INTERNSHIP REPORT

FIELD STUDY ON SUBSTATION AND BBT SYSTEM

A field study submitted to the Department of EEE, Faculty of Engineering, DIU in partial fulfillment of the requirements for the Award of Degree of Bachelor of Science in Electrical and Electronic Engineering.

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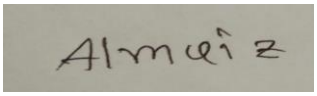
APPROVAL

A field study about "500KVA sub-station and BBT" observance conducted by Md.Almuiz, ID: 153-33-3036, 19th Batch, B.sc in EEE program of Daffodil International University, under my supervision. This work has been carried out by them in the Home in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering was presented to the audience of the Exam Committee on January 2019 and has been accepted as satisfactory.

Signature of the Candidate



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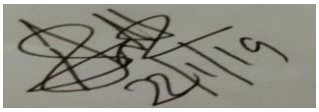

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ACKNOWLEDGEMENT

First of all, we give thanks to Allah. We would like to take this opportunity to express my appreciation and gratitude to project supervisor Md. DaraAbdusSatter, Assistant Professor & Associate Head, Department of EEE, Faculty of Engineering, Daffodil International University, for being dedicated in supporting, motivating and guiding me through this internship. This internship can't be done without his useful advice and helps. Also thank you very much for giving us opportunity to field study.

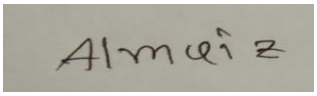
Also I want to convey thankfulness to Mohammad Rafat , Lecturer, Department of Electrical and Electronic Engineering, Faculty of Engineering, Daffodil International University, for his help, support and constant encouragement. Apart from that, we would like to thank our entire friends for sharing knowledge information.

To my beloved family, we want to give them our deepest love and gratitude for being very supportive and also for their inspiration and encouragement during our studies in this University.

CERTIFICATION

This to certify that this internship "500KVA sub-station and BBT system" is done by the following students under my direct supervision and this work has been carried out by them in the department of Electrical and Electronic Engineering under the faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of bachelor of science in Electrical and Electronic Engineering. The presentation of the work held on.

Signature of the candidate



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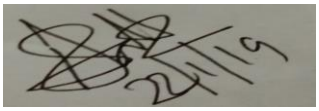

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DEDICATED TO

To my Family and my Friends

ABSTRACT

Soundly, electrical power substations have utilized static and electromechanical gadgets for power framework insurance, supervisory control and metering. Every gadget freely gains and procedures the power framework information from relating instrumentation transformers, circuit breakers, detaches, tap changers, and so on. This methodology has two impediments. First is the expense related with every gadget getting power framework flags freely that incorporates loads of copper wire cost and work cost for these wiring. Furthermore, every gadget has just the neighborhood data from relating associations. Present day microchip based handling innovation and fiber optic based correspondence innovation has given a chance to gain and process electrical power framework data in exceptionally viable ways. Along these lines microchip based innovation has opened up the new time of coordinated substation assurance and control. The focal points and difficulties of coordinated substation are tended to in this report. Further, the contextual investigation on Hydro-one encounters with incorporated substation capacities is likewise portrayed. Progression in current practices for substation assurance and control joining is clarified. At long last, the highlights of IEC 61850 based substation work combination are outlined and it has been demonstrated that these highlights upgrade the mix in substation assurance and control.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

Electrical transformer is a static electrical machine which changes electrical power starting with one circuit then onto the next circuit, without changing the recurrence. Transformer can increment or decline the voltage with relating reduction or increment in current. Electrical substation for circulation framework is the principle supply to change over the high voltage to low voltage and where stack are dispersed to the customers. Voltage framework for the electrical framework to supply for household buyer and mechanical purchaser.Industrial facility which will provide straightforwardly from Transmission Main Intakes, Main Distribution Sub station. Substation is where every single electrical hardware, high voltage exchanging, three stage transformer, high voltage links, low voltage links, low voltage feeder column, battery charging and so forth which are utilized for electrical providing in power framework and to ensure the security of the framework by the insurance conspire. Fundamentally, electrical framework have one or a few approaching and active circuit which are controlled by high voltage exchanging and meet in at least one in the equivalent of bus-bar framework. By and large, electrical substation is a point in appropriation framework where: A place where a few electrical types of gear are introduced and utilized for electrical vitality in power framework. A place where the security of the framework is gives via naturally protection conspire. A place where one or a few approaching and active circuit are met at least one bus-bar framework and controlled by high voltage exchanging hardware which is utilized for exchanging. A place where stack are circulated, controlled and secured.

1.2 Objectives

The fundamental target of field considers is learn and think about field contemplate with physically information. This incorporate concentrate the 500KVA sub-station and BBT framework for used to another task

1. How think about establishment a sub-station.

2. To gauge stack limit and supply.

3. Structure a straightforward circuit and locate reasonable equipment for this part.

1.3 Destination of Work

The fundamental guideline behind working of a transformer is the wonder of shared enlistment between two windings connected by normal attractive transition. The figure at right demonstrates the most straightforward type of a transformer. Fundamentally a transformer comprises of two inductive loops; essential winding and auxiliary winding. The loops are electrically isolated however attractively connected to one another. At the point when, essential winding is associated with a wellspring of exchanging voltage, substituting attractive transition is delivered around the winding. The center gives attractive way to the transition, to get connected with the auxiliary winding. The majority of the motion gets connected with the optional winding which is called as 'valuable transition' or primary 'motion', and the motion which does not get connected with auxiliary winding is called as 'spillage motion'. As the transition delivered is substituting (its bearing is persistently changing), EMF gets prompted in the auxiliary twisting as per Faraday's law of electromagnetic acceptance. This emf is called 'commonly actuated emf', and the recurrence of commonly incited emf is same as that of provided emf. On the off chance that the optional winding is shut circuit, commonly prompted flow courses through it, and subsequently the electrical vitality is exchanged from one circuit to another circuit.

1.4 Methodology

A probabilistic technique is displayed, considered to help the electric framework arranging engineers in the determination of the dispersion substation areas, considering the hourly load

changes or the everyday stack cycle. The hourly load focuses, for every one of the diverse hourly load situations, are determined deterministically. These area focuses, appropriately weighted by their journalist stack greatness, are utilized to figure the best fit likelihood dispersion. This dispersion is utilized to decide the most extreme probability border of the territory where the substation ought to ideally be situated by the arranging engineers, considering, for instance, the accessibility and the expense of the land parcels, which are components of uncommon significance in urban territories, and different hindrances that might be available in the last determination of the substation site. Results are introduced and talked about for the use of the philosophy to a genuine case, accepting three diverse bivariate likelihood circulations: the Gaussian dispersion, a bivariate form of Freund's exponential dissemination, and the Weibulllikelihood conveyance.

1.5 Field study Outline

It gives the whole scope of administrations, advances, and parts that are required for the effective development and activity of a high-voltage substation of any sort. It is dependent upon you to choose from a far reaching scope of accessible administrations:

- Concept, arranging, designing
- Project execution including venture the board and assembling of every key part
- Commissioning
- Operation
- Maintenance, restorations, overhauls, destroying of old gear
- Financing

CHAPTER 2

THEORY

2.1.0 Type of transformers

Transformers generally have one of two types of cores:

- Core type
- Shell type

2.1.1 Core type transformer:

For the most part, the name related with the development of a transformer is dependent upon how the essential and auxiliary windings are twisted around the focal overlaid steel center. The two most normal and essential plans of transformer development are the Closed-center Transformer and the Shell-center Transformer.

In the "shut center" type transformer, the essential and optional windings are twisted outside and encompass the center ring. In the "shell type "transformer, the essential and auxiliary windings go inside the steel attractive circuit (center) which frames a shell around the windings as appeared as follows.

