Electrical Substation Maintenance and Protection Under Grid North-2, DPDC

A thesis submitted in partial fulfillment of the requirement for the Award of Degree of Bachelor of Science in Electrical & Electronic Engineering

Submitted By

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DAFFODIL INTERNATIONAL UNIVERSITY

January 2019

ঢাকা পাওয়ার ডিস্ট্রিবিউশন কোম্পানী লিমিটেড
DHAKA POWER DISTRIBUTION COMPANY LIMITED
(An Enterprise of the Government of the People's Republic of Bangladesh)
ISO 9001: 2008 Certified

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Participation Certificate

This is to certify that Mr. Md. Sajal Karim, ID No: 151-33-2519, Student of Electrical and Electronic Engineering Department, Daffodil International University has successfully completed a two months long internship program entitled "Electrical Substation Maintenance and Protection" under my office.

I surely hope that the knowledge that he has gathered from this program will help him a great deal in his future career. I wish him every Success.

03/12/18
Md. Abdul Wahed Halim
Executive Engineer
Grid North-2, DPDC.

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Please note that, following four (04) students of Electrical and Electronic Engineering Department of Daffodil International University are required to undergo two months internship as part of the academic requirements.

Therefore Daffodil International University would like to have your kind consideration to hire them as intern to your esteemed company for the period as stipulated above.

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C.E (Grid, O&M)

SE, Grid (North)

Dep grid N-2

Pls take action.

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Declaration

We hereby declare that this internship report is an outcome of our own work and effort. Any information from other sources has been acknowledged in the reference section. We further declare that the work reported in this internship has not been submitted, either in part or in full, anywhere else for any other degree or publication.

Supervised by:

Dr. M. Shamsul Alam

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Dedicated to

Our Parents

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The Authors

January 2019

Dhaka, Bangladesh

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The table of our training schedule in Dhaka Power Distribution Company (DPDC) is given below:

Date	**Division**	**Time**	**Mentor**
01.09.2018 (Saturday)	Moghbazar 132/33 Kv Grid Sub-station.	10am to 05pm	Engr. JonyBarua
06.09.2018 (Thursday)	Moghbazar local 33/11 Kv Grid Sub-station.	10am to 05pm	Engr. JonyBarua
08.09.2018 (Saturday)	Tejgaon 33/11KV Sub-station.	10am to 05pm	Engr. JonyBarua
13.09.2018 (Thursday)	Asad-gate 33/11KV Sub-station.	10am to 05pm	Engr. Md. Sazzad Hossain
15.09.2018 (Saturday)	Green road 33/11KV Sub-station.	10am to 05pm	Engr. Md. Sazzad Hossain
20.09.2018 (Thursday)	Lalmatia 33/11KV Sub-station.	10am to 05pm	Engr. Md. Sazzad Hossain
22.09.2018 (Saturday)	Taltola 33/11kv sub-station	10am to 05pm	Engr. Md. Mahbubur Rahman
27.09.2018 (Thursday)	Khilgaon(Gulbag) 33/11KV Sub-station.	10am to 05pm	Engr. Md. Mahbubur Rahman
29.09.2018 (Saturday)	Ullon 33/11KV Sub-station.	10am to 05pm	Engr. Md. Shahanur Rashid
04.10.2018 (Thursday)	Madartek 132/33KV Sub-station.	10am to 05pm	Engr. Md. Shahanur Rashid
06.10.2018 (Saturday)	Madartek(local) 33/11KV Sub-station.	10am to 05pm	Engr. Md. Shahanur Rashid
11.10.2018 (Thursday)	Ullon 33KV GIS Switching-station.	10am to 05pm	Engr. Md. Shahanur Rashid
13.10.2018 (Saturday)	Goran 33/11KV Sub-station.	10am to 05pm	Engr. Md. Shahanur Rashid

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Executive Summary

The power sector of Bangladesh have gone up against different issues depicted by nonappearance of supply limit, visit control cuts, unacceptable nature of supply and poor cash related and operational execution of the division substances. There have been different changes in the power division in Bangladesh since the self-sufficiency. An extensive part of these progressions fail to obtain the perfect outcome the power portion. Among the three crucial parts of the power system, late change practices were focused on age and transmission. The most pressing issues in the influence fragment have been with the movement structure, which is depicted by overpowering system setback and poor amassing execution. This report relies upon our transitory position practices which we have done at DPDC (Dhaka Power Distribution Company Limited). This report focuses on the assignment of DPDC, their vision, supply limit, money related condition, allocation of influence and future orchestrating. Dhaka Power Distribution Company Limited (DPDC) is one of the greatest power course associations in Bangladesh. Dhaka Power Distribution Company Limited (DPDC) had been solidified on 25th October, 2005 under the Companies Act 1994 with an affirmed offer capital of Tk. 10,000 (ten thousand) center confined into 100 (one hundred) crore standard offer of Tk. 100 each. The association was yielded approval to start business from 25th October, 2005 and started its ability from fourteenth May 2007. Association started its business undertaking on first July of 2008 by expecting authority over all focal points and liabilities from the then DESA. While the association started its movement the amount of customers were 6,55,908, directly we have around 11,74,987 (on January 31, 2018) Temporary employment is such an opportunity to take in those activities that are related to our authentic building world. In the midst of my entrance level position period, I have had the ability to gather some learning on grid substations and their assignment and upkeep which are solidly related to my examination materials. We have furthermore viewed their definitive activities of control room; principle errand room, IT (Information and Technology) and one point movement which will no ifs ands or buts help us with envisioning the feasibility in our practical life

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CHAPTER-1

Introduction

1.1 Broad Objective

The Broad Objectives of this research are mainly to understand of this each and every equipment of distribution substation.

1.2 Specified Objective

In order to obtain the broad objectives we have to find out of the following objectives. They are follows:

1. Study on Substation.
2. Test and check the equipment's of Substation.
3. Identifying different types of apparatus for operating this Substation.
4. Learning probable solution of the different

1.3 Company Profile

The historical backdrop of intensity age and appropriation in Dhaka city is exciting. Custom goes that the Nawab of Dhaka presented power in Dhaka in 1901 when he introduced a little generator in his living arrangement Ahsan Manzil. Power age for open use began in 1930 when an exclusive organization M/S DEVCO built up a power dispersion framework. Privately owned businesses oversaw control age and dispersion framework in Dhaka until the finish of British guideline in 1947. In 1957 the Government of Pakistan assumed control over the private claimed organizations in Dhaka and in 1959 they were set under the recently settled East Pakistan Water and Power Development Authority (EPWAPSDA). After the freedom of Bangladesh,

Bangladesh Power Development Board (BPDB) supplanted EPWAPDA's Power wing in 1972. The power age and circulation arrangement of Dhaka was overseen by BPDB until 1991. A self-ruling association named Dhaka Electric Supply Authority (DESA) was made by a statute proclaimed by the President in March 1990 to enhance administrations to the purchasers and to improve income accumulation by diminishing the common high framework misfortune. DESA assumed control over the power appropriation framework in and around Dhaka city in October 1991, yet the purview of intensity age stayed with BPDB. Later in 1998, an auxiliary organization Dhaka Electric Supply Company Limited (DESCO) was shaped to assume control over a couple of territories of the Dhaka city from DESA. Furthermore, in 2008, DESA was canceled and supplanted by DPDC. At its of initiation, DPDC region was around 7473 square kilometer in and around the capital city. Subsequently, according to government choice, in the wake of giving over the city peripherals to Rural Electrification Board (REB) and a few sections of the Metropolitan territory to Dhaka Electric Supply Company Ltd (DESCO), DPDC region is decreased to just around 350 square kilometer, extended in the southern piece of the capital city of Dhaka and abutting townships of Narayangonj.

DESA, the progenitor of DPDC was set up as a major aspect of a change procedure to guarantee better administrations to the power purchasers, build up the power dispersion framework and decrease framework misfortune. Before the setting up of DESA, the power advancement board endured a framework loss of 45%. DESA figured out how to chop it down to around 26%. Be that as it may, as it additionally turned into a losing worry because of different reasons, DPDC was presented as a major aspect of the change procedure to supplant DESA. DPDC has figured out how to chop down the framework misfortune to single digit as of late.

1.4 Summary

Stations are very important part of elcetrical system. There are different kind of sub-stations which works at different purpose. Transmission substation transforms the voltage to a level suitable for transporting electric power over long distance. All the power subtation transforms the voltge to a level suitable for the transmission system. So, the of instruments to change some

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characteristic of electric supply is called a sub-station. Different kinds of apparatus like transformer, switchgear, PFI are used for sub-station.

Transformer is the main component employed to change the voltage level of electric supply. Switchgear detects the fault and disconnects the unhealthy section from the system. PFI improves the earning capacity of a power station.

1.4 Methodology

The research of this paper has been done with the help of different sources. The paper was cheeked by the authorized persons of the Grid North-2, DPDC during preparation. The data was chosen accurately throughout the entire period of the session. Although there were several sources but some of them are mentioned here as the references. The information of this report has been collected from the following sources:

1. Construction Operation and Maintenance Department.
2. Member Service Department.
3. General Service Department.
4. Engineering Department.

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CHAPTER-2

Sub-station & its purpose

2.1 Substation

The gathering of mechanical assembly used to change some normal for electric supply is known as a substation.

