Innovative Journal for Opportunities and Development in Science & Technology,
Volume 2,Issue 1, Jan 2022
Paper Id: – IJ2021V2I1 - 4A-E,
ISSN 2582-6026

REVIEW ON CASE STUDY OF MULTI-FUNCTIONAL INDUCTION MOTOR

[1]Sahil M. Mulani, [2]Nilkhant V. Wagh, [3]Dipak R. Tale, [4]Rohit M. Kshirsagar
[5]Kalim N. Kazi, [6]T. V. Deokar

[1]UG Scholar, Electrical Engineering Department, S.B. Patil College Of Engg., Indapur
[2]UG Scholar, Electrical Engineering Department, S.B. Patil College Of Engg., Indapur
[3]UG Scholar, Electrical Engineering Department, S.B. Patil College Of Engg., Indapur
[4]UG Scholar, Electrical Engineering Department, S.B. Patil College Of Engg., Indapur
[5]UG Scholar, Electrical Engineering Department, S.B. Patil College Of Engg., Indapur
[6]Asst. Prof., Electrical Engineering Department, S.B. Patil College Of Engg., Indapur
[5]kalimkazi@gmail.com

ABSTRACT :- In this paper, a redesigned model is proposed to perform three functions on single three phase Induction motor. We are going to change its original design and redesigning of stator of three phase motor in which the rotor remains unchanged. It will be designed in a such way that it can act as a multi-functional machine for multiple applications

Key Words :- Induction motor, Rotary Phase converter, Welding transformer

1. INTRODUCTION

The induction motor is basically ac motor means they need an alternating voltage as the source for their operation. They can run on both the 1-phase or three phase ac supply, though the 1-phase induction motor is useful only for new applications. In most of the applications the three-phase induction motor are preferred. The transfer of energy from stator to rotor of an induction motor takes place entirely inductively with the help of flux. Hence induction motor is called as 'rotating transformer' with stator forming primary and rotor forming (short –circuited) rotating secondary. As the induction motor is nothing but rotating transformer, this same concept can be used to implement the motor as welding transformer. Welding transformer requires low voltage (50 to 60volts) and high current (upto180A) for joining of two metal parts using electrical arc welding.

1.1 OBJECTIVE

The induction motor is useful in various places including the industrial sector and also in the agricultural area. The induction motor is cheap in cost and used in driving loads only
Generally, for the welding the special Transformer which is only designed for welding purpose. For this special purpose transformer cost is considerably also high. Also, for some applications we require the 3-phase supply for machine but only 1-phase supply is available. Hence to fulfill such requirements it is proposed to make the induction motor multifunctional. With the help of rewinding in Stator of motor it can be used as welding transformer.

The induction motor also works on the 1-phase AC supply with the capacitor The placement of the starting and the running winding of 1-phase operation is in same slot that are used for the three-phase operation in between them the B type insulation that separate there winding. So, in such condition any of them can be used at the time to work. When performing 1-phase operation, the capacitor is used to generate starting excitation, then after acceleration, it can be disconnected by a simple arrangement.
When supply is given to three phases, an emf is induced in winding used for 1-phase operation. The opposite pole connections are put together in parallel to increase the current capacity. Hence step down of voltage is done when connected in parallel, gives (60V approx.) with high current (up to 100A) which is ideal supply used for 'Electric Arc Welding' [2].

II. LIERATURE REVIEW

An Induction motor is an asynchronous AC motor where power is supplied to the rotating device by means of mutual Induction (Electromagnetic induction). The induction motor was invented by Nikola Tesla in 1882 in France but the initial patent was issued in 1888 after Tesla had moved to the United States. The induction motor with a cage was invented by Mikhail Dolivo-Dobrovolsky about a year later in Europe [5]. Now-a-days the most common induction motor is the squirrel cage rotor motor. An electric motor converts one form of energy to another form i.e., Electrical energy to mechanical energy in its rotor (rotating part). There are different ways to supply power to the rotor. In a DC motor this power is supplied to the armature winding directly from a DC source, while in an induction motor this power is induced in the rotating device by mutual induction. An induction motor is also called a rotating transformer because the stator (stationary part) is the primary side of the transformer and the rotor (rotating part) is the secondary side. In industrial drives the induction motors are widely and frequently used especially polyphase induction motor[5]. Induction motors are now the preferred choice for industrial motors
due to their rugged construction, absence of brushes (which are required in most DC motors) and the ability to control the speed of the motor.

Innovative Journal for Opportunities and Development in Science & Technology,
Volume 2,Issue 1, Jan 2022
Paper Id: – IJ2021V2I1 - 4A-E,
ISSN 2582-6026

III. MAIN FUNCTION

This redesigned induction machine has all the advantages of AC induction machines along modifications, in it can be made multi-functional.

A. A three-phase induction motor,
B. A 1-phase induction motor (capacitor arrangement),
C. A rotary phase converter and
D. A welding transformer.

