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AUTOMATIC STAR DELTA STARTER USING CONTACTORS AND TIMER

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Abstract

This project is designed to provide reduced voltage to induction motor at the time of starting, in order to limit starting current of induction motor and to protect it from heavy starting current. Every induction motor draws heavy starting current by inherent nature. This heavy starting current causes damage to the insulation of winding or sometimes breakdown of motor and millions of economical damage may occur. To cope up with this situation certain mechanism is required and this is achieved by using star to delta conversion of motor connection. The high starting current is directly proportional to supply voltage. If rated voltage is applied at starting of the induction motor, then motor draws heavy starting current but if reduced voltage is applied to the motor at starting then motor draws less starting current. In order to apply reduced voltage at starting star delta configuration is used. In star configuration phase voltage is less than the line voltage where as in delta configuration phase voltage is equal to line voltage so that motor is first connected in star configuration to apply reduced voltage and after few seconds delay motor is connected in delta configuration and rated voltage is applied to get full torque.

Index Terms: *Induction Motor, Main Contactor, Star Contactor, Delta Contactor, Thermal Overload Relay, Timer.*

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1. INTRODUCTION

Automatic Star/Delta starters are most commonly used starters in industrial and agricultural sector. Before Automatic star-delta starter, manual star delta starters were used, which are time consuming and can causes fatal shocks too. To introduce automation in this manual starter, we are using three contactors which will connect the induction motor in star or delta configuration across the supply according to the operating conditions. The motor is connected in star configuration at the time of the starting will limit the supply voltage which will ultimately reduce the starting current of the induction motor to which the contactors are connected, when the motor acquires 80% of its rated speed the star configuration is converted into delta configuration using contactors. This will supply the induction motor its rated supply voltage and the motor will be operating normally. This results into smooth starting of the induction motor and the high starting current expected to be drawn by the motor at starting will be limited.

2. LITERATURE REVIEW

Types of Starters

In industries 80% motors used are three phase induction motors which always come across certain abnormal conditions like heavy starting current, single phasing, prolonged overloading, Stalling etc. For that different kinds of starters with different protection schemes are used they are given below.

2.1 DOL Starter

It is direct online starter. It does not limit the current but only used for starting and stopping of motor as well as to protect against overload condition. In this method directly switch the stator of three phase squirrel cage induction motor onto the supply mains the motor at the time of starting draws very high starting current for the very short duration but such high value of the current does not harm the motor because of rugged construction of motor

2.2 Rotor Resistance Starter

It can be only used for slip ring induction type motors and not for the squirrel cage type motors. This will decrease the

starting current increases the starting torque and also improves the power factor. It consists of three slip rings which are connected to the external resistances. As the speed increases the rotor resistance is cut step by step.

2.3 Star-Delta Starter

It can limit the starting current but it requires more human interference or manual operation to change the state of motor from star to delta. This method is used for the motors designed to operate in delta connected windings. The stator phases are first connected to the star by the help of triple pole double throw switch. As the speed reaches the 80% of the rated speed TPDT switch is operated and the motor is connected in the delta connections.

2.4 Autotransformer Starter

It can also limit the starting current but it requires manual operation and it is so costly.as the name suggests this method autotransformer is connected in between three phases of the power supply of the induction motor. The autotransformer is a step down transformer hence it reduces the per phase supply voltage this reduction in voltage reduces the starting current of the motor.

Soft starting of induction motor is one of the method in which supply frequency and supply voltage both are controlled in well proportion to have smooth starting of induction motor as well as to limit the starting current of motor but this requires costly equipments such as converter and inverter so that overall cost of soft starter increases. Hence economical point of view automatic star delta starter is one of the best project in the world.

Every starter mentioned above has certain drawbacks such as DOL starter does not limit the starting current of induction motor, Rotor resistance starter has more I2R losses, Autotransformer starter has more cost, manual star delta starter requires frequent human intervention. To beat these problems automatic star delta is invented.

3. PROPOSED METHODOLOGY

In star connection, $phase\ voltage = 1/\sqrt{3}\ line\ voltage$ and in delta connection $phase\ voltage = line\ voltage$. So if we connect motor in delta connection full rated voltage is applied and motor draws heavy starting current but in star connection reduced voltage is applied to motor and motor draws less starting current. This principle is used to form star delta starter and to avoid manual operation of this starter a timer is inserted in the star delta starter to make it automatic. In automatic star delta starter one star contactor is used to connect motor in star configuration and one delta contactor to connect motor in delta configuration. One timer is used to make it automatic and thermal overload relay is used to protect the motor from overload.

