ANALYSIS OF CONDUCTOR TESTING REPORT (BREB)

A Interne submitted in partial fulfillment of the requirements for the Award of Degree
Bachelor of Science in Electrical and Electronic Engineering

Submitted by
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Certification

This is to certify that this Intern Ship and thesis entitled "**Bangladesh Rural Electrification Board**" is done by the following student under our direct supervision and this work has been carried out by him in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

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EXECUTIVE SUMMARY

Bangladesh Rural Electrification Board, commonly Known as BREB, is a Government Organization which distributes electricity at the all Bangladesh of Rural Area. BREB was formed in October 1977 as the country first Electricity distribution company under the BREB Board and palli Bidyut Samity Established on 1978 to change the quality of electricity distribution system under the continuous renovation/ Reconstruction activities of Bangladesh most important power sector.

The report provides an overview of the Training and Development Division, BREB H/Q, Network operation Division, Dhaka Division, Testing & Repairing Division and Meter Plant Division of BREB. Working with the Organization as an intern for a small period of three month, the main aspect was to acquire information and data to evaluate the culture, Working environment, and other practices of the company

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Chapter-1

1.1Introduction:

In the fall semester of 2018 we got an opportunity to complete the industrial training in Bangladesh Rural electrification Board under pbs-1 is one of the biggest power distribution company in Bangladesh. It covers approximately whole rural area of Bangladesh .They introduce electricity among the illiterate or village people and encourage them for using electricity with appropriate way (without any miss use).

History of Electricity

Dhaka is the capital city of Bangladesh but before 1900 there was no electricity. According to the people saying the 1st generation started at‘‘Ahsan Manjil’’ Nawab of Dhaka installed a small generator in his residence and started generating power on 7th of December 1901, which is considered as the introduction of electricity in the Dhaka city but it was not for public use.

After that in around 1930 M/S. DEVCO developed 400v level electricity distribution system for public use. In the year 1933 a power generation station was established named ‘‘Dhanmondi power House’’ in generated 1500KW power and they are last commercial seller of the distribution system among the public.

In the year 1947, power generation, transmission and distribution authority in the then East Pakistan region was confined within some private companies. The electricity supply in the 17 districts were limited to the township areas only for a limited time except Dhaka city area. At that time other some private companies, power was used to be generated by some isolated industries like tea, sugar, textile, garments factory, cement factory etc.

In aggregate, the generation capacity of this region was about 21 MW at that time. To cope up with the growing power demand of this region, the Govt. of Pakistan created Electricity Directorate in 1948 to plan improved power supply. In 1957 Govt. took over the Department of Electrical and Electronics Engineering, Daffodil International University. The private owned companies in Dhaka and placed them under the Electricity directorate for power generation and distribution. In 1959, East Pakistan water and power Development authority (EPWAPDA) was established to look after generation, transmission, distribution and sale of electricity throughout the province of the then East Pakistan. After the independence of Bangladesh in 1972, Bangladesh power Development Board (BPDB) was created to look after the same function. And for rural area distribution they introduce rural Electric Board (REB) in 1978. Dhaka Electric supply, headed by a chief engineer under BPDB used to control the electricity distribution and sales in Greater Dhaka District area up to September 1991. To improve service to the consumers and to enhance revenue collection by reducing the prevailing high system loos, Dhaka Electric supply authority (DESA) was created by an ordinance promulgated by the president of the people‘s Republic of Bangladesh in 1990.

1.3 System loss (Power Factor Loss)

The power factor is defined as subject to the usual distributed losses in the production and transmission process. We can calculate system loss, system loss= [(Total generations-total distribution)/total generation]*100%.
At the first stage of generations and distributions there were a lot of power loss or system loss in our system. For reducing these losses a team was built up for training at United State of America. They thought that because of the wire used before, there were a lot of losses and for reducing that they were learning about the American wiring system. At that time we used covered wire to distribute electricity, the cover of the wire made the losses. Engineers saw that in America they use open wire and for that there would be a low system loss. The team came back and through that knowledge they started supplying electricity at rural areas. And they named that section Rural Electrification Board (REB)

1.4 Rural Electric Board (REB)

It constituted under a government ordinance of 1977 and started functioning in 1978. It implements the program of distribution of power in rural areas and constructs power distribution line and power Sub-Stations through rural electric societies which is Palli Bidyut Samity (PBS) on the principal of co-operative.

