FIELD STUDY ON OPRATION, MAINTENANCE, OVERHAULING, TROUBLESHOOTING AND SERVICEING OF BANGLA TRAC LIMITED (BANGLA CAT)

A report submitted to the Department of Electrical and Electronic Engineering in partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Electrical and Electronic Engineering (EEE).

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CERTIFICATION

This is to the certify that this report entitled “study of operation, maintenance, overhauling, troubleshooting and servicing, is done by Md. MASUDUR RAHMAN, AND MD. SAMIUL ALIM, under we direct supervision and this work has been carried out by him in the, BANGLA TRAC LIMITED (Bangla cat) company. Of the Department of electrical &electronic engineering under the faculty of engineering of Daffodil international university in partial fulfillment of the requirements for the degree Bachelor of Science in electrical and electronic engineering .the presentation of the work was held on

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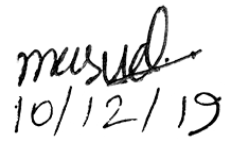

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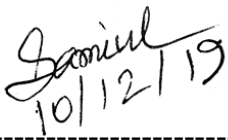

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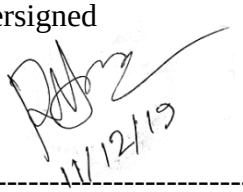

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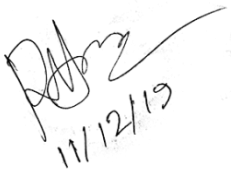

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From the very beginning, I would like to express my gratitude to the Almighty Allah for giving me the ability and the strength to finish the task successfully and within the scheduled time. About this report “Study on operation, maintenance, overhauling, troubleshooting and servicing” has been prepared to fulfill the requirement of B.Sc. degree. I am very much fortunate that I have received sincere guidance, supervision and co-operation from various persons. I would like to thank of BANGLA TRAC LIMITED (BANGLA CAT), for given me the opportunity to work. I would like to thank MR. MD. DARA ABDUS SATTER Head of Department, Electrical &Electronic Engineering. I would also like to thank we co-supervisor K.B.M RAKIB HASAN, Lecturer Department of Electrical & Electronic Engineering daffodil international University for being helpful the time of we internship. A big thanks to its Engineers whose guidance and training came handy in obtaining the perfect knowledge and experience about the Electrical & Electronic installation operation and maintenance and it will definitely be useful in my future. on the submission of my internship report on: operation, maintenance, overhauling, troubleshooting. I would like to extend my gratitude and sincere thanks to MD. HUMAYUN KOBIR deputy manager- diesel generator, for being a source of guidance and inspiration during this period. Their wonderful style of mentoring has surely made my training period a great learning experience. I would also like to thank all staff of BANGLA TRAC LIMITED (Bangla Cat) limited whose kindly spared for me much of their precious time in giving me support and information .finally we cordial thanks to we parents whose continuous support was a genuine source of motivation behind making this report a fruitful one.

ABSTRACT

During the field study period the practical experiences is achieved over the topics related alternator high tension panel ,operation of low tension ,motor controlling ,stator motor ,air gap measure between PMG & Exciter, to arrange spark plug gasket for every maintenance ,to arrange cat grease ,to arrange cat coolant ,Intel air system ,air cleaner service indicator ,after cooler condensation battery electrolyte level , engine oil level crankshaft vibration damper ,power and load ,distribution board ,and control panel .

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Nov 17, 2019

To Whom It May Concern

This is to certify that **Mr. Md. Masudur Rahman**, student of Daffodil University had successfully completed his Industrial Training Program (4 weeks) with Bangla Trac Limited (BanglaCAT), the authorized dealer of CATERPILLAR Inc. USA in Bangladesh from Jun 20, 2019 to Jul 25, 2019.

The subject matter of the Industrial Training Program was Maintenance, Overhauling Commissioning and Troubleshooting related issues of various gas and diesel Caterpillar (USA) gensets and machines.

During his Industrial Training Program he followed instructions according to the satisfaction of the management. He was keen to learn the lessons and was enthusiastic in completing any assignment that was given to him time to time.

We wish him all the best for his future endeavors.

17/11/19

Md. Mamunur Rahman Khan
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Abbreviation

KV = Kilo Volt

KVA= Kilo Volt Amperes

AC=Alternating Current

Hz=Hertz

PF=Power Factor

OS=Operating System

HT=High Temperature

Fry=Frequency

Gen=Generator

DC=Direct Current

PF=Power Factor

CT=Current Transformer

HT=High Temperature

OS=Operating System

LT=Low Temperature

Chapter 1

Introduction

1.0 Introduction

Power Supply System is the most significant division in an electrical site and Furthermore our nation. The Report is about the detail depiction of intensity supply framework and controlling framework, Diesel Generator, engine and working technique of Diesel Generator and engine by and large upkeep and all sort of data. The general procedure of a Transformer, Motor, Diesel Generator is featured here. This Report will help anyone who is intrigued to think about power supply framework and Diesel Generator.

1.1 Background

Diesel Generators are some of side in BANGLA CAT are as per the following. Right off the bat, all the fundamental parts of the generator are fabricated and collected at a solitary source. After Caterpillar has presented four years or twenty thousand time run hourly guarantee just because universally, just for the right range. Fundamentally, Bangla Cat diesel generators keep up motor transient reaction necessities and acknowledge full percent appraised load in one stage. The diesel motor has four stock that joins reliable execution and brilliant efficiency with least weight. Continuously, the Caterpillar principle control framework, BANGLA CAT UPS, ATS and switchgear guarantees a predictable power supply and association with your armada through on location and remote checking alternatives. For next time, Caterpillar EMCP 4 control board gives expandable controller choices, some of the board for right thing, and an easy to use interface.

From 5.4 to 14,800 W (6.75kVA to 18,500kVA) of intensity potential, the profoundly proficient CAT. Diesel generators have been Field-demonstrated in a huge number of utilizations around the world. Their industry driving mechanical and electrical structure and engine turning over abilities assist them with staying coordinated to the presentation and yield. Diesel Generators are Environment same as usually and are reasonable for Green Projects because of its low emanation of NOX, COX, HC.

1.2 Origin of the Report

As a section satisfaction of Bachelor of Science in Electrical and Electronic Engineering program I have done this practicum report .My report entitled as "Sub-station activity, support."

Basis on this one month length down to earth experience I have done this report and I have work under the guidance of Eng. HUMAYUN KABIR HEMAL, Head of Diesel motor Department, and different group of BANGLA TRAC LIMITED .

1.3 Objectives of the Repot

1.3.1 General Objective

The prime objective of this project are to extrovert my field study knowledge to the practical field with adequate conceptualization and understanding the performance of the parameters in case of power generation, Supply System ,operation, maintenance and motor working procedure ,compressor, Alternator, Control panel etc.

1.3.2 Specific Objective

- Study on power Supply system, operation and maintenance of electrical Machine and Apparatus.
- To supply proper Electrical Transmission and Distribution line.
- Study on Difference types of limited switch, Isolator, Fuse, timer Relay, Circuit breaker, Magnetic Contactor, Transformer.
- To study working procedure of Diesel Generator and transformer.
- To study and working Procedure of a Motor.
- To Determine the process of maintaining, operation and maintenance of a Diesel generator, transformer.
- Suggest probable solution of the Identified problem.
- Identify Different types of problems of Electrical Machines.

1.4 Significance

While the power segment in Bangladesh has seen numerous examples of overcoming adversity in the last couple or the years, the street that is spotted with difficulties that outcomes from the expand exist between what arranged area has had the option to convey. There is no uncertainty that the interest for power is expanding quickly with the improvement of expectation for everyday comforts, increment of agribusiness creation, procedure of businesses just as in general

Development of the nation. In our nation emergency of power in national Grid, Private industry and one are utilizing their very own capacity plants and Generators joining with the national network to satisfy the address the issue of power.

1.5 Scope and Opportunities

Power is one of the most critical factors in Bangladesh. Like the countries of the world, the solicitations control is extending bit by bit in our country .so the significance is High than some other zone. In the hour of globalization control frustration has become a serious issue for our country. This report will Cover and offer the odds to know different sorts of device use in Bangla Cat Limited Diesel Engine, Power Generation and Controlling System of various developing issue during power Generation.

1.6 Methodology

In driving this examination, the Following system was gotten is gathering Data and information similarly as preparation of the Report.

1.7 Sources of Data

- Primary Data: Primary data are collected from the books about Diesel generator, transformer, Motor, the user manual to the engineers, technicians of the company, and official documents of the company.
- Secondary Data: Secondary data has been collected from the online resources and journals.

