ENHANCEMENT OF POLYPHASE INDUCTION MOTOR WORKING AS A ROTARY PHASE CONVERTER AND WELDING TRANSFORMER

HARSHADA S. BELANKE,
Electrical Department, Vishveshwarya Technical Campus Patgaon, Miraj. Shivaji University Kolhapur, Maharashtra, India. harshadasbelanke@gmail.com,

SUCHITA D. CHOUGULE
Electrical Department, Vishveshwarya Technical Campus Patgaon, Miraj. Shivaji University Kolhapur, Maharashtra, India. chougulesuchita1008@gmail.com

MONALI A. KORE,
Electrical Department, Vishveshwarya Technical Campus Patgaon, Miraj. Shivaji University Kolhapur, Maharashtra, India. koremonali@gmail.com

ROHINI D. KUKADE,
Electrical Department, Vishveshwarya Technical Campus Patgaon, Miraj. Shivaji University Kolhapur, Maharashtra, India. rohinikukade13@gmail.com

DIPALI R. PATIL,
Electrical Department, Vishveshwarya Technical Campus Patgaon, Miraj. Shivaji University Kolhapur, Maharashtra, India. patildipali108@gmail.com,

PROF. SNEHAL M. KULKARNI.
Electrical Department, Vishveshwarya Technical Campus Patgaon, Miraj. Shivaji University Kolhapur, Maharashtra, India. kulkarni.snehal51@gmail.com

ABSTRACT
In this paper, a model which is implemented on idea that, the Polyphase induction motor works as welding transformer and rotary phase converter on a single Polyphase Induction motor by redesigning of stator winding of that motor. In our proposed model, for obtaining these three functions the rotorremains as it is and we only changed the design of stator winding.
KEYWORDS: Bell Push Switch, Polyphase Induction motor, Rotary Phase Converter, Rotating Transformer, Welding Transformer.

I. INTRODUCTION

With the almost universal adoption of ac system of distribution of electric energy for light and power, the field of application of ac motors has widened considerably during recent years. As a result, motor manufactures have tried, over the last few decades, to perfect various types of ac motors suitable for all classes of industrial drives and for both single and three phase supply.

Three-phasesquirrel-cage induction motors are widely used in industrial drives because they are rugged, reliable and economical. Single-phase induction motors are used extensively for smaller loads, such as household appliances like fans. Although traditionally used in fixed-speed service, induction motors are increasingly being used with variable-frequency drives in variable-speed service. VFDs offer especially important energy savings opportunities for existing and prospective induction motors in variable-torque centrifugal fan, pump and compressor load applications.

A three phase induction motor consists mainly two parts that is rotor which is rotating in nature and stator which is stationary.

The operation of three phase induction motor is based upon the application of Faraday's law.The stator winding are connected to the three phase supply and the rotor circuit is closed,the induced voltages in the rotor windings produce rotor current that interact with the air gap field to produce torque.

In fact, an induction motor can be treated as a Rotating transformer i.e. one in which primary winding is stationary but the secondary is free to rotate. The transfer of energy from stator to rotor of an induction motor takesplace entirely inductively, with the help of flux mutually linking the two. Hence the induction motor

essentially transformer with stator forming primary and rotor forming rotating secondary.

II. PURPOSE

- How this project will lead to a ordinary welding transformer?

A perfect balanced 3 phase welding transformer is not available in market which is very essential to run on small 3 phase alternator (of some rating). Basically the welding transformer is a single phase machine. Only few welding transformer are 3 phase. They are either. 1. Open delta connection type 2.Scott connection type (with center tapped auto transformer). The current drawn from the supply is not balanced. The center phase draws double compared with other phase lines e.g. -18A/36A/18A/, 25A/50A/25A. We have successfully developed a 3phase welding transformers drawing equal current on 3 phase lines.

- Is there use of any converter?

No! Here we do not use an any single converter. Because we used 7.5Hp squirrel cage motor for this & divided the stator winding in 2 part, out of which one winding is used for 3.5 HP, 3Phase induction motor & other 4HP are used for single phase. For increasing current capacity of single phase winding we increase conductor effective diameter.

- How will be this project more effective regarding the cost?