2.2 Elements of an electrical substation

Fig 2.1 : Elements of an electrical sub-station

Substations have exchanging, assurance and control gear, and tranformer. In an easy substation, breakers are utilized to intrudes on any short out or over-burden flows that may happen on the system. Little appropriation substation may utilize re-closer electrical switch s or breakers for

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insurance of dissemination circuits. Substations are don't generally has generator, regardless by many way thats an power plants may has a alternative close-by. Distinctive contraptions, for instance, capacitor and voltage controller may similarly be arranged at any substation. A Substations will be at present look in main separated regions, undergrounds, or arranged by uncommon reason structures. Raised structures may have a couple of indoor substations. Indoor substations are typically found in urban zones to decrease the uproar from the transformers, for reasons of appearance, or to shield switchgear from over the high environment or poor conditions. At Where a many substations have a metallic fence, it must be suitably grounded to shield people from high voltages that may occur in the midst of fault in the framework. Earth imperfections at a substation can cause a ground potential climb. Streams spilling in the Earth's surface in the midst of a fault can influence metal things to have an on a very basic level sudden voltage in contrast with the ground under a person's feet; this touch potential presents a danger of electric stun.

2.3 Classifications of Substation

Substations might be portrayed by their voltage class, their applications inside the power framework, the strategy used to protect most associations, and by the style and materials of the structures utilized. These classifications are not incoherent; to take care of a specific issue, a transmission substation may incorporate noteworthy circulation capacities, for instance.

2.4 Classifications of Electrical Substations

There were a few different ways to arranging substations. Be that as it may, the two most imperative methods for grouping them are as indicated by

• Service necessity

• Constructional highlights.

As per benefit necessity. A substation might be called up to change voltage height or enhance control factor or convert a.c current. control into d.c current. control and so on. As indicated by the administration necessity, sub-station might be characterized into:

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Transformer sub-station: Those sub-station which change the voltage dimension of electric supply are called transformer sub-stations. These sub-stations get control at some voltage and convey it at some other voltage. Clearly, transformer will be the principle part in such sub-stations. A large portion of the sub-stations in power framework are of this sort.

Exchanging sub-stations: These sub-station don't change the voltage level approaching and active lines have a similar voltage. Nonetheless, they just play out the exchanging tasks of electrical cables.

Power factor rectification sub-stations: Those sub-stations which enhance the power factor of the framework are called control factor amendment sub-stations. Such sub-stations are commonly situated at the less than desirable end of transmission lines. These sub-stations by and large utilize synchronous condensers as the power factor enhancement gear.

Recurrence changer sub-stations: Those sub-stations which change the supply recurrence are known as recurrence changer sub-stations. These sub-stations get a.c. power and convert it into d.c. control with appropriate device to supply for such purposes as footing, electroplating, electric welding and so on.

Mechanical sub-stations: Those sub-stations which supply capacity to individual modern concerns are known as mechanical sub-stations.

As indicated by development highlights. A sub-station has numerous components (e.g. circuit breakers, switches, wires, instruments, and so on.) which must be housed appropriately to guarantee constant and dependable administration. As per constructional highlights, the sub-stations are named:

• Indoor sub-station

• Outdoor sub-station

• Underground sub-station Pole-mounted sub-station

2.5 Visited sub-stations and details:

2.5.1 Name of sub-station: Moghbazar 132/33 Kv Grid Sub-station.

Address: 17/1, Shahid Tajuddin sarani, FDC more, Tejgaon, Dhaka.

Incoming Line: 4 incoming line of 132 kv Rampura 1 and Rampura 2.

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Outgoing Line: 24 outgoing line of 33 kv.

Power Transformer: 7 power transformer. GT-1, 2, 3& TR 1,2,3,4.

Name of 33Kv feeder : Doctor lane, T&T, EcorAis, Aambag, Tejgaon S/S 1&2, Modhubag, Banglamotor, Mogbazar nearest, MP suit, Konipara, Iskaton, Garden, Ispahani, BGMEA, Noyatola, BSRS, OLD building, TCB, Pollibhaban 1 &2, Sangsad, Holiday Inn.

2.5.2 Name of sub-station: Moghbazar local 33/11 Kv Grid Sub-station.

Address: 17/1, Shahid Tajuddin sarani, FDC more, Tejgaon, Dhaka.

Incoming Line: 2 incoming line of 33kv.

Outgoing Line: 14 outgoing line of 11 kv.

Power Transformer: 7 power transformer. GT-1,2,3& TR 1,2,3,4.

Name of 11Kv feeder : Tejgaon-1,2,3, Lalmatia-1,2, Green road-1,2, Moghbazar T&T-1,2, Kawran bazar and Local transformer TR-1,2,3,4.

2.5.3 Name of sub-station: Tejgaon 33/11KV Sub-station.

Address: 206, Tejgaon industrial area, Dhaka.

Incoming Line: 3 incoming line of 33kv from Moghbazar circuit 1,2 (underground) and Moghbazar circuit 3 (overhead)

Outgoing Line: 17 outgoing line of 11kv

Power Transformer: 3 power transformer TR1,2,3.

Name of 11Kv feeder : Sat rong, Rangsbhaban, Orion lab, Nina kabyo, Lucas, Babli, Karnaguly, Baddameghna, Nakhalpara, Rasul bag, Ahsanullah, Santa, Civil aviation, Tejgaon s/s, GMG, Link road, Shikachor.

2.5.4 Name of sub-station: Asad-gate 33/11KV Sub-station.

Address: Asad gate, Near Arong,

Incoming Line: 2 incoming line of 33kv from Shatmasjid 1,2.

Outgoing Line: 11 outgoing line of 11kv.

Power Transformer: 2 power transformer TR1,2.

Name of 11Kv feeder : Gonobhaban, Town hall, Iqbal Road, Post office, B.B.S jadughar, WASA, Shukrabad, Rapa plaza, Zakirhossain, New colony, Aowrangajeb, Shongshod, Sonar bangla, Humayon Road, Asadgate, Spare.

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2.5.5 Name of sub-station : Green road 33/11KV Sub-station.

Address: Central road, Dhanmondi, Dhaka.

Incoming Line : 2 incoming line of 33kv from Moghbazar CKT 1 &Dhanmondi grid circuit 1.

Outgoing Line : 11 outgoing line of 11kv.

Power Transformer : 2 power transformer TR1,2 of 20/28MVA.

Name of 11Kv feeder : Local RMU, Green view, Central road, New market, DPH, KathalBagan, Green road east, North road, Green road s/s, Plane majsid, Malancha.

2.5.6 Name of sub-station : Lalmatia 33/11KV Sub-station.

Address: House no: 22/1, Road no: 14 (New), 25(Old) AA/A, Dhaka.

Incoming Line : 3 incoming line of 33kv from Moghbazar, Shat masjid and Kollanpur.

Outgoing Line : 16 outgoing line of 11kv.

Power Transformer : 2 power transformer TR1&2 of 20/28MVA.

Name of 11Kv feeder : Musium, 13/A, Shankar, Zafrabad, Lalmatia, Road no-15, Asad gate, Road no-27, Ibnsina, Road no-31, Satmosjid west, Officers quarter, Road 32, 12/A, Incoming Zigatola, Road 25.

2.5.7 Name of sub-station : Taltola 33/11kv sub-station

Address: 1460/2/Kha, Block A, Jhilpara, Taltola, Khilgaon, Dhaka.

Incoming Line : 2 incoming line of 33kv from Ullon1 &Ullon 2.

Outgoing Line : 12 outgoing line of 11kv.

Power Transformer : 3 power transformer TR1,2&3 of 20/28MVA & 10/14MVA.

Name of 11Kv feeder : Adorshobag, Tilpa para, TV road, Khilgaongovtcoloney, Central Basabo, East Rampura, Model college, Chowdhuray para, Reaj bag, Nearest overhead, Haji para, MatirMoshjid.

Battery charger: 2

2.5.8 Name of sub-station : Khilgaon(Gulbag) 33/11KV Sub-station.

Address: 412, Gulbag, Khilgaon, Dhaka.

Incoming Line : 3 incoming line of 33kv from Ullon, Taltola and Maniknagar.

Outgoing Line : 9 outgoing line of 11kv.

Power Transformer : 2 power transformer TR1&2 of 20/28MVA.

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Name of 11Kv feeder : West Shantibag, Police line, BTV, Gulbag, Shantinagar S/S1, East Malibag, Shahajahanpur, BanjirBagun, Shantinagar 2.

Battery Charger: 2

2.5.9 Name of sub-station : Ullon 33/11KV Sub-station.

Address: Ullon Local 33/11kv substation, WABDA road, Ullon, West Rampura, Dhaka.

Incoming Line : 2 incoming line of 33kv from PGCB 1&2.

Outgoing Line : 6 outgoing line of 11kv.

Power Transformer : 2 power transformer TR1&2 of 10/14MVA.

Name of 11Kv feeder : West Malibag, Bagichartek, Ullon, Mirbag, West Rampura, Mohanagar.

Battery Charger : 4

2.5.10 Name of sub-station : Madartek 132/33KV Sub-station.

Address : 3no East Madartek, Dhaka.

Incoming Line : 2 incoming line of 132kv from Rampura 1 & 2.

Outgoing Line : 4 outgoing line of 33kv.

Power Transformer : 2 power transformer TR1&2 of 50/75MVA.

Name of 11Kv feeder : Local 1,2 &3, Goran.

