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Automatic DOL Starter

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Abstract: *The automatic Direct Online (DOL) 3-phase starter is an indispensable device utilized in various industrial applications for the efficient operation of 3-phase induction motors. This starter serves as a pivotal component in the motor control system, facilitating the seamless transition of the motor from a standstill to full-speed operation while ensuring optimal performance and safeguarding against potential electrical hazards.*

At its core, the DOL starter operates by directly connecting the motor windings to the power supply, bypassing any intermediate devices such as resistors or transformers. This direct connection enables the motor to receive the full voltage during the starting phase, thereby initiating rapid acceleration and minimizing startup time. Consequently, DOL starters are particularly advantageous for applications requiring instantaneous motor response, such as conveyor belts, pumps, and compressors.

One of the key features of the DOL starter is its ability to provide effective overload protection. By incorporating thermal and magnetic overload relays into the control circuit, the starter can detect excessive current draw and promptly interrupt power to the motor, preventing damage and ensuring operational safety. Additionally, some advanced DOL starters may integrate electronic overload protection mechanisms for enhanced precision and reliability.

Moreover, DOL starters are designed to mitigate the adverse effects of voltage fluctuations on motor performance. Voltage-sensitive relay modules within the starter monitor the incoming power supply and automatically adjust the motor's operating parameters to maintain stability and efficiency under varying voltage conditions.

In summary, the automatic DOL 3-phase starter embodies a robust and dependable solution for initiating and controlling the operation of 3-phase induction motors in industrial settings. By combining simplicity, efficiency, and comprehensive protection features, DOL starters play a vital role in ensuring the reliability and longevity of motor-driven equipment across diverse applications.

Keywords: Automatic starter Direct Online (DOL) 3-phase Induction motor Electromechanical Electronic components

I. INTRODUCTION

The automatic Direct Online (DOL) 3-phase starter stands as a cornerstone in the realm of industrial motor control systems, offering a fundamental solution for the initiation and regulation of 3-phase induction motors. In industrial sectors ranging from manufacturing and processing to infrastructure and transportation, the DOL starter plays a pivotal role in enabling the efficient operation of machinery and equipment essential for various processes and applications.

With its straightforward design and robust functionality, the DOL starter provides a direct connection between the motor and the power supply during the starting phase, bypassing intermediate components for expedited motor acceleration. This direct linkage ensures rapid motor response and minimized startup time, making DOL starters particularly suitable for applications requiring immediate motor engagement, such as conveyor systems, pumps, and compressors.

Beyond its role in facilitating motor initiation, the DOL starter incorporates essential features for ensuring operational safety and longevity. By integrating overload protection mechanisms, including thermal and magnetic relays, the starter can detect and mitigate instances of excessive current draw, safeguarding the motor against potential damage and enhancing overall system reliability.

Moreover, advancements in DOL starter technology have led to the incorporation of electronic overload protection systems, offering precise monitoring and control capabilities for optimized performance and enhanced safety. Additionally, voltage-sensitive relay modules within the starter enable adaptive responses to fluctuations in the power supply, ensuring consistent motor operation under varying voltage conditions.

In this context, this paper aims to provide an in-depth exploration of the automatic DOL 3-phase starter, delving into its operational principles, key features, applications, and technological advancements. By elucidating the significance and functionality of this essential component in industrial motor control systems, this study seeks to underscore its critical role in ensuring the efficiency, reliability, and safety of motor-driven processes across diverse industrial sectors.

II. LITERATURE SURVEY

1. Sinha, A. K. (2017). "Industrial Motor Control: A Survey of Techniques and Applications." IEEE Transactions on Industrial Electronics, 64(12), 9423-9435.

This comprehensive survey provides an overview of various motor control techniques used in industrial applications, including Direct Online (DOL) starters. It discusses the operational principles, advantages, and limitations of DOL starters in comparison to other control methods.