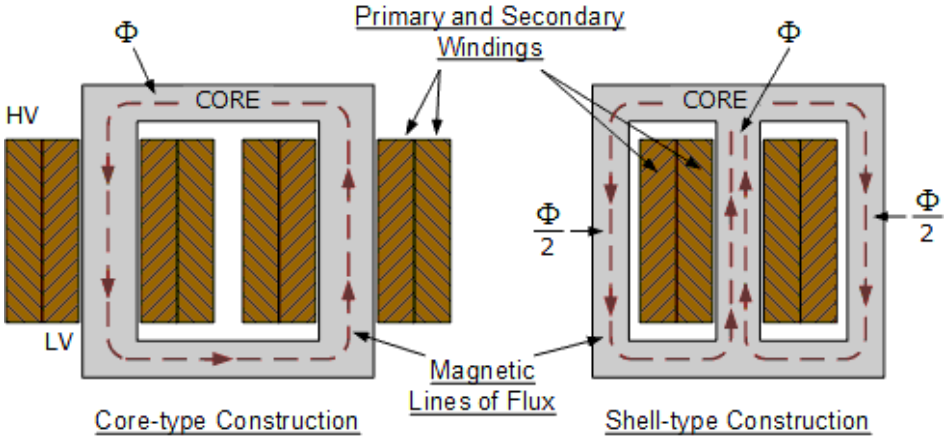


Figure 2.1 core type transformer Figure 2.2: shell type

In the two sorts of transformer center structure, the attractive transition connecting the essential and auxiliary windings ventures altogether inside the center with no loss of attractive motion through air. In the center kind transformer development, one portion of each winding is folded over every leg (or appendage) of the transformers attractive circuit as appeared.

The curls are not masterminded with the essential twisting on one leg and the auxiliary on the other yet rather 50% of the essential winding and half of the optional winding are put one over the other concentrically on every leg so as to increment attractive coupling permitting for all

intents and purposes the majority of the attractive lines of power experience both the essential and optional winding in the meantime. Be that as it may, with this sort of transformer development, a little level of the attractive lines of power stream outside of the center, and this is designated "spillage transition".

Shell type transformer centers beat this spillage transition as both the essential and auxiliary windings are twisted on a similar focus leg or appendage which has double the cross-sectional territory of the two external appendages. The preferred standpoint here is that the attractive motion has two shut attractive ways to stream around outside to the loops on both left and right hand sides before returning back to the focal curls.

This implies the attractive motion coursing around the external appendages of this kind of transformer development is equivalent to Φ/2. As the attractive motion has a shut way around the curls, this has the upside of diminishing center misfortunes and expanding by and large proficiency.

2.1.2 Shell Type Transformer

The coils are former wound and mounted in layers stacked with insulation between them. A shell type transformer may have simple rectangular form (as shown in above fig), or it may have a pose:

i) Step up transformer: Voltage increases (with subsequent decrease in current) at secondary.
ii) Step down transformer: Voltage decreases (with subsequent increase in current) at secondary.

A) On the basis type of supply:

i) Single phase transformer
ii) Three phase transformer

B) On the basis of their use:

i) Power transformer: Used in transmission network, high rating
ii) Distribution transformer: Used in distribution network, comparatively lower rating than that of power transformers.

C) Instrument transformer:

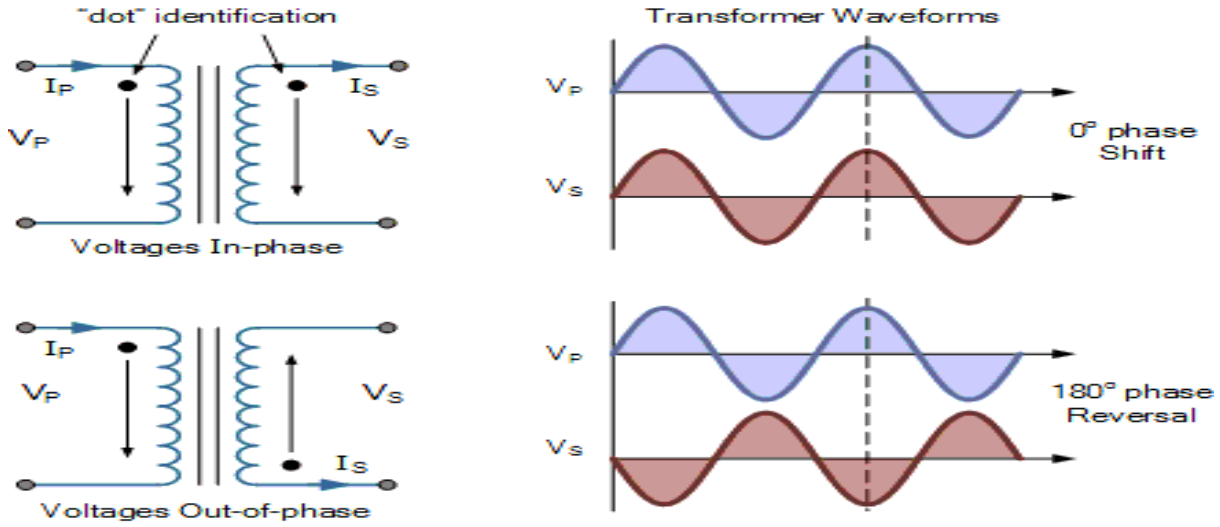
Used in relay and protection purpose in different instruments in industries

- Current transformer (CT)
- Potential transformer (PT)

D) On the basis of cooling employed

- Oil-filled self cooled type
- Oil-filled water cooled type
- Air blast type (air cooled)

2.1.3 Transformer Construction using Dot Orientation



2.1.4 Transformer Primary Tap Changes

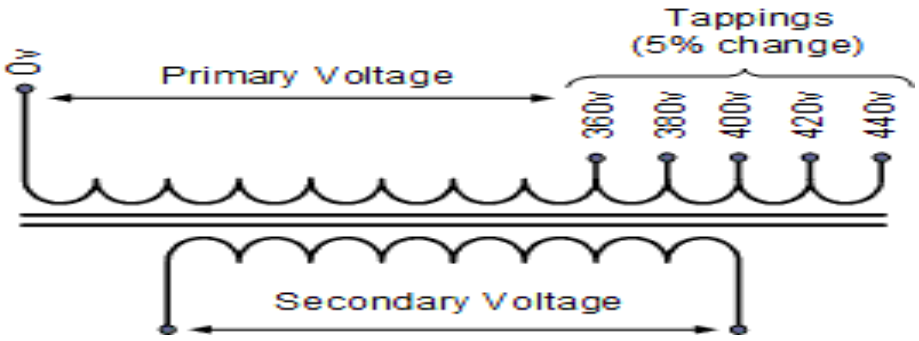


Fig 2.4: tap change

In this basic precedent, the essential tap changes are determined for a supply voltage change of ±5%, however any esteem can be picked. A few transformers may have at least two essential or at least two auxiliary windings for use in various applications giving diverse voltages from a solitary center.

2.1.5 Transformer Core Losses

The capacity of iron or steel to convey attractive motion is a lot more noteworthy than it is in air, and this capacity to enable attractive motion to stream is called porous. This implies a steel covered center can convey an attractive motion multiple times superior to that of air. In any case, when an attractive motion streams in a transformers steel center, two sorts of misfortunes happen in the steel. One named "vortex current misfortunes" and the other named "hysteresis misfortunes".

2.1.6 Hysteresis Losses

Transformer Hysteresis Losses are caused in light of the erosion of the atoms against the stream of the attractive lines of power required to polarize the center, which are always altering in esteem and course first one way and after that the other because of the impact of the sinusoidal supply voltage.

Additionally, transformers are intended to work at a specific supply recurrence. Bringing down the recurrence of the supply will result in expanded hysteresis and higher temperature in the iron center. So diminishing the supply recurrence from 60 Hertz to 50 Hertz will raise the measure of hysteresis present, diminished the VA limit of the transformer.