Battery Charger : 2

2.5.11 Name of sub-station : Madartek(local) 33/11KV Sub-station.

Address : 3no East Madartek, Dhaka.

Incoming Line : 3 incoming line of 33kv.

Outgoing Line : 15 outgoing line of 11kv.

Power Transformer : 3 power transformer TR1,2&3 of 20/28MVA & 10/14MVA.

Name of 11Kv feeder : Sobujbag, Madartek, Rajarbag, Goran, DokkhinKhilgaon, Manda, Town, Bisshoroad, Mugdapara, Singapore road, Mayakanon, Ahmedbag, WASA road, Nandipara, Thihomony.

2.5.12 Name of sub-station : Ullon 33KV GIS Switching-station.

Address : Ullon 132/33kv grid sub-station. WABDA road, Ullon, West rampura, Dhaka.

Incoming Line : 2 incoming line of 33kv.

Outgoing Line : 6 outgoing line of 33kv.

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Power Transformer : 5 power transformer TR1&2, GT1,2&3.

Name of 11Kv feeder : Taltola ckt1, Kakrail, Taltola Ckt2, Basundhara City, Goran, Khilgaon.

2.5.13 Name of sub-station : Goran 33/11KV Sub-station.

Address : Plot no M1, Block-M, Road no-7, South Banasree, Rampura, Dhaka-1219.

Incoming Line: 3 incoming line of 33kv from Ullon.

Outgoing Line: 7 outgoing line of 11kv.

Power Transformer: 3 power transformer TR1,2&3 of 10/14MVA.

Name of 11Kv feeder: Meradiya, Forazi, Shiphaibag, Buyen para, Ideal, West Banasree, Nearest.

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CHAPTER-3

Transformer

3.1 Introduction

The transformers are a statik electrical contraption what trades imperativeness by an inductive type coupling between thos windings circuit. An scontrasting current in the basic winding makes a moving appealing movement in the transformer's middle and along these lines a fluctuating alluring change through the discretionary winding. This fluctuating appealing movement affects a moving electromotive power (emf) or voltage in the discretionary winding. Transformers can be used to vacillate the general voltage of circuits or isolate them, or both. Transformers keep running in size from thumbnail-sized used in enhancers to units checking a few tons interconnecting the power grid. A wide extent of transformer designs is used in electronic and electric power applications. Transformers are essential for the transformer, allocation, and use of electrical. Transformers are used to fabricate voltage before transmitting electrical imperativeness over long partitions through wires. Wires have block which loses imperativeness through joule warming at a rate contrasting with square of the current. By changing ability to a higher voltage transformers engage preservationist transmission of power and dispersal. Hence, transformers have shaped the power supply industry, enabling age to be found remotely from motivations behind intrigue. Transformers are also used generally in electronic things to wander down the supply voltage to a measurement sensible for the lowest voltages circuit them contain. The transformers similarly electrical detaches the ending customer for the contact of the supply voltage.

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3.2 Types of transformer

There are many kinds of transformer. They tries to represent the whole power system.

3.2.1 Power transformers

Laminate core

These are the most well-known kinds many transformer, broadly utilized to machines in change over mains voltage to low voltage to control gadgets

• Entirely accessible in a power appraisals going MW from MW

• Insulate cover limits whirlpool currents misfortunes

• Little apparatus and electronics transformer may utilize a splits bobbing, giving an abnormal state of protection betwen this winding.

• Rectangulated center

• Core overlay stamping is as a rule fit as a fiddle sets. Other shape sets are now and then utilized

• Mumetal shield can not be fitted to lessen EMI (an electromagnetic impedance)

• As screen windings are once in a while utilized between 2 control windings

• Little machine are hardware transformer may has a warm removed inherent

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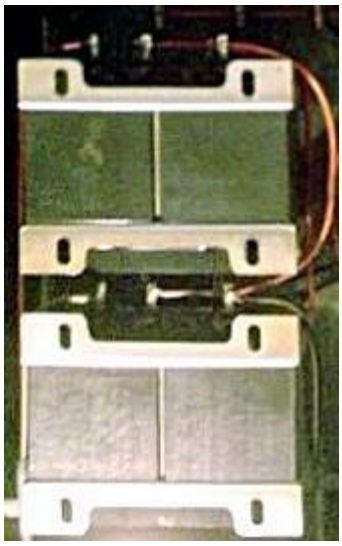

Fig 3.1: Laminated core transformer.

3.2.2 Autotransformer

The auto transformer makes them wind ,which have a higher (or low) voltage are conveyed is trapped inevitably along the windings. Hithe auto transfomer is low than the pile control rating. It is controlled by: (|Vin-Vout|)/Vin x stack VA. For example .Voltage is associated over a touch of the twisting, over another piece of a comparable winding. The power rating of the auto transfomer is lower than the store control rating. It is dictated by: (|Vin-Vout|)/Vin x stack VA. For example, an auto transformer used to modify a 1000 VA load to a 240 volt supply is assessed at: (240V-120V)/240V x 1,000MA = 500VA. Immnse three-organize auto transformers are used in electric power scattering structures, for example, to interonnect 33 kV or 66 kV sub-transmission systems. For the voltage extents are outperforming of 3:1,an auto transformer is more affordable, lighter, more diminutive and more capable than a withdrawing (two-windings) transformer of a comparable ratings.

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3.2.3 Variables auto transformer

An auto transformer exposes parts of the looping loops and creates this auxiliary association with a booster carbon brush, an autotransformer becomes a intensively factor, the ratio may be achieved by considering the slightest increase due to massive voltage changes.

3.2.4 Polyphase transformer

Forlifes transformer, different single-stage transformers can be used, or can be associated with a single polyfasse transformer at all stages. For three layers Transformers, three essential windings are connected together and three optional windings are connected together. Examples of associations are Y-Delta, Delta-Y, Delta-Delta and Y-Y. A vector displays the differences between the winding and stage points in them. Off-scope involves a rotation with the Earth (ground-bound), the world association point is usually a Y winding interior purpose. Auxiliary shutdown of a delta ventilation, a packet of ground (high leg delta) can be attached with an internal tap or grounded at one stage (corner-grounded delta). An extraordinary reason is the polyphase transformer crisscross transformer. There are many imaginative designs, which can include six winding and various tapes.

3.2.5 Grounding transformer

Grounding transformer are utilized to permit three wire (delta) polyphase transformer supplies to oblige stage to unbiased loads by giving an arrival way to current to a nonpartisan. Establishing transformers most normally consolidate a solitary twisting transformer with a crisscross winding arrangement however may likewise be made with a wye-delta disconnected winding transformer association.

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3.2.6 Oil cooled transformer

For the large transformers used in electricity isolation or electrical components, the transformer center and the curls are covered in cold and protected oils. Curl and loop and center move around, circulating through the circulation of the oil circle through the conduits. In the slightest evaluation, the outer oil tank is cooled and an air-cooler radiator is used for greater evaluation. Where higher ratings are needed, or where a building or underground transformer is used, oil shafts are used to streamline oil and oil-to-water warm exchanger can be used in the same way. Some Transformers may have PCB where its use was approved. For example, in South Africa until 1979, substituted liquid substances, for example, are currently using silicone oil.

3.2.7 Instrument transformer

The machine's transformers are usually used to work devices from high voltage lines or high current circuits, securely assume and control hardware from higher voltage or flow. The essential wrench of the transformer is associated with high voltage or high current circuits, and the meter or transfer is associated with the auxiliary circuit. Instrument transformers can also be used as a reference transformer so that the auxiliary amount can be used without affecting the required hardware.

The terminal shows pieces of evidence (for example, H1, X1, Y1, and so forth, or awed for a spat or spot condition). Each ventilation shows an edge, shows the stage between equal prompt polarity and winding. These two instrument machines are applicable to transformers. The exact rights of terminals and cables are standard for measuring validable evidence and protective hand valve machines.instrumentation.

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Fig 3.2: Instrument transformers.

3.3 The ideal transformer

3.3.1 Real transformer deviations from ideal

The perfect model ignores the accompanying essential direct viewpoints in genuine transformers:

Center misfortunes on the whole called polarizing current misfortunes comprising of:

• Hysteresis Loss because of nonlinear use of the voltage connected in the transformer center

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• Eddy current Loss because of joule warming in center relative to the square of the transformer's connected voltage.

Though the perfect windings have no impedance, the windings in a genuine transformer have limited non-zero impedances as:

• Joule Loss because of opposition in the essential and auxiliary windings

• Leakage motion that escapes from the center and goes through one twisting just bringing about essential and optional responsive impedance.

3.3.2 Leakage flux

The perfect transformer show expects all the transitions produced by the necessary changes, each of which includes the rotation, which includes it. By and by, some conversions cross the way that the windings go outside. Such conversion spillage is naming the speed, and generally results in spillage adhesion in arrangements with composite transformer windings. With the speed of speed, it is again given priority with each cycle of providing life and release from interesting fields. It is simply not a power lag (see Streyad luck as below), but as a result of the low voltage control, the optional voltage is not particularly related to the necessary voltage, especially due to excessive pressure. Transformers are usually intended for less spillage adhesion purposes. In any case, it is difficult to accept all the spillage transit from the basic effects of transformer functioning. Split speed and the integrated effect of electric field around winding is such that it

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exchanges life-bound from optional to indispensable.