4. BLOCK DIAGRAM

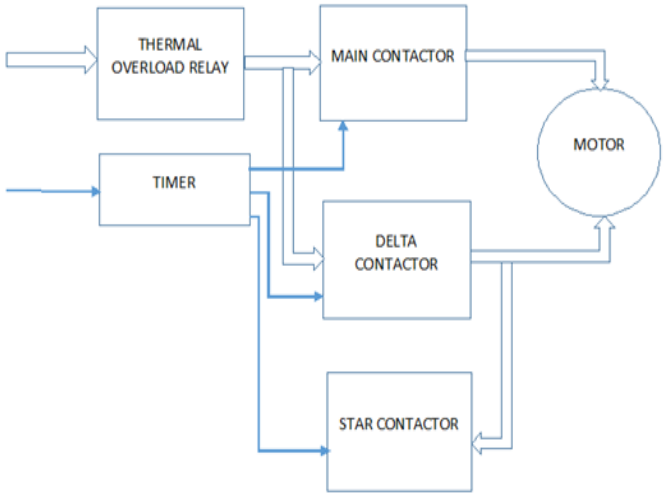

Fig-1: BLOCK DIAGRAM

4.1 CONTACTOR

4.1.1 Main Contactor: Contactor is a device which is used to make and break the circuit. Main contactor is a driver contactor which is used to drive star and delta contactor. It receives three phase supply from thermal overload relay and its output three phase terminal goes to induction motor.

4.1.2 Star Contactor*:* Star contactor connects the induction motor in star configuration and reduces supply Voltage to induction motor in order to limit the starting current of motor. It receives the three phase supply from the output of the delta contactor and its output ends are short circuit.

4.1.3 Delta contactor*:* Delta contactor connects the motor in delta configuration and supplies rated supply voltage to motor. It receives three phase supply from input side of driver contactor and its three phase output goes to induction motor.

4.2 Thermal Overload Relay

Thermal overload relay protects the motor from overload condition of motor. It works on the principle of expansion of bimetallic plates due to excessive heating due to heavy overload current. Bimetallic plate is made of two different metals of having different coefficient of temperature. A current carrying coil is wounded on bimetallic plate which heats the plate causing expansion of plate. The plate bends and trips the motor circuit. Three bimetallic plates are incorporated in all the three phases to form complete protection from heavy overload current. Thermal overload relays are ambient temperature compensated for operation from 5 degree Celsius to 60 degree Celsius.

4.3 Timer

Timer is a device which is used to provide specific time delay specific time delay to star operation after completion of time delay motor is connected in delta configuration. It requires single phase supply, one phase and one neutral. From timer neutral is looped to all the contactors. At starting of induction motor timer energizes the star contactor to connect motor in star configuration and after completion of time delay it energizes the delta contactor to connect the motor in delta configuration.

5. WORKING

When we press start button of starter main contractor is energized and simultaneously star contactor is energized by star delta timer and motor is connected in star configuration to provide reduced voltage in order to limit the starting current of induction motor. After few seconds of time delay provided on timer, star contactor is de-energized and delta contactor is energized to connect the induction motor in delta configuration to provide rated voltage to motor in order to produce rated torque of motor. During the normal operation of motor if overload occurs then thermal overload relay trips the circuit and motor is disconnected from supply in this way motor is protected from overload condition. this type of starter is used for the motors having capacity above 5HP both the star and delta contactor should not be closed at the same time otherwise dead short circuit will take place which is very dangerous. so that proper co-ordination between these two contactors is necessary.

6. CONCLUSION

An automatic star delta starter protects the induction motor from heavy starting current as well as reduces voltage and current fluctuations to neighbouring equipment. Also it is very cost effective solution as compare to other starters.

to any operation. In star/delta starter timer is used to give

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REFERENCES

[1]. L Nagarjan, Assistant Professor Department of Electrical and Electronics Engineering, Annai Mathammal Sheela Engg College, India." Star Delta Starter Using Soft Switch For Low Power Three Phase Induction Motors." Australian Journal of Basic and Applied Sciences, 9(21) Special 2015, ISSN:1991-8178.

[2]. Agbo D. O., Kureve D. T, Shittu D. H, "Implementation Of An Automatic Induction Motor Starter With Delay Using Microcontroller." international journal of scientific & technology research volume 3, issue 5, may 2014. ISSN 2277-8616.

[3]. H.H. Goh, M.S. Looi, and B.C. Kok," Comparison between Direct-On-Line, Star-Delta and Auto-transformer Induction Motor Starting Method in terms of Power Quality." Proceedings of the International Multi Conference of Engineers and Computer Scientists 2009 Vol II IMECS 2009, March 18 - 20, 2009, Hong Kong.

[4]. Theraja, B. L and A. K. Theraja, A Text Book Of Electrical Technology. S. Chand Company Ltd. New Delhi, pp. 851-918, 2001.