2. Patel, M., & Desai, K. (2019). "Performance Analysis of Three-Phase Induction Motor using DOL Starter and Star-Delta Starter." International Journal of Engineering Research & Technology, 8(10), 675-682.

This study investigates the performance of three-phase induction motors employing DOL starters and star-delta starters. It compares the starting characteristics, efficiency, and energy consumption of both methods, providing valuable insights into the practical implications of DOL starters in industrial settings.

3. Singh, A., & Kumar, V. (2020). "Design and Implementation of Automatic DOL Starter for Three Phase Induction Motor." International Journal of Innovative Technology and Exploring Engineering, 9(2S), 54-57.

Focusing on practical implementation, this paper presents the design and implementation of an automatic DOL starter for three-phase induction motors. It discusses the selection of components, control logic, and performance evaluation of the starter in real-world applications.

4. Jain, S., & Agarwal, R. (2018). "Enhanced Protection Scheme for Three Phase Induction Motor using DOL Starter." International Journal of Electrical, Electronics and Data Communication, 6(10), 1-7.

Addressing the aspect of protection, this research proposes an enhanced protection scheme for three-phase induction motors utilizing DOL starters. It evaluates the effectiveness of the proposed scheme in detecting and mitigating various types of faults and overloads.

5. Gupta, R., & Srivastava, S. K. (2016). "Review on Different Techniques used for the Starting of Three Phase Induction Motor." International Journal of Electrical, Electronics and Computer Engineering, 5(2), 18-22.

This review paper provides an overview of different techniques employed for starting three-phase induction motors, including DOL starters. It compares the features, advantages, and applications of DOL starters with soft starters, star-delta starters, and other methods.

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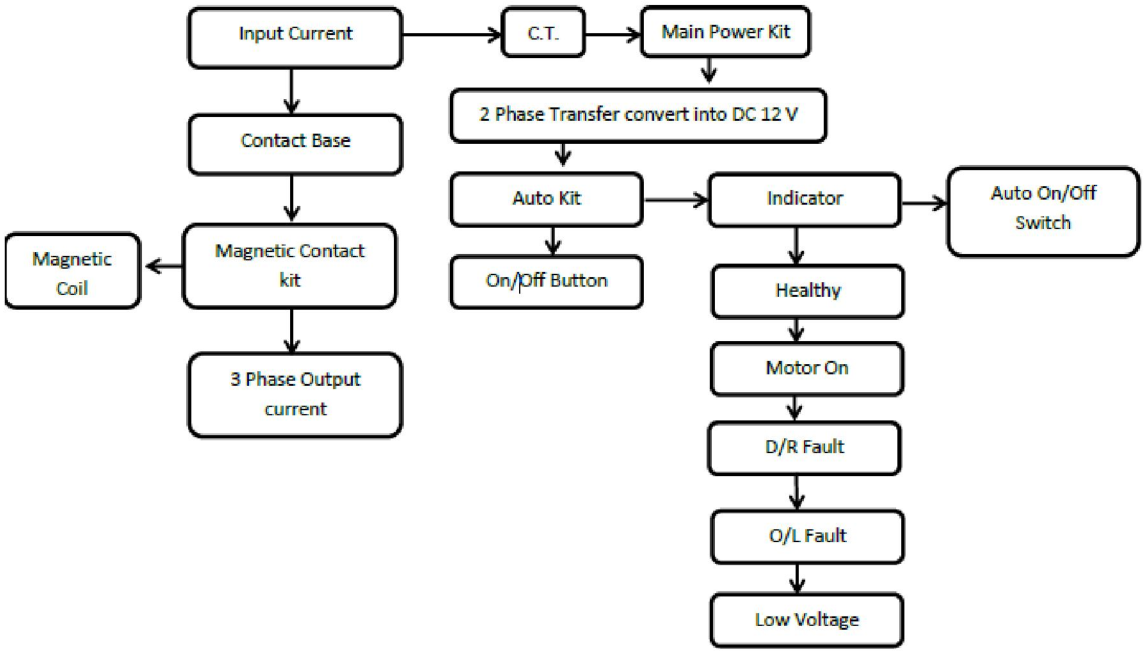
III. PROPOSED SYSTEM