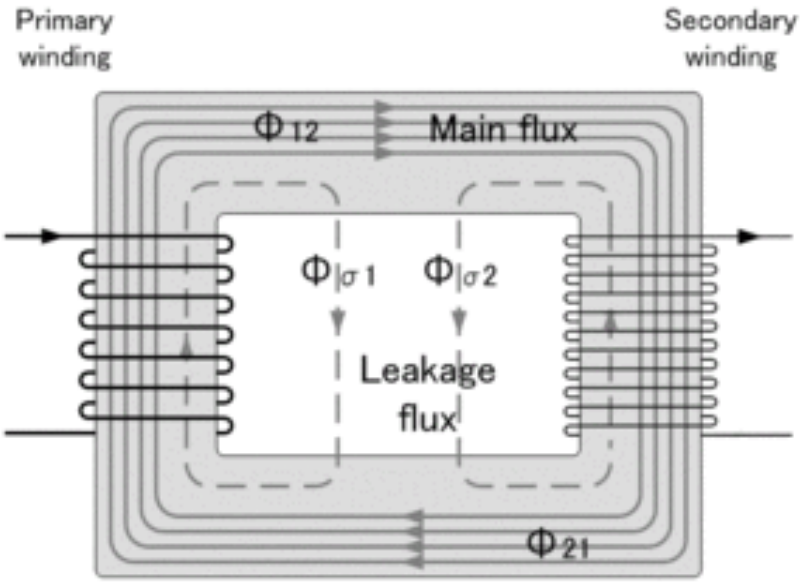

Fig 3.5: Leakage flux of a transformer.

3.3.3 Energy losses

A standard transformer will be a lucky misadventure, and will be 100% efficient. Under the transformer, the wind, the wind, and the broad structures are produced in the earth. Large transformers are usually increasingly effective, and those who evaluate more than 98% of their work for greater expansion. Using superconducting winding, the test transformers achieve 99.85% efficiency. Increasing efficiency can lead to huge animations, and subsequently cash, widely cash in stacked transformers; Exchanges are running off at the extra beginning and superconducting plans. The misfortune of the transformer is objectionable to the load, usually the unfortunate ones are so valuable to release the hipps, the misfortune of the full stack, the misfortune of half-stack, and so forth. Hipstresses and Vortex are still stuck in all the hazards and do not command a hip strongly. Growing rolling joule as a result of increased misery loads. No-hip misfortune can be severe, so even a passive transformer reduces the cost of electrical supply and running costs. Structural transformers for low losers require a larger center, great quality

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silicon steel, even lazy steel for central and thick wire, which increases the initial expense so that an exchange between the initial expense and the running costs (excessively fulfilling lucrative transformers) .

Transformer losses emerge from:

Winding joule losses

Current moving through winding conductors causes joule warming. As recurrence builds, skin impact and nearness impact causes winding opposition and, consequently, misfortunes to increment.

Hysteresis losses

Each time the attractive field is switched, a little measure of vitality is lost because of hysteresis inside the center. As per Steinmetz's recipe, the warmth vitality because of hysteresis is given by $W_h \approx \eta \beta_{max}^{1.6}$, and,

Hysteresis misfortune is in this manner given by $P_h \approx W_h f \approx \eta f \beta_{max}^{1.6}$

where, f is the recurrence, η is the hysteresis coefficient and βmax is the most extreme transition thickness, the exact type of which shifts from about 1.4 to 1.8 yet is regularly given as 1.6 for iron.

Whirlpool current losses

A center produced by ferromagnetic materials using additional carriers and the same type of components similarly consists of a neutral short circular turn through its full length. The virtual flows through the plane of the plane at a plane like a speed and is in charge of the resistant heat of the central elements. Cyclone current is a mind-boggling power of reclaimed square and reverse square of material thickness. Unlike a strong square, the vortex flow lags can be reduced by securing a shield of plates electrically from each other; All transformer overlaid or use comparable stations at low frequency.

Center shape and shell frame transformers

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Shut center transformers are developed in 'center shape' or 'shell frame'. At the point when windings encompass the center, the transformer is center shape; when windings are encompassed by the center, the transformer is shell frame. Shell frame configuration might be more common than center shape plan for dispersion transformer applications because of the relative straightforwardness in stacking the center around winding loops. Center shape configuration tends to, when in doubt, be increasingly temperate, and hence progressively predominant, than shell frame structure for high voltage control transformer applications at the lower end of their voltage and power rating ranges (not exactly or equivalent to, ostensibly, 230 kV or 75 MVA). At higher voltage and power appraisals, shell frame transformers will in general be increasingly common. Shell shape configuration will in general be favored for additional high voltage and higher MVA applications in light of the fact that, however more work serious to make, shell frame transformers are described as having naturally better kVA-to-weight proportion, better short out quality attributes and higher invulnerability to travel harm. Transformer would have no energy losses, and would be 100% efficient. In practical transformers, energy is dissipated in the windings, core, and surrounding structures. Larger transformers are generally more efficient, and those rated for electricity distribution usually perform better than 98%.

Experimental transformers using superconducting windings achieve efficiencies of 99.85%.The increase in efficiency can save considerable energy, and hence money, in a large heavily loaded transformer; the trade-off is in the additional initial and running cost of the superconducting design.

As transformer losses vary with load, it is often useful to express these losses in terms of no-load loss, full-load loss, half-load loss, and so on. Hysteresis and eddy current losses are constant at all loads and dominate overwhelmingly at no-load, variable winding joule losses dominating increasingly as load increases. The no-load loss can be significant, so that even an idle transformer constitutes a drain on the electrical supply and a running cost. Designing transformers for lower loss requires a larger core, good-quality silicon steel, or even amorphous steel for the core and thicker wire, increasing initial cost so that there is a tradeoff between initial costs and running cost (also see energy efficient transformer).

Eddy current losses

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Ferromagnetic materials also form a single short-circuitised clock across its entire length of a core made from well conductors and such a material. Eddie currents typically share fluid in a flat region and are responsible for heating resistant core components. Eddy current damage supply is a complex function of reverse square of frequency and material thickness. Eddie's current losses can be reduced by making a solid block instead of electrically cutting a stack of insulation plates from each other; All transformers operating at lower frequencies use laminated or similar cores.

3.3.4 Core form and shell form transformers

Off core transformer 'core form' or 'shell form' is built. When the windings are enclosed in the core, the transformer is the main form; When the windings are surrounded by the core, the transformer shell form is in. The shell form design can be flowing more than the core form design for distribution transformer applications due to relative comfort in core stacking around distribution distribution coils. Core form design, as a general rule, is more profitable and more common, its voltage is higher than the shell form design for high-voltage power transformer applications and the power rating range (less than or equal to the sample, 230 kV or 75 mVA). High voltage and power ratings, shell form transformers tend to be more prevalent. Because shell form design may be preferred for additional high voltage and superior MVA applications, although more labor is intensive production, shell form transformers are spontaneously identified as KV-to-weight ratio, good short-circuit power characteristics and higher defense. Transit damage

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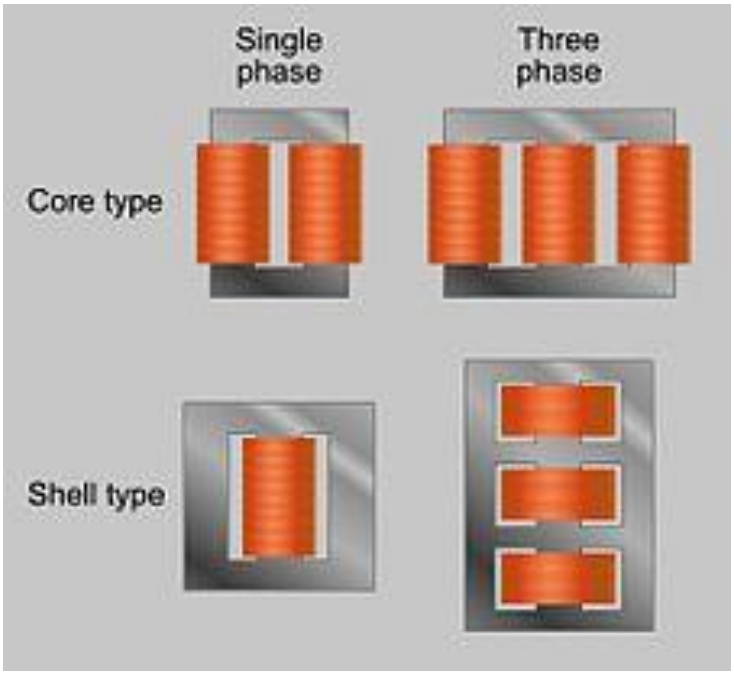

Fig 3.7: Core form shell type; Shell form core type.

3.4 Construction

3.4.1 Laminated steel cores

In order to use the power or sound frequency, the transformer generally has high porousness silicon steel making center. The steel is usually an open position and the center along this line is incredibly reducing the current charging and limiting the transformation in such a way that the couple is rolling around couples. Early Transformers engineers have long understood that the centers built from strong iron are causing current bad luck, and their structures are free of this impact with the centers, including protected iron cable packs. The next plans create the center through thin steel cover level stacking, which is a rule that has been used. Each cover protection is protected from neighbors by a thin non-inductive layer. For a general transformer status center, a base cross-sectional region is seen to stay away from immersion.