2.1.7 Eddy Current Losses

Transformer Eddy Current Losses then again are caused by the stream of circling ebbs and flows prompted into the steel caused by the stream of the attractive transition around the center. These coursing flows are created in light of the fact that to the attractive transition the center is acting like a solitary circle of wire. Since the iron center is a decent conductor, the swirl flows instigated by a strong iron center will be expansive.

2.1.8 Copper Losses

In any case, there is likewise another kind of vitality misfortune related with transformers called "copper misfortunes". Transformer Copper Losses are for the most part because of the electrical opposition of the essential and optional windings. Most transformer loops are produced using copper wire which has opposition in Ohms. This opposition restricts the charging flows coursing through them.

At the point when a heap is associated with the transformers optional twisting, extensive electrical flows stream in both the essential and the auxiliary windings, electrical vitality and power misfortunes happen as warmth. For the most part copper misfortunes fluctuate with the heap current, being just about zero at no-heap, and at a greatest at full-stack when current stream is at most extreme.

A transformers VA rating can be expanded by better plan and transformer development to lessen these center and copper misfortunes. Transformers with high voltage and current evaluations need conveyors of substantial cross-segment to support limit their copper misfortunes. Expanding the rate of warmth dissemination (better cooling) by constrained air or oil, or by enhancing the transformers protection so it will withstand higher temperatures can likewise build a transformers VA rating**.**

CHAPTER 3: LITERATURE REVEWS

3.1.0 These are the basic components of a transformer.

- Laminated core.
- Windings.
- Insulating materials.
- Transformer oil.
- Tap changer.
- Oil Conservator.
- Breather.
- Cooling tubes

kVA stands for **Kilovolt-Ampere** and is the **rating** normally used to rate a **transformer**. The size of a **transformer** is determined by the **kVA** of the load. ... The Current that passes through **transformer** windings will determine the Copper Losses, whereas Iron Losses, Core Losses or Insulation Losses depends on voltage. Copper losses (I^2R) depends on current which passing through **transformer** winding while Iron losses or core losses or Insulation losses depends on Voltage. That's why the **transformer rating** may be expressed in VA or **kVA**, not in W or kW.

What is a three phase transformer?
Three Phase Transformer Star and Delta Configurations. But what do we mean by "star" (also known as Wye) and "delta" (also known as Mesh) when dealing with **three-phase transformer** connections. A **three phase transformer** has **three** sets of primary and secondary windings.

3.1.1 Technical Specification of 11/0.415 KV ,500 KVA Distribution Transformer

Serial	Technical Specification	Requirement of BTCL	Technical Data
1	Rated Capacity (KVA)	500	500
2	Rated Frequency (Hz)	50	50
3	Rated Voltage (Primary), V	11000	11000

4	Rated Voltage (Secondary), V	415	415
5	Core	Japan	South Korea
6	Insulation Materials	South Korea	South Korea
7	Manufactured by	RPTL	RPTL
8	Accessories	Silica gel Breather Thermometer Buchloz Relay	Silica gel Breather Thermometer Buchloz Relay
9	Winding	Super enameled copper wire	Super enameled copper wire
10	No. of Phase	three	three
11	Cooling System	Oil Naturally Air Cooled	ONAN
12	No. of HT Bushing	Three Nos.	Three Nos.
13	No. of LT Bushing	Four Nos.	Four Nos.
14	Bushing Position	Tank Top	Tank Top
15	Accessories	Conservation oil level indicator drain and filling valves lifting lungs bi-directional rollers with first fitting of oil in Transformer	Conservation oil level indicator drain and filling valves lifting lungs bi-directional rollers with first fitting of oil in Transformer

There are different ways of cooling transformer in order to protect from thermal degradation.

1) ONAN-Oil natural air natural
2) ONAF- Oil natural air forces
3) OFWF- Oil forced water forced
4) ODAF-Oil directed air forced
5) ODWF- Oil directed water forced

3.1.2 Cooling System of Transformer

This is the simplest **transformer cooling system**. The full form of ONAN is "Oil Natural Air Natural". Here natural convectional flow of hot oil is utilized for cooling. In convectional circulation of oil. This hot oil which comes to upper side, will dissipate heat in the atmosphere by natural conduction, convection & radiation in air and will become cold. In this way the oil in the transformer tank continually circulate when the transformer put into load. As the rate of dissipation of heat in air depends upon dissipating surface of the oil tank, it is essential to increase the effective surface area of the tank. So additional dissipating surface in the form of tubes or radiators connected to the transformer tank. This is known as radiator of transformer or radiator bank of transformer.

ONAF- Oil natural air forces

The full form of **ONAF** is "Oil Natural Air Forced". As the heat dissipation rate is faster and more in ONAF transformer cooling method than ONAN cooling system, electrical power transformer can be put into more load without crossing the permissible temperature limits

OFWF- Oil forced water forced

In this method, the oil is cooled in the cooling plant using air blast produced by the fans. These fans need not be used all the time. During low loads, fans are turned off. Hence the system will be similar to that of Oil Natural Air natural (ONAN). At higher loads, the pumps and fans are switched on, and the system changes to Oil Forced Air Forced (OFAF). This method increases the system efficiency. This is a flexible method of cooling in which up to 50% of rating ONAN can be used, and OFAF can be used for higher loads. This method is used in transformers having ratings above 30MVA.

ODAF-Oil directed air forced

ODAF or Oil Directed Air Forced Cooling of Transformer can be considered as the improved version of OFAF. Here forced circulation of oil directed to flow through predetermined paths in transformer winding. pre-decided oil flowing paths between insulated conductor are provided for ensuring faster rate of heat transfer.

3.1.3 Tap changer

Above demonstrates a normal focus tap transformer. The tapping point is in the correct focus of the optional winding giving a typical association with two equivalent however inverse auxiliary voltages. With the inside tap grounded, the yield VA will be sure in nature regarding the ground, while the voltage at the other auxiliary, VB will be negative and inverse in nature, that is they are 180o electrical degrees out-of-stage with one another

CHAPTER 4: RESULTS AND DISCUSSION

4.1.0 Loading Transformer

Transformer provide a voltage on secondary winding to transfer power between their I/O they require to load.

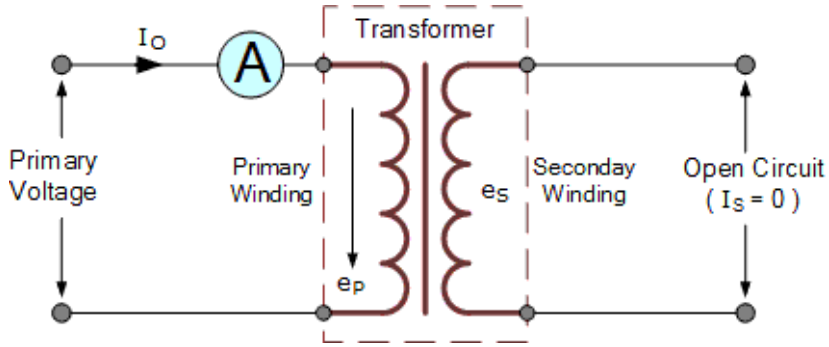


Fig 2.5: transformer basic circuit diagram

In the past transformer instructional exercises, I expected this transformer is perfect, that is one in which are no center misfortunes in the transformer winding. In genuine transformers there will be misfortunes related with the transformers stacking "on-stack". Well initially how about we see the end result for a transformer when it is in this "no-heap" condition, that is with no electrical load associated its secondary winding no optional flow streaming.

When its auxiliary side winding is open circuited, at the end of the day, nothing is joined and the transformer stacking is zero. At the point when an AC sinusoidal supply is associated with the essential twisting of a transformer, a little current, IOPEN will move through the essential curl twisting because of the nearness of the essential supply voltage.