Chapter 2

POWER GENERATION BY DIESEL GENERATOR

2.0 Introduction

Generator is the primary hotspot for power. Each Industry required generator when not a framework supply. There are numerous generators use for any Industry. Generator are, Ship Generator, Perkins generator, Diesel generator, Duets Generator, SDMO generator and so on.

2.1 Power Sources of Bangla Cat Generator

Bangla cat Limited has ten Big Generator and Two Big Ship generator power sources.
They are:

i. Perkins Generator (500 KVA)
ii. Duets Generator (500 KVA)
iii. Volvo Generator (450 KVA)
iv. John Deere (250 KVA)
v. SDMO Generator (500KVA)
vi. Perkins Generator (435 KVA)
vii. Volvo Generator (400 KVA)
viii. Perkins Generator (550KVA)
ix. Duets Generator (200 KVA)
x. SDMO Generator (500 KVA)

2.1.1 Ship Generator

There are two big ship generators here, this generator produces huge amount of electricity. This are

1. Ship Generator – 01 (1170 KVA)
2. Ship Generator -02 (1175 KVA)

Here all Generator supplies electricity continuously, when there is no Rural Electrification Board (REB) line. All time Hall factories run by REB line electricity but Electricity has gone, on that

time hall factory run by generator .Everyday Bangla Cat Limited Diesel engine supply electricity and this demand can full fill every time if this company will continue. Otherwise, the companies some sites are take rest (no electric supply available)[i].

2.2 Diesel Generator

A Diesel generator is the blend of a Diesel motor with an electrical generator (regularly an alternator to created electrical vitality. Diesel producing sets are utilized in places without association with the power matrix, as crisis control supply if the framework comes up short, just as for increasingly complex application, for example, BANGLA CAT generator, fundamental help diesel motor to the power lattice. Sizzling of Diesel generators is basic to maintained a strategic distance from low burden or a deficiency of intensity and is entangled by present day gadgets, explicitly non-straight loads.

Fig 2.1 Diesel Generator (Perkins)

2.2.1 Specification of Perkins generator

Name	Perkins
Company Location	UK
Model Number	G500
Serial Number	CSGAD0419
Capacity	500 KVA
Power Factor	0.8
Rated Voltage	415/240 V
Rated Current	550 A
RPM	1500
Rated Frequency	50Hz
Phase	3
Max. Ambient temp	30
Excitation Voltage	35 V

Table 1: Specification of Perkins generator

2.3 Ship Generator

The Ship Generator is the most significant part in an Electrical Energy. This ship Generator is the huge estimate and can created enormous Electricity. This sort of Generator accessible in this organization. This Ship Generator is 1170 VA and Maximum burden is 1100A current. At the point when, RED line Current has gone, on that time This Company Run by this Generator. This

is Diesel Engine.

Fig 2.2: Ship Generator

2.3.1 Specification of Shop Generator

Name	Ship Generator
Company location	USA
Machine Modal Number	L5794GSI ESM
Machine Serial Number	C-94861/1
Engine Model Number	VHP5904GSID
Engine Serial Number	C-91861-901/1
Fuel	Natural Gas and Diesel
Capacity	1170 KVA
Rated voltage	415/240 V
Rated Current	1100A
Power factor	0.8
Rotation	CCW
Rated Frequency	50Hz
Phase	3
RPM	1200

Weight	25186kg
Input Voltage	12-36 VDC
EXC Volts	30
EXC Amps	7
Stator connection	Wye
Air inlet Temp. Limit F/C	100/38

Table 2: Specification of Ship generator

2.4 A Simple AC Generator

Underneath appears as figure we see a Very straightforward AC Generator. The generator comprises of a pivoting considered attractive field a Rotor and a stationary loop of wire called. The Rotor is a lasting Magnet which comprises of a south attractive shaft and north attractive post. As the engine turns, its attractive field cuts over the stationary stator. A voltage is actuated into the stator winding. At the point when the magnets North pool passes the Stator, current streams in a single Direction. Current streams in the restriction course when the magnets South Pole passes the stator. The steady inversion of current stream brings about a rotating Current (AC) waveform that can be diagrammed as appeared in future.

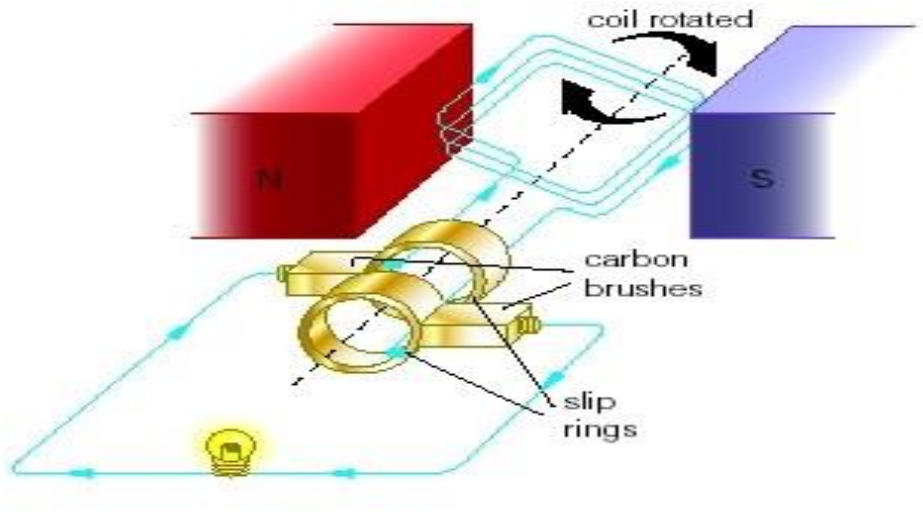

Fig 2.3 Simple AC Generator system

The Rotor might be a 2-post type having a solitary north type having a solitary north and a solitary south attractive shaft. All kind of rotors is four post type with two south and two north attractive shafts. As we can apply:

1. The 2-pole rotor must be turned at 3600rpm to produce an AC frequency of 60 Hertz, or at 300rpm to deliver an AC frequency of 50 Hz.
2. The 4-pole Rotor must operator at 1800rpm to deliver a 60 Hertz AC frequency or at 1500 rpm to deliver a 50 hertz AC frequency.

2.5 Generator operation

BANGLA CAT diesel engine described briefly as follows:

1. Some "residual" magnetism is present in the rotor and is sufficient to induce approximately 7 to 12 volts AC into the stator's AC power windings.
2. During the time engine controller circuit board battery voltage to the rotor, next the brushes and ship circuit.

    i. The battery voltage is called "Field Boost".
    ii. Flow of direct current through the rotor increases the strength of the magnetic field above that of "residual" magnetism alone.

1. "Residual" plus "Field Boost" magnetism induces a voltage into the stator excitation (DPE), battery charge and AC Power windings.

2. Excitation winding unregulated AC Output is delivered to an electronics voltage regulator, via an excitation circuit breaker.

- A Reference Voltage has been continued on to the voltage Regulator as we see.
- An Actual ("sensing") voltage is delivered to the voltage Regulator via sensing leads from the stator AC power windings.
- Regular compare the actual main voltage to its preset reference voltage continue.

- If the actual (sensing) voltage is less than the respect reference voltage, the Regulator will increase the regulated current flow to the Rotor.
- In the manner described, the Regulator maintains an actual (sensing) voltage that that is equal to the pre-set reference voltage.

2.6 Name and Functions of different Parts of Diesel Generator

Generators are widely used to produce AC voltage. Understand how these generators work, the function of BANGLA CAT of the diesel generator must first be understood. The purpose of the following components of a generator is given below:

2.6.1 Alternator

Alternators work on a similar crucial of electromagnetic enlistment as BANGLA CAT generators. Substituting voltage might be created by a curl in the attractive field or by turning an attractive field a stationary loop. The estimation of the voltage produce on-

- The number of turns continue in the coil
- Strength of the field we see main part
- The speed at which coil or magnetic field rotators work[ii].