1.5 Palli Bidyut Samity (PBS)

Company profile: Dhaka Palli Bidyut Samity (DPBS)

Figure: 1.1 Nameplate Of the PBS

Based on the universal principle of cooperative, Palli Biddut Samities (PBS) of REB are formed as democratic, decentralized and autonomous organizations where the member consumer enjoy equal opportunities and are entitled to exercise equal rights. Continuous support from the government and donor agencies and the people associated with the

programme and comparative transparent and accountable system of the PBS has helped to set a high standard of performance of the organization. The owners of PBSs are its customer members and PBS management is accountable to a locally elected Board of Directors and the overall performances of the PBSs are controlled by REB. REB is basically running on funding from the government and development partners. Some of the PBSs are still not financially self reliant as most of their consumers are residential

connection holders. A „PBS Revolving Fund' was established with the help of financially sound Samities for the PBSs which are yet to be self reliant to reduce their dependence on government and development partners.

Strategy

Its main ethics is no loss no profit.

1.6 Objective of Internship

1. To compare our theoretical knowledge with the practical work
2. To see the practical equipments those are being used in power generation, transmission and distribution system.
3. To gather idea about the company
4. To gather the idea about the distribution of PBS 1
5. Risks related during the distribution process.

6. Various problems related to this company and distribution system.

1.7 Scope and Methodology

This report is based on the internship program where we reviewed about Generator and the basic making process of a transformer and establishment of switchgear, current transformer, and potential transformer. We also reviewed the operation of Generator and testing process of these components. The report contains relevant information about a sub-station as was observed during the internship program.

1.8 Process of generation to distribution

At first we have to generate electricity then it will transmit to the Grid. And from grid electricity has transferred to the different distribution company. From the distribution company through transformers, Company supplies the electricity to the house hold or industry.

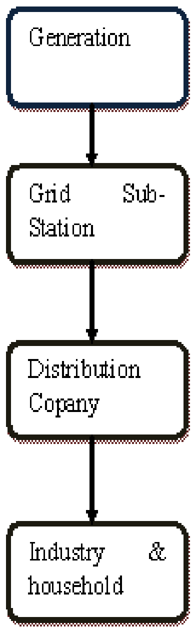


Figure1.2: Flow Chart of Our Electric Supply System

During our internship we have learned distribution first and generation at last. But for arrange our report properly and for describing our knowledge clearly we have written generation first and distribution later.

Chapter 2

Conductor Testing

2. Definition of Conductor

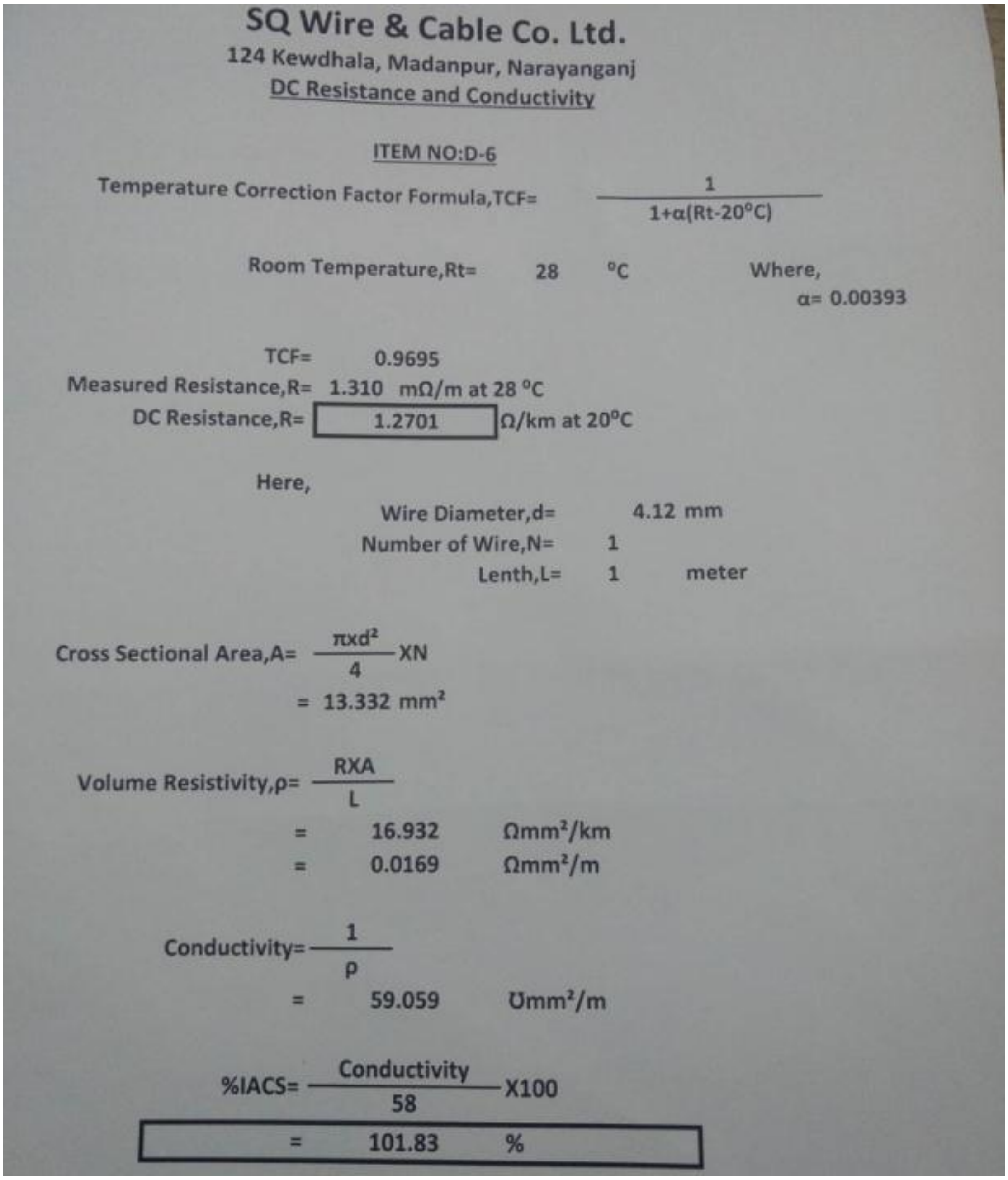
Conductor: An Electrical Conductor is a Substance in which electrical charge carriers usually electrons move easily from atom to atom to with the application of voltage. Conductivity in general is the capacity to transmit something such as electricity or heat carrier. We are called easily conductor material is flow of current and voltage other device in electrical engineering

