# MULTIPURPOSE INDUCTION MOTOR

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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.**

***Keywords - Poly-phase Induction motor, Rotary Phase Converter, Rotating Transformer, and Welding Transformer.***

## I. INTRODUCTION

Three phase induction motors are the most frequently used in Industry. They are simple, rugged and easy to maintain. An induction motor or asynchronous motor is an AC electric motor in which the electric current in the rotor needed to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding. An induction motor can therefore be made without electrical connections to the rotor. An induction motor's rotor can be either wound type or squirrel-cage type. A three phase induction motor has two main parts: a stationary stator and rotating rotor.

The operation of three phase induction motor is based on 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 or engineering works for their own applications. To meet their requirement they are used separately in the industries which increases the capital and running cost of the industry.

To overcome this difficulty we are going to use our proposed model to operate three Application 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 designed on basis of our model are listed under this section. A general description of respective functions are followed by their working in our model.

A. Act as a Poly-phase Induction Motor The three phase induction motor operates on a induction principle in which 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 Welding transformer is such kind of stepped down transformer which produces a large ampere of current and low voltage in its output side (secondary side). Generally the welding is 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 secondary open circuit voltage of about nearly 60-70V and having negative voltage characteristic can be used for welding work. Hence for this some design modifications can be done in stator winding.

C. Act as a Rotary Phase Converter The phase converter (single phase to three phase) is used because three phase service from the electric utility is not available in all location. Three phase service is generally costly to install so phase converter is easy to service. A three phase converter is an electrical machine that converts power from one poly phase system (including frequency) to another, converting through rotary motion. Typically single phase electric power is used to produce three phase electric power locally to run three phase loads (any industrial machinery with three phase motors) in premises (residential or consumer) where only single phase is available.

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 putting into practice 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 essential 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, after the motor has picked up about 70-80% percent of full load speed the starting winding is disconnected using switch from the main winding.

A. Hardware Design and Working

- For this model we use the squirrel cage induction Motor in which stator winding is connected in delta configuration. The hardware arrangement of the model along with its working will be discussed under this section.
- In this proposed model we have taken the

Induction motor which is manufactured by SEI Company, having rating of three phase 4pole, 5 HP, 1440 RPM, 36 slots squirrel cage Induction motor.
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 windinginstar,Therefore, Turns/Phase =Actual turns/√3 as the turns are reduce ampere per turn increase, hence 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

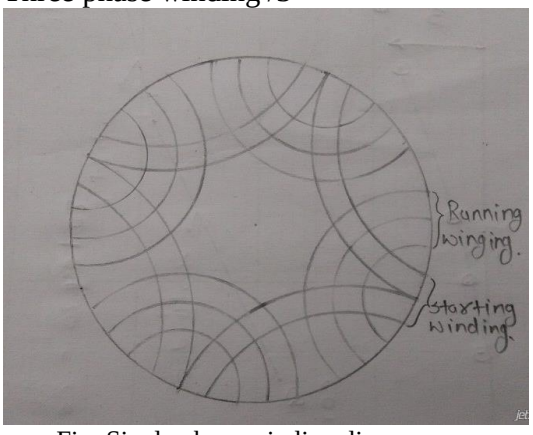


Fig: Single phase winding diagram

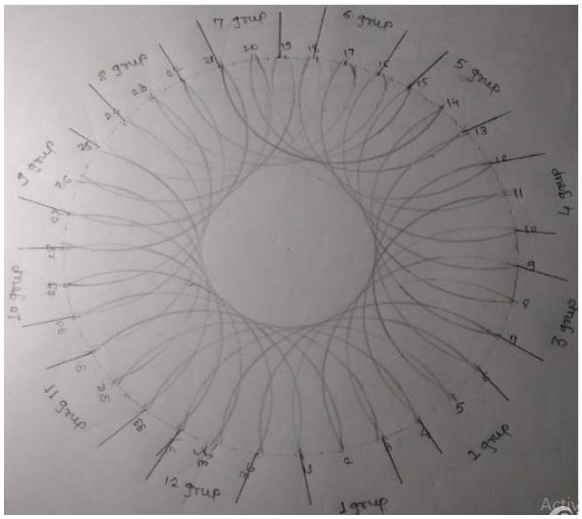

Fig: Complete connection diagram

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. RESULTS

### A. Single Phase Motoring

In this supply is given to single phase winding of the model, as mentioned above the output generated will be three phase(Step up) which will be used for driving three phase load.

On No load

| Input Voltage | Input Current | Speed | Output Voltage | Output Current |
|---|---|---|---|---|
| 230V | 5 Amp. | 1450 rpm | 420V | 0 |

On Load
Load- 1 HP, 1500 RPM, 2Amp. 3 phase Induction Motor

| Input Voltage | Input Current | Speed | Output Voltage | Output Current |
|---|---|---|---|---|
| 230V | 5.5 Amp. | 1450 rpm | 420V | 2 Amp. |

B. Three Phase Motoring
In this three phase winding is acts as a primary and hence supply given to three phase winding and single phase winding acts as a secondary. Secondary output is either single phase (230V) or stepped down voltage.

On No load:

| Input Voltage | Input Current | Speed | Output Voltage | Output Current |
|---|---|---|---|---|
| 440V | 2.5 Amp. | 1500 rpm | 230 V | 0 |

On Load:
Load- 1Phase, Ceiling fan

| Input Voltage | Input Current | Speed | Output Voltage | Output Current |
|---|---|---|---|---|
| 440V | 3 Amp. | 1500 rpm | 220 V | 1 Amp. |

On Load:
Load- Welding

| Input Voltage | Input Current | Speed | Output Voltage | Output Current |
|---|---|---|---|---|
| 440V | 5 Amp. | 1500 rpm | 30 | 95Amp. |

## VI. ADVANTAGES

Multifunctional induction motor is more appropriate 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.
- Three phase Motoring and welding or three phase motoring and any single phase load (fans, lighting, TV etc.) or single phase motoring and three phase load (3 phase machines and any load up to 1 HP) can run simultaneously.
- Can be used where three phase supply is not available.

## VII. CONCLUSION

In our proposed model, one machine performs number of operations, it is economically useful and suitable at places where less space required. Cost of project model is half to that of total cost of different machine. Therefore cost is 50-60% of total cost of different machines required for different applications.

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 benefits and convenient to use.

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