A. A three-phase induction motor:

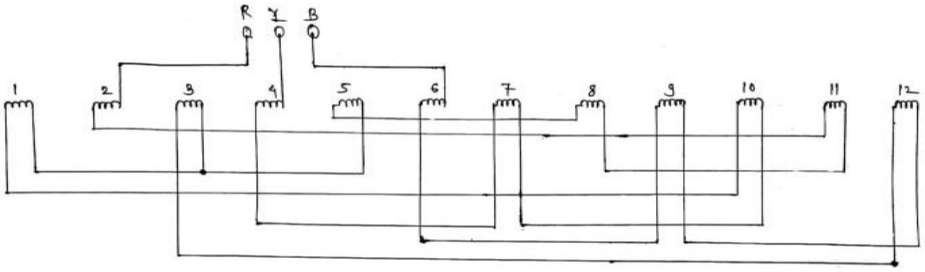

Fig 1. Connection of three phase winding in model.

The proposed induction machine is derived from the standard three-phase induction motor which functions on the principle of rotating magnetic fields. When a three-phase supply is applied to the stator windings separated by phase electrically by 120O in space, a rotating magnetic field is set in the stator winding. This voltage is induced in the rotor to cause motion. Induction machine has three phase winding in the stator and a squirrel cage rotor which makes the machine operate as a three-phase induction motor. The winding is similar to that of a common three phase induction machine.

B)A 1-phase induction motor (capacitor arrangement)

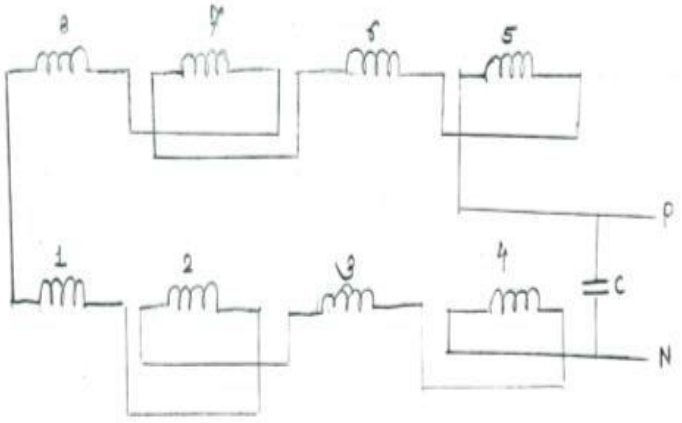

Fig 2. Connection of 1-phase winding in model

Innovative Journal for Opportunities and Development in Science & Technology,
Volume 2,Issue 1, Jan 2022
Paper Id: – IJ2021V2I1 - 4A-E,
ISSN 2582-6026

1) Main winding and
2) A starting winding (auxiliary).

The main winding and auxiliary winding is connected in parallel and is placed physically at 90o to it in stator. A 90o phase difference between the two windings is acquire by connecting the auxiliary winding in series with a capacitor and switch. When the motor is first excited, the starting switch is closed. The capacitor is in series with the auxiliary winding at that position. The capacitor is of such value that the auxiliary circuit is effectually a resistive-capacitive circuit (Xc capavtive reactance). In this circuit the current (I) leads the line voltage(V) by about 45° (Xc about equals R). The main winding has adequate resistance-inductance (Inductive reactance XL) to cause the current to lag the line voltage by about 45° (because XL= R). The current is 90o out of phase hence magnetic field is generated. This results the two windings act like a 2-phase in stator [4].

c) A rotary phase converter

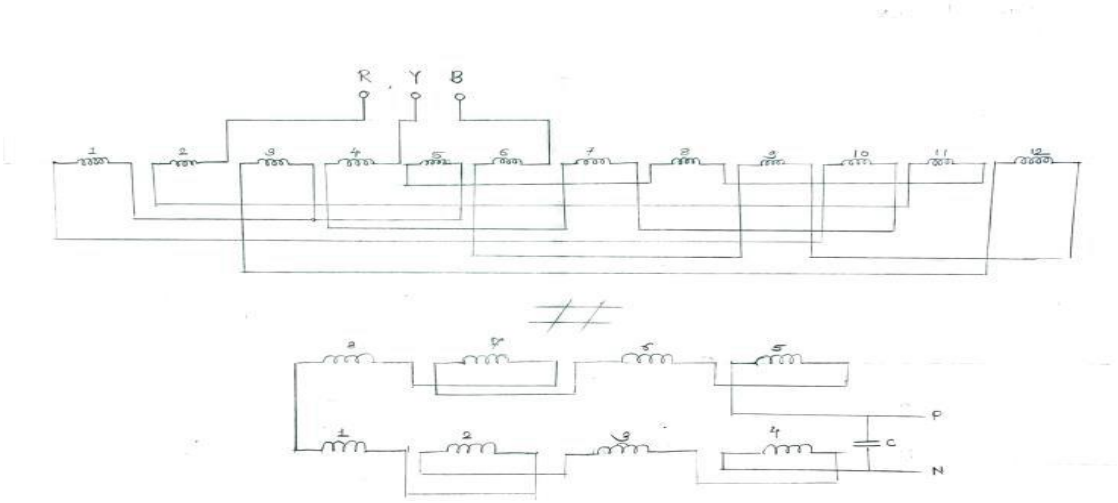

Fig 3.Winding arrangement to work as a phase converter

We cannot operate both 3-phase and 1-phase on that motor if one of the supplies is available as a source of motor. Then phase conversion is able to done from 1-phase to 3-phase and 3-phase to 1-phase and vice-versa [4]. Phase converters are applied where it is difficult to erect a three-phase loading system because of arrangement requirements and cost.