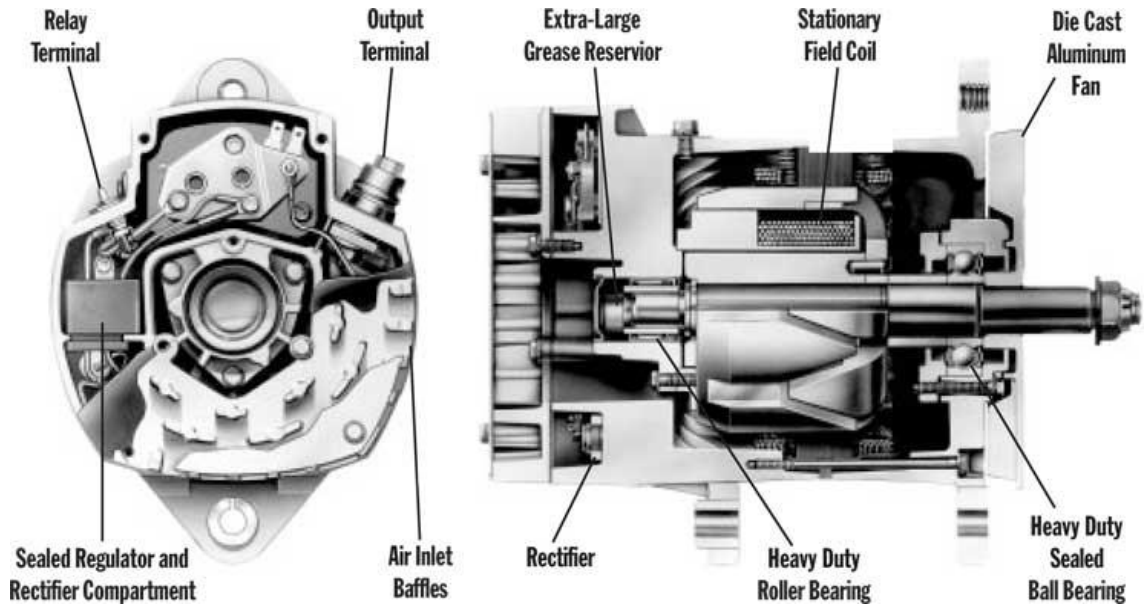

Figure 2.4 Generator Alternator Parts

2.6.2 Specification of Perkins Alternator

Capacity	500 KVA
Power Factor	0.8
Rated Voltage	415/240 V
Rated Current	550 A
RPM	1500
Rated frequency	50 Hz
Phase	3
Temp	30
Excitation Voltage	35 V
Excitation Current	3 A

Table 3: Specification of Perkins alternator

2.6.3 Rotating Components

- Main Field (rotor)
- Exciter Armature
- Permanent Magnet (PMG)
- Bridge Rectifier

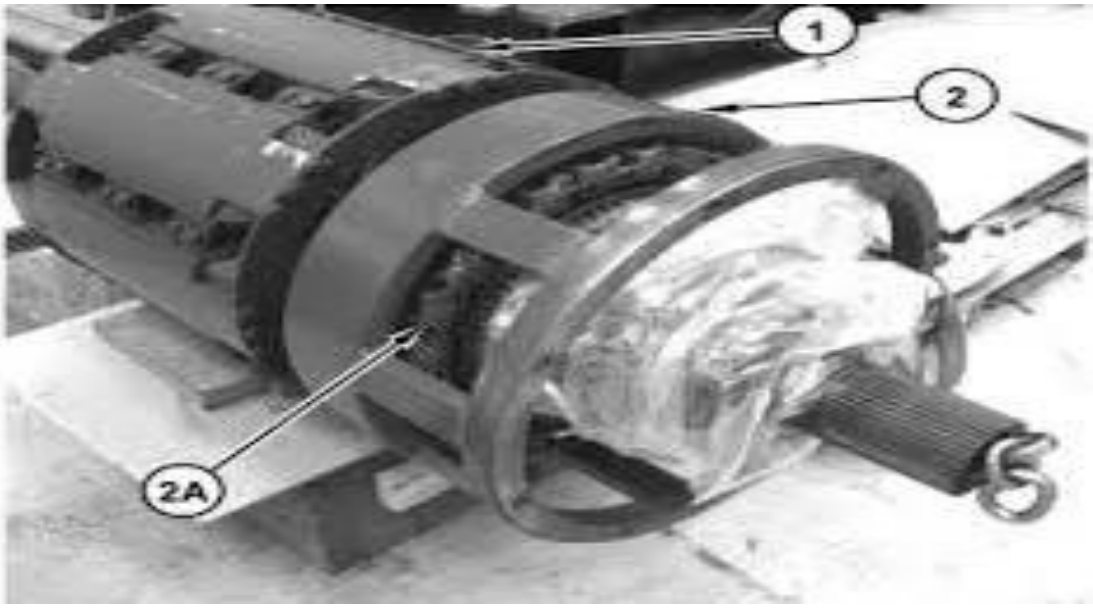

Figure 2.5 Armature Assembly

(1-Bearing ,2-Rotating permanent magnet,3-bridge Rectifire,L3-Exciter Armature,L4-Rotating Field)

2.6.4 Main Rotor

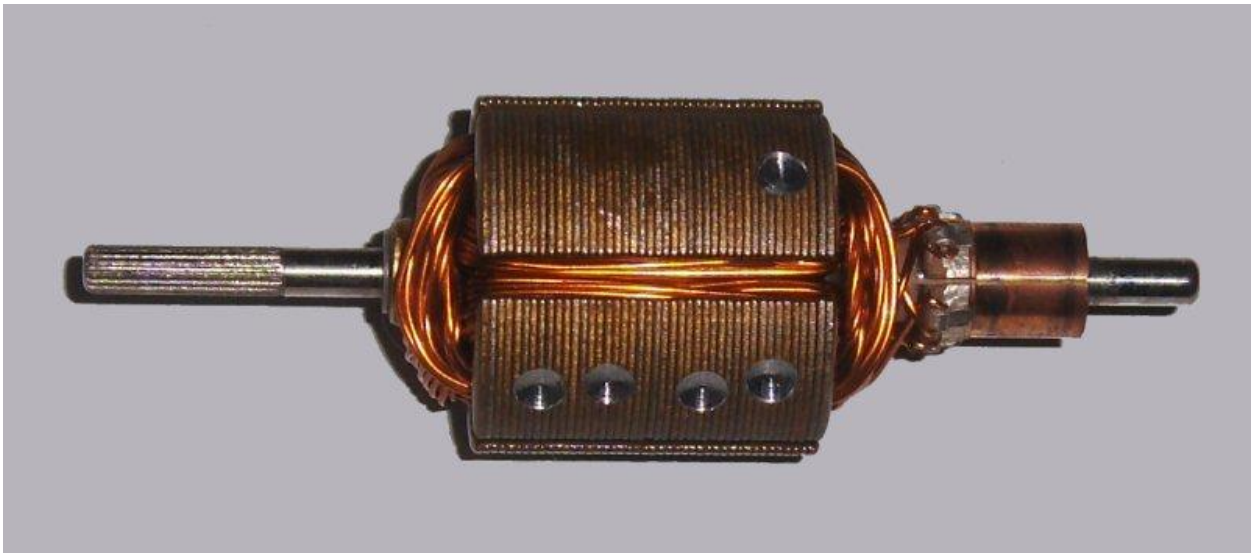

Figure 2.6 Armature construction

The primary rotor is the principle part of a synchronous generator, which Rotates on the grounds that the wires and attractive field of the AC synchronous generator are organized so a torque is created about the rotor hub .In certain structures, the rotor can Act to fill in as the armature,

crosswise over which the information voltage is provided .The fundamental Rotor of Ac synchronous generator is a pole that contracted with the shafts. The fundamental rotor is continually turning through the armature field. At that point there produce an electromagnetic motion and applied to an outer burden through the armature.

2.6.5 Coupling

Figure 2.7 Coupling

A coupling is a Device used to interface two shafts together the entirety of their closures to transmit control. Couplings don't regularly permit detachment of shaft activity, through there do leave torque constraining coupling which can slip or disengaged when some torque limit is surpassed .The basic role of couplings is to join two bits of pivoting hardware while allowing some level of misalignment or end development or both .By cautious choice, establishment and support of couplings, generous sparing can be made in diminished upkeep cost and personal time.

2.7 Basic Component of a Generator Engine

- Engine head

- Engine block
- Fly wheel
- Crank shaft
- Main shaft
- Cam shaft
- Big-end breaking
- Piston
- Piston ring
- Connecting rod
- Liner
- Oil pump
- Injector
- Fuel pump
- Water pump
- Ac pump
- Rocker arm
- Intake valve
- Exhaust valve
- Intake manifold
- Exhaust manifold
- Changing alternator
- Turbo charger
- Filter
- Lube oil
- Fuel
- Air
- Radiator
- Fan

2.7.1 Radiator

Fig 2.8 Radiator

Capacity a Radiator is a kind of warmth exchanger. Of is intended to move heat from the hot coolant that moves through it to the air passed up the fan.

