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Contactless Start of Three Phase Induction Motor with Single phasing protection amidst Corona Pandemic

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Abstract – The noble corona virus lead to complete shut down of all Industries in India. Production almost came to a halt during the lock down and the Indian economy had to go through tough times. Slowly as the lock down was lifted in stages the biggest challenge that came before the Government was to restart theindustries following the norms of Social Distancing. As we know that three phase Induction motors are the widely used prime movers in Industry because of their robust construction , low maintenance cost and variable speed operation. These motors are installed in almost 90% of industrial processes where there switching is carried out to control different machines in Industries. This switching is based on physical touch with the motor starter. Amidst corona pandemic when the machine operators change their shifts the virus may settle down on the motor starter and this way is likely to spread at a faster rate. In this paper a methodology has been developed to offer contact less start of three Phase Induction Motor to offer both Electrical Fire safety as well as safety against the global corona virus

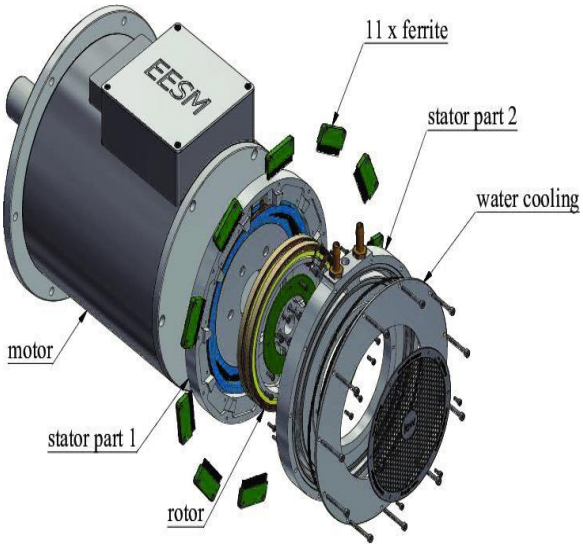
Keywords – corona; Induction Motor; Contactless

INTRODUCTION

A three phase Induction Motor has different methods of starting .In industries mainly two types of starting methods are used. For small motors up to 11 KW capacity Direct Online starters are used and for Motors having capacity more than 11 KW Star Delta starters are used. Even though explosion proof motor starters have been developed by some Switchgear companies yet they appear to be very costly. The contactless [1] start methodology that has been developed in this paper offers not only contact less start to prevent the spread of noble corona virus but also offers added Single phasing[2] protection to motor along with annunciation

Components used

*1)*Plug in relay, 2 Nos



2) SMPS , 1 No
3) Power Contactor, 1 Nos
4) PNP Sensor , 1 Nos
5) NPN Sensors , 1 Nos

LITERATURE SURVEY

The operation of an Electrical excited Synchronous Machine through contactless Energy transfer to the rotor has already been developed. In this scheme the energy is transferred to

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the rotor without any mechanical contact This system is called Contactless Energy Transfer system. Fig. 1 shows an exploded view of such a system[3]

Figure 1

The contactless health monitoring system through infrared thermograph technology [4] is another big achievement to protect a three phase Induction Motor against sudden faults occurrence. In this technique the condition monitoring of the Induction Machine is carried out by connecting various sensors directly to the machine for early stage detection of faults. Thus preventive maintenance is offered to the induction machine using this technique .

