

# INDUCTION MOTOR ACTING AS A WELDING TRANSFORMER AND PHASE CONVERTER

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**Abstract** - In this paper, a model is proposed to perform three functions on a single three phase Induction motor. We are going to implement the redesigning of stator of three phase Induction motor in which the rotor remains as it is. In such a way that it can act as a rotary phase converter and welding transformer.

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**Index Terms** - Bell Push Switch, Polyphase Induction motor, Rotary Phase Converter, Rotating Transformer, Welding Transformer.

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## I. INTRODUCTION

Three phase induction motors are the most frequently encountered in Industry. They are simple, rugged and easy to maintain. They run at essentially constant speed from zero to full load. The speed is frequency-dependent and, consequently, these motors are not easily adopted to speed control.

A three phase induction motor has two main parts: a stationary stator and revolving rotor.

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 takes place 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. 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 functions on 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.

## III. MAIN FUNCTIONS

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 action which 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.

#### IV. 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 have taken the Induction motor having rating of three phases, 5 HP, 1440 RPM.  
Therefore,  
No. of pitch = No. of stator slot / No. of poles  $\pm 1$  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/ $\sqrt{3}$   
As the turns are reduce the gauge of wire increases.
- For three 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

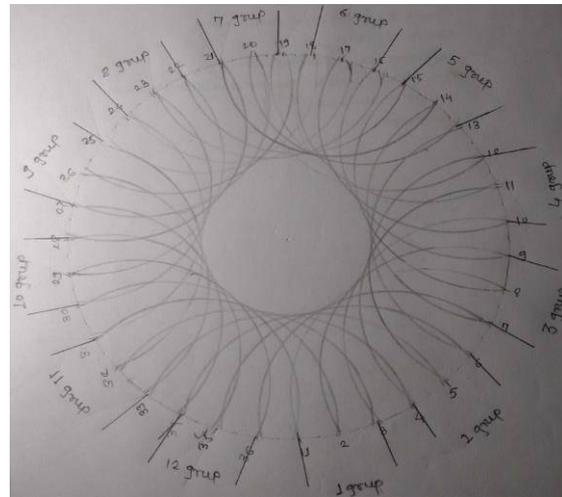


Fig .Connection Diagram of both Three Phase and Single Phase Winding

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.
- 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 of each 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.

#### V. 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.

## VI. 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.

## CONCLUSION

In our proposed model the one machine performs number of its economically useful and suitable at places where less space required. 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.

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