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The cover curves are stopping the rolling flow in very curve ways that encase lesser infections, thus reducing their size. The more straightforward cover reduces the loser, still progressively difficult and the construction is expensive. The thin overlays are generally used in high-frequency transformers, ready to work up to 10 kg with thin steel cover. Usually high flux silicon steel is made for use in power or audio frequencies. The steel often has free space and the core basically reduces the magnetic current and limits the flank to a path that closely connects the windings. Early Transformer Developers soon realized that the bruised edges made from solid iron have been damaged by Eddy's current, and their designs associate this effect with corrosive iron wire bundles. The following designs stack the thin steel lamination strings into a core, which is a principle that is in use. Each lamination insulator is insulated from neighbors by a thin non-conducting layer. The universal transformer indicates a minimum cross-secular area to avoid synthesis for the equation cores.

Effects of lamination The ED currents are restricted to very elliptical pathways that surround the slight flow and reduce their coverage. Slim laminations reduce the loss, but the structure is more rugged and expensive. Thin lamination is usually used in high-frequency transformers, very thin steel laminations can work up to 10 kg.

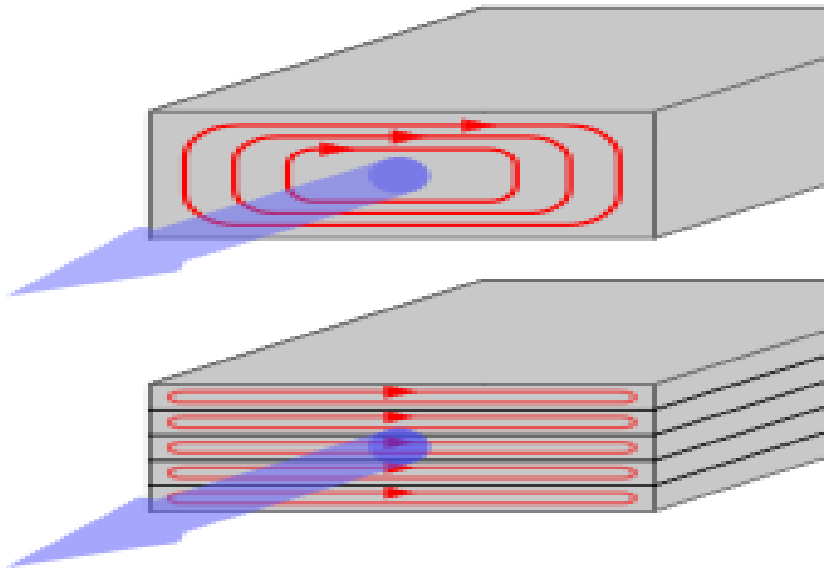

Fig 3.8: Laminating the core greatly reduces eddy-current losses.

The old name of the old-fashioned transparency is made by e-structured steel sheets of e-moded pieces using an interleaved pylose, a common plan of overlays. Such a plan would generally be more unfortunate, but it is extremely annoying to make. The cutting center or the center of the

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center of the center of the center are made around a rectangular frame, rotating a steel strip and then combining the layers. Then the two pieces are cut in size and the two C parts together with a steel tie and the center is enriched. The changes that they have in the desired perspective are the reduction of hesitation, gradually adjusting the grain of metal grains. The remancence of a steel core is meant that it keeps a static interesting field when the control is empty. When the control is re-applied, the linking field will create high temperatures until the rest of the attraction reduces after the remaining AC waveforms are connected. Overcurrent confirmation gadget, for example, must choose the cable to pass this innocent intern. In Transformers associated with long, overhead power transmission lines, due to the Jummagnetic loss of sun-based snowflow, the flow starts and the center's immersion and transformer confirmation gadgets may cause the work of gadgets.

Displacement Transformers can achieve less hip-hip misfortunes using less uncommon high-precision silicon steel or unconstrained (non-crystal) metallic streams. Higher indicating the cost of central elements reflects the life of transformers through light loads by low people.

3.4.2 Winding

The indicator tool used for winding depends on the application, but in all cases, separately, they must be electrically protected from each other, so that the guarantee can pass through each intersection. For little power and flag transformers, which are less likely to flow between the low and consistent curves of the flow, loops are regularly curved from the magnet wire controlled, for example, Form War Tires. To work on high voltage, large power transformers may be copied with copper rectangular strip channels protected by oil-infected paper and pressboard squares..

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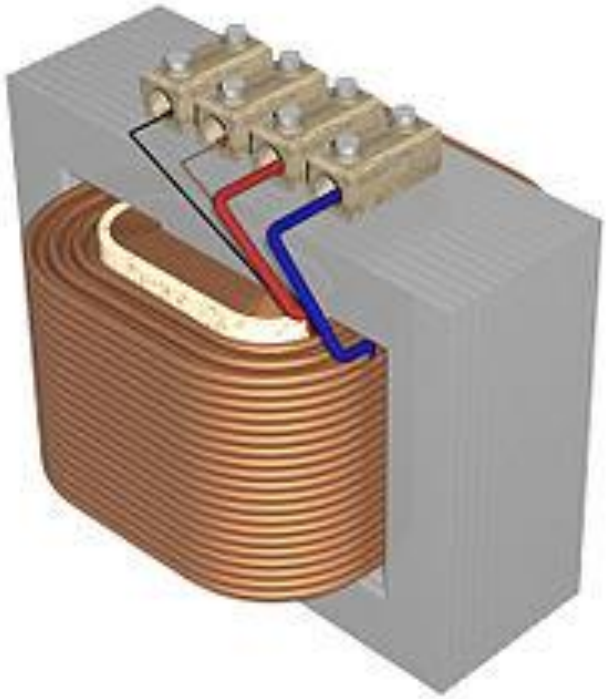

Fig 3.9: Windings are usually arranged concentrically to minimize flux leakage.

The ten-kilo kilo hert-powered high-frequency transformers often contain plated windmills made of plated leg wires to reduce skin-effect and proximity effect losses. Large power transformers also use multiple-strained containers, as current non-uniform distribution in low power frequencies is otherwise available in high-current winding. Each trap is separately interrupted and the stars are arranged so that rotating, or at certain points during the entire rolling period, each part is in different relative positions between the conductor. Transposition conducts the current flow at each end of the conductor, and Eddie reduces the current losses in the air. Blank conductor is more flexible than a solid conductor, similar size, helpful support.

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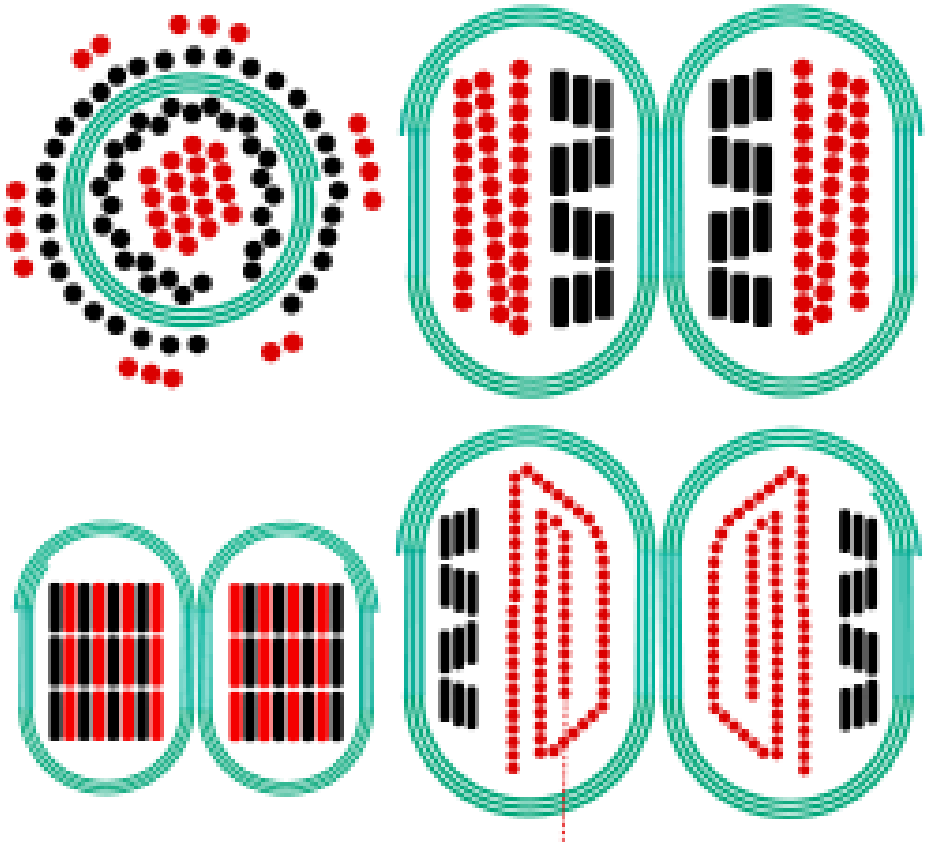

Fig 3.10: Transformer windings.