Type of Conductor Material:
Silver
Platinoid
Mercury
Zinc
Cadmium
Copper
Gold
Aluminum
Tungsten
Chromium
Steel
Bronze
Phosphor bronze
Iron
Silver copper alloy
Nickel
Manganese
Nichrome
Carbon
Brass
Antimony
Platinum Annealed
Tin

2.1 Conductor Testing Name:

Resistance: Resistance is an electrical quantity that measures how the device or material reduce the electric current or electron flow through it conductor.

Formula of resistance test



SQ Wire & Cable Co. Ltd.

124 Kewdhala, Madanpur, Narayanganj

DC Resistance and Conductivity

ITEM NO:D-6

Temperature Correction Factor Formula,TCF= $\frac{1}{1+\alpha(Rt-20^{o}C)}$

Room Temperature,Rt= 28 ^{o}C

Where, α= 0.00393

TCF= 0.9695

Measured Resistance,R= 1.310 mΩ/m at 28 ^{o}C

DC Resistance,R= 1.2701 Ω/km at 20^{o}C

Here,

Wire Diameter,d= 4.12 mm

Number of Wire,N= 1

Lenth,L= 1 meter

Cross Sectional Area,A= $\frac{\pi x d^2}{4}$ XN

= 13.332 mm²

Volume Resistivity,ρ= $\frac{RXA}{L}$

= 16.932 Ωmm²/km

= 0.0169 Ωmm²/m

Conductivity= $\frac{1}{\rho}$

= 59.059 ℧mm²/m

%IACS= $\frac{Conductivity}{58}$ X100

= 101.83 %

2.2 Different type of conductor Name:
Bangladesh Rural Electrification Board is a Government Electricity Distribution organization. To the distribution Line are used different aluminum conductor and Solid copper conductor.

- All-Aluminum Conductors (AAC)
- All-Aluminum alloy Conductors (AAC)
- Aluminum Conductor Steel Reinforced (ACSR)
- Aluminum Conductor alloy Reinforced (ACAR)

2.3 Conductor testing List:

Length Measurement

Weight Measurement

Hot Test

Carbon Test

Insulation Test

Resistance Test

SQ WIRE & CABALE CO.LTD

KEWDHALA, MADANPUR, BANDAR

NARAYANGONJ

Manufacturer	: SQ Wire & Cable Co. Ltd.
Purchaser	: Bangladesh Rural Electrification Boar(BREB)
Tender Package No	: URIDS (E)-G-11-01
Lot No.	: URIDS (E)-G-11-01
Contract No.	:BREB/URIDS(DMCS)/URIDS(E)-G-11-01/2017-
2018, Dated	: 19/03/2019
BREB Item No.	: D-2 (#1/0 AWG ACSR RAEVN)
Contractual Quantity	: 5500 KM
Inspected Quantity	: 891.45 KM
|Consignment	: 4th
Date of	: 23/10/2018