2.7.2 Starter System

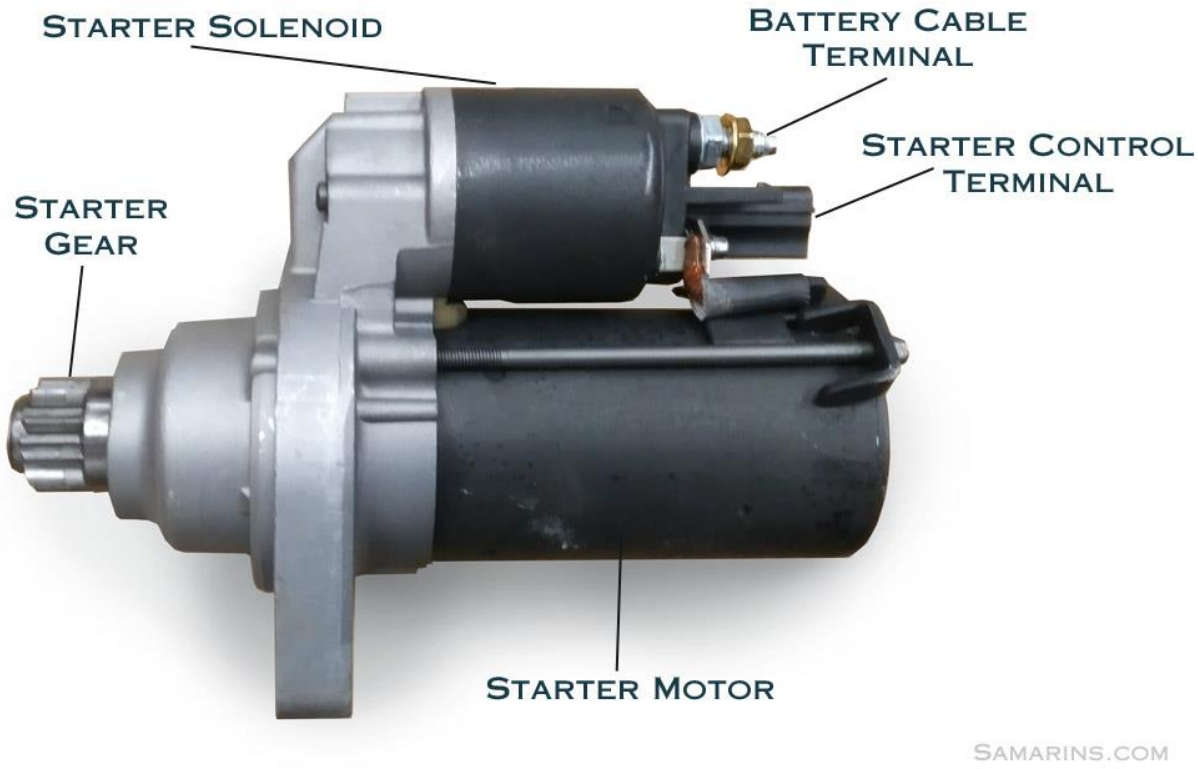

Fig 2.9 Starter motor system

Bangla CAT inward burning motors expect of framework to get them into primary activity. Most cylinder motors utilize a starter engine controlled by a similar battery as runs the rest electric frameworks. Interior ignition motors are frequently by pull framework ropes. Huge stationary and marine motors might be begun by the coordinated infusion of compacted air into chambers or incidental with cartridges.

2.7.3 Cooling system

We know that in case of combustion engines, combustion of air and fuel takes place inside the engine cylinder and hot gases are generated .The temperature of gases will be 2300- 2500 c . This is a very high temperature and result into burning of oil film between the engine parts and may result into seizing or welding of the same important part. So, this temperature must be

reduced to 150-200 c at which the engine will work must efficiently. There are two types of main cooling system.

- Air cooling system
- Water cooling system

2.7.4 Air cooling system

This framework broadened surfaces are made on the chamber dividers solid and solid, chamber head. Warmth created due ignition in the motor chamber will be directed to this blades and when the wind currents over the balances, warmth will be scattered to air.

The amount of heat dissipated to air.

- Amount of air through the fins
- Fin surface area through
- Thermal conductivity of metal used through

2.7.5 Water cooling system

In is the strategy cooling water coats are given around the chamber, chamber head, valve seats and so forth the water when coursed chip away at the coats, it assimilates heat through of burning .this boiling water will at that point be down with cooling in radiator somewhat by a fan and incompletely by the stream built up the forward movement of the vehicle. The cooled water is re-circled through the water coats in to motor inside.

Water cooling system mainly consists of

- Radiator
- Thermostat valve
- Water pump
- Fan
- Water jackets

2.7.6 Lubrication system

Inside burning motors require grease that moving parts slide effectively activity over one another. deficient grease subject the pieces of the motor to metal-to-metal contact ,rubbing , heat develop – ,fast wear regularly coming full circle in parts turning out to be grinding welded

together for example cylinders in their chamber . Enormous end course up will at some point lead to an associating bar breaking and jabbing out through the crankcase.

CHAPTER 3

Electrical supply system of Transformer

3.1 Introduction

In ahead of schedule there was a little interest for electrical vitality with the goal that little power stations on the generator side were worked to supply lighting and warming burdens. Anyway the across the board utilization of mechanical vitality by present day human advancement as produce mass electrical vitality financially and proficiently .the expanded interest of electrical vitality can met by building huge power stations at great spots where fuel or water vitality is accessible in wealth. BANGLA CAT through the system can be partitioned into two sections:

- Transmission
- Distribution

3.2 Electric supply system

The conveyance of electrical power from a power station to the Consumers premises known as to line main supply system. An electric supply consists of three principal components:

- Power station
- Transmission line
- Distribution system

The electric supply system can be broadly classified into two parts:

- D.C or A.C system
- Overhead or underground system

Presently a day's 3-stage A.C framework is normally adopter for age and transmission of electric power as a practical recommendation. Anyway appropriation of electric power done by 3-stage, 4 wire A.C System. The undergrounding framework is progressively costly then the overhead framework. Therefor in our nation, overhead framework is for the most part adopter for transmission and conveyance of electric power.

3.3 Typical A.C power supply scheme

The large network of conductor between the power station and consumer can be broadly divided into two parts:

- Transmission system
- Distribution system
- Each part can be further sub-divided into two parts:
- Primary transmission
- Secondary transmission
- Primary distribution
- Secondary distribution

3.3.1 Generating station

Station speaks to the creating to the station where electric power is delivered by 3-stage alternators and working in parallel. Generator normal associating voltage is 11kv. for economy in the transmission of electric power, the age voltage is ventured up to 132Kv at the age station with the assistance of 3-stage transformers .the transmission of electric power at high voltage has a few points of interest including the sparing conduit material and high transmission productivity .in this manner the decision of legitimate transmission voltage is basically an issue of financial matters. The essential transmission on the conveyed at 220 KV, or 400 KV and so on.

3.3.2 Primary transmission

The electric power at 132 KV is transmitted by 3 stage, 3 wire overhead framework to the edges of the city .This terms the essential transmission.

3.3.3 Secondary transmission

The essential transmission line ends at the getting station which normally lies at the edges of the city .at the accepting station, the voltage is lessens of the city. At the getting station, the voltage is decreasing to 33 KV by step-down transformer. Structure this station, electric power is transmitted at 33 KV by 3-stage, 3-wire overhead framework to different sub-station situated at the key in the city. This is the optional transmission.

3.3.4 Primary distribution

The auxiliary transmission line at the sub - station where voltage is decreased from 33 KV to 11 KV, 3-stage, 3-wire. The 11 KV line run along the significant street sides of the city. This structures the essential appropriation. It might be noticed that large shoppers are for the most part provided power at 11 kV for further taking care of with their own sub-station.

3.3.5 Secondary distribution

The electric power from essential conveyance line (11 kV) is conveyed to dispersion sub-station. These sub - station are situated close to the purchaser's areas and venture down the voltage to 400 v, 3-stage, 4-wire for optional circulation. The voltage between any two stages is 400 V and between any stage and neural is 230 V. the single-stage private lighting load is associated between any one stage and nonpartisan, while 3-stage, 400 v engine load is associated crosswise over 3-stage lines straightforwardly.

3.3 Transformer

Masco enterprises restricted uses a stage down transformer to step down the voltage of DESA line from 11 KV to 415 V. it does as such with comparing increment in current however without changing in recurrence. The transformer is comprising of two curls – essential and auxiliary loop. The loop is electrically isolated however attractively connected through a way of low hesitance. The essential curl is associated with 11 KV substituting voltage of REB line. A substituting motion is step up in the overlaid center, the greater part of which is connected with the auxiliary curl and creates commonly – incited EMF. At the point when the subsequent curl circuit is shut, flow streams in it thus electric vitality is moved from the essential loop to the optional loop.