White: cover. Green Rolling: The grain silicone steel is located. Dark: The primary turning oxygen made of copper free. Red: Secondary rolling. Top left: Tordedal transformer. Right: C-center, yet the e-center will be comparable. Dark windings are made in the film. Top: Two windings are equal in all closing capacitance low. As most of the centers require extra protection as a reasonable conveyor at some rate. Base: Low capacitance for low-control high-voltage transformers for one side of the booster curve. Left left: decreasing spillage inductance will increase the capacitance prompt. Flash transformer windings limit the spillage inductance and stra capacitance to increase high-frequency response. Loops part of the area, and those segment interleaved between the other winding sections. Power-repetitive transformers may have a tube in the middle of the street, usually for the voltage change, the higher the voltage turns to the twist, the twist focus. Tap can be physically reconnected, or the taps developing a manual or programmed switch may be accommodated. Programmed on-stack-tap changers are used for transmission or transmission of electrical power in gear, for example, for programmable voltage

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controllers for circular segment heat transfer transformers or touch-tones. Sound repetition transformers, used to keep the position amplifier open for sound transmission, enables each speaker to change the barrier. An inside tap transformer is used to phase out the yield of a sound power intensifier in a push circuit on a regular basis. The Tx Transformer is fundamentally the same in AM transmitter.

Dry Type Transformer Rotation Protection Structure Standard Open Eject 'Plan and Preparation' may be due to high quality plans that include development or vacuum weight Impressions (VPI), Vacuum Weight Implimentation (VPE) and Cast Loop Epitome Forms. In the VPI system, heating, vacuum and weight mixing, the rolling polyester gum protection coat layer is used to seal, tie, and distribute fully with bacterial air violets, which results in increased protection from the crown. VPI windings are similar to VPI winding, but insure more insurance against natural effects, for example, from the water, the Earth or the Destructive Depositor, by regular Duplicate DNA to regular epoxy quotes.

3.5 Insulation drying

Before oil is present for the development of oily transformers, the protection of winding completely drips from the linking moisture. Dry artifacts are done at the facility, and likewise may be needed as a field advantage. The view around the drying coat, or the steam-phase drying (VPD) may end up where an invisible dissolved exchanges are curled and warmer by build-up in the center. For a little transformer, anti-warmth is used by the current wave in the winding. The warmth can be very well controlled, and it is vigorous productive. This technique is called Low Frequency Heating (LFH), because the current is compared to the visible visibility of the net mesh, which is present in very few repetitions, which are regularly 50 or 60 hex. Reduced the effect of loyalty in a low frequency transformer, so current voltage current prompts may be expected. The LFH drying technique is similarly used for the establishment of more transformers.

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CHAPTER-4

Switchgear

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4.1 Introduction

The mechanical assembly utilized for exchanging, controlling and securing the electrical circuits and gear is known as switchgear.

The switchgear gear is basically worried about exchanging and interfering with flows either under ordinary or anomalous working conditions. The tumbler switch with common circuit is the least complex type of switchgear and is utilized to control and ensure lights and other hardware in homes, workplaces and so on. For circuits of higher rating, a high breaking limit (H.R.C.) meld related to a switch may fill the need of controlling and ensuring the circuit. Be that as it may, such a switchgear can't be utilized beneficially on high voltage framework (3.3 kV). Right off the bat, when a breaker blows, it sets aside some opportunity to supplant it and therefore there is intrusion of administration to the clients. Besides, the circuit can't effectively intrude on extensive blame flows that outcome from shortcomings on high voltage framework.

With the progression of intensity framework, lines and other gear's work at high voltages and convey expansive flows. At the point when a short out happens on the framework, overwhelming current coursing through the gear may cause impressive harm. So as to hinder such overwhelming flaw flows, programmed circuit breakers (or basically circuit breakers) are utilized. An electrical switch is switchgear which can open or close an electrical circuit under both typical and irregular conditions. Indeed, even in examples in light of the fact that an electrical switch can likewise circuits, and additionally break them without substitution and along these lines has more extensive scope of utilization through and through than a breaker.

4.2 Essential Features of Switchgear

The essential features of switchgear are:

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Complete reliability: With the proceeded with pattern of interconnection and the expanding limit of producing station, the requirement for dependable switchgear has happened to central significance. This isn't amazing on the grounds that switchgear is added to the power framework to enhance the unwavering quality. At the point when blame happens on any piece of the power framework, the switchgear must work to segregate the broken area from the rest of.

Absolutely certain discrimination: When fault happens on any area of the power framework, the switchgear must have the capacity to separate between the broken segment and the solid segment. It ought to disengage the defective segment from the framework without influencing the sound area. This will guarantee coherence of supply.

Quick operation: When fault happens on any piece of the power framework, the switchgear must work rapidly with the goal that no harm is done to generators, transformers and other hardware by the short out flows. In the event that blame isn't cleared by switchgear rapidly, it is probably going to spread into solid parts, therefore imperiling complete shutdown of the framework.

Provision for manual control: Switchgear must have arrangement for manual control. In the event that the electrical (or gadgets) control fizzles, the essential task can be brought out into through manual control.

Provision for instruments: There must be arrangement for instruments which might be required. These might be as ammeter or voltmeter on the unit itself or the fundamental current and voltage transformer for associating with the principle switchboard or a different instrument board.

4.3 Switchgear Equipment

Switchgear covers a wide scope of hardware worried about exchanging and interfering with flows under both typical and irregular conditions. It incorporates switches, wires, circuit

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breakers, transfers and other gear. A concise record of these gadgets is given underneath. In any case, the peruser may locate the nitty gritty exchange on them in the consequent parts.

4.3.1 Switches: A switch is a gadget which is utilized to open or close an electrical circuit helpfully. It tends to be utilized under full load or no heap conditions however it can't intrude on the blame flows. At the point when the contacts of a switch are opened, a bend is created noticeable all around between the contacts. This is especially valid for circuits of high voltages and vast current limit.

The switches might be arranged into

• Air switches

• Oil switches

The contacts of the former are opened in air and that of the latter are opened in oil.

Air break switch: It is an air switch and is intended to open a circuit under load. So as to extinguish the bend that happens on opening such a switch, exceptional arcing horns are given. Arcing horns are bits of metals between which circular segment is framed amid opening activity. As the switch opens, these horns are spread more distant and more distant separated. Subsequently, the circular segment is protracted, cooled and interfered. Air break switches are commonly utilized outside for circuits of medium limit, for example, lines providing a modern load from a principle transmission line or feeder.

Isolator or disconnecting switch: It is basically a blade switch and is intended to open a circuit under no heap. Its primary reason for existing is to detach one part of the circuit from the other and isn't proposed to be opened while current is streaming in the line. Such switches are commonly utilized on the two sides of circuit breakers all together that fixes and substitutions of circuit breakers can be made with no threat. They ought to never be opened until the electrical switch in a similar circuit has been opened and ought to dependably be shut before be shut the electrical switch is shut.

Oil switches: As the name suggests, the contacts of such switche opened under oil, for the most part transformer oil. The impact of oil is to cool and extinguish the curve that will in general

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shape when the circuit is opened. These switches are utilized for circuit of high voltage and vast current conveying limits.

4.3.2 Fuse

A wire is a short pitch of metal, embedded in the circuit, which softens when unnecessary current streams thought it i.e. Breaker is a least difficult current interfering with gadgets for assurance frame intemperate current. It is utilized for over-burden or potentially cut off in medium voltage and low voltage establishments.

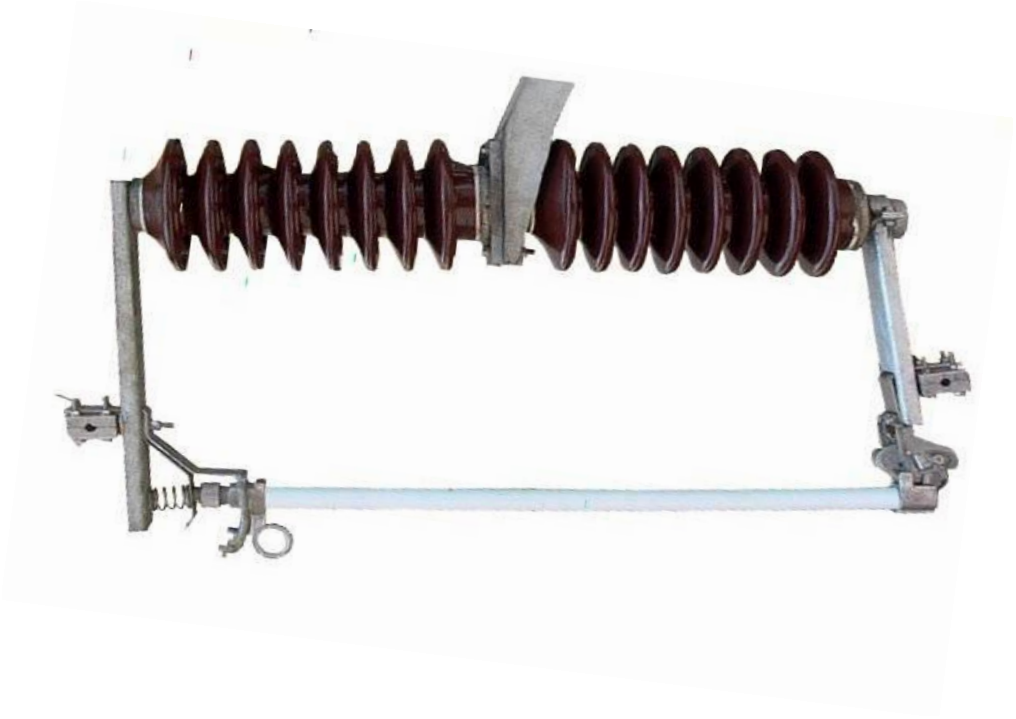

Figure 4.1: Fuse

Fuse characteristic

> Low melting point.