SL. No	Description of Test	Unit	Req. Value	Found Value	Remarks
1	Size of Conductor	AWG	6	6	
2	Number of wire	No./mm	1	1	
3	Diameter of Copper wire	Mm	4.115	4.12	
4	Max DC Resistance of wire at 20	Ω/km	1.404	1.2701	
5	Min. Conductivity of wire	% IACS	100	101.83	
6	Max Ultimate Breaking Strength	Kgf	346	307.51	
7	Weight of Copper wire	Kg/km	118.4	118.60	
8	Conductor length of Coil No.117	Meter	320	321	

SQ WIRE & CABALE CO.LTD
KEWDHALA, MADANPUR, BANDAR
NARAYANGONJ
Calculation of Breaking Load Test
Item no. D-2

Aluminum, 1=	165.43 Kgf
Aluminum, 2 =	153.73 Kgf
Aluminum, 3 =	155.99 Kgf
Aluminum, 4 =	154.37 Kgf
Aluminum, 5 =	148.38 Kgf
Aluminum, 6 =	160.26 Kgf
Steel, 7 =	1383.83 Kgf
Total =	2321.99 Kgf

Calculation of Zinc Coating Test
Item No. D-2

Original Weight of Specimen, W1 = 9.87 gm
Weight of Stripped Specimen, W2 = 9.43 gm
Stripped Steel Wire Diameter, D = 3.290 mm
Weight of Zinc Coating = $\frac{W1 - W2}{W2} \times D \times 1920$

Chapter No. 03

Substation Equipment

3. Grid Substation:

Grid Substation is an important part of a power system. The generated electric power from different power plants the Grid substation. Power plants as well as another Grid would be the input of a Grid Substation .The substation transmits the generated power to the distribution company substation (33/11kv).Maximum Grid substations are remotely controlled. These substations are controlled from a control room. From the control room engineers can operate everything of the substation like input power, output power, temperature, feeder line on/off even tap change. A grid substation can be classified into two types.

132/33kv

230/33kv

Components of substations: There are lots of equipment’s in the substatio which are used for generation, transmission and distribution system.

- Primary transmission Line
- Secondary transmission Line
- Transformer
- Control room
- Circuit breaker
- Insulator
- Lighting arrester
- Isolator
- Grounding wire
- Auto relay

3.1 Transmission Line

Primary Transmission Line:

In a Grid substation has different incoming power supply line is called primary power line .primary power lines of a grid substation will either 400kv or 200kv. From these lines grid substation get the power which is used for transmission line.

Now present distribution line are used of Bangladesh rural electrification board three types that 33/11kv, 11/0.4kvand 400/230 volt.

Secondary Power Lines:

The outgoing power line which carries the transmitted power is called secondary power line. Input HT power is step down by a step down transformer and make an output line known as secondary line. Secondary line voltage 132kv or 66kv

3.2 Transformer of Principal :

Transformer is an electrical static device no change of power and frequency only change of current and voltage. Transformer action used electromagnetic induction law. To the primary side applied A.C voltage (vp) and secondary side automatically induced (vs) A.C voltage.

- Different types of transformer:
- Depends of voltage two type
  - Step up transformer
  - Step down transformer
- Instrument transformer:
  - Current transformer
  - Voltage/potential transformer
- Core type of transformer:
  - Shell type core transformer
  - Spiral type core transformer
    - Instrument transformer:

In substations, bus bar and other lines carry high voltage but our measuring equipment’s are operating on low voltage and current. So to protect these from destructions, we need to use instrument transformer. Current transformer and potential transformer are two types of instrument transformer. These Instrument Transformer supply the required current and voltage which is essential to operate those measuring and protection of equipment’s.

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled conductors- the transformer's coils. A varying current in the first or primary winding creates a varying conductors the transformer's core and thus a varying magnetic field through the secondary winding. Thus varying magnetic field induces varying electromotive force (EMF) of "voltage" in the secondary winding. This effect is called mutual induction.

