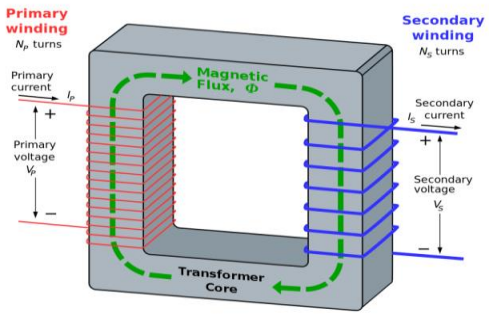
Design, Manufacture and Testing of Energy Efficient 2kVA Single Phase Shell Type Class H Insulated 12/24 – 230V Dry Type Transformer

[1]Sachin K, [2]Chaithra K, [3] Mani R, [4] Shruthi A,
Rafi Ahmed Z
Assistant professor, Dept. of EEE
Don Bosco Institute Of Technology, Bengaluru

***Abstract*- This paper is aimed to carry out detailed study of the design, manufacture and testing of a 2kVA transformer with complete hands-on experience at Technofabs Pvt. Ltd in compliance with their market standards. To make it energy efficient. It is a step up transformer. From input 12/24V we can step up to 230V. In the lines of application it is one of the best transformer.**

I. INTRODUCTION

The transformer is a device that transfers electrical energy from one electrical circuit to another electrical circuit through the medium of magnetic field and without a change in the frequency. The transformer is an electromagnetic energy conversion device, since the energy received by the primary is first converted to magnetic energy and it is then reconverted to useful electrical energy in the other circuit. In transformer, the electrical energy transfer from one circuit to another circuit takes place without the use of moving parts it has therefore, the highest possible efficiency out of all the electrical machines and requires almost negligible amount of maintenance and supervision. The transformer can be used to transfer the electrical energy in either direction, from high voltage to low voltage circuits or from low voltage to high voltage circuits by changing the number of turns of the primary and secondary of the transformer. Therefore it is difficult to design a transformer of required desired rating. Hence we are going through industrial exposure at KAVIKA industries and same analysis is used in implementation and the development of a transformer of smaller rating(less than 2 KVA).



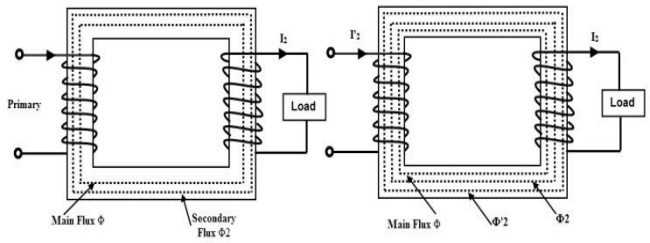
II. OBJECTIVES

Understanding the working principle of transformer.

- Learning the constructional details of a transformer at the industry.
- Implementing the same for the construction of lower rating transformer.
- For decreasing or increasing voltage and current levels from one circuit to another circuit in low and high current circuits.
- For matching the impedance of a source and its load for maximum power transfer in electronic and control circuits.
- For isolating DC while permitting the flow of AC between two circuits.

III. METHODOLOGY

The operation of the transformer is based on the principle of mutual induction between two coils or winding which are linked by a common magnetic flux. When the primary winding is energized with ac source supply, a magnetic flux is established in the primary winding. This flux is linked with both primary and secondary windings because the core provides a low reluctance path for the magnetic flux. Hence, most of the flux produced by the primary winding links with the secondary winding. This is called as main flux or useful flux. And also, the flux which does not link with the secondary winding is called as leakage flux. Most of the transformers are designed to have low leakage flux to reduce the losses.



According to the Faraday's laws of electromagnetic induction, this flux linkage with both primary and secondary windings induces EMFs in them. This EMF induced in each winding is proportional to the number of turns in it. The voltage or EMF induced in the primary winding is called as back EMF which opposes the input supply voltage to the extent that no primary current would flow. But small magnetizing current flows through the primary of the transformer. The EMF induced in the secondary winding is the open circuit voltage. If the secondary circuit is closed or the load is connected, secondary current starts flowing through it which causes to create demagnetizing magnetic flux. Due to this demagnetizing flux, the unbalance is created between the applied voltage and back EMF. To restore the balance between these two, more current is drawn from the supply source so that equivalent magnetic field is created to balance with secondary field.