With the auxiliary circuit open, not all that much, back emf alongside essential winding opposition to restrain stream of this essential power. The ammeter above will show a little current coursing through the essential twisting despite the fact that the optional circuit is open circuited. This no-heap essential current is comprised of the accompanying two parts:

- An in-stage current, IE which supplies the center misfortunes (vortex current and hysteresis).
- A little current, IM at 90o to the voltage which sets up the attractive transition.

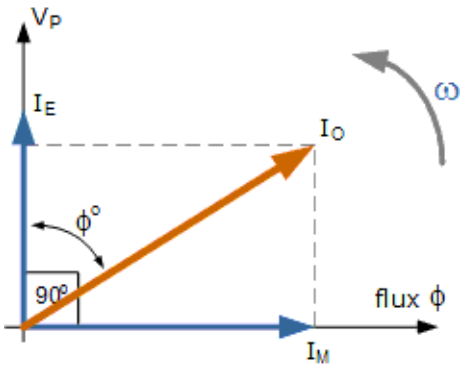


Figure: vector diagram

Note this no-heap essential current, Io is little contrasted with the transformers ordinary full-stack current. Additionally because of the iron misfortunes present in the center and a little measure of copper misfortunes in the essential winding, Io does not fall behind the supply voltage, Vp by precisely 90o, (cosφ = 0), there will be some little stage edge distinction.

4.1.1 Transformer loading example :

A solitary stage transformer has a vitality part, IE 2 Ampere and a polarizing segment, IM of 5 Ampere. Ascertain no-heap current and coming about power factor.

$$I_O = \sqrt{I_M^2 + I_E^2}$$

$$I_O = \sqrt{5^2 + 2^2}$$

$$I_O = 5.4 Amps$$

$$I_M = I_O \sin\phi$$

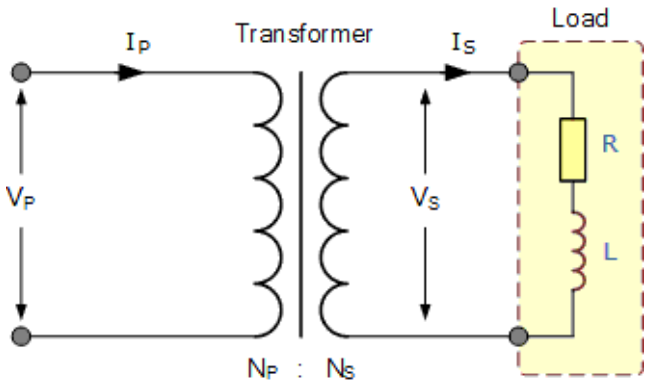
$$\sin\phi = \frac{I_M}{I_O} = \frac{5}{5.4} = 0.9259$$

$$\therefore \sin^{-1}\phi = 67.8^\circ$$

4.1.2 Transformer “On-load”

At the point electrical load is associated with the optional twisting of a transformer stacking is along these lines more noteworthy than zero of a flow streams in the auxiliary twisting to the heap. This optional current is because of the actuated auxiliary voltage, set up by the attractive motion made in the center from the essential power.

This joined attractive field diminishes EMF essential winding. Essential power keeps on expanding the centers attractive at its unique quality a transformer to work accurately. And reasonable condition should dependably exist between the require and extra attractive fields. Consider the circuit underneath.



We realize that the turns proportion of a transformer expresses that the aggregate prompted voltage in each winding is relative to the quantity of turns in that winding and furthermore that the power yield and power contribution of a transformer is equivalent to the volts times amperes, (V x I). In this manner

$$\text{Power}_{Prim} = \text{Power}_{Sec}$$

$$V_P \times I_P = V_S \times I_S$$

$$\text{then } \frac{V_P \times I_P}{V_S} = I_S$$

$$\therefore \frac{V_P}{V_S} = \frac{I_S}{I_P}$$

Be that as it may, we likewise know already that the voltage proportion of a transformer is equivalent to the turns proportion of a transformer as: "voltage proportion = turns proportion". At that point the connection between the voltage, current and number of turns in a transformer can be connected together and is in this way given as:

4.1.3 Transformer Ratio:

$$n = \frac{N_P}{N_S} = \frac{V_P}{V_S} = \frac{I_S}{I_P}$$

- Where:
- $N_P/N_S = V_P/V_S$ - represents the voltage ratio
- $N_P/N_S = I_S/I_P$ - represents the current ratio

The current oppositely relating to voltage and unit of turns. Infers with a transformer stacking on the discretionary turning in order to keep up a good power level over transformers windings, if the voltage is wandered up, the current must be wandered down and the a different way. Figuratively speaking, "higher voltage-cut down current

As a transformers extent is the associations between the amount of turns in the fundamental and discretionary, the voltage over each winding, and the current through the windings, we can enhance the above transformer extent condition to find the estimation.

$$V_P = \frac{V_S N_P}{N_S} = \frac{V_S I_S}{I_P}, \qquad V_S = \frac{V_P N_S}{N_P} = \frac{V_P I_P}{I_S}$$

$$N_P = \frac{V_P N_S}{N_P} = \frac{N_S I_S}{I_P}, \qquad N_S = \frac{V_S N_P}{V_P} = \frac{N_P I_P}{I_S}$$

$$I_P = \frac{V_S I_S}{V_P} = \frac{N_S I_S}{N_P}, \qquad I_S = \frac{V_P I_P}{V_S} = \frac{N_P I_P}{N_S}$$

The total current drawn from the supply by the basic winding is the vector aggregate of the no-store current, Io and the additional supply current, I1 in view of the helper transformer stacking and which waits behind the supply voltage by an edge. We can exhibit this relationship as a phasor graph.

he mean current drawn from the supply by the basic winding is the vector total of the no-pile current, Io and the additional supply current I1 as a result of the helper transformer stacking and which waits behind the supply voltage by an edge of Φ.

4.1.4 Transformer Loading Current:

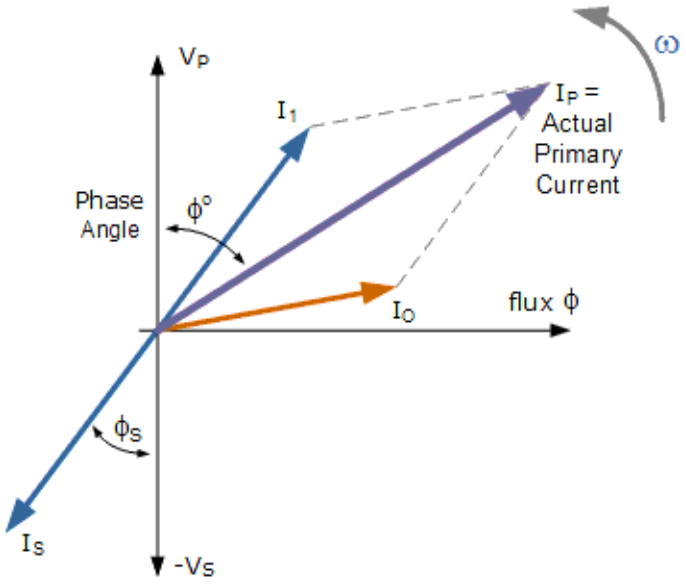
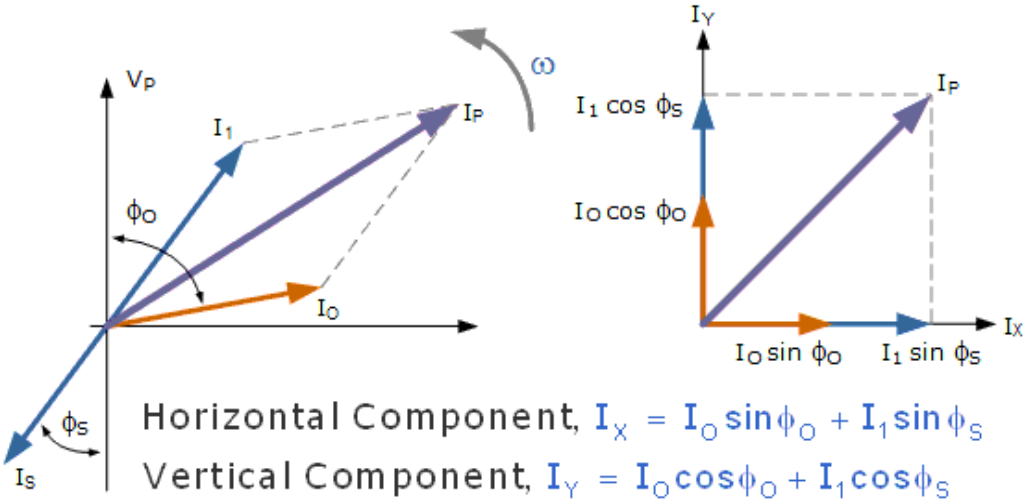