3.4.1 Three phase transformers

Transformers utilized in three – stage framework may comprise of bank of three single - stage transformer or a solitary three – stage transformer which is twisted on a typical attractive center. In Walton, they utilize three single – stage transformer which make a bank and create three stage supply. the bank of three single – stage transformer portion offer the benefit of adaptability .on account of an un adjusted burden, at least one transformer in the bank can be supplanted by a

bigger or littler evaluated transformer .as far as support a breaking down transformer in the bank of transformer can be effectively supplanted while the enter basic center three – stage transformer would might be require substitution.

3.4.2 Working procedure of a transformer

A transformer is a static piece contraption by methods for which electric power in one circuit is transformer into electric intensity of a similar recurrence in another circuit. It can raise or lower the voltage in a circuit yet with a relating diminish or increment in current. The physical premise a transformer is common enlistment between two circuit connected by a two attractive motion

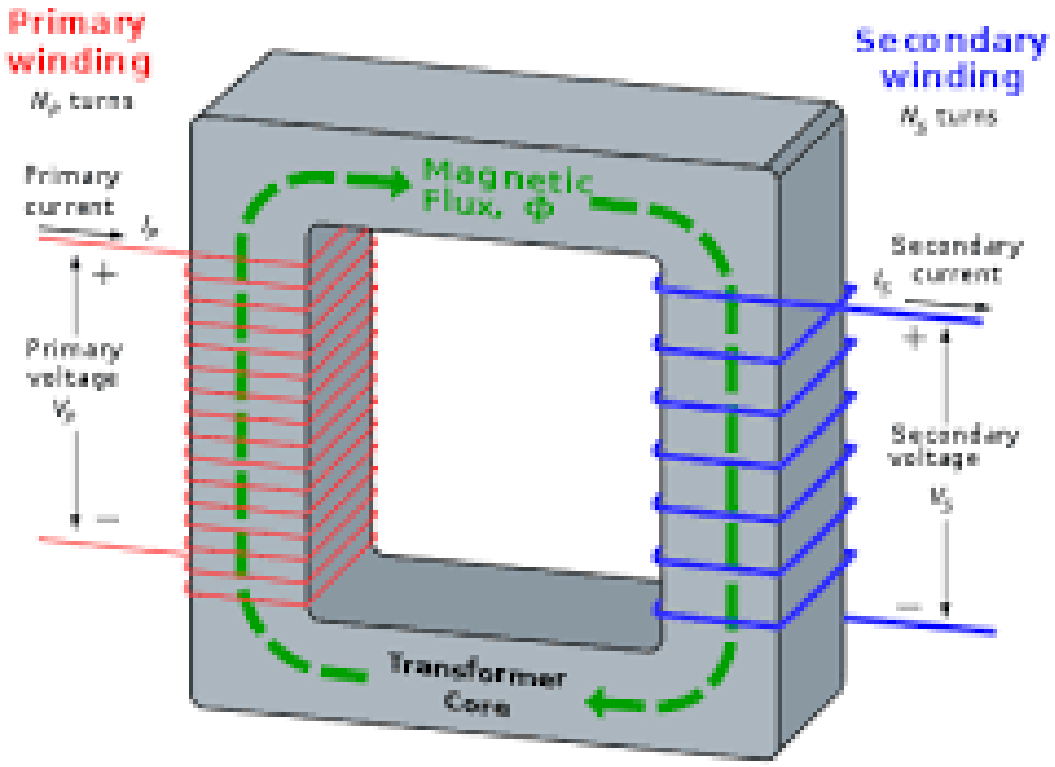

Figure 3.1 Core of a transformer

In this simplest form, it consists of two inductive coil which are electrically separated but magnetically linked through a path of low reluctance. The two coils possess high mutual inductance. If one coil is connected to a main source of alternating, an alternating flux is set up in the laminated core, most of which is linked with the other coil in which it produces mutually induced (according to faraday's lows electromagnetic induction e=mdi). If the second coil circuit

is closed a current flow in it and so electric energy is transferred form the first coil to the second curl. The main loop, electric vitality is sustained the AC. supply mains, is called essential winding and the other from which vitality is drawn, out, is called auxiliary winding.

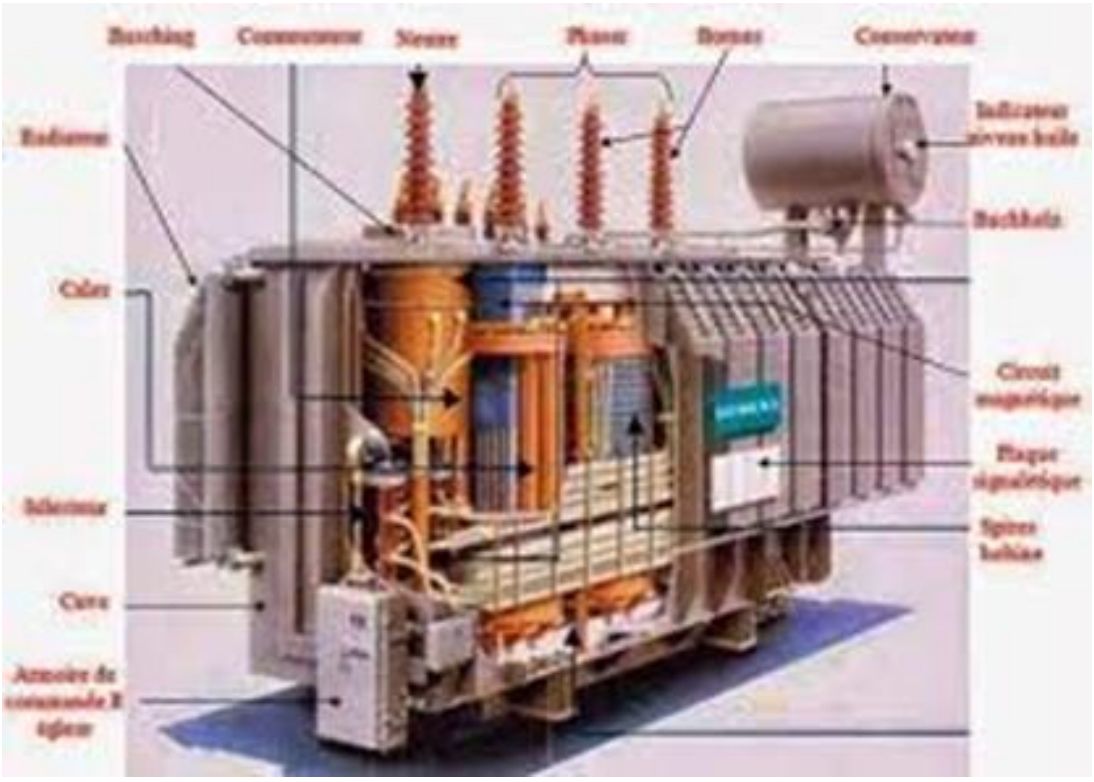

Figure 3.2 Internal structure of a transformer

3.4.3 Parts of the transformer

- LV winding
- HV winding
- Conservator
- Oil level indicator
- Breather
- Drain coke
- Transformer
- Earth point
- Temperature gauge
- Buchholz relay

- Low-voltage bushing
- High voltage bushing
- Thermo- meter
- Carriage
- Expulsion vent

3.4.4 Transformer Components

Oil-immersed transformer components is

- Tank
- Rollers
- Rating plate
- Air dehumidifier
- Oil level indicator
- Oil conservator
- Buchholz relay
- High voltage bushing
- Tap changer
- Low voltage bushing
- Lifting lug
- Thermometer

3.4.5 Protection of Transformer

Transformers are an electrical and broad segment of the power framework. Because of the long lead time for fix of and substitution of transformer a significant objective of transformer insurance is restricting the harm to a blamed transformer. Barely any security capacities, as over excitation insurance and temperature based assurance hardly any this objective by the distinguishing working conditions that couple of cause disappointment transformer. The exhaustive transformer assurance gave by various capacity defensive transfers is suitable for basic transformer all things considered. The kind of insurance for the transformer differs relying upon the application and the significance of the transformer. Transformer are ensured fundamentally against flaws and over-burden. The sort of security utilized ought to be interface

the hour of disengagement for issues with the transformer and to diminish the danger of calamitous inability to the primary inevitable fix. Any all-encompassing activity of the transformer under strange condition, for example, blames or over-burdens bargains the life of the transformer, which implies sufficient insurance ought to be accommodated speedier disconnection of the transformer under such conditions.

