FAULT ANALYSIS AND PROTECTION SYSTEM USNIG SENSORS

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Abstract*—The aim of the project is to analyse the fault from under-voltage/over-voltage and overheating conditions. The main types of external faults experienced by these motors are over loading, single phasing, unbalanced supply voltage, phase reversal and ground faults. The machine should be shut down immediately when a fault is experienced so as to avoid damage of the system

Keywords—IM, under voltage, Single Phasing, Over Current, Phase Reversal

1. INTRODUCTION

Induction Motors are generally utilized as a part of industry due to their rigidity and speed control flexibility. In this manner, the issue of induction motor protection attracted many researchers. This Project aim is the protection of Motor. There are different techniques for fault identification and protection of motor. Some of fault detection using Artificial Neutral Network, Stator fault checking strategies, Microcontrollers based protection system and Programmable Logic Controller (PLC) based protection system. In this task, the technique utilized is Microcontroller based protection system. The circuit will take the full control of the motor and it will protect the motor from several faults, for example, over voltage and under voltage and the circuit will switch on the motor under safety conditions. The circuit is completely controlled by the microcontroller and the microcontroller will consistently monitors the voltages of the three phases and if the voltage goes abnormal then it will switch off the motor until they are typical. With the help of current transformer which senses the current and if it exceeds some particular level then comparator sends this signal to microcontroller to stop the motor. All the conditions are shown by it over the LCD display. In this paper we are utilizing the 8 bit microcontroller PIC 16F877A It is a 40 pin microcontroller. The protection of induction motor with microcontroller has adaptability to switch off at required time, monitors phase of motor at each time furthermore every motoring activity is known through LCD display. It also protects the motor from single phasing as its maintenance cost is low. Likewise the learning about fault mode behavior of an induction motor drive system is critical from the angle of improved system protection & control.

2. LITERATURE REVIEW

•Fault Detection and Protection of three phase Induction Motors Using Sensors

- Ganapathy Subramanian ,Asst.Prof. Department of EEE, IFET College of Engineering, Villupuram .-2007

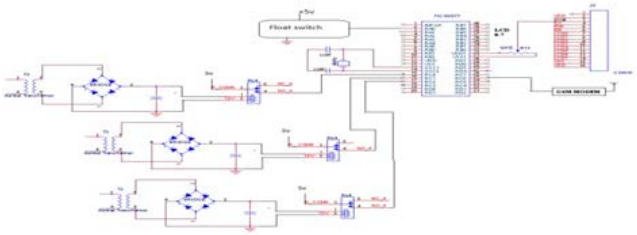
-IM can be protect using some component such as timer, contactors ,voltage and current relay. This method is known as classical method. that is very basic and mechanical dynamic parts. Protection of an induction motor (IM) against possible problems, such as overvoltage, overcurrent, overload, overtemperature, and undervoltage, occurring in the course of its opera- tion is very important, because it is used intensively in industry as an actuator. IMs can be protected using some components, such as timers, contactors, voltage, and current relays.

•Microcontroller based protection and control of low voltage motors by using zigbee Technology.-2011

-Rajasekar thota (m.tech)Quba engineering and technology ,Nellore.
-This project microcontroller based protection and control of low voltage motors less than 600v

-It will review the princple of low voltage protection (thermal over load,ground fault and unbalance)
•Faults Identification in Three-Phase Induction Motors Using Support Vector Machines
•Rahul Khopkar ,Department of Electrical Engineering . -2014
The machine should be shut down when a fault is experienced to avoid damage and for the safety of the workers. Computer based relays monitor the machine and disconnect it during the faults. Induction motor is one of the most important motors used in industrial applications. The operating condition may sometime lead the machine into different fault situations. The main types of external faults experienced by these motors are over loading, single phasing, unbalanced supply voltage, locked rotor, phase reversal, ground fault, under voltage and over voltage.