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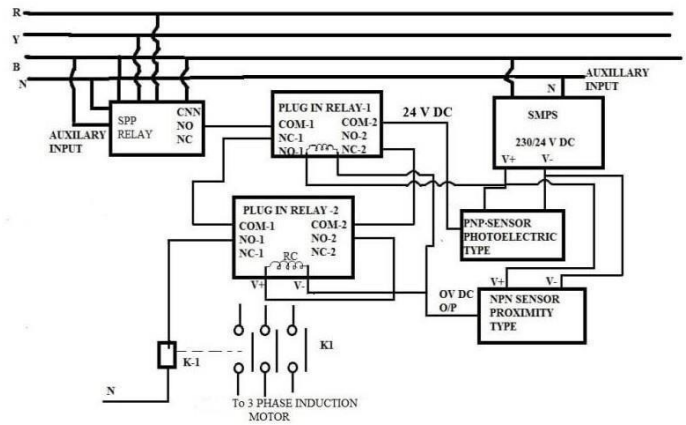
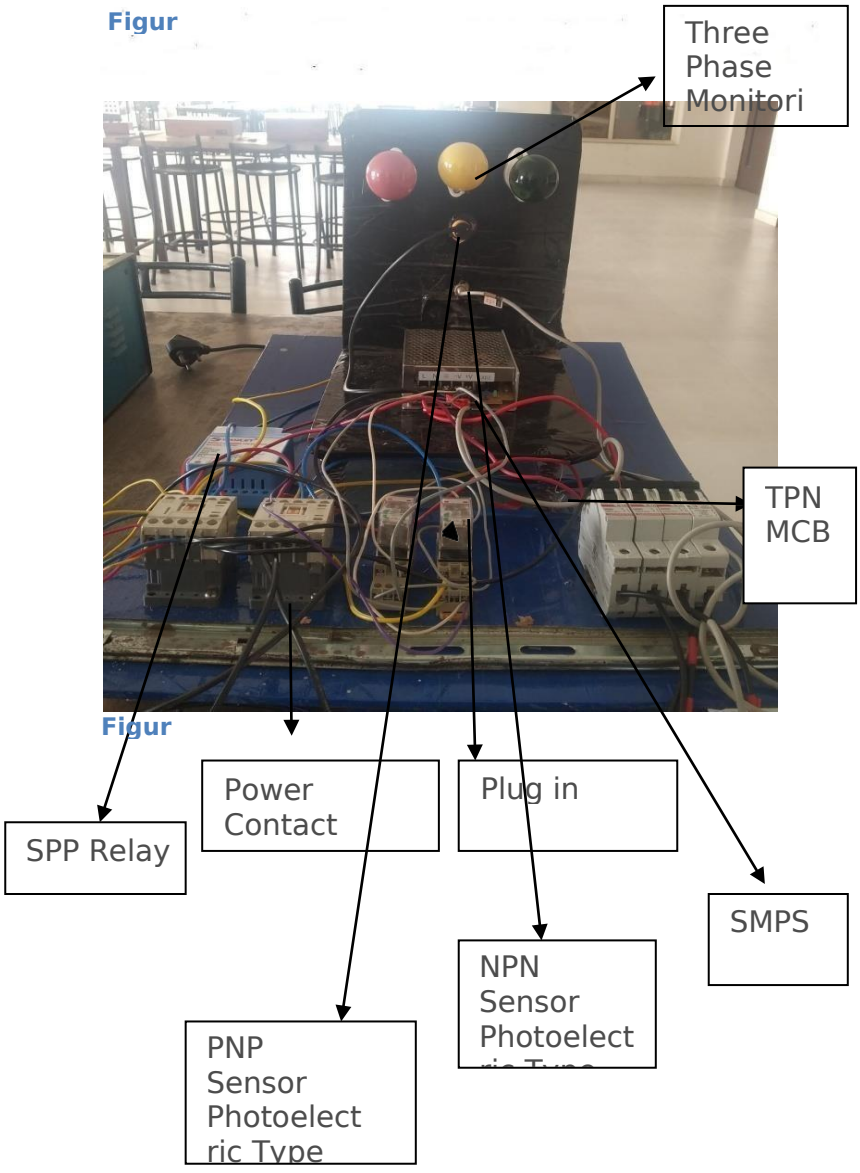
Methodology

The block diagram in Figure 2 clearly shows how the contactless start system is going to work for a three phase Induction Motor. Two Plug in Relays having coil voltage of 24 V DC are used. Each relay is 8 Pin with two common , two normally open and two normally closed contacts. There are two types of sensors used one Photoelectric Sensor[5] Source type and the other NPN type photoelectric sensor sink type. A switch mode power supply is used to provide auxiliary supply to the two sensors used . The plug in relays 1 and 2 used are of DC type and also receive supply from the SMPS The outputs of both the sensors are used to control the switching action of plug in relays respectively. Plug in relay 1 in this connection behaves as master relay and ensures to stop the motor when the NPN sensor is actuated. The PNP sensor on the other hand ensures touch less start when the sensor is actuated and turns on the relay 2



Figur



Figur

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The SPP relay in the diagram ensures to protect the Motor against single phasing. As we know that single phasing is an abnormal condition that occurs when one of the three phases supplying power to the motor develops an open circuit as shown in figure 4. During normal condition when all the three phases are healthy the current flowing through the three Phases L1 L2 and L3 are balanced and equal to 10 ampere .

