EXPERIMENT 3

THREE PHASE TRANSFORMERS

EQUIPMENT:

* 3 Phase Transformer
* Three Phase AC Variable Supply
* AC Voltmeter
* Connecting Wires

INTRODUCTION:

A **three**-**phase transformer** is made of **three** sets of primary and secondary windings, each set wound around one leg of an iron core assembly. Essentially it looks like **three** single-**phase transformers** sharing a joined core as in Figure below. **Three phase transformer** core has **three** sets of windings.



**CONSTRUCTION:**

A three-phase transformer of a single unit is used widely because it is lighter, cheaper and occupies less space than the bank of three single-phase transformers. The three-phase transformer construction is of two types: Core type and Shell type.

TYPES:

The primary and secondary windings of a **transformer** can be connected in **different** configuration as shown to meet practically any requirement. In the case of **three phase transformer** windings, **three forms** of connection are possible: “star” (wye), “delta” (mesh) and “interconnected-star” (zig-zag).

APPLICATION:

**Three phase** power is **used by** electric power distribution grids and to power large motors and other large loads. Like other types of transformers, **three phase** transformers are **used to** increase or decrease the voltage from one side of the **transformer** to the other.

OBJECTIVE:

* To connect transformers in Δ and Υ configurations.
* Identify **three**-**phase transformers**.
* Determine the lead identification of **three**-**phase transformers**.
* Explain the efficiencies involved.
* Determine the benefits and the detriments of three-phase transformers.

APPLICATION:

* Three-phase transformers are used for power generation and electrical distribution network applications.
* They can be found in high power industrial loads such as rectifiers, motor drives, and other equipment.
* **Three Phase transformers** are widely used as Power **transformers**, Distribution **transformers** and in Electrical Grids.
* It can increase or decrease the value of capacitor, an inductor or resistance in an AC circuit. It can thus act as an impedance transferring device.
* It can be used to prevent DC from passing from one circuit to the other.
* It can isolate two circuits electrically.

PROCEDURE:

Part I

* The circuit shown in Figure 3.3 has three transformers connected in a delta- delta configuration.



Delta – Delta (Δ- Δ) b) Record the values in Table – I. For Δ-connection, VL= V

Input Voltage =70V

TABLE – I (Primary and Secondary side Phase and Line Voltages for Δ – Δ configuration)

|  |  |  |
| --- | --- | --- |
|  | PRIMARY | SECONDARY |
| VØ(Measured) | 123.8 | 52.0 |
| VL(Measured) | 123.8 | 52.0 |
| VØ(Calculated) | 121.1 | 47.7 |
| VL(Calculated) | 121.1 | 47.7 |

Part II a) the circuit shown in Figure 3.4 has three transformers connected in a delta wye configuration.



|  |  |  |
| --- | --- | --- |
|  | PRIMARY | SECONDARY |
| VØ(Measured) | 70.0 | 27.4 |
| VL(Measured) | 70.0 | 47.8 |
| VØ(Calculated) | 70.0 | 27.5 |
| VL(Calculated) | 70.0 | 47.7 |

Part III a) the circuit shown in Figure 3.5 has three transformers connected in a wye delta configuration.



|  |  |  |
| --- | --- | --- |
|  | PRIMARY | SECONDARY |
| VØ(Measured) | 40.6 | 27.50 |
| VL(Measured) | 70.2 | 27.49 |
| VØ(Calculated) | 40.3 | 27.57 |
| VL(Calculated) | 70.0 | 27.57 |

Part IV a) the circuit shown in Figure 3.6 has three transformers connected in a wye – wye configuration.



|  |  |  |
| --- | --- | --- |
|  | PRIMARY | SECONDARY |
| VØ(Measured) | 40.10 | 15.3 |
| VL(Measured) | 70.83 | 27.49 |
| VØ(Calculated) | 40.3 | 15.8 |
| VL(Calculated) | 70 | 27.5 |

ISSUE:

I faced issue in calculating measured values.

CONCLUSION:

To summarize this experiment, all of the objectives have been achieved. We gain so many knowledge about three phase circuit. First of all, we manage to determine the phase sequence of three-phase supply. Next, we manage to identify the waveform and determine the relationship between line and phase voltages as well as current for star and delta connected load.

POST LAB QUESTIONS

* Which type of transformer connections are used at the distribution side?

Delta-star connected **transformers** are widely **used** in low power **distribution** with the primary windings providing a three-wire balanced load to the utility company while the secondary windings provide the required 4th-wire neutral or earth **connection**.

2. Write the type of transformer used in lab with respect to cooling?

Transformers can be divided in two types as

* dry type transformers and
* Oil immersed transformers.

Different **cooling methods of transformers** are -

* For dry type transformers
* Air Natural (AN)
* Air Blast
* For oil immersed transformers
* Oil Natural Air Natural (ONAN)
* Oil Natural Air Forced (ONAF)
* Oil Forced Air Forced (OFAF)
* Oil Forced Water Forced  (OFWF)