3. FAULT MONITORING METHOD



Various types of AC Induction motors are accessible in the market. Different motors are suitable for different applications. In spite of the fact that AC induction motors are simpler to design than DC motors, the speed and the torque control in different types of AC induction motors require a greater understanding of the configuration and the characteristics of these motor. Despite the fact that IMs are solid, they are subjected to some undesirable burdens , causing faults resulting in failure. The electrically related faults, for example, over- voltage, over-current, under-voltage, under- current, over-loaded over- temperature. The over-voltage and over-current can be manmade or natural. Possible causes for over-currentincorporate short circuits, excessive loads, and inaccurate configuration. Monitor of an IM is a quick developing innovation for the detection of initial faults. It avoids unexpected failure of an industrial process. In spite of their robustness they do occasionally fail and their resulting unplanned downtime can prove very costly. Therefore, condition monitoring of electrical machines has received considerable attention in recent years. The control of the parameters such as voltage, current, speed, load and temperature is also become very important for the health of the induction motor. Due to the faults in such parameters there can be damage to the motor.

Classical monitoring techniques for three-phase Induction motors are generally provided by some combination of mechanical and electrical devices such as timers, contactors, voltage relays, current relays and earth fault relay etc. these techniques are very basic and involve some mechanical dynamic parts of the equipment can cause problem in the course of operation and can reduce the life and efficiency of system. A computer based protection system also has been introduced, measurements of the various faults of phase voltages, phase current, temperature and speed were achieved and transferred to computer for final protection decision but this system requires separate analogue to digital conversion cards which increases cost and size of the system. A PLC based system which deals with monitoring control system of Induction motor is introduced, in these systems the parameters are sensed with the help of analog modules, processed and displayed on PC. The ladder programming and SCADA software is used to monitor the parameters on the PC, In case faults are detected the alarms are blown and the motor is stopped. But it requires separate PLC module, analog modules and software which are costly. And these systems do not find the tolerable limit values of motor parameters. Microprocessor based protection systems are developed but they do not provide control action, they only display information on screen and blow alarm.

As stated above, each fault affects severely on induction motor. Due to Under-voltage motor is not able to run at its full speed and single phasing also causes the problem of under-voltage. The under voltage occurs when a reduced supply voltage with a rated mechanical load on the motor. Open winding in motor, any open in any phase anywhere between the secondary of the transformer and the motor primary phase open. The effect of single phasing on three phase IM vary with service condition and motor thermal capacities. Large amount of heat will generates due to extra current flowing through winding therefore over-current fault is also dangerous for induction motor. Due to load in excess of safety rating of motor will cause the over current fault. Therefore large amount of heat generated in the motor which cause the winding failure. The phase reversal occurs when two of the three phases(R Y B)of line reverses .Most of the motors will react very badly to such a situation motor could suddenly begin to turn in the wrong direction, causing major collateral damage.

Types of Motor Failure and Protective Features:-

There are various components which cause engine disappointment. The most well-known are:

•Overload
• Single staging
• Voltage unbalance
• Voltage too high/low
• Bearing disappointment
• Rapid obligation cycle
• Restricted ventilation
• Moisture and vibration

On the off chance that mechanical disappointments are wiped out, shielding the engine windings from over temperature is the prime function of motor protection. But even bearing failures can result in motor winding failure if not detected in time. There are a number of ways that motors can be protected with respect to the needs of plant management. Table 1 below classifies these functions. There is no substitute for the proper application of motors or proper maintenance. However, protective devices can help you to use the motor to its optimum limits.