Here the complete 1-phase winding is considered in a circuit plus auxiliary winding which states that the total number of 1-phase windings is equal to the number of three-phase windings, that means primary turns is equal to secondary turns and the transformation ratio is 1.

Innovative Journal for Opportunities and Development in Science & Technology,
Volume 2,Issue 1, Jan 2022
Paper Id: – IJ2021V2I1 - 4A-E,
ISSN 2582-6026

The redesigned induction motor consists of three-phase as well as 1-phase windings in its stator. When the machine is supplied at the stator, EMF also gets induced in 1-phase windings across which a 1-phase voltage occurs [4].

d) A welding transformer.

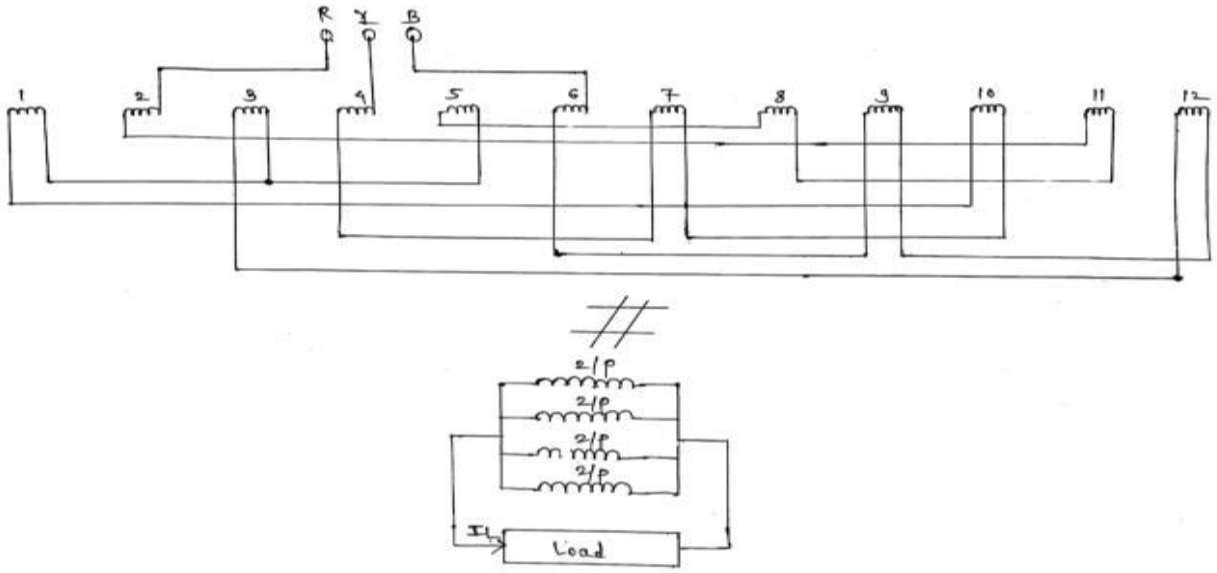

Fig 4.Winding arrangement to work as welding transformer

In welding transformer high current is generated at the secondary side. In the welding transformer operation, the running windings of the 1-phase motor are considered to step down voltage.

For joining two metal parts by electrode which requires low voltage and high current. We know that induction motor is rotating transformer same principle we are going to use to operate an induction motor as a welding transformer. A step-down transformer with open circuit voltage of about approximately 60V-70V and having negative voltage characteristic can be used for welding work. Hence for this some design modifications can be on stator [4].

REFRANCES

[1] Harshada S. Belanke, Snehal M. Kulkarni et al., “Induction motor acting as a welding transformer and phase converter”, International journal of industrial electronics and electrical engineering-Vol.5, May 2017

[2] Mr. Satyawan S. Bahir, Ms. Mrunali K. Dhole et al., “Multifunctional Induction Motor”, International Research Journal of Engineering and Technology (IRJET)Volume: 07 Issue: 06 | June 2020

[3] Nandawadekar Ajit Dattu et al., “Multifunctional Induction Machine”, IEEE International WIE conference on Electrical and Computer engineering,19-21, Dec 2016
[4] Sanjeevikumar Padmanaban, Sonali A. Sabnis,
Lucian Mihet-Popa et al. "Hardware Implementation and a New Adaptation in the Winding Scheme of Standard Three Phase Induction Machine to Utilize for Multifunctional Operation: A New Multifunctional Induction Machine" Multidisciplinary Digital Publishing Institute, Published: 1 November 2017

[5] Mr.M.V. Rao, “Basic Electrical Engineering”, Edition-2006-2007. A book titled "Design of Electrical Machine" by Nirali publication.