Following the protection should be taken

- Over / under voltage protection
- Earth fault protection
- Buchholz relay
- Oil level
- Oil temperature /pressure
- Short circuit
- Surge oil protector
- Pressure regulating valve
- Winding temperature

Chapter 4

Distribution protection System

4.1 Introduction

The Distribution framework carries capacity to every one of our homes and organizations. Solid electric power is the appropriation framework essential to each on to everybody and SEL offers shrewd assurance, observing, and control gadgets to join the best nature of administration accessible and correspondence abilities to make a brilliant keep up the best nature of administration reclose control items are good with all prominent recloses and offer propelled control and computerization capacities.

Drinking spree security items are utilized on utility, modern, and business electrical frameworks round the world and incorporate many inherent highlights, for example, stage estimation units, rationale control conditions, and coordinated correspondence conventions. Voltage clients and help the dispersion matrix work all the more productively.

Age from sustainable power sources all around proposed as an incomplete option in contrast to the arrangement of our country's vitality issues. Security, operational issues are acquainted with the BANGLA CAT motor when this age is dissemination network. Tended to is the issue of dispersion framework presentation of cogeneration sources and the progressions and alterations which might be required in the utilization of present-day BANGLA CAT diesel motor security gadgets. An example framework is considered, and framework assurance and coordination with and insurance without cogeneration has been determined through an advanced flaw and framework coordination program. The outcomes show through the investigation of a few frameworks that extra coordination and assurance contemplations will be required when sizable cogeneration sources are acquainted with keep up a high level of unwavering quality and administration congruity.

4.2 Distribution System Protection: Overview

- Run of the mill circulation arrange models
- Insurance nuts and bolts and read nuts and bolts and prerequisites (audit)
- Brief audit of assurance of insurance ways of thinking and plans:
- Unit/non unit
- Differential/distance/over current
- Reclose
- Sectionalizes
- Fuses
- Summary of operation and setting of distribution protection.
- Practical considerations[iii].

4.2.1 Faults on power system

- Usually characterized by large fault currents
- Shortcoming current level for the most part drops with good ways from source because of impedance transformers in the system
- Large voltage depression around the point of fault (load impedances shorted)

4.2.2 Various types of Line Fault

Type of Fault

- Phase to Ground fault (Earth Fault)
- Phase to Phase fault Not with Ground
- Double phase to Ground fault

Operation of Relay

- Earth Fault Relay
- Related Phase Over current relays
- Related Phase Over current relays and Earth Fault relays

4.2.3 Over-current Protection of Distributed Systems

Over-current assurance is along these lines, over-current insurance is basically proposed to work just under deficiency condition or current transfers ought not be introduced simply as an approach to secure frameworks is Nevertheless, hand-off settings are regularly

Ohm regularly chose considering, over-load and over-loads. over current Never conditions. An over-current pre getting regularly power ready to detect any adjustment in the sign, which it is d/or voltage transformer and complete a particular activity that the approaching sign is outside a foreordained range. Normally the hand-off works or opening electrical contacts, with respect to stumbling of an electrical switch. Shutting or opening choose

4.3 Types of Over-current Relays

Concerning the transfer working over current transfers might be arranged into primary three gatherings: Definite Time, And Inverse Time.

4.3.1 Definite Current Relay

This sort of trademark makes the hand-off to work immediately when the present arrives at a foreordained worth.

The setting is picked so that the transfer, which is introduced at the farthest substation away from the source, will work for a little current worth and the hand-off working flows are step by step expanded at every substation, moving towards the source. In this way, the farthest hand-off from the source works initially detaching the heap in the neighboring site of the issue.

For this situation the security setting depends on most extreme issue level conditions (three stage hamper), when an issue level is lower, these settings may not be appropriated as the deficiency won't be cleared until it arrives at the insurance setting esteem. Along these lines to the shortcoming will take some season of during which hardware harmed. In outcome, positive current transfer assurance has slight selectivity at high estimations of short out flows. Then again if the dependent on lower estimation of deficiency current, may bring about some unnecessary activity of level increment. Because of these hindrances, positive current transfers are no settings depend on breakers as the flaw level utilized as a solitary over regular in blend brew over-current security, however their utilization as a prompt part is very mix with different kinds of assurance.

4.3.2 Definite Time Relay

In this kind of transfer the setting distinctive working occasions on to working occasions. The settings can be adjusted so that the transfer, which is driven at the uttermost substation away from the source, is stumbled in the most limited time, and the transfers are stumbled in grouping having longer time delays, moving back in the source time assurance is increasingly specific as the working time can be set in fixe. Notwithstanding, blames near the source, which brings about higher flows might be cleared in a generally significant time-frame. This transfer permit setting of two free parameters, the pickup setting and the time dial setting. The pickup setting characterize the present worth important to work the hand-off and the time dial sets the definite planning of the transfer activity.

4.3.3 Inverse Time Relays

These transfers work in a period that is conversely relative to the issue current. Opposite time transfers have the benefit of that shorter stumbling times can be accomplished without taking a chance with the security selectivity. These transfers are arranged dependent on their trademark bends, which characterize the speed of activity as opposite, extremely backwards increment.

4.3.4 Over Current Relay gives protection against

Over current incorporate short out assurance, and short circuits can be

1. Phase faults
2. Earth faults
3. Winding faults

Short out flows are proceed with times of commonly 5 to 20 full load current. Quick issue leeway is continually going on short circuits.

4.3.4.1 Purpose of over current Protection

These are the most important purposes of over current relay:

- Detect abnormal conditions
- Isolate faulty part of the system
- Speed Fast activity to limit harm and threat Discrimination Isolate just the flawed area
- Dependability / reliability

- Security stability
- Cost of protection against cost of potential hazards

4.3.4.2 Application of over current Relay

Distribution Protection

Over current transferring is current handing-off is very appropriate to dissemination framework insurance for the accompanying reasons:

- It is basically simple and inexpensive.
- Very often the relays do not need to be directional and hence no PT supply is required.
- It is conceivable to utilize a lot of two O/C transfers for security against between stage shortcomings and a different Overcurrent hand-off for ground issues.

Transformer Protection:

- Used only when the cost of overcurrent relays are not justified.
- Extensively also at power-transformer locations for external-fault back-up protection.

Line Protection:

- On some sub transmission lines where the cost of distance relaying cannot be justified.
- Essential ground-flaw insurance on most transmission lines where separation transfers are utilized for stage deficiencies.
- For ground back-up protection on most lines having pilot relaying for primary protection.

Motor Protection:

- Used against overloads and short-circuits in stator windings of motor.
- Inverse time and instantaneous over current phase and ground
- Over current relays used for motors above 1000 kW.

4.3.5 Directional Over current relays

At the point when the power framework isn't spiral (source on one side of the line), an over current transfer might have the option to give sufficient insurance. Kind of transfer can work right in on bearing of current stream and squares the other way.

Three conditions must be fulfilled for its activity: current extent, time delay and the directionality of current stream can be recognized utilizing voltage as a kind of perspective of current security can be given directional element by including directional component Three conditions m directionality. The di bearing over-current stick the insurance framework specific heading area framework. Directional over-current assurance reacts to over-flows for a course stream. In the event that power stream is the other way, the directional over-current remains un employable.

Directional over sign over-current insurance includes over-current hand-off and control directional hand-off in lager transfer packaging. Power directional hand-off not quantify the power however is attempts to react to the sort of intensity stream.

Directional activity utilized where the selectivity can be accomplished by directional power stream. The directional hand-off provide to the guidance where dumping happens, comparative with the right of the transfer. It is set to such an extent that it supply for issues happening in one side as it were. It doesn't represent issues happening in the fundamental course. Consider a feeder AC going through subsection B. The electrical switch CB3 is given a directional Relay 'R' which will trip the breaker CB3 if shortcoming power stream in course Cal one. In this way for deficiencies in feeder AB, the circuit breakerCB3 doesn't trip superfluously. Anyway it is the privilege BC the electrical switch CB3 outings to done Since it's defensive handing-off is set with a directional component to act in heading AC Another intriguing multi sort of directional assurance is that of turn around control security of generator.

On the off chance that the prime mover falls flat, the generator keeps on running as an engine and takes control from Directional power security works as per the heading of intensity stream. Insurance works when the power bearing is turned around in to the ordinary Working diesel motor. Power transfer is diverse in development than stream direct over-current hand-off.