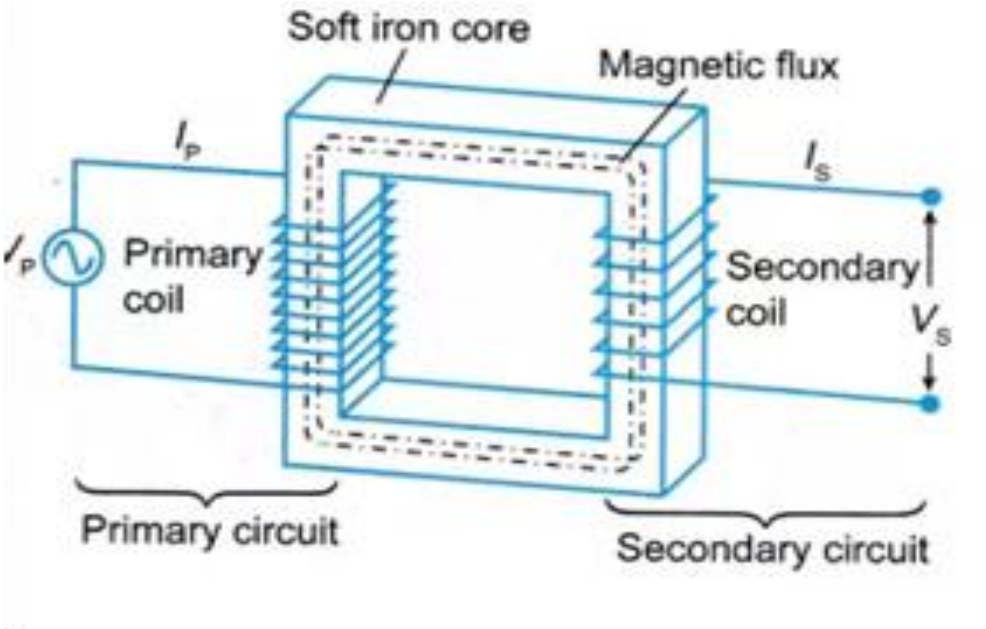


Figure: 3.1 shows working principle of transformer.

Transformer is a very important device in power system. A study of the records of modem transformer breakdowns shows that between 70%-80% of the number of failures are caused by short-circuit between turns. Then we also investigate different types of vector group of transformer. But the detection and technique for turn fault used in recent years are difficult that is dissolve gas analysis, partial discharge etc. Also, the vector group mismatches is not a fault directly so it is not considered as a serious issue. The checking procedure used in to determine vector group are difficult because there have to maintain clock number settings related to their phase angle. So, we have been motivated to perform this task.

3.3 List Raw Materials of Transformer

Transformer's raw materials are shown below

1.Winding machine 1

1. Tools
2. 3.Raw of materials,

- Copper Wire 5.5kg for HT side
- Copper Wire 5kg for LT side
- Insulation paper
- Cotton tape
- Scotch tape
- Gum
- Thinner
- Insulating burnish
- Strapping still
- Gas cap
- Ampere tube
- Pressure valve
- Supper glue
- Scrap paper
- HT bushing
- T bushing
- Socket

3.4 Significance of Δ to Y connection:

The close circuit on the delta side provides some benefits. Voltages on the secondary's have improved balance. Also it cancels third harmonics since these are not supported on the three wire system. A delta connection on the secondary side provides the possibility of large circulating currents if the Characteristics of the 3 windings are not perfectly balanced. Y connection avoids this

Significance of Δ Y to connection:

The Y-Δ transform can be used to eliminate one node at a time and produce a network that can be further simplified

3.5 Transformer faults:

In order to maximize the lifetime and efficiency of a transformer, it is an important to be aware of possible faults that may occur and to know how to detect them quickly. Regularly monitoring and maintenance can make it possible to detect new flaws before much damage has been done. Here we are going to focus on various types of transformer faults in brief.

Failures of transformer can be classified into following:

1. **Winding failure due to short-circuits.**

- Turn to turn faults
- Phase to phase faults
- Phase to ground faults
- Open winding or end to end faults
- Turn to Earth faults

2. **Earth faults:**

- Star connected winding with neutral point earthed through an impedance
- Star connected winding with neutral point solidly earthed.

3. **Terminal failures:**

- Open leads
- Loose connections
- Short- circuits

4. On-load tap change failures:

- Mechanical
- Electrical
- Short- circuit
- Over heating

4. **Abnormal operating conditions.**

- Over fluxing
- Overloading
- Overvoltage

5. **Core faults.**
6. **Phase sequence and vector group compensation**
7. **External faults**

3.6 Protection systems for transformer:

The principal relays and systems used for transformer Protection at Dhaka PBS-1 grid-substation are described below.

- ☐ Buchholz devices providing protection against all kind of incipient fault i.e. Slow – developing fault such as insulation failure of windings, core heating , fall of oil level due to leaky joints etc.
- ☐ Earth-fault relays providing against earth-faults only.
- ☐ Over current relays providing protection mainly phase-to-phase faults and overloading.
- ☐ Differential system (or circulating current system) providing protection against both earth and phase fault.

3.7 Losses in Transformer:

During my internship period at Dhaka PBS-1 -substation, I have acquired knowledge about transformer losses. These are as follows:

Iron Losses: In actual iron cores, in-spite of lamination, some heat is still produced by the eddy currents.

Copper Losses: In actual practice, coils of the transformer possess some resistance. So a part of energy is lost due to heat produced by the resistance of the coils.

Hysteresis Losses: The alternating current in the coils repeatedly takes the iron core through complete cycle of magnetization. So energy is lost due to hysteresis

3.8 Power Transformer:

High Power ratings transformer is called power transformer, which is generally used in high voltage power transmission network. The power transformers of grid substation are commonly step down transformer. Power transformer of grid substation are two type ratings.

3.2 Figure of Power transformer

Primary lines are connected at delta (Δ) to the transformer and secondary lines are at Y connection.

3.9Isolation Transformer

These types of transformer operate with a one-to- one turn's ratio between primary and secondary, as isolating the line from the secondary load. Usually, an isolation transformer further comprises of Faraday shield, which is in fact a screen of Non magnetic metal wound between the primary and secondary and then connected to the transformer core.

Figure-3.3 Isolation Transformer

d. Instrument transformers: Instrument Transformer two Type

1. Current Trans Former

2. Potential Transformer

There are several transformer used as an instrument transformer

3.10 Current transformer:

Current transformer helps to transform current from higher to lower value, which means that current transformer steps down current to a required ratio. Current transformer is connected in series with the system. In substation we can easily identify current transformer because current transformer is connected in series. There are many current transformer used for the measuring purpose. During our

Figure-3.4 current transformer

Industrial period we have visited 132kv transmission lines where observed a current transformer with ratio 800:1. It means if primary current is 800 A then secondary current will be 1A. Its burden is 30 VA. So the load connected to the secondary side should be under 30 VA

3.11 Potential Transformer:

Potential transformer step down voltage for measuring instruments on a required ratio. Potential transformer is connected parallel with the system. As potential transformer are connected across the line, we can identify potential transformer easily in substation.

This potential transformer is connected to the 132 kv Busbar.

Figure: 3.5 Voltage Transformer

In Dhaka PBS Substation are used three types transformer are these

- Single Phase Transformer
- Three Phase Transformer
- Auxiliary Transformer

3.12 The purpose of Potential transformer:

i. To reduce the line voltage to a value. It is suitable for standard measuring instruments, relays, etc.

ii. To isolate the measuring instruments, meters, relays, etc. from high voltage side of an installation.

iii. To sense abnormalities in voltage and give voltage signals to protective relays to isolate the defective system.

Generally the Transformers are either to △Y or △Y to connected. If

High voltage side Delta connected then Low Voltage side Y connected and vice versa

3.13 Relay

Relay is a protective electrical switch which is mainly used for detecting any type of abnormal condition of the system. It provides a signal to the circuit breaker to take steps for that abnormal condition. There are different types of relays used in Grid substation, like:

- Many types of relay under description:
- Electromagnetic attraction
- Electromagnetic induction
- Buchholz relay
- Distance protection rely
- Auto re-closing

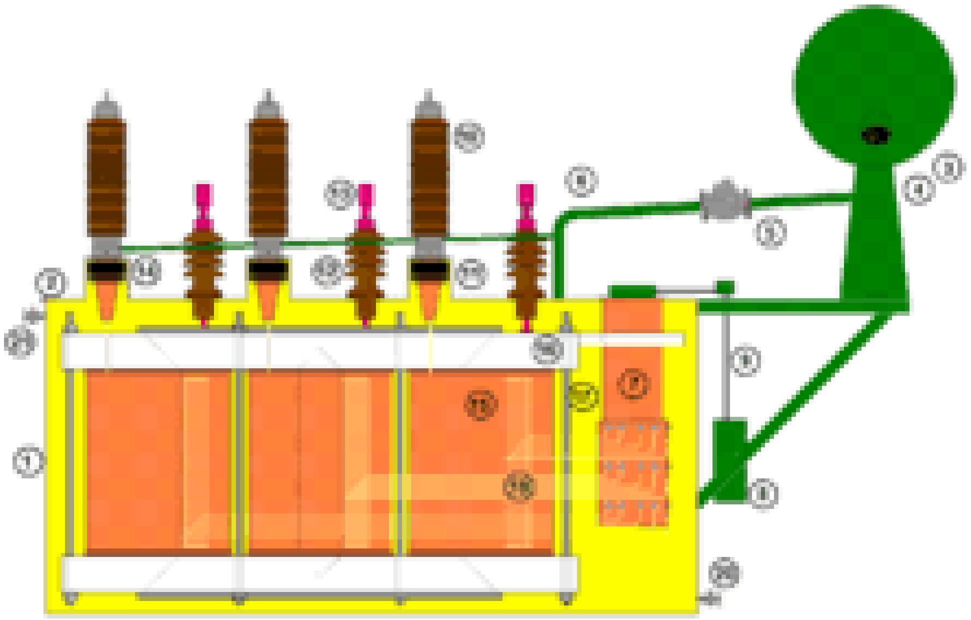


Figure: 3.6 Buchholz Relay

3.14 Circuit breaker:

Circuit breaker is a protective device of electrical engineering. when a short circuit occurs, heavy current flows through the contacts of the circuit breaker before they are opened by the protective system. At the instant when the contacts begin to separate, the contact area decrease rapidly and large fault current causes increased current density and hence rise in temperature. Actually we are called circuit breaker is a switch or protective device.

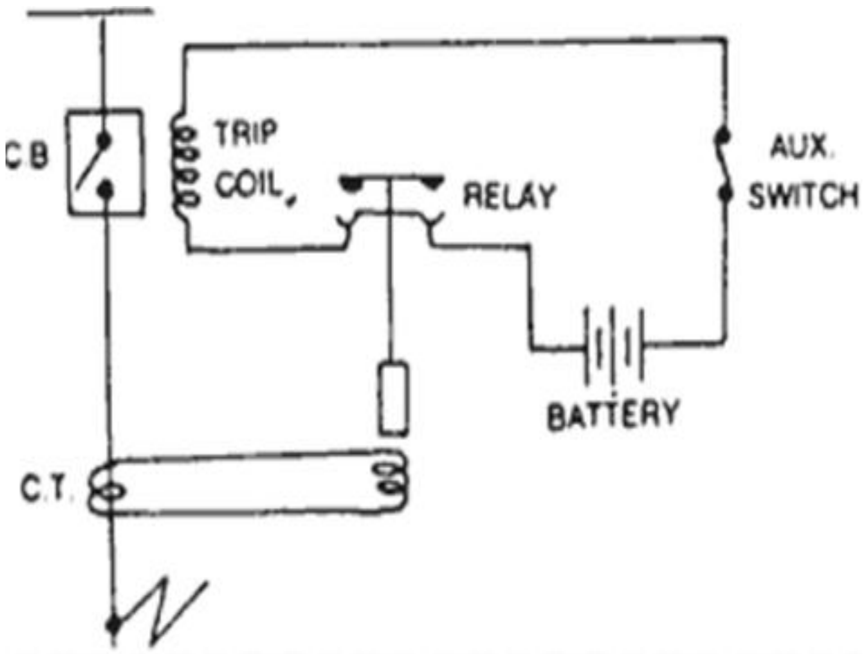


Figure: 3.7 Circuit Breaker

Under description of circuit breaker type

- Oil circuit breaker
- Plain break oil circuit breaker
- Arc control oil circuit breaker
- Low oil circuit breaker
- Maintenance oil circuit breaker
- Air blast circuit breaker

3.15 Sulfur hexafluoride (SF6) circuit breaker:

SF6 circuit breaker are used at 230 KV or 132KV bus bars in grid. This circuit breaker consists of sulfur hexafluoride gas. Sulfur hexafluoride (SF6) is an inert gas which has good dielectric and arc extinguishing properties. This dielectric property is much higher than air, so SF6 breakers can operate very quickly. This breaker can trip the circuit breaker within half cycle (10) ms

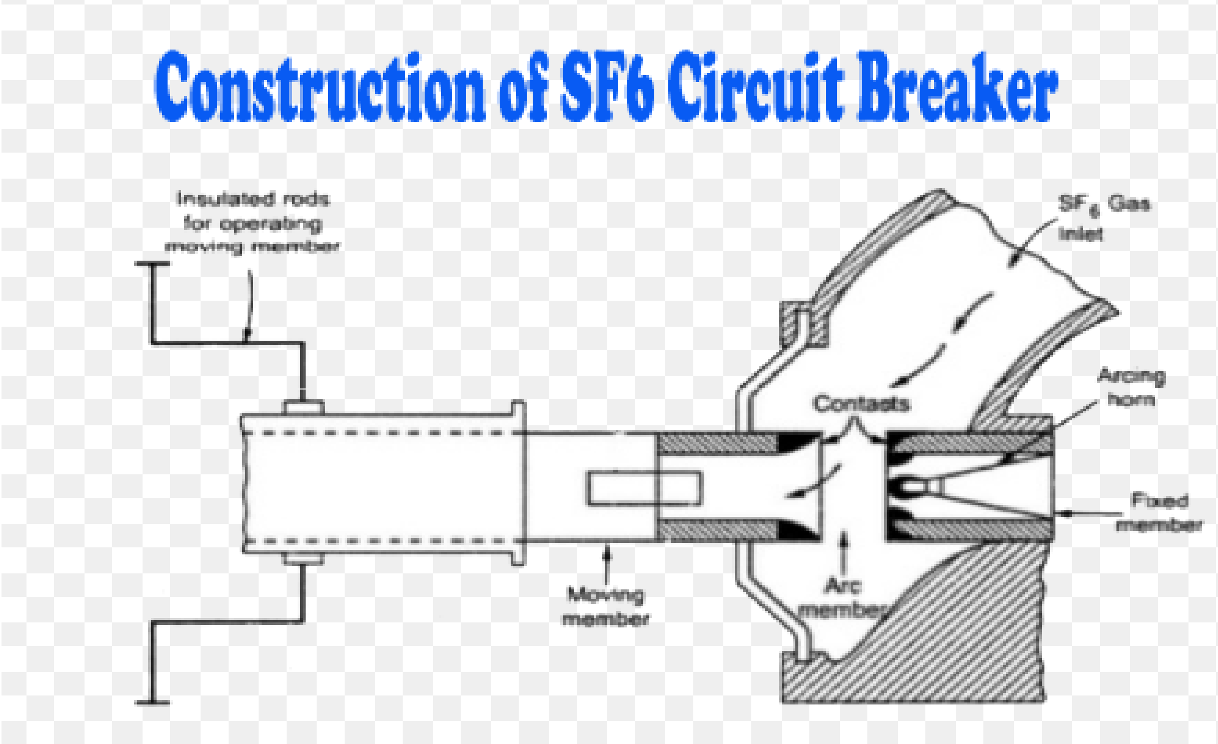


Figure: 3.8 **Sulfur hexafluoride (SF6) circuit breaker**

3.16 Control room & Panel Board:

Actually control room is very important in power system. This control room is open for seven (7) days and twenty four (24) hour. The basic operation of a control rooms or grid.

- Communicates with other control rooms or grids.
- Communicates with line maintenance teams.
- Manage load shedding.
- Record data (supply load, demand load, fault section etc).

Control relay panels facilitate centralized control of the related controlled equipment in power stations, switching stations and industrial plant. The panels are bolted together to from a board. This approach permits replacement, extensions and rearrangement when necessary. The panel incorporates control switches lamps for remote control of equipment. A “remote or supervisory’’ selector switch is also provided of supervisory control from remote control center.

Figure- 3.9 Control room & Panel Boa

3.17-Insulator:

An insulator is a material that does not respond to an electric field and completely resistance the flow of electric charge. Dielectric materials with high dielectric constants are considered insulators. These material are used in electrical equipment as insulator or insulation. The function is to support or separate electrical conductors without allowing current through themselves.

Figure: 3.10 Insulator

- Type of Insulator

  Guy insulator

  Pin insulator

  Suspension insulator

  Stain insulator

  Shackle insulator

3.18 Lighting arrester:

A lighting arrestor is that material which is used on electrical power systems to Protect the insulation and conductors of the system from the damaging effects

of lighting. Lighting arrester is also called surge arrester.

The typical lighting arrester has a high voltage terminal and ground terminal.

Type of lighting arrester

Rod gap arrester
Horn gap arrester

Multi gap arrester
Expulsion type lighting arrester
Valve type lighting arrester

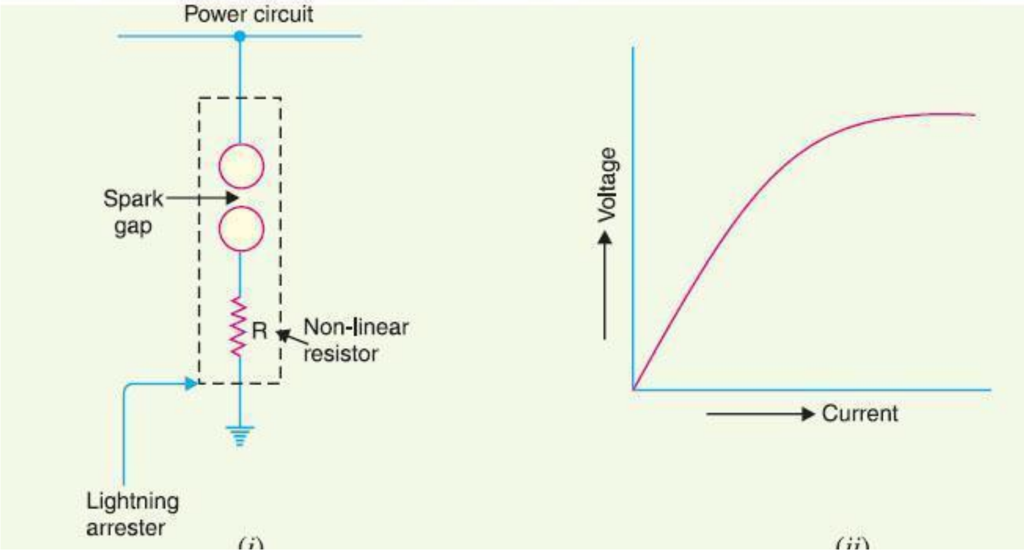


Figure