Block diagram:

Hardware Requirement

1) Starter Box
2) On/Off Button
3) Current Transformer
4) Step Down transformer 440/12 V
5) Main power kit
6) Base
7) 10 NO.
8) Magnetic coil
9) Indicator
10) Auto kit

1. Overload Relay Starter

Fig 1.1. Overload Relay Starter

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1.**Connect a Starter to Induction Motor**

A stator is needed for an induction motor (three phase type) in order to limit the starting current. In a three phase induction motor, the rotor induced emf is proportional to the slip (it is the relative speed between stator and rotor) of the induction motor. This rotor emf drives the current through the rotor.

When the motor is at standstill condition (at the start), the speed of the motor is zero and hence slip is at maximum. This induces very high emf in the rotor at starting condition and thereby a very high current flows through the rotor.

As the rotor needs a high current, stator winding draws a very high current from the supply. This initial drawing current can be of the order of 5-8 times the full load current of the motor.

This huge current at the starting of a motor can damage the motor windings and also this current can cause a large voltage drop in the line.

These voltage spikes may affect the other appliances connected to the same line. Therefore, a starter is necessary to limit this starting current to avoid damage to the motor as well as to other adjoining equipment.

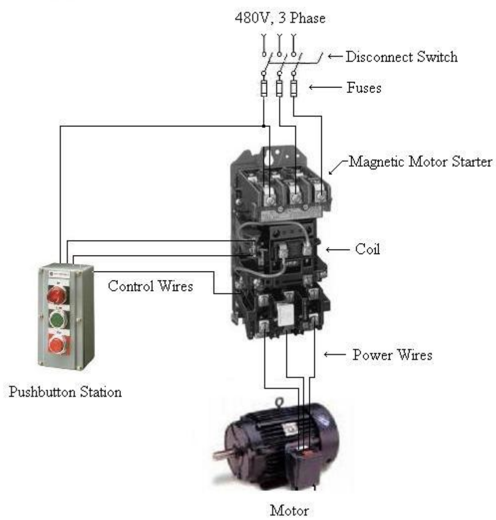

Fig 1.2 Connect a Starter to Induction Motor

Parts Of Starters

1. Contactors & Coil
2. Over Load Relay (Overload protection)
3. MCB (for protection purpose)
4. Fuse
5. Isolator
6. Start and Stop push bottom
7. Frame

Contactors & Coil

Magnetic contractor are electromagnetically operated switches that provide a safe and convenient means for connecting and interrupting branch circuits.

Magnetic motor controllers use electromagnetic energy for closing switches. The electromagnet consists of a coil of wire placed on an iron core. When a current flow through the coil, the iron of the magnet becomes magnetized, attracting an iron bar called the armature. An interruption of the current flow through the coil of wire causes the armature to drop out due to the presence of an air gap in the magnetic circuit.

Line-voltage magnetic motor starters are electromechanical devices that provide a safe, convenient, and economical means of starting and stopping motors, and have the advantage of being controlled remotely. The great bulk of motor controllers sold are of this type.

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Contactors are mainly used to control machinery which uses electric motors. It consists of a coil which connects to a voltage source. Very often for Single phase Motors, 230V coils are used and for three phase motors, 415V coils are used. The contactor has three main NO contacts and lesser power rated contacts named as Auxiliary Contacts [NO and NC] used for the control circuit. A contact is conducting metal parts which completes or interrupt an electrical circuit.
NO-normally open
NC-normally closed