In directional over-current hand-off, the directional component doesn't quantify the greatness old It faculties as well as heading of intensity stream. Turn around Power Relays, the component

estimates greatness and heading of intensity stream control. It send directional component Directional of stream for stumbling Reverse forces security against motoring activity of a generator and Principle of directional insurance

4.3.6 Directional Over-current Relay Protection Coordination

Directional over-current handing-off (DOCR) is basic, financial, have the likelihood to pick distinctive stumbling attributes and in this way is normally utilized as essential power framework security in circulation frameworks. An essential assurance ought to work each time an insurance component recognizes a flaw on the power framework. Additionally, back up transfer security ought to be given to work when, for reasons unknown, the essential assurance doesn't work. The reinforcement security ought to be structured with a period deferral to delay the activity of the transfer and give time for the essential assurance to work first the serious issue with this kind of insurance is the unpredictability in playing out the transfers coordination, for the most part in multi-source systems. New hand-off settings are actualized as burden, age level or framework topologies changes. Changes in the framework are recognized by distinguishing the activity situation. Distinctive activity situations are examined in this part and they are: disseminated framework convert with DG associated. To secure the framework, computerized over-current transfers are utilized, as they have the likelihood for utilizing diverse stumbling attributes

4.3.7 Differential Relay

The relays used in power us used in power system protection are of different types. Among them differential relay monthly used relay for protecting transformers and generators from localized faults.

Definition of Differential Relay

The differential hand-off is one that works when there is a contrast between at least two comparable amounts surpasses a foreordained worth. In differential transfer conspire circuit, there are flows originated from two pieces of an electrical power circuit. These two flows meet at point where a hand-off curl is associated. As per Kirchhoff Current Law, the resultant flow coursing through the hand-off loop is correct however summation of two flows, originating from two different pieces of the electrical circuit. In the event that the extremity and abundance flows are acclimated to such an extent that the whole But because of any variation from the norm in the power circuit, if this equalization is broken, that implies the aggregate of these two flows no

longer than zero and there will be non-zero current over through the hand-off loop along these lines to the hand-off being worked.

Types of Differential Relay

1. Current Balance Differential Relay
2. Voltage Balance Differential Relay

In current differential transfer two current transformers are fitted on the either side of the Equipment to be ensured. The auxiliary circuits of CTs are associated in arrangement in such a way the convey optional CT current same way. Working curl of the transferring component is over the CT's optional circuit associate. Under typical working conditions, the secured gear either control transformer or alternator conveys ordinary current stream. In this circumstance, state the auxiliary current of CT, is I, and optional current of CT2 is 12. It is additionally obvious from the Circuit that the present going through the transfer curl is only 1.- 12. As we said before, the present moving through answer previous proportion and extremity are so picked, Ti = 12, henceforth there will be no present through the hand-off curl. Presently if any shortcoming happens outer to the zone secured by, inside through essential of the both current transformers and in this way optional of both current transformers stay same as on account of ordinary working conditions. Salty current pas flows of both Therefore at that the secured simple charge at that circumstance the hand-off won't be worked. Be that as it may, if any ground flaw happened inside turned hardware as appeared, two auxiliary flows will be never again equivalent. At that case differential transfer is being worked to segregate the flawed gear (transformer or alternator) from the framework.

Type of relay systems suffers from disadvantages

1. There might be a likelihood of crisscrossing in link impedance from CT optional to the transfer board.
2. These pilot links' capacitance prompts erroneous activity of the transfer when huge through shortcoming outside to the gear.
3. Coordinating of current transformer can't be accomplished thus there might be spill current coursing through the hand-off when all is said in done working conditions.

4.3.8 Percentage Differential Relay

Intended to reaction to the differential current in the term of its partial connection to the present coursing through the secured side. Kind of hand-off, there are limiting loops notwithstanding the working curl of the transfer. The controlling curls produce inverse to the working torque. Under ordinary and through state of issue, controlling torque is large working torque. Subsequently transfer stays dormant. Inner deficiency happens, the working power surpasses the predisposition power and subsequently worked of the transfer. Predisposition power can be balanced by differing the number working circle on the limiting loops. As appeared in the figure beneath, if l, is the auxiliary current of CT, and is the optional current of CT2 then current through the working loop is , 12 and current through the controlling curl is (+12)/2. In typical and through deficiency condition quad created by controlling loops because of current (+12)/2 is more noteworthy than torque delivered by working curl because of current ,- 1 however in inner defective condition these become inverse. Room the above clarification, more noteworthy the present coursing through the controlling curls,

It is obvious from the estimation of the current required for working curl to be worked. The transfer is considered higher the worth hand-off on the grounds that the working current required to outing can be communicated as a rate hand-off of through current.

4.4 CT Ratio and Connection for Differential Relay

This straightforward thumb rule is thumb decide is that the present transformers on any star winding ought to be associated and the present transformers on any delta winding ought to be associated in star. Done to dispose of zero succession current stream in the hand-off circuit.

In the event that the CTs are associated in star, the CT proportion will be 1/1 or 5 A CTs to be associated in delta, the CT proportion will be 1./0.5775 or 5X0.5775 A

Commonly, earth issues are SLG and LLG issues. Earth flaws are recognized by nearness of zero grouping[iv]

4.5 Summary:

The appropriation framework carries capacity to every one of our homes and organizations. Dependable electric power is imperative to everybody and SEL offers insightful assurance, checking, and control gadgets to keep up the best nature of administration accessible and correspondence abilities to make a brilliant network. Reclose control items are good with all famous recloses and offer propelled control and mechanization capacities.

Feeder assurance items are utilized on utility, modern, and business electrical frameworks around the globe and incorporate many inherent highlights, for example, stage estimation units, rationale Control conditions, and coordinated correspondence conventions. Voltage guideline the best power quality to clients and help the dispersion matrix work all the more proficiently.

CHAPTER 5

PROTECTION SYSTEM AND SWITCHGEAR

5.1 Introduction

BANGLA TRAC LIMITED (BANGLA CAT) was comprised as a power conveyance organization in November 2004 under the Companies Act 1994 as a Public Limited Company. The intensity of the Distribution Western Zone (CHATTAGRAM Division, DHAKA Division and Greater SYLHET containing 21 locale and 20 barring REB territory) of past Bangladesh Power Development Board (BPDB), put under lien being the workers of BANGLA CAT in October 1, 2003. [1]

5.2 Protection of Generator

Notice that the portrayal of the referenced insurances will be made on aggregate point of view and hypothetical information as this is difficult to see security frameworks live on account of their inside associations we are seeing.

- Differential Protection.
- Loss of Field or Excitation Protection.
- Current Unbalance Protection.
- Over Current Protection.
- Restricted Earth Fault Protection.
- Over Voltage Protection.
- Reverse Power Trip.
- Under Voltage Trip

Fundamentally, these all are different sorts of transfers. Presently a portion of these transfers are quickly talked about in the accompanying sections of the part as beneath.

5.2.1 Differential Protection

Aggregate point of view, we saw a few differentials secure for generator. It is a transfer. It is utilized here in BANGLA CAT to ensure generator twisting against inner deficiencies h as stage to-stage and three stage to-ground flaws. We were informed that the differential hand-off at has been utilized in the generator is really present differential transfer.

5.2.2 Loss of Field Excitation

Field excitation is a defensive measure taken against the disappointment of AVR or field circuit in open or short out. Because of these disappointment generator goes about as an enlistment engine. Assurance against Loss of Excitation is significant field.

5.2.3 Current Unbalance Protection

Aggregate viewpoint that present unbalance happens because of contrast in three stage voltage. There is insurance against this in generator. This is utilized in light of the fact that because of current lopsidedness, high current is initiated in the rotor of generator which prompts overheating of engine and consuming of windings. Actually this is a switchgear transfer that is utilized in it. This transfer has additionally been utilized in order to think about the heaps of different circuits.

5.2.4 Current Protection

In it, generator is intended to work constantly at evaluated KVA, recurrence and power factor over a scope of 95% to 105% of appraised esteem. Working of the generator past evaluated KVA may bring about hurtful over current. This prompts overheating of stator and disappointment of protection. This is extremely a dangerous condition for individuals working in the unit. Thus, such a security is taken in generator unit.

5.2.5 Restricted Earth Fault Protection

The working capacity of BANGLA CAT it is like generator differential security. It secures the voltage twisting of intensity transformer against inside shortcomings. The set current transformer nonpartisan and stage side of the power transformer are only utilized for this insurance. The insurance can't distinguish flaw inside one winding. Upon the discovery of a stage to stage or stage to ground shortcoming in the winding, the unit is stumbled naturally from control unit in it.

