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Braking System Planning on 3 Phase Induction Motors Using Full-Wave Rectifiers

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ABSTRACT

Induction motors are the most commonly used motors in various industrial equipment and public facilities such as conveyors, pump rotation, elevators, escalators. Induction motors that have rotors have remaining rotation when the engine is turned off, to rotate the motor in the opposite direction often waiting until the rotor stops rotating. This study is the result of the design and study of the manufacture of a three-phase induction motor braking device, where the use of a wave rectifier safety device will stop the remaining rotating field by reversing the rotating field by injecting DC current into the rotating field so that the rotating field stops. The test results show that the braking system when the tool is turned on in the first test and the second test, the current is stable with the initial forward current condition of 1.50 A, and the current when braking is 2.59 A.
***Keywords**: Induction Motors, Three-Phase, Braking System.*

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Introduction

Three-phase induction motors are one of the most common types of electric motors used in industry as well as in daily life. This motor works based on the principle of electromagnetic induction, where the electric current flowing on the stator coil (the stationary part) will produce a rotating magnetic field [1]. This rotating magnetic field then induces an electric current on the rotor coil, resulting in an electromagnetic force that causes the rotor to rotate [2].

The induction motor is often still spinning when the engine is turned off, therefore to reverse the rotation in the opposite direction it takes time to wait for the rotational field to stop [3]. The braking system on the induction motor aims to save time so as not to wait for the rotary field to stop by itself and the braking system also aims to stop the rotation of the induction motor safely or safely [4].

The utilization of diodes as full-wave rectifiers that function to convert alternating current (AC) into direct current (DC) [5]. In contrast to a half-wave rectifier that utilizes only half the cycle of the AC signal, a full-wave rectifier utilizes the entire positive and negative cycles of the AC signal [6].

In this study, a 3-phase induction motor braking system will be designed by utilizing a full-wave rectifier to control the residual rotary field. Then there will be a meal.

Method

The research media that will be made is in the form of designing a braking system applied to a 3-phase induction motor by utilizing a full-wave rectifier. The research method Research and Development (R&D) was chosen as the method in this study. The Research and Development method is a research approach used to develop new products or improve existing products. These products can be in the form of various things, ranging from software, tools, learning materials, to training programs. The main goal of this method is to produce products that are effective and efficient in solving problems or meeting specific needs. The Research and Development stage is in the form of potentials and problems, information collection, system design, system design improvement, system testing, and system revision.

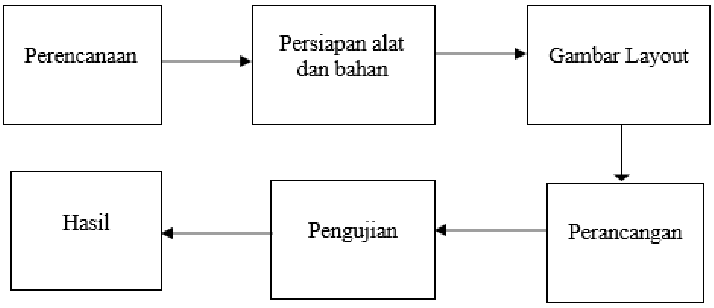

Figure 1. Research framework

In designing the tools that are carried out, they adjust to the framework of thought that has been made so as not to deviate from the idea of designing the tools to be made.

a) First, prepare a schematic drawing of the circuit for the reference for making tools on the panel board
b) Prepare the polywood boards, install MCB 3 Phasa 10 A and MCB 1 Phasa 2A and 4A.
c) Then install the NO and NC contactors on the panel board (Polywood) and install the DBC next to the NO and NC contactors.
d) Then install a push button, selector switch, diode bridge that will be used as a converter of AC current to DC current on the panel board and TOR for temperature safety.

Figure 2 shows images of the research media design process such as in the above tool design stages, media trials, and research data collection processes.

Figure 2. It is a process of designing research media, media trials, and data collection processes.

Figure 3 shows a 3-phase induction motor circuit using a DOL (direct on line) circuit using braking, an electrical control circuit that provides current to the induction motor so that the induction motor can run and is often used in the industrial field [7].

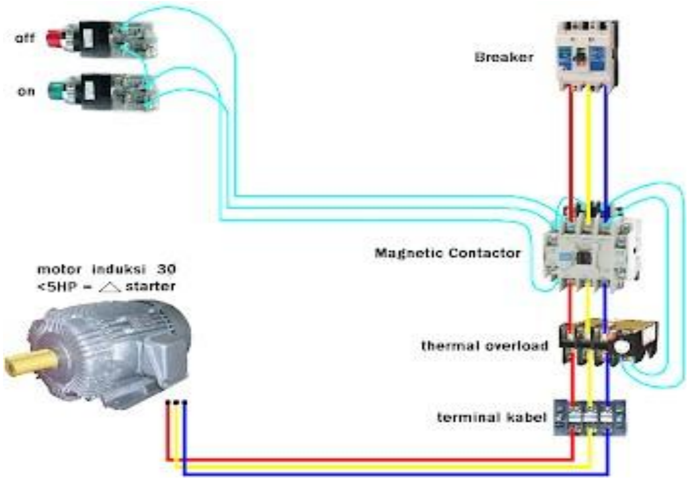

Figure 3. DOL (Direct on Line) Network

In simple terms, to stop the rotor rotation of the motor induction voltage on the stator is converted from an AC voltage source to a DC voltage in a very short time. Torque is a very important parameter in the selection of DC motors for an application [8]. The torque in a DC motor results from the interaction between the magnetic field generated by the field coil and the current flowing on the anchor coil. When an electric current flows through the anchor coil that is inside the magnetic field, an electromagnetic force will arise that causes the anchor coil to rotate [9].

Result and Discussion

Measurement using the Star network.

In table 1 below it is clear that when a 3-phase induction motor is started using a circuit Star with the state forward then the voltage produced is 388 V and when the condition Reverse then the voltage produced is 392 V.

Table 1. The test results use the Star series.

Testing	Voltage/Voltage
Forward	388 V
Reverse	392 V

Measurement with braking system

In the second measurement, a time difference was used, namely for the 1st experiment for 5 seconds and for the 2nd experiment for 8 seconds. The initial current in the 1st and 2nd experiments had the same current at the time of the forward and have different currents at the time of the Reverse that is, a difference of 0.02 amperes at the time of the initial current with a difference within 3 seconds.

However, at the time of braking current for the 1st and 2nd attempts, the current is not different, only at the time of the 2nd attempt for braking current, the state Reverse it's different 0.02 ampere Because there was a time gap of 3 seconds with the 1st attempt.

Table 2. The test results use a braking system

Testing	**Information**	**Early currents**	**Current during braking**
1st	*Forward*	1,50 A	2,59 A
	Reverse	1,38 A	2,59 A
Wed 2	*Forward*	1,50 A	2,59 A
	Reverse	1,36 A	2,47 A

In table 2. This shows that in the braking system when the tool is started on the first test with the second for the initial current on the forward it remains stable and when reverse There is a difference in the starting current and the current when braking.

Conclusion

From the results of the design of the research media and the results of the test, it can be concluded that:

1. By using a full-wave rectifier braking system, a control system that is easy to manage and can be developed is obtained.
2. The braking system when the tool is switched on in the first test with the second for the initial current in forward and reverse conditions remains stable, although there is a slight difference in the starting current and braking current due to non-technical factors at the time of testing.
3. This braking system is more advanced and is used in Forward-Reverse and DOL (Direct On Line) circuits because it is more practical to use when the AC current is injected with a short DC current, the induction motor will stop immediately.

Refrences

Andreas Prabowo, "Dynamic branking design on a three-phase induction motor based on the atmega16 microcontroller", Online Journal of Students in Electrical Engineering, Vol. 1 No. 1, p. 2-4. 2016.

Sutarno, "Dynamic braking of induction motors with direct current (DC) injection", Journal of Electrical Engineering, Vol. 2 No. 1, p. 44. 2010.

Parsa, I. N. "ELECTRIC MOTORS". In I. N. Parsa, ELECTRIC MOTOR (p. 104). mushroom: CV. Constellation of Rise. 2018.

Zulhal, "Basics of Electrical Power Engineering and Power Electronics". In Zulhal, Basics of Electrical Power Engineering and Power Electronics (pp. 101, 199, 200). Jakarta: PT Gramedia. 1988.

Petruzella, "Industrial Electronics". Translated by Sumanto. Yogyakarta : Andi Offset.2001.

Fitzgerald, A, E. Jr, Charles, Kingsley., Umans., stephen, D, Electric Machinery,6th edition, Mc Grew Hill.2003.

Muhaimin & Zamzami, "Dynamic Braking Planning on 3 Phase Induction Motors Using Programmable Logic Controller (PLC)" vol.2 No.1 ISSN:2598-3954.September.2018.

Fakhrizal, Reza, "Application of Programmable LogicController (PLC) on the Induction and Protection of Star (Y)-Triangle (Δ) Three-Phase Induction Motor", Research, Diponegoro University, Semarang, 2007.
Saleh, Anang Supriadi. Textbook on Energy and Agricultural Electrification. In the Textbook on Energy and Agricultural Electrification (p. 63). Yogyakarta: CV Budi Utama.PT.DENSO SALES INDONESIA,. 2010. Service Manual Setelah Pemasangan. Jakarta.