I. SPECIFICATIONS

Type of transformer: Single phase, shell type step up transformer, dry type. **Frequency**: 50Hz **KVA rating**: 2KVA
VOLTAGE ratings: Primary side: 0-24V Secondary side:0-230V
CURRENT ratings:

Sl.No	Proposed System	Existing System
01	Losses are reduced	Losses are more
02	Efficiency is high	Efficiency is less compared to the proposed system
03	Insulation lamination are coated(3% space is occupied)	Insulation on lamination are varnished(10% space is occupied)
04	Lamination thickness is reduced to 0.3mm	Lamination thickness of 0.5mm
05	There system have a small gap for clearance i.e. 2.5mm on each side.	This system have a large gap for clearance i.e. 10mm winding to yoke.
06	It has a life span of 40 years .	It has a life span of 25 years.

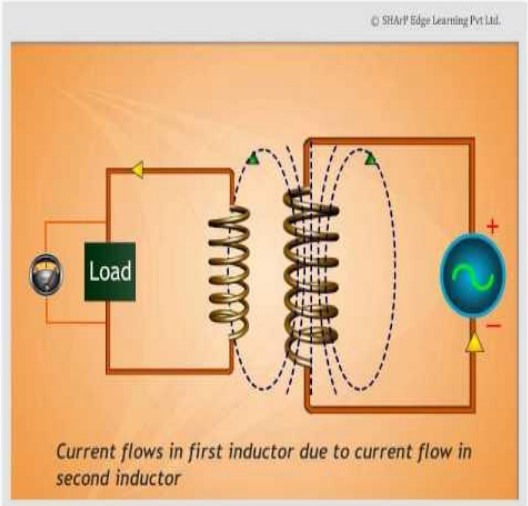
Primary side: 85A Secondary side:9A
Type of COOLING: AIR COOLED(NATURALLY)

KVA RATING	%EFFICIENCY
1-5	95%
5-20	96%
20-100	97%
100-10000	98%
10000 ABOVE	99%

Type of INSULATION: CLASS H
Withstand temperature: upto**150**degree Celsius

II. PRINCIPLE

- A Transformer works on the principle of mutual induction. According to this principle, when the magnetic flux linking with one coil changes, an EMF is induced in the other coil.
- The figure below shows the MUTUAL INDUCTANCE Process.



III. APPLICATIONS

- Used in BATTERY CHARGING.
- Used in electronics equipment's.
- Used in uninterruptable power supply.
- Used for home appliances.

IV. MATERIALS USED

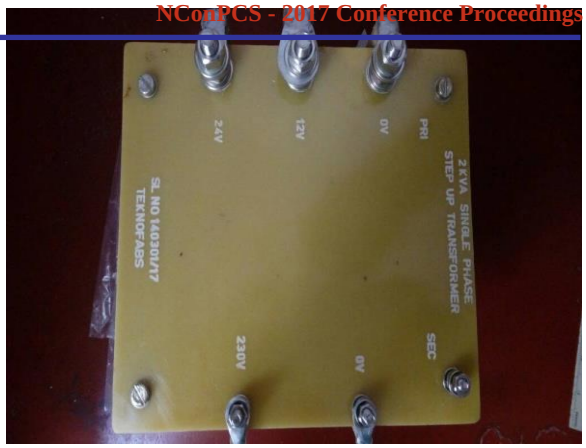
Bobbin, Copper (For Windings)
Insulating Materials, Fibre Glass Tape, Polyester Film, Millex Paper, Core Lamination, E And I Shape, Terminal Sleave Shied (For Earthing), Clamps, Bolt, Collar Bush, Terminal Leg Rating Plate

I. FUTURE SCOPE

By adopting the proposed changes the losses can be reduced significantly to boost the efficiency. The maximum achievable efficiency in the transformers of various ranges is given below.

II. COMPARISION BETWEEN PROPOSED SYSTEM AND EXISTING SYSTEM.

I. PROPOSED MODEL PICTURES



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- 2.http://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&ved=0ahUKEwjiy4XWyLLRAhVJp48KHZjFB-4QFggvMAM&url=http%3A%2F%2Fwww.ymcaust.ac.in%2Felectrical%2Fimages%2Ftransformer_design.pdf&usg=AFQjCNEhtlozfsrep67-s4ioGDZRE4e.