If we compare this machine withdifferent devices used for the same application we can found that the cost of this machine is 1\4thto that of total cost of different applications. The cost of 7.5 H.P induction motor is about 8000 to 10000 rupees the cost of welding transformer of same rating is about 13000 to 15000 rupees. While the cost of machine is very affordable.

III. LITERATURE REVIEW

In today's world, in industries an induction motor and the welding transformers are frequently used in the industries for their own applications. To meet their requirement they are used separately in the industries which increases the installation cost of the industry.

To overcome this difficulty we are going to implement our proposed model to operate three functionson the same induction motor. The use of multipurpose motors is very Convenient for used in mega workshops. Hence the cost require for two machine gets reduces. Also an approach towards the motor performance gets increases.

IV. BLOCK DIAGRAM

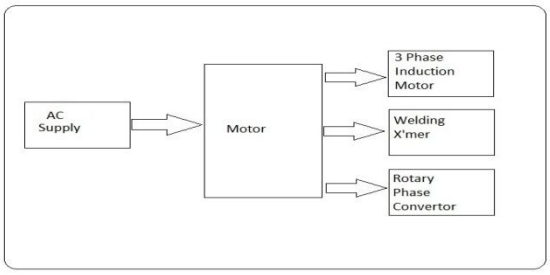

Fig.1.-Block diagram of proposed model

The functions that formed the basis of our model are listed under this section. A general description of each functions are followed by their working in our model.

A. ACT AS A POLYPHASE INDUCTION MOTOR

The three phase induction motor operates on a principle of rotating magnetic field which is produced by stator winding. When one of the winding is excited with alternating voltage, rotating field is set up. This field produces an electromagnetic force in the other winding by transformer actionwhich in turn circulates current in the rotor. The currents flowing in the second winding interact with the field produced by the first winding there by producing a torque which is responsible for the rotation of the rotor.

B. Act as a Welding Transformer

Generally the welding can be used for joining of two metals which requires low voltage and high current.As we know the induction motor is a generalized transformer, the same principle can be used to operate induction motor as a welding transformer. A step down transformer with open circuit voltage of about approximately 60-70v and having negative voltage characteristic can be used for welding work. Hence for this some design modifications can be done stator winding.

C. ACT AS A ROTARY PHASE CONVERTER

The phase converter is usually used because three phase service from the electric utility is not available in all location. Three phase service is generally expensive to install so phase converter is easy to service.

A three phase converter is a device that produces three phase electrical power from a single phase source, thus allowing the operation of three phase equipment at a site that only has single phase electrical service these were static phase converter and they have changed little since that time. Over the years, other technologies have been employed as a phase converter.

A phase converter has a common two types one is static phase converter and another is rotary phase converter.

V. REDESIGN AND DEVELOPMENT

As per our concept we only redesigning the stator winding and rotor is remains as it is.

The concept of project is nothing but the implementation of the split phase starting winding used for single phase winding. The winding are in space quadrature the main winding is supplied with current displaced in time from the current in main winding by as nearly 90 degree as possible. The requisite phase displacement between the current in main, running, starting winding is obtained by connecting suitable capacitance in series with them. With this split phase motor, the starting winding is cut out from the main supply, usually by bell push switch, after the motor has picked up about 75 percent of full load speed.

For this concept we use the squirrel cage induction motor which has a delta winding. The hardware arrangement of the model along with its working will be discussed under this section.

A.Hardware Design and Working

In this proposed model we taken the Induction motor having rating of three phases, 5 HP, 1440 RPM.

Therefore,

No. of pitch = No. of stator slot /No. of poles ± 1

Therefore after each 8 or 10 pitch distance the coil passes towards another slot.

For Three phase Induction motor double layer,single conductor is used. The turn per coil of proposed model is 108.

Thereby obtaining actual turns, Therefore,

Actual turns = No. of turns/2

In Redesigning we have to connect winding in star, Therefore,

Turns/Phase =Actual turns/√3

As the turns are reduce the gauge of wire increases.

Forthree phase Double layer winding is used so, turns per phase being half of that.

Therefore,

Turns/slot = No. of slot * Half of turns/phase.