Fig 4.6: Transformers Loading Current

If we given currents I_s & Io we calculate the primary current I_p by this methods.



$$\therefore I_p = \sqrt{I_X^2 + I_Y^2} \quad \text{and} \quad \text{p.f.} = \cos\phi = \frac{I_Y}{I_p}$$

4.1.5 Transformers Voltage Regulation

The voltage control of a transformer is described as the modification in assistant terminal voltage when the transformer stacking is at its most prominent, i.e. full-stack associated while the basic supply voltage

is held consistent. Course chooses the voltage drop that occurs inside the transformer as the pile voltage ends up being unnecessarily low a result of the transformers stacking being to high which therefore impacts its execution and viability.

Voltage control is conveyed as a rate of the no-stack voltage. That point if E addresses the no-store helper voltage and V addresses the full-stack discretionary voltage, the rate bearing of a transformer is given as

$$\frac{\text{No load - Full load}}{\text{No Load}} = \frac{E - V}{E} \times 100\%$$

So for example a transformer passes on 100 volts at no-store and the voltage drops to 95 volts at full load, the control would be 5%. The estimation of E-V will depend on the internal impedance of the winding which joins its resistance is R and even more basically its AC reactance X of the current and the stage edge.

In like manner voltage bearing generally increases as the power factor of the pile ends up being all the all the more slacking. Voltage bearing concerning the transformer stacking can be either positive or negative in regard, that is with the no-load voltage as reference, the change down in charge as the store is associated, or with the full-stack as reference and the switch up in heading as the pile is diminished or ousted.

In the accompanying instructional exercise about Transformers we will look at the Multiple Winding Transformer which has more than one basic winding or more than one assistant winding and see how we can interface no less than two discretionary windings together in order to supply more voltage or progressively current to the related load

4.1.5 The Auto transformer

Primary and secondary windings of an Auto transformer are conducted electrically and magnetically reducing the costs

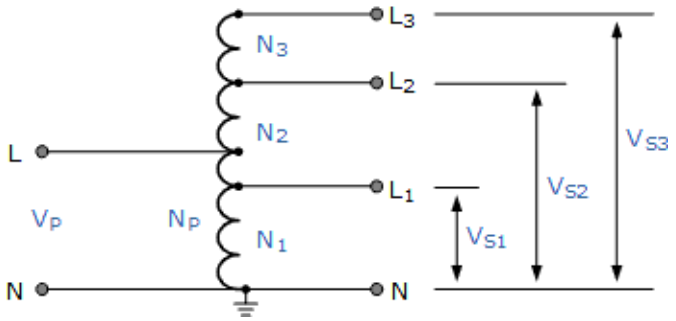


Fig 4.7: Auto transformer

Not at all like the past voltage had transformer which has two electrically segregated windings called: the essential and the optional an Auto transformer has just a single voltage winding which is basic to the two sides. This single winding is tapped at different indicates along its length give a level of the essential voltage supply over its optional load. At that point the autotransformer has the typical attractive center however just makes them wind, which is normal to both the essential and auxiliary circuits.

The area of twisting assigned as the essential piece of the winding is associated with the AC control source with the auxiliary being a piece of this essential winding. An autotransformer can likewise be utilized to step the supply voltage up or somewhere around switching the associations. In the event that the essential is the aggregate winding and is associated with a supply, and the auxiliary circuit is associated crosswise over just a segment of the twisting then the optional voltage is ventured down.

4.1.6 Dis-advantages of an Autotransformer

• Principle damage of an autotransformer is that it does not have the essential to optional twisting isolation of a regular twofold twisted transformer. At that point an autotransformer can not be securely utilized for presume down higher voltages to much lower voltages appropriate for littler burdens.

• If the auxiliary side winding ends up open-circuited, stack current quits moving through the essential winding halting the transformer activity bringing about the full essential voltage being connected to the optional terminals.

• the optional circuit endures short out condition of the subsequent essential power would be a lot bigger of a comparable twofold twisted transformer because of the expanded motion linkage harming the auto transformer.

• From the nonpartisan association is regular to both essential and optional windings and earthing of the auxiliary twisting consequently earthing the essential as there no disconnection between two windings. Twofold twisted transformer at times used to disengage gear from world.

Autotransformer has numerous utilizations and optimize including the beginning acceptance engines control of transmission lines can utilize to shift voltage when it required elective proportion near solidarity.

4.1.7 Current Transformer

The Current Transformer is a sort of "instrument transformer" is intended to create a substituting current in optional winding which is it corresponding to current being estimated in its requirement.

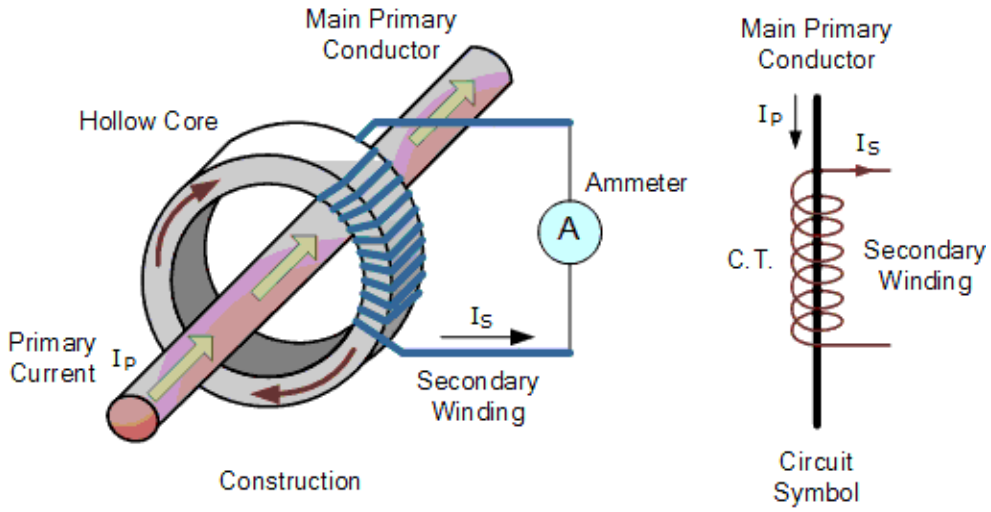


Fig 4.8: construction of Current Transformer

Flow transformer diminish high voltage flows to a much lower esteem and give an advantageous optimizing the genuine electrical flow streaming an AC transmission line utilizing a idle ammeter. The essential of activity of a fundamental current transformer is marginally not quite the same as that of a conventional voltage transformer.

Different voltage or power transformer took a gander at already, the present transformer comprises of just a single or not very many turns as its essential winding. This essential winding can be of either a solitary level turn, a curl of substantial wire folded over the center or only a conduit or transport bar set through a focal gap as appeared.

Because of this sort of game plan, the present transformer is frequently alluded too as an "arrangement transformer" as the essential winding, which never has in excess of a not very many turns, is in arrangement with the current conveying conductor providing a heap.