> High conductivity.

> Least deterioration due to oxidation.

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> It carries the normal current without overheating.

Advantage and disadvantage

Advantage:

> It is cheapest form of protection available.

> It requires no maintenance.

> Its operation is inherently completely automatically unlike a circuit breaker which requires and elaborates equipment for automatic action.

> It can make heavy short circuit currents without noise or smoke.

> The smaller size s of fuse element imposes a current limiting effect under short circuit condition.

> The inverse time current characteristics of a fuse make it suitable for over current protection.

> The minimum time of operation can be made much shorter than with circuit breaker we.

Disadvantages

 Continuation is lost in rewiring or replacing a fuse after operation.

 On heavy short circuit discrimination between fuse in series cannot be obtain unless there is sufficient difference in the size of the fuses concern.

 The current time characteristics of a fuse cannot always be correlated with that of the protected apparatus.

Type of fuse

Low Voltage Fuse

a. Semi Enclose Rewritable Fuse

It is used where the low values of fault current are to be interrupted. It consists of a base and a fuse carrier. When a fault occurs, the fuse element is blown out and the circuit is disconnected. The fuse carrier is taken out and the blown out fuse element is replaced by the new one. The fuse carrier is than reinserted in the base to restore the supply.

b. High Rupturing Capacity (HRC) Fuse

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A cartridge intertwines joins having breaking limit higher than certain predetermined esteem. It comprises of warmth opposing clay body having metal end-tops to which is welded silver current conveying fore bearing. The space inside the body encompassing the fore bearing is totally stuffed with filling powder. The filling powder is chalk, Plaster of sets, quartz or marble residue and goes about as a circular segment extinguishing and cooling medium under ordinary load condition the circuit component is at a temperature underneath its softening point. It conveys ordinary current without over warming when blame happens, the present increments and the breaker merciful melts previously the blame current achieves its first pinnacle. The compound response between the silver vapor and the filling power results in the arrangement of a high obstruction substance which helps in extinguishing the circular arc.

Figure 4.2: HRC Fuse

4.3.3 Circuit breaker

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During the operation of power system, it is often desirable and necessary to switch on or off the various circuits lines, distributors, generating plants etc. A circuit breaker is a piece of equipment which can

• Make or break a circuit either manually or by remote control under normal conditions

• Break a circuit automatically under fault conditions

• Make a circuit either manually or by remote control under fault conditions.

Thus a circuit breaker incorporates manual (or remote control) as well as automatic control for switching functions.

Operating principle

An electrical switch basically comprises of settled and moving contacts, called anodes. Under typical working conditions, these contacts stay shut and won't open naturally until and except if the framework winds up defective. Obviously, the contacts can be opened physically or by remote control at whatever point wanted. At the point when a blame happens on any piece of the framework, the trek loops of the electrical switch get invigorated and the moving contacts are pulled separated by some component, in this way opening the circuit. At the point when the contacts of an electrical switch are isolated under blame conditions, a circular segment is struck between them. The current is hence ready to proceed until the point when the release stops. The creation of bend defers the present interference process as well as produces colossal warmth which may make harm the framework or to the electrical switch itself.

Classification of circuit breaker

There are a few different ways of characterizing the circuit breakers. Be that as it may, the broadest method for into arrangement is based on medium utilized for curve annihilation. The medium utilized for bend annihilation is normally oil, air, sulfur hexafluoride (SF6) or vacuum. Likewise, electrical switch might be grouped:

Oil circuit breaker- Which employs some insulating oil (e.g. transformer oil) for arc extinction is called oil circuit breaker.

Air-blast circuit breakers- In which high pressure air-blast is used for extinguishing the arc is called air-blast circuit breaker.

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Sulphur hexafluoride circuit breakers- In which sulphur hexafluoride (SF6) gas is used for arc extinction is called sulphur hexafluoride circuit breaker.

Vacuum circuit breaker- In which vacuum is used for arc extinction is called vacuum circuit breaker. Each type of circuit breaker has its own advantages and disadvantages.

4.3.4 Lighting Arresters

At Mogbazar framework substation, we have seen a few lighting arresters. Lighting arrester is a gadget, utilized on matrix substation to ensure the protection on the network substation from the harming impact of lighting. The run of the mill lightning arrester otherwise called flood arrester has a high voltage terminal and a ground terminal. At the point when a lightning flood or exchanging flood goes down the power framework to the lighting arrester, the current from the flood is occupied around the ensured protection as a rule to earth. Lighting arrester is introduced on a wide range of bits of gear, for example, control posts and towers, control transformers, circuit breakers and transport structures in substation. The picture of lighting arrester and GT-2 is given in figure (4.8).

Figure 4.8: Lighting Arrester and GT-2 at mogbazar grid-substation.

The image of lighting arrester indicator is given in figure (4.9).

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Figure 4.9: Lighting arrester indicator at Mogbazar grid-substation.

4.3.5 Battery and Battery Charger

Battery is the core of Substation. Battery is a capacity gadget. It is required for back-up dc supply to guarantee assurance. Battery supplies 110V dc voltage to the control and assurance circuit when air conditioning falls flat or charger comes up short. In a substation, dc Voltage is required for insurance, control and flagging. Battery charger amends the 400V air conditioning into 110V dc and supplies the dc voltage to control boards for the referenced reason and also charges the batteries.

4.3.6 Bus-Bar Arrangements

At the point when various generators or feeders working at a similar voltage must be specifically associated electrically, transport bar are utilized as the regular electrical part. Transport bars are copper poles or thin walled cylinders and work at steady voltage. There are various types of transport bar are,

Single Bus-bar System: The single transport bar framework has the most straightforward plan and is utilized for power stations. It is additionally utilized in little outside stations having moderately few active or approaching feeders and lines. Figure demonstrates the single transport - bar framework for a run of the mill control station. The generators, active lines and transformers are associated with the transport bar. Every generator and feeder is controlled by an

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electrical switch. The isolators allow to seclude generators, feeders and circuit breakers from the transport bar for support and straightforward task.

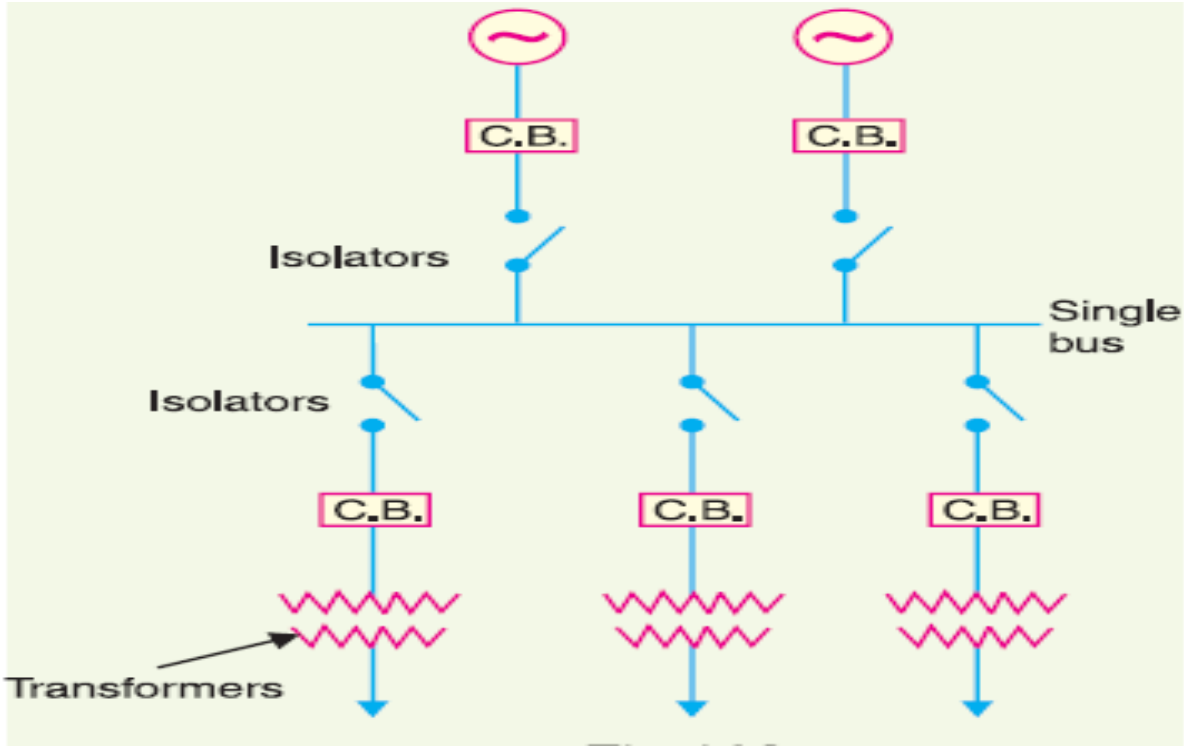

Fig 4.10: Single Bus-Bar arrangement.

Disadvantages: Single bus-bar system has the following three principal disadvantages they are

• The bus-bar cannot be cleaned repaired or tested without de-generating the whole system.

• If a fault occurs on the bus-bar itself, there is complete interruption of supply.

• Any fault on the system is fed by all the generating capacity, resulting in very large fault currents.