For single phase,

Total No. of turns = Turns of Three phase winding /3

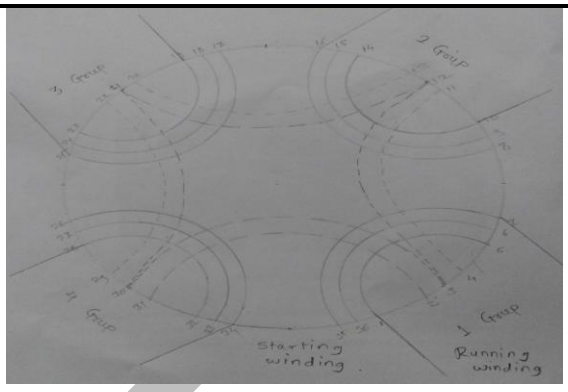

Fig.2. Connection Diagram of both Three Phase and Single Phase Winding

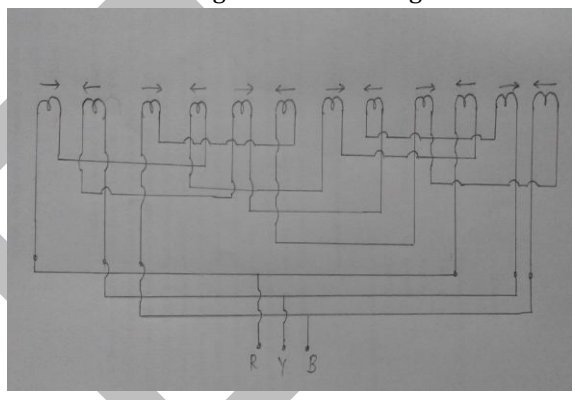

Fig.3. Connection of proposed model

The stator cores there are 36 slots. In each slot winding is divided in three parts on the basis of number of turns. Out of these windings first winding is for the three phase induction motor and second and third winding is made for the single phase induction motor and welding transformer.

In the redesigning gauge of copper wire changes but turns remains same as that of original three phase induction motor.

Winding used for induction motor is generally lap type with a diamond shaped coils is for stator.

The insulation used for winding is class E and class F and insulation paper used is of nomex.

For three phase winding, the conductor is of single layer double conductor and for single phase, double layer single conductor.

The starting and ending ofeach coil of group is brought out which when connected in series,gives out half of input supply. Hence step down of voltage is done and when connected in parallel,gives low voltage with increasing current which is ideal supply used for electrical arc welding.

For single phase operation, capacitor start then it will give doubled input supply. Hence the motor gives step up operation.

We will use the bell push switch for producing starting torque on single phase induction motor.

VI. RESULT

Table I

Sr. No.	Content	Voltage (V)	Current (A)
1.	Three Phase Induction Motor	440	5.5
2.	Single Phase induction motor	234	9
3.	Welding Transformer	51	139

VII. ADVANTAGES

Multifunctional induction motor is more convenient as compared to the normal induction motor.

 Motor requires less space.

 Motor is able to do at time two operations that is motoring and welding.

 One more advantage is that less weight compared to separate combination of welding transformer and induction motor as well. Hence cost require for two machines get reduced.

As per the industrial point of view, it helps to reduce installation cost because multiple operation in same induction motor.

VIII. APPLICATIONS

 The use of the multipurpose motor used in mega workshop.

 This motor is also used for traction.

 Metal cutting workshop.

 It can be used for heavy fabrication industry and steel industry.

IX.CONCLUSION

In our proposed model the one machine performs number of operations. It is economically useful and suitable at places where less space required. So cost of project machine is half to that of total cost of different machine. Therefore cost is 50-60%.

We are getting very useful information about design related to the calculations of induction motor. Hence the use of multifunctional motor result in lots of advantages and convenient to use.

REFERENCES

1) Daut, K. Anayet, M. Irwanto, N. Gomesh, M. Muzhar, M. Asri, Syatirah,"Parameters calculation of 5HP AC Induction Motor" International Conference on Applications and Design in Mechanical Engineering (ICADME).
2) Reference Book, Electrical Engineering Design Manual by M. G. Say, Third Edition, 1962, Page no. 169 to 176.
3) P. C. Sen, Principles of Electrical Machine and Power Electronics, Coiley 1999.
4) Stephen J. Chapman, Electrical Machinery Fundamental, 4/E MC Graw-Hill Induction Motor.

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