The auxiliary twisting in any case, may have countless turns twisted on a covered center of low-misfortune attractive material. This center has an extensive cross-sectional region with the goal that the attractive transition thickness made is low utilizing a lot littler cross-sectional zone wire, contingent on how much the current must be ventured down as it endeavors to yield a steady current, free of the associated load.

The optional winding will supply a current into either a short out an ammeter or resistive load until the point that the voltages actuated in secondary at sufficiently enormous soak center.

As opposed to a voltage transformer, the fundamental current of a present transformer isn't dependent of the discretionary load current yet rather is controlled by an external load. The helper current is typically assessed at a standard 1 Ampere or 5 Amperes for greater basic current evaluations.

There are three fundamental sorts of current transformers: wound, toroidal and bar.

• Wound Current Transformer – The transformers fundamental winding is physically related in course of action with the conductor that passes on the conscious current gushing in the circuit. The extent of the helper current is liable to the turns extent of the transformer.

• Toroidal Current Transformer – These don't contain a fundamental winding. Or maybe, the line that passes on the present spilling in the framework is hung through a window or hole in the toroidal transformer. Some present transformers have a "split focus" which empowers it to be opened, presented, and close, without separating the circuit to which they are joined.

• Bar type Current Transformer – This sort of current transformer uses the genuine connection or transport bar of the crucial circuit as the fundamental winding, which is similar to a singular turn. They are totally shielded from the high working voltage of the system and are ordinarily dashed to the present passing on device.

Current transformers can decrease current measurements from countless down to a standard yield of an acknowledged extent to either 5 Ampere for common errand. Thusly little and exact instruments and control devices can be used with CT's since they are shielded a long way from any high-voltage electrical links. There are a collection of metering applications and uses for current transformers for instance with Wattmeter's control factor meters watt-hour meters guarded exchanges.

By extending the amount of discretionary windings Ns the helper current can be made significantly tinier than the current in the basic circuit being assessed in light of the way that as Ns increases Is goes some place close to a relating total. Accordingly, the amount of turns and the current in the basic and assistant windings are associated by a retrogressive degree.

from which we get:

$$T.R. = n = \frac{N_P}{N_S} = \frac{I_S}{I_P}$$

$$\text{secondary current, } I_S = I_P\left(\frac{N_P}{N_S}\right)$$

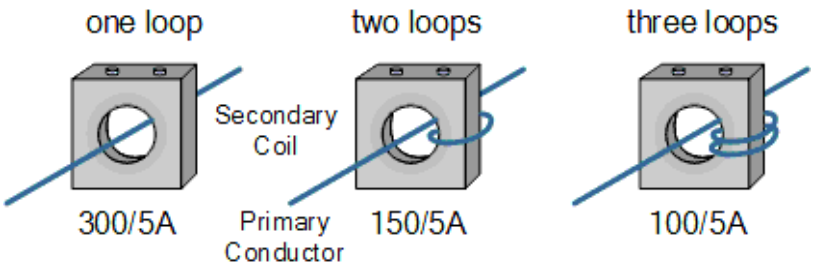


Fig 4.9: Current Transformer Primary Turns Ratio

4.1.8 Current Transformer Example

A bar-type current transformer which has 1 turn on its fundamental and 160 turns on its helper is to be used with a standard extent of ammeters that have an internal hindrance of 0.2ω. The ammeter is required to give a full scale redirection when the fundamental current is 800 Amps. Figure the most extraordinary helper present and discretionary voltage over the ammeter

Secondary Current:

$$I_S = I_P\left(\frac{N_P}{N_S}\right) = 800\left(\frac{1}{160}\right) = 5A$$

Voltage across Ammeter:

$$V_S = I_S \times R_A = 5 \times 0.2 = 1.0\,\text{Volts}$$

We can see over that since the optional of the present transformer is associated over the ammeter, which has a little obstruction, the voltage drop over the auxiliary winding is just 1.0 volts at full essential current.

High voltage grounds that the voltages per turn proportion relatively steady in essential and optional windings.

Therefore:

$$T.R. = n = \frac{V_P}{V_S} = \frac{N_P}{N_S}$$

$$\therefore\ V_S = V_P\left(\frac{N_S}{N_P}\right) = 480\left(\frac{160}{1}\right) = 76{,}800V \text{ or } 76.8kV$$

Present transformer commitment worked no-heap included when the rule major current is going through it likewise as a voltage transformer ought to never work into a short out. On the off chance that the ammeter is to be cleared a short out ought to be put over the optional terminals first to go out on a limb of stun. This high voltage is in light of the fact that when the assistant is open-circuited the iron focus of the transformer works at an abnormal state of inundation and with nothing to stop it, it makes an oddly far reaching discretionary voltage, and in our fundamental model over this was resolved.

4.1.9 3 Phase Transformers

3-p Transformers is mother of power distribution where Delta or Star connections

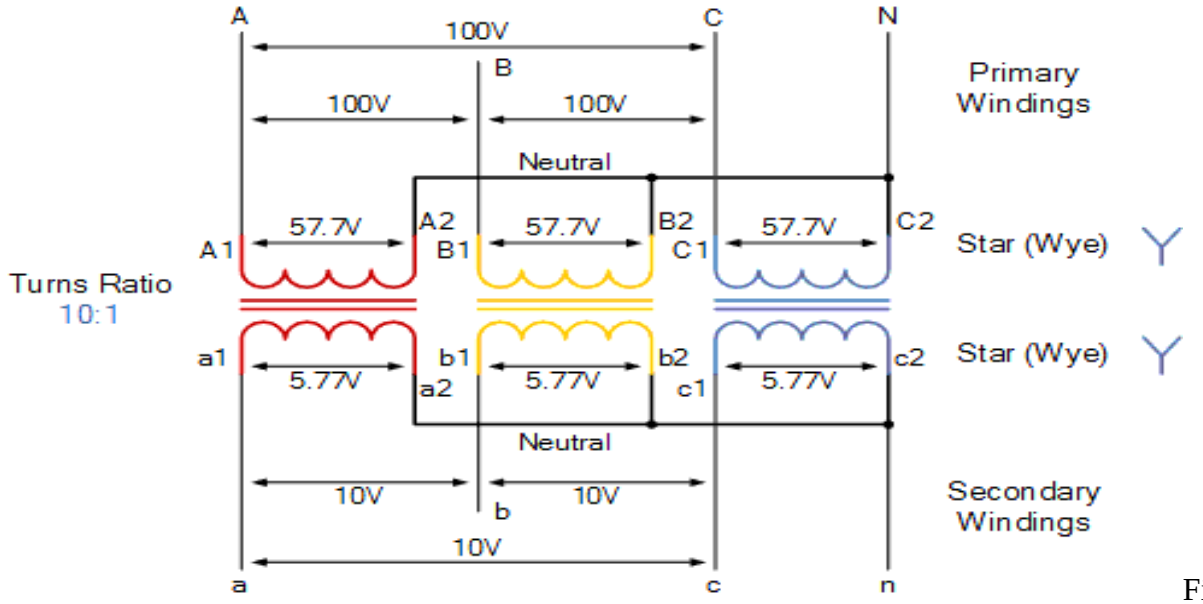
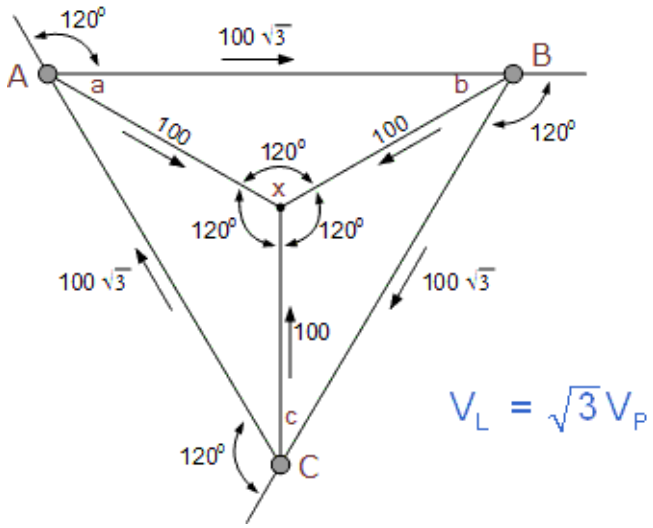


Fig 4.10: three phase transformer

4.2.0 Three Phase Voltage and Current

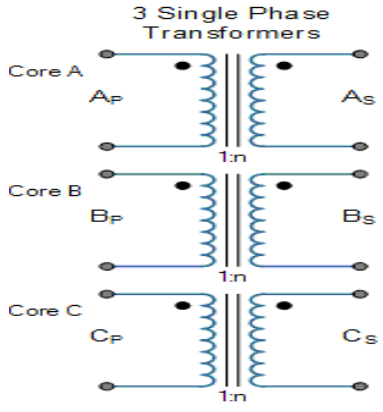


Where: VL is line-to-line voltage, and VP is stage to-unbiased voltage.