Single bus-bar system with Sectionalization: In large generating stations where a few units are introduced, it is a typical practice to sectionalize the transport so blame on any area of the transport bar won't cause finish shutdown. This is shown in figure which demonstrates the transport bar partitioned into two segments associated by an electrical switch and isolators. Three chief focal points are guaranteed for these game plans. Right off the bat, if a blame happens on any of the transport bar, that area can be secluded without influencing the supply to different

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areas. Also, if a blame happens on any feeder, the blame current is much lower than with unsectionalised transport bar. This allows the utilization of circuit breakers of lower limit in the feeders. Thirdly, fixes and upkeep of any area of the transport bar can be done by de-invigorating that segment just, disposing of the likelihood of finish close down. It is advantageous to remember that an electrical switch ought to be utilized as the sectionalizing switch so that uncoupling of the transport bar might be completed securely amid load exchange. Besides, the electrical switch itself ought to be furnished with isolators on the two sides so its support should be possible while the transport bar are alive.

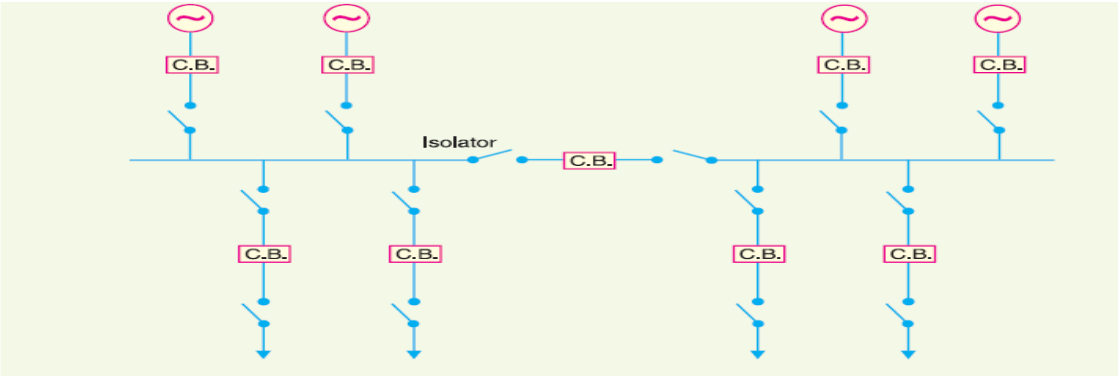

Fig 4.11: Single Bus-Bar with sectionalisation system.

Duplicate bus-bar system: In large stations, it is vital that breakdowns and upkeep should impedance as meager as conceivable with progression of supply. So as to accomplish this goal, copy transport bar framework is utilized in imperative stations. Such a framework comprises of two transport bars, a "primary transport bar" and a "save " transport bar. Every generator and feeder might be associated with either transport bar with the assistance of transport coupler which comprises of an electrical switch and isolators.

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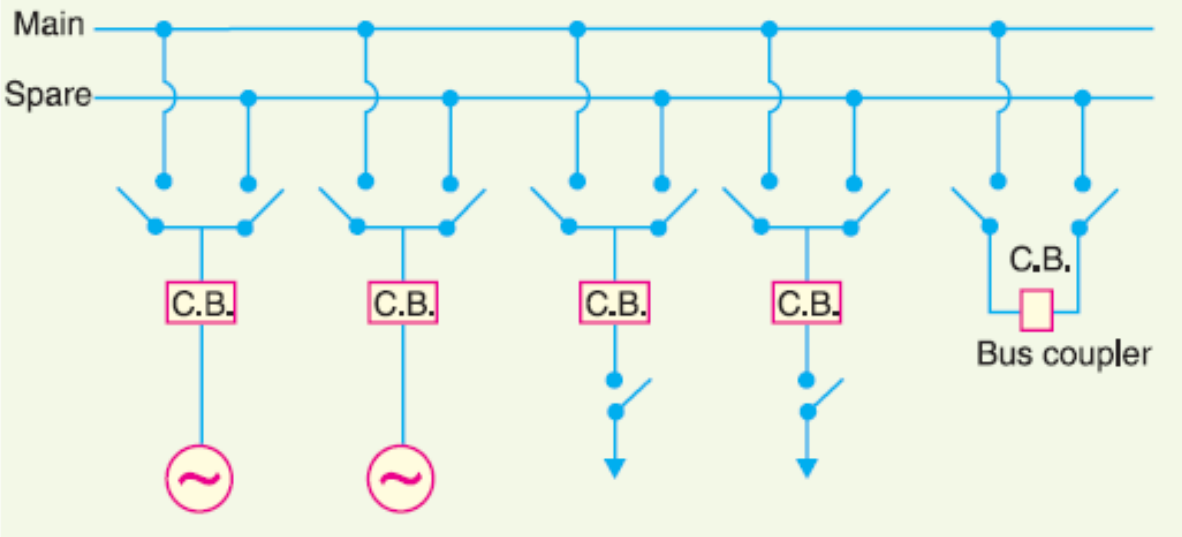

Fig 4.12: Duplicate Bus-Bar arrangement.

Advantages: On the off chance that fix and support it to be carried on the principle transport, supply require not be hindered as the whole load can be exchanged to the extra. The testing of feeder circuit breakers should be possible by putting them on extra transport bar, subsequently keeping the principle transport bar undisturbed. In the event that a blame happens on the transport bar, the network of supply to the circuit can be kept up by exchanging it to alternate bus-bar.

4.3.7 Short-Circuit

At whatever point blame happens on a system with the end goal that a substantial current streams in at least one stages, a short out is said to have happened. At the point when a short out happens, a substantial current called cut off courses through the circuit. At the point when a short out happens, the voltage to blame point is diminished to zero and current of unusually high greatness flows through the system to the point blame. Then again, an over-burden implies that heaps more prominent than the planned qualities have been forced on the framework. Under such conditions, the voltage at the over-burden point might be low, however nit zero. The undervoltage conditions may reach out for some separation past the over-burden point into the rest of the framework. The flows in the over-burden hardware are high yet are generously lower than that on account of a short-circuit.

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Causes of short-circuit: A short circuit in the power system is the result of some kind of abnormal conditions in the system. It may be caused due to internal and external effects.

Internal effects: internal effects are caused by breakdown of equipment or transmission lines, from deterioration of insulation in a generator, transformer etc. Such troubles may be due to ageing of insulation, inadequate design or improper installation.

External effects: External effects causing short circuit include installation failure due to lighting surges, overloading of equipment causing excessive heating; mechanical damage by public etc.

Effects of short-circuit

At the point when a short out happens, the current in the framework increment to an anomalous high esteem while the framework voltage diminishes to a low esteem.

The overwhelming current because of short out causes unreasonable warming which may result in flame or blast. Some of the time hamper the type of a curve and makes extensive harm the framework. For instance, a bend on a transmission line not cleared rapidly will consume the conductor seriously making it break, bringing about quite a while intrusion of the line. The low voltage made by the blame has an exceptionally hurtful impact on the administration rendered by the power framework. On the off chance that the voltage stays low for even a couple of moments, the consumers motors might be closed down and generators on the power framework may wind up flimsy.

Short-Circuit currents

Most of the failures on the power system lead to short-circuit fault and cause heavy current to flow in the system. The calculations of these short-circuit currents are important for the following reasons:

• A short-circuit on the power system is cleared by a circuit breaker or a fuse. It is necessary, therefore, to know the maximum possible values of short-circuit current so switchgear of suitable rating may be installed to interrupt them.

• The magnitude of short-circuit current determines the setting and sometimes the types and location of protective system.

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• The magnitude of short-circuit current determines the sizes of the protective reactors which must be inserted in the system so that the circuit breaker is able to withstand the fault current.

• The calculation of short-circuit currents enables us to make proper selection of the associated apparatus (e.g.bus-bar, current transformers etc) so that they can withstand the forces that arise due to the occurrence of short circuits.

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CHAPTER-5

Conclusion

5.1 Discussion

We have spent some remarkable days at DPDC during our internship program. DPDC is one of the best practical grounds for the Electrical and Electronic Engineers in our country. We must say the theories that we have learned at our University was practically observed by us at DPDC. We consider ourselves very much lucky to have our internship program with a reputed electricity distribution company like DPDC. It gave us an opportunity to implement our theoretical knowledge in practically. Our achievements from DPDC are as follows:

• Industrial training provided by DPDC has enriched our practical knowledge.

• It has enlarged our thinking capacity about practical operations of the different equipment.

• It has increased our confidence level for facing job interview in future.

• DPDC gave us a unique experience of observing the equipment of substation.

The friendly environment in DPDC encouraged us to co-operate with each other. We have learned a lot and obtained practical knowledge during our internship at DPDC which will help us in future life.

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5.2 Problems

We have already gathered some knowledge about DPDC's practical operations. But within the limited time it was really difficult task to gather the whole knowledge about everything. Due to some privacy problem we could not get enough pictures and enough accesses to every place. Due to some mechanical fault, it was really a difficult task to visit and gather some knowledge about three of our advised substation. At that time due to the frequent maintenance at Ullon 33/11KV Sub-station; it was not possible for me to know about the coolers of the grid. Due to some technical problems I could not observe the single bus bar of Madartek(local) 33/11KV Sub-station.

5.3 Recommendation

Our resources are limited, but the proper utilization of this resources by the skilled and trained man power can help the optimize use of this resources. So DPDC should be more careful about system loss which can help them to achieve the acceptable loss levels.

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