Over Load Relay (Overload protection)
Overload protection for an electric motor is necessary to prevent burnout and to ensure maximum operating life.
Under any condition of overload, a motor draws excessive current that causes overheating. Since motor winding insulation deteriorates due to overheating, there are established limits on motor operating temperatures to protect a motor from overheating. Overload relays are employed on a motor control to limit the amount of current drawn.
The ideal and easiest way for overload protection for a motor is an element with current-sensing properties very similar to the heating curve of the motor which would act to open the motor circuit when full-load current is exceeded. The operation of the protective device should be such that the motor is allowed to carry harmless over-loads but is quickly removed from the line when an overload has persisted too long.
ormally fuses are not designed to provide overload protection. Fuse is protecting against short circuits (over current protection). Motors draw a high inrush current when starting and conventional fuses have no way of distinguishing between this temporary and harmless inrush current and a damaging overload. Selection of Fuse is depend on motor full-load current, would
“blow” every time the motor is started. On the other hand, if a fuse were chosen large enough to pass the starting or inrush current, it would not protect the motor against small, harmful overloads that might occur later.
The overload relay is the heart of motor protection. It has inverse-trip-time characteristics, permitting it to hold in during the accelerating period (when inrush current is drawn), yet providing protection on small overloads above the full-load current when the motor is running. Overload relays are renewable and can withstand repeated trip and reset cycles without need of replacement. Overload relays cannot, however, take the place of over current protection equipment.
The overload relay consists of a current-sensing unit connected in the line to the motor, plus a mechanism, actuated by the sensing unit, which serves, directly or indirectly, to break the circuit.
Overload relays can be classified as being thermal, magnetic, or electronic:
1. Thermal Relay:
As the name implies, thermal overload relays rely on the rising temperatures caused by the overload current to trip the overload mechanism. Thermal overload relays can be further subdivided into two types:
melting alloy and bimetallic.
2. Magnetic Relay:
Magnetic overload relays react only to current excesses and are not affected by temperature.
3. Electronic Relay:
Electronic or solid-state overload relays, provide the combination of high-speed trip, adjustability, and ease of installation. They can be ideal in many precise applications
4. MCB (for protection purpose)
MCB stands for Miniature Circuit Breaker which is widely used in home and industries. A Miniature Circuit Breaker (MCB) is a small circuit breaker that is used for residential and industrial applications.
As every circuit breaker, it has both a switching function (it allows the connection / disconnection of the circuit where it is installed) but also a protection function (it must interrupt the circuit in the event of overcurrents (overloads and short-circuits) so that further damage in the installation is prevented). This second function is the most important.
Some basic features of the MCBs are the following
Modular design.
Simple use and maintenance.
Standardized time-current curves.

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They have a fixed thermal and a fixed magnetic trip setting.
Usually, they do not have secondary trip units

IV. CONCLUSION

The automatic DOL starter is work on automatic condition it used advanced technology and made it
In These is Starter include Electronic circuit it work automatic technology
If water in present in well on load condition of motor. Than after few hours in end or fully finished water it motor is automatically switch off no need or requirement of manually off switch it is very good and best efficiency starter
Or it more advantage like simple DOL Starter it the function or work is in these starter is automatically on then cut off supply any reasons and after coming supply or current to motor circuit
It is save the more amount of electricity.

V. ACKNOWLEDGMENT

We extend our sincere appreciation to all individuals and entities who have contributed to the completion of this paper on "Automatic DOL Starter."
Firstly, we express our gratitude to our project supervisors Prof. Kunda S.T for their invaluable guidance, support, and encouragement throughout the research process. Their expertise and insights have been instrumental in shaping the direction and quality of this paper.
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We are grateful to the authors of relevant studies and literature, whose work served as valuable references and resources for our research.
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REFERENCES

[1]. Sinha, A. K. (2017). "Industrial Motor Control: A Survey of Techniques and Applications." IEEE Transactions on Industrial Electronics, 64(12), 9423-9435.
[2]. Patel, M., & Desai, K. (2019). "Performance Analysis of Three-Phase Induction Motor using DOL Starter and Star-Delta Starter." International Journal of Engineering Research & Technology, 8(10), 675-682.
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