A transformer cannot go about as a stage changing gadget and change single-stage into three-stage or three-stage into single stage. To make the transformer associations good with three-stage supplies we have to interface them together with a specific goal in mind to shape a Three Phase Transformer Configuration.

A three stage transformer can be built in interfacing together three single-stage transformers, in this manner framing an alleged three stage transformer bank pre-collected and adjusted three stage transformer which comprises of three sets of single stage windings mounted onto one single overlaid center.

4.2.1 Three Phase Transformer Connections



Primary Configuration	Secondary Configuration
Delta (Mesh)	Delta (Mesh)
Delta (Mesh)	Star (Wye)
Star (Wye)	Delta (Mesh)
Star (Wye)	Star (Wye)
Interconnected Star	Delta (Mesh)
Interconnected Star	Star (Wye)

The essential and optional windings of a transformer can be associated in various set up as appeared meet for all intents and purposes any necessity. On account of three stages transformer windings three types of association are conceivable star delta and interconnected-star.

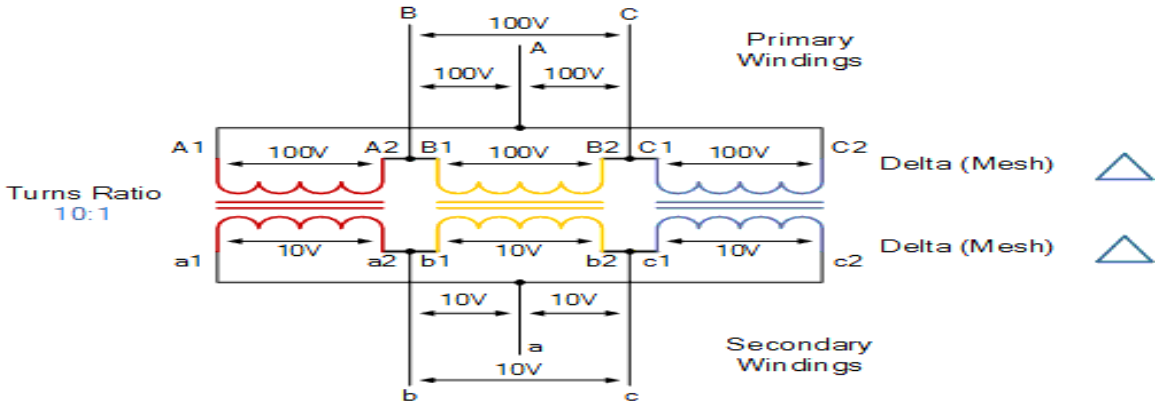
4.2.2 Transformer Delta and Delta Connections

In a delta associated gathering of transformers, the line voltage, VL is equivalent to the supply voltage, VL = VS. Be that as it may, the current in each stage winding is given as: $1/\sqrt{3} \times$ IL of the line current, where IL is the line current.

One disservice of delta associated three stage transformers is that every transformer must be twisted for the full-line voltage and for 57.7 percent, line current. The more noteworthy number of turns in the twisting, together with the protection between turns, require a bigger and more costly loop than the star association. Another inconvenience with delta associated three stage transformers is that there is no normal association.

In the star-star course of action yy-and delta-wye every transformer has one terminal associated with a typical intersection, or impartial point with the three outstanding closures of the essential windings associated with the three-stage mains supply. The quantity of turns in a transformer twisting for star association is 57.7 percent, of that required for delta association.

The star association requires the utilization of three transformers, and if any one transformer progresses toward becoming deficiency or incapacitated, the entire gathering may wind up debilitated. In any case, the star associated three stage transformer is particularly helpful and conservative in electrical power dispersing frameworks, in that a fourth wire might be associated as a nonpartisan purpose of the three star associated secondaries as appeared.4.2.4 Transformer Star and Star Connections



$$V_P = \frac{1}{\sqrt{3}} \times V_L = \frac{1}{\sqrt{3}} \times 100 = 57.7 \text{ Volts}$$

The secondary current in each phase of a star-connected group of transformers is the same as that for the line current of the supply, then $I_L = I_S$.

4.2.3 Star-Delta Turns Ratio

$$TR = \frac{N_P}{N_S} = \frac{V_P}{\sqrt{3}V_S}$$

In like manner, for a delta– star associated transformer, with a 1:1 turns proportion, the transformer will give a 1:√3 advance up line-voltage proportion. At that point for a delta-star associated transformer the turns proportion moves toward becoming:

4.2.4 Delta-Star Turns Ratio

At that point for the four essential setups of a three-stage transformer, we can list the transformers optional voltages and flows as for the essential line voltage VL and its essential line current IL as appeared in the accompanying table.

Three-phase Transformer Line Voltage and Current:

Primary-Secondary Configuration	Line Voltage Primary or Secondary	Line Current Primary or Secondary
Delta – Delta	$V_L \Rightarrow nV_L$	$I_L \Rightarrow \frac{I_L}{n}$
Delta – Star	$V_L \Rightarrow \sqrt{3}.nV_L$	$I_L \Rightarrow \frac{I_L}{\sqrt{3}.n}$
Star – Delta	$V_L \Rightarrow \frac{nV_L}{\sqrt{3}}$	$I_L \Rightarrow \sqrt{3}.\frac{I_L}{n}$
Star – Star	$V_L \Rightarrow nV_L$	$I_L \Rightarrow \frac{I_L}{n}$

4.2.5 Three Phase Transformer Construction

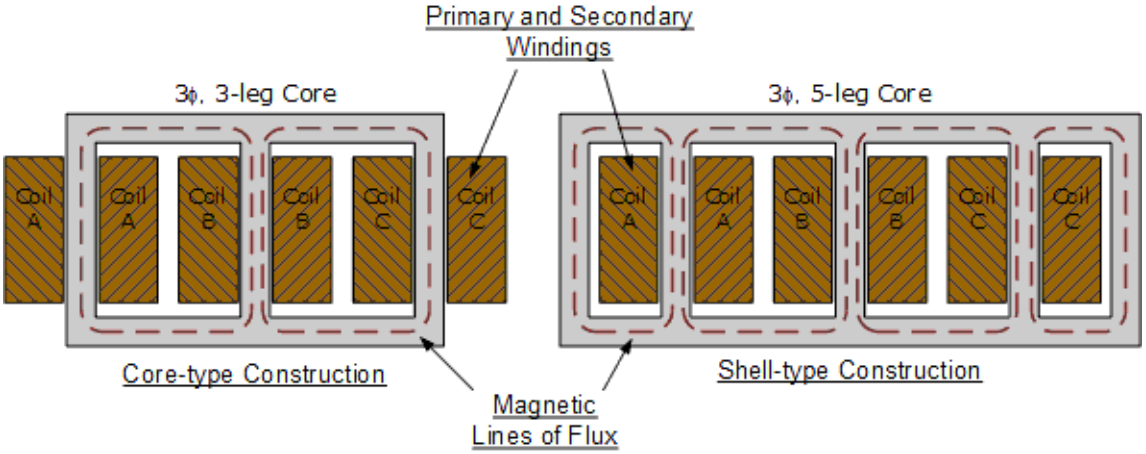


Fig 4.11: primary and secondary coil winding

The three-appendage center sort three-stage transformer is the most well-known technique for three-stage transformer development enabling the stages to be attractively connected. Transition of every appendage utilizes other two appendages for arrival way with the three attractive motion's the center created by the line voltages contrasting in time-stage. In this manner the motion in the center stay almost sinusoidal wave creating optional voltage of supply.