Necessity for motor protection:

It could be accepted that legitimately arranged, dimensioned, introduced, worked and kept up drives ought not to separate. In actuality, be that as it may, these conditions are barely ever perfect. The recurrence of diverseengine harm varies since it relies on upon distinctive

Particular working conditions. Measurements demonstratethat yearly down times of 0.5...4% must be normal. Mostbreakdowns are brought on by an over-burden. Protectionshortcomings prompting earth issues, swing to-turn or

twisting short-circuits are brought on by overabundancevoltage or pollution by sogginess, oil, oil, dust or chemicals. The approximate percentages of by these individual faults are:

•Overload 30%
•Insulation damage 20%
•Phase failure 14%

- Bearing damage 13%
- Ageing 10%
- Rotor damage 5%
- Others 8%

Thusly, the going with centers must be seen to guarantee issue free operation of an electrical drive:
•Correct design: a suitable engine must be decided for each application.
•Professional operation: proficient establishment and customary support are preconditions for shortcoming free operation.
•Good engine protection: this needs to cover all possible issue zones.
Fault analysis and protection system using Sensors.

4. DESCRIPTION

In under voltage protection of motor protects the motor from the under voltage. When supply system has low voltage than the rated of in motor then under voltage protection section of protection supply is provided to motor. It has same concept as overvoltage it also has comparator which compare two oltage one form supply and another from the voltage drop across the variable résistance. When voltage drop across the variable resistance is lower than specified value, this signal sends to microcontroller through ADC. If the input voltage becomes over then automatically both contactors will be trips. The contactors are connected through relay driver & relay circuit. Relay driver is used for to increasing the current handling capacity of incoming signals from microcontroller unit and microcontroller stop the operation of motor in the case of running and fails to operate in case of starting. In single phasing protection for 3 phase induction motor system, if any one of the phases is faulted then automatically trips both the contactors. Generally in single phase supply voltage is lower value than specified value. On this value of voltage motor is unable to start. Comparator which compares single phasing supply voltage and rated specified voltage, and single sends to microcontroller and microcontroller generates single and contactor will be trip through relay drive which stop the motor if motor is running and does not allow to motor start in case of standstill. Single phasing occurs as a result of several possibilities. As a loose wire, a bad connection, bad starter contacts, overload relay problems, a bad breaker, a blown fuse etc.

Phase reversal problem occurs in motor when the supply phase is reversed due to wrong connection (except than RYB) due to phase reversal motor starts running in anticlockwise (opposite direction from normal) would cause operation and safety problem. Most of three phases motor run opposite phases. Abnormal contactor operates when any one the phase changes in input side so as to motor will rotates with regular rotation. Also two contactors trips when any fault occur in input line voltage. This type of protection is used in application like elevators where it would be damaging or dangerous for the motor to run in reverse. Generally when motor is connected with the important application then type of protection being much more important .When the load is connected with motor then reversal of phase means Direction of rotation is changed. It could cause serious problem therefore much more care is required to protect the motor form such type of fault. The overheating protection system is placed to turn the motor off when the excess heat is generated within the motor. This protection system will rest the motor until it cools to safe operating temperature. Over- current protection of motor means protect the motor, if load is exceed than specified value. This over- current in motor is generally caused by overloading of motor, bearing seizes up something locked the motor shaft from turning. Each phase current is sensed by using current transformer and if current level exceeds its rated value then comparator sends signal to microcontroller to stop the motor. And one of latest provision is implemented in our project is that it corrects the phase sequence so to run the motor in proper direction with change in R,Y,B sequence this is done by phase checker circuit. LCD is used for display of all LCD faults and message to user

5. CONCLUSION AND FUTURE WORK

Protection of motor from under voltage, single phasing, over current and phase reversal 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. The protection circuit can be used to protect the costly electrical appliances from abnormal conditions like sag, swell, under voltage and overvoltage and avoid appliances being effected from harmful effects. There are certain features that can be added in this system.

Microcontroller and GSM based protection system is a reliable technique for monitoring and controlling the electric distribution system, the microcontroller works up to 100C temperature.
For long distance data transmission, GSM technology is a reliable and robust one.
Any kind of fault occurring in the distribution system results the GSM modules to send instant messages automatically to the base station.
GSM based microcontroller protection system will serve as a reliable, easy and cost effective solution for monitoring and controlling the electric distribution system.

The concept in future can be extended by integrating an alarm which sounds when voltage fluctuations occur.

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