5.2.6 Reverse Power Protection

Our assistant consultant acquainted us with another kind of security for generator called Reverse Power Protection. As a matter of fact, an assurance for the Prime mover of the generator than for the entire generator. It portrays a condition where the prime mover of a generator isn't providing

adequate torque to keep the generator rotor turning at a similar recurrence as the framework to which the generator is associated. The generator will really turn into an engine and will draw current from the lattice and will supply torque to the prime mover which should supply torque to the generator and opposite side. Thus an insurance transfer is set up by BANGLA CAT inside the generator prime mover

5.2.7 Under voltage Trip

In BANGLA CAT, there is likewise security transfer for under voltage event. Technique is utilized to counteract close of the breaker in botch. In this framework stumbling is commonly deferred. Done so the voltage drop is brought about by time in flaw took into account the suitable breaker or wire to work and voltage to be recouped without loss of intensity supply.

5.3 Protection of Transformer

In BANGLA CAT simply like some other plant, it has various sorts of transformers like Power transformer, Current transformer, many Step-up and Step-down transformers for transmission of current to matrix and others. Furthermore, along these lines, bunches of assurance has been dealt with for the security reason here in BANGLA CAT. In reality, the BANGLA CAT authority introduced a security plot all in all for the transformer assurance as far back as the plant was worked for simple checking and area reason. Assurance conspire is that portrayed down here quickly dependent on aggregate point of view.

5.3.1 Unit Transformer Protection Scheme

BANGLA CAT has a propelled Transformer Protection Unit intended for use on 3-stage control transformers as we watched. Give touchy fast differential security of inner stage and ground blame as time and quick over auto insurance for current, winded transformers. The client selectable consonant limitation setting forestalls bogus stumbling on charging inrush and over excitation. At whatever point any issues happen assurance unit trips down and find a way to secure the transformers.

5.4 Transmission Line Protection

Transmission Line insurance frameworks are intended to recognize the area of deficiencies on the transmission line and to confine just the blamed segment. Challenge to the transmission line assurance lies in dependably recognizing and confining flaws trading off the security of the framework will be proceeding. Just demonstrated the Distance hand-off, talked about will be beneath.

5.4.1 Distance Relay

From the aggregate point of view, transfer take a shot at the premise that the impedance of a transmission line is relative to its length. Separation estimation it is suitable to utilize a transfer fit for the impedance of a line up to a foreordained point. Hand-off is depicted as a separation transfer and is intended to work flaws for just happening between the hand-off area and the chose arrive at point, Protection for issues that may happen in various line segments.

5.5 Different relay systems

Despite the fact that few insurance transfers for generators and transformers have just been examined already yet there were sure totally new transfers that were appeared to us in BANGLA CAT. These are exceptionally recognizable to control plant builds however as an understudy, these are absolutely new framework in BANGLA CAT.

5.5.1 Buchholz Relay

Significant transfer for transformer is a Buchholz hand-off which is found to a slanted pipe between the transformer itself and its oil protection tank. It is mechanical wonder. There are utilized to screen enormous transformers for oil misfortune or protection. At whatever point there will be a minor inside issue, the transformer protecting oil will distinctive hydrocarbon gases CO2 and Co. The gases created because of deterioration of transformer protecting oil will gather in the upper piece of the transformer oil compartment which causes fall of oil level in it. At whatever point the oil level will fall, Alarm circuit will be invigorated which means will be stumbled. Gathering the collected gases from the gas discharge pockets on the highest point of the transfer and by dissecting them, plant designers can work the kind of deficiency in the transformer. Much the same as some other plants, BANGLA CAT this hand-off utilized also and our understudy counselor for that day referenced that it is a fundamental and significant part.

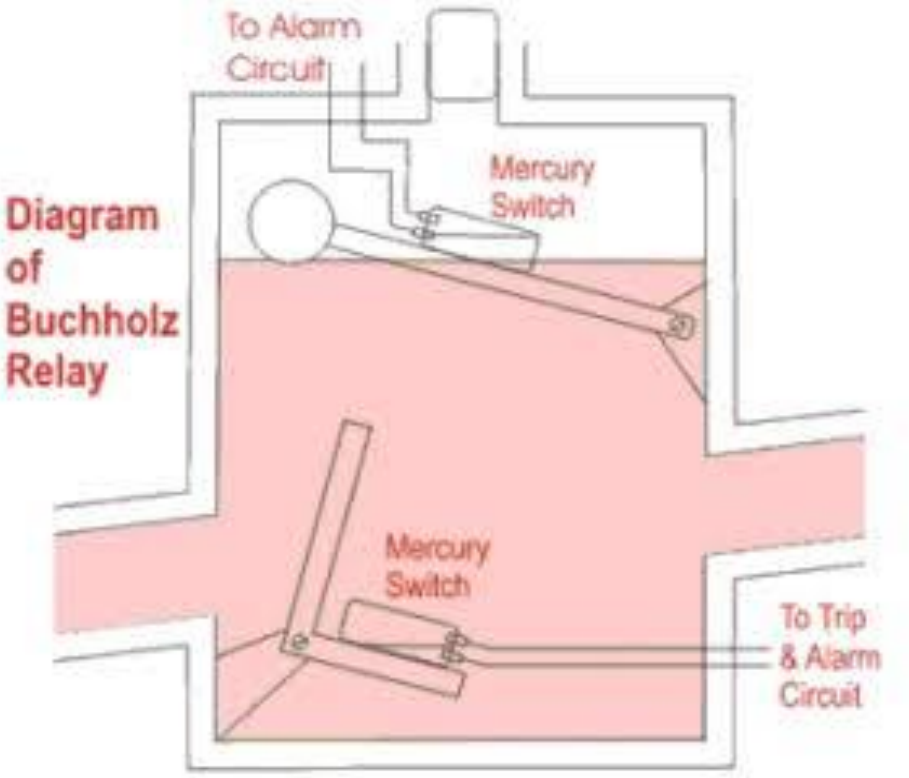

Figure 5.1: Buchholz Relay

CHAPTER 6

CONCLUSIONS

6.1 Conclusion

BANGLA CAT Power transformer is one of the significant hardware in control. Albeit outfitted with flood arresters, differential, numerous establishing assurance, but since of complex interior structure, electric and warm field uneven and because of numerous different components, the mishap rate stays high. In this Field study paper, we talked about quickly about different kinds of flaws and insurance plan of Generator. Hopeful about breaking down the transformer blames in subtleties and required insurance plans. We are exceptionally glad to do our proposal with assistance of this is one and only organization in Bangladesh which works with control supply. BANGLA CAT is a set up organization and has a decent notoriety. Here Engineers assume incredible job. This connection makes our hypothetical information solid. We adapt essentially how a sub-station is ensured by defensive hardware. We additionally find out about transport bar course of action. A sub-station takes control from a power generator at that point as indicated by the shopper request they step down the power and supply the power. Taking and appropriation of intensity there are all the methodology. We are additionally found out about the sub-station and the working standard of all sub-station equipment's. Designer and chief in all areas were useful to every one of us time. We trust that the functional experience which we have picked up from Bangla Cat will be useful for our future employment part.

6.2 Limitation of the work

BANGLA CAT is rumored organization in Bangladesh to transmit control around the Industry. In spite of the fact that their control framework is awesome, there is some issue in charge framework. The greater part of the board is worked by physically. On the off chance that any framework fizzles, it sets aside a lot of effort to work once more. The framework will be excellent and productive if the control framework would remote control or mechanized framework. Other than that, some mistake happens during perusing in view of utilizing simple meter coming about numerous issue are showed up in estimation. On the off chance that all of meters is computerized, if all of meters is advanced, there will no way to blunder in perusing. On

the off chance that all framework had under controlled of BANGLA CAT framework, control framework would have many favorable position. In spite of the fact that we realize that a transformer is the fundamental piece of intensity transmission division, yet in some cases its assurance framework are not appropriately determined by power. Those are comprises transformer issue and power misfortunes.

6.3 Future Scope of the work

The patterns delineated before will proceed with all the more dominant hand-off will develop with all the more preparing force, running increasingly refined and conveying better assurance execution (speed, affectability, security, and reliability). Creators will all the more frequently return to first principals in control building to extricate increasingly natty gritty qualities of the secured and controlled contraption to gadget better P&C techniques. Consistent losses physical points of confinement of what is conceivable when using current stream withy the voltage estimations and other framework. Security capacities designed for speed will be all the more regularly executed with parallel and complimentary calculations. At least two calculations may work in, each reacting quickly under certain, however not all, conditions, unit frequently, these calculations will be locked in just for a constrained timeframe to support the speed of activity when it is sheltered. Thus, however reliable calculation, ordinarily dependent on the basic recurrence segments, need to run in foundation to guarantee constancy and implement the normal working trait of the capacity.

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