CHAPTER 5

5.1 Bus-bar Trunking System (BBT)

Transport bar trunking frameworks (BBT) comprise of protected copper or aluminum transport bars encased in a trunking. Utilize a master epoxy pitch covering to protect every conductor, the covering is connected to the transport bars utilizing an in-house created and industry driving procedure. Transport bar trunking is measured in plan and is provided in pre-manufactured lengths and accessible in a scope of conductor setups. It item go regularly incorporates elbows, T-connectors, feeder units, board spines and different other standard or custom segments that make it easy to arrange for any application.

5.2 Bus-bar highlights of character:

1) Easy to configuration control conveyance and clear system structure,
2) Easy building and establishment probability
3) Law starts vitality and high short out esteem.
4) Fast and straightforward establishment with least devices.
5) During establishment, there is no waste or scrap. So it's condition amicable.
6) Easily be expelled and re-utilized where required

5.3 Specifications

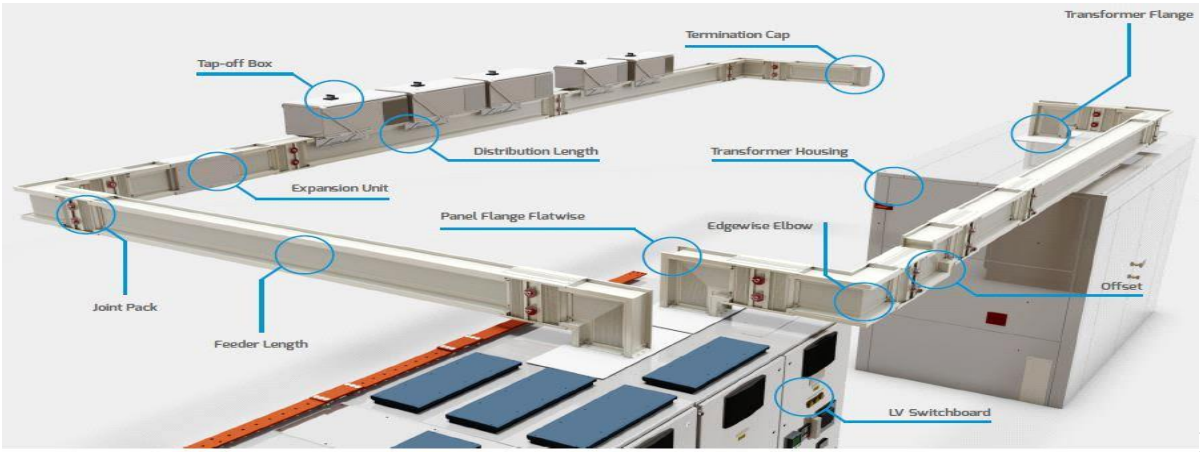


Fig:

bus-bar trunking system

5.4 Bus-bar Trunking system benefits than Cable

Serial No.	Bus-bar Trunking system	Cable
I	**Features :**	
	Completing it great, subsequently add to style of building	Improper cabling may ruins the feel of building
	Numerous floor building power bolstering should be possible with single Bus trunking system	Multiple floor building power encouraging must be finished with different link sets. This make the total framework awkward.
	Power tap off should be possible from the single framework introduced.. On the off chance that the heap transforms we need to simply supplant the Tap off boxes of higher rating	Not conceivable. Extra links to be laid till the specific floor.
II	**Voltage Dropped :**	
	The voltage drop of bus trunking is less when contrasted with cables.	Dropped voltage more than BBT
III	**Structural :**	
	Case of 3200A(Cu) measurement is: 151(w)x340(h) and light in weight.	Cables structure 700mm wide i.e., link plate and so on is overwhelming and possesses more space.
	Add up to run is comprised of various components which are joint together.	Single length different cables are introduced,

	Subsequently making the total framework upkeep friendly.	making it support not inviting.
	Simple retrofitting of the component is conceivable in the event that the area and shopper load	Easy retrofitting of the component is beyond the realm of imagination on the off chance that the area and buyer stack
Completely encased	Can't be altered. Fit and overlook system2	Insulation Needs to kept up on customary premise.
IV	Level of Protection**:**	
	No Special security is to be taken for establishment as bus-bars are presently accessible up to IP68 insurance class	Special assurance is to be taken for establishment in OUTDOOR territory
V	Walled in area **:**	
	It comprises of bus-bars in a defensive walled in area, including straight lengths, fittings, gadgets and accessories.	Cables are just protected with various layers of PVC.
	High Short circuit quality and high fire protection	Low Short circuit quality and low fire insurance
VI	**Termination :**	
	Coordinate end through bus-bars	The strategy for link end is exceptionally unwieldy
	Termination is straightforward and easy	Additional underpins are required to hold the links inside the board
	Have an exceedingly conservative structure and can be bowed up to 90 degree.	Cables are for the most part introduced in packs and with such a cross segment, to the point that they can not be bowed firmly.
VII	**Time & Cost Consumption :**	
	Measuring bus-bars the fashioner just needs to make figuring on a solitary riser which diminishes configuration time and costs.	It is important to ensure each link exclusively with a wire and when laying the links in groups it is important to stay them legitimately so they can withstand the electro dynamic powers created in case of a short out. Along these lines, the originators need to invest more energy in counts.
VIII	Utilization of extra things :	
	No extra backings are required.	Heavy work is required to lay the links
	No additional gaps/patterns are required.	Holes to be made in the organ plate for settling link
	No needed cable tray , supported on	Cable tray or the digging must needed

	wall.	
	No link plate is required, upheld on roof/wall.	Cable plate or the burrowing of the trench is required to lay the links
	Configuration checked switchgear get together, limits from maker's catalogue	Limits rely upon the laying technique and link gathering. The de rating factor must be resolved/determined
IX	**Halogen Free :**	
	Free of halogen	It may have halogen.

Chapter 6

CONCLUSIONS

All objective parts of this field study I can assign and collect data. This system is able to detect objects within the sub-station. Amplitude of the sub-station are attached , materials , and size. The technique could utilized for the exchange of power the nation over through the electrical cables.the circuit was not providing the most proficient or greatest effectiveness, because of the center misfortunes not measuring up to the copper misfortunes. The greater the reflector, the better the reflection, and the more grounded the reflection flag is. the extraordinary capacity to adjust to different conditions and encompassing conditions. So in the event that you expands the voltage out, the current out must reductions. On the off chance that you venture up the voltage , with the goal that voltage yield is twofold the voltage input.Subsequent to experiencing all the harsh occasions of activity the short experience has opened up the scientists eyes to a more extensive world. For every one of the slip-ups that have made and the quantity of deadlocks that the analyst has incidentally caught himself in, the specialist trusts he will experience one more day to be a superior individual in this specialized field. It is proudly that the analyst declares his consummation of this undertaking as per the necessity of destinations that have been expressed in the early sections.

Through this field think about, the specialist has picked up a great deal of learning in KAVR its related family particularly on the most proficient method to utilize the catch includes and controlling the info yield ports and clocks. A ton of important data likewise acquired amid this field think about which isn't instructed in classes all through five years of study. Close to, different aptitudes, for example, correspondence, critical thinking, self-learning abilities and self-working capacity have been produced in the specialist himself accomplishing this point.

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