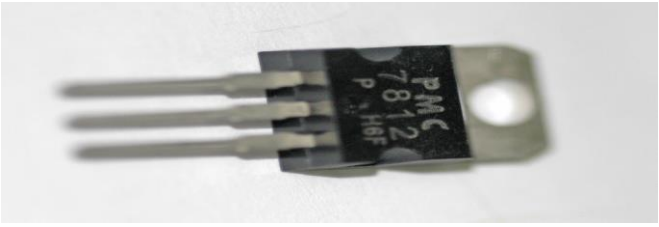

Figure 4: Voltage Regulator

III. RESULT ANALYSIS

Hardware Implementation:

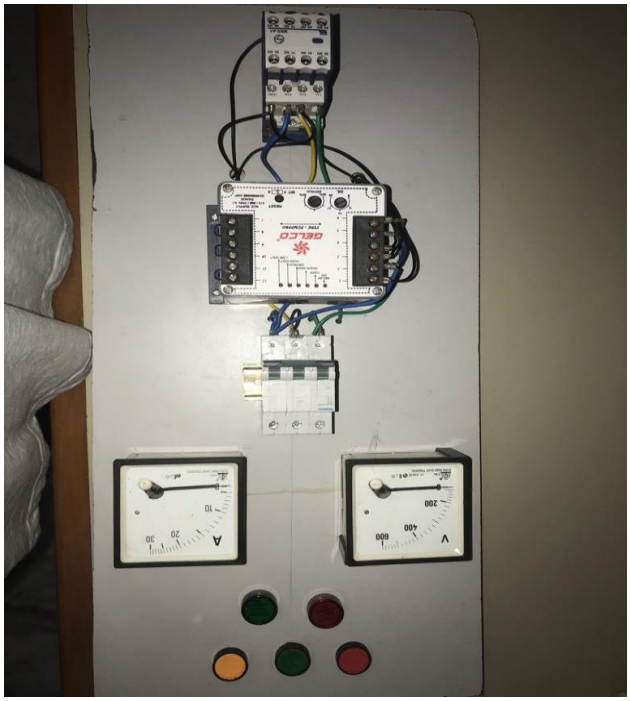

Figure 5. System Model

In this panel we used the following equipments: 1. Voltmeter and Ammeter 2. Contactor (MNX-12) 3. MGR (Motor Guard Relay) 4. MCB and Fuse 5. Push Button and Light Indication 1. Voltmeter and Ammeter: Voltmeter show the 415 V which is given to the relay's auxiliary contacts no. 5 and 6. Ammeter show the current at the time of overload and over current fault occurred in the motor.

Contactor (MNX-12): This device works as a line circuit breaker it receives trip command from relay and trip on the fault condition.

MGR (Motor Guard Relay): It is basically current sensing single phasing preventer which gives total protection to three phase ac electric motor. The basic principle of operation is o sensing negative sequence current components and it trips electric motor starter as soon as it exceeds the dangerous level. This model offers protections up to motor terminals & is un defective to the motor back e.m.f. it is available in two models namely mgr & mgr-c. Both models are basically same with slight difference in features like under/over voltage protection and inverse time current characteristic setting. These models offer total protection against single phasing on supply side as w ell as motor side. Overloading (inversely time current characteristics) reverse supply, current unbalance & low / high voltage, /manual reset provision etc is provided. The enclosure is made from high impact polystyrene molded with nylon mounded connection strip. It is available up to 200 amps. Green led indicates SPP healthy condition and red led indicates overloading condition. Both models offer single phasing protection even if motor is on no load.

IV. CONCLUSION

Protection of three phase induction motor from under voltage, single phasing, over current and over voltage provide the smooth running of motor improves its lifetime and efficiency. Generally these faults generated when supply system is violating its rating. In three phase induction motor when running at rated voltage, current and load these faults are not generated. For smooth running of motor generally concentration on supply voltage under the prescribe

limit and load which is driven by the motor should also be under the specified limit.

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