In single phasing condition Phase L3 develops an open circuit and this increases the electrical loading in the remaining two phase L1 and L2 . Thus the motor winding insulation gets heated up and results in the burning of motor.

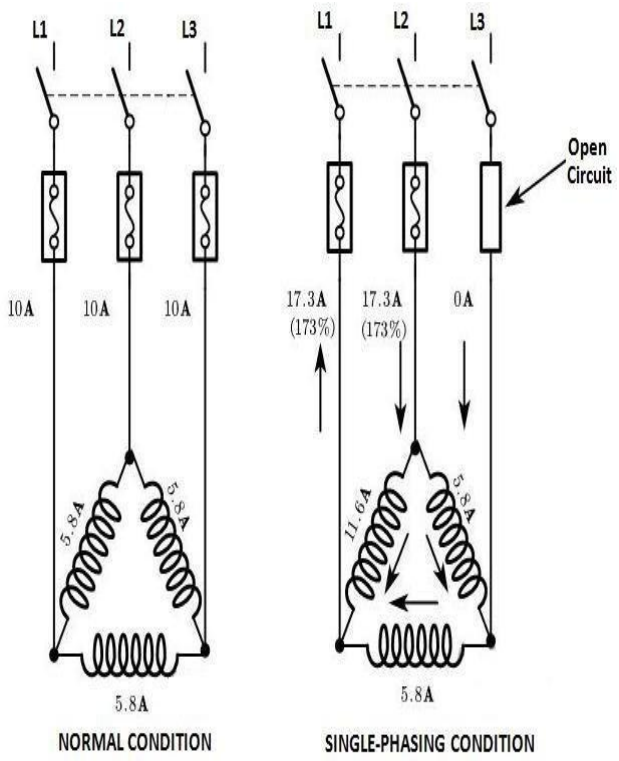

Figure 4

As shown in figure 3 the three bulbs of red yellow and blue colour are being used for status monitoring of the three phase supply system. Parallel connection of these bulbs has been done with the single Phasing Relay. Three Phase supply has been used to feed power to three Phase Induction Motor . For creating the condition of single phasing a miniature circuit breaker is present in each phase. During healthy condition of all the three phases the motor contactor K_1 coil is actuated and the motor runs without any interruption. However when any phase MCB is switched off only two phases are supplied to the

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motor and this actuates the single phasing preventer relay which ultimately interrupts the supply being fed to the contactor coil K_1 and the contactor becomes open circuit and stops the motor

The pilot model developed in figure 3 has been made for direct online starting of 1 HP three phase Induction Motor through contactless control. The same model can be upsized to start three phase Induction motors of any rating by up scaling the contactor rating .

CONCLUSION

Thus it is seen that through developed model of starting a three phase Induction Motor without touching the motor starter pushbuttons a more safer way has been offered to start the Induction Motor.

This technique will prove helpful in large scale Industries where production hours are planned in three shifts and each shift has a new operator . Here the need to touch the motor starter by every operator will be eliminated and the spread of global corona virus will be controlled . Moreover this scheme also protects the motor against single phasing which is responsible for the burning of almost 80% of Three Phase Induction Motors present in any manufacturing Industry . In the proposed scheme the motor is offered hard start and no methodology has been developed to control the frequency and voltage of the motor. The isolation between the power and control circuit keeps the operator away from the motor starting panel. Hence the operator is also offered safety from electrical fire caused owing to three phase short circuit.

FUTURE SCOPE

The developed model can be implemented by a PLC [6] controller too and then the two models can be compared in terms of different parameters such as clarity of wiring , smoothness of motor operation and cost benefit analysis . In applications where variable speed is desired a variable frequency drive can also be connected with existing model and modbus communication can be done between PLC and drive. An alarm system can also be triggered with the existing model to detect the abnormality of single phasing so that when the supply to the motor is interrupted when the motor is handling some critical process , the operator who is in some remote location may listen to the alarm and reset the motor quickly . Thus production loss in the line can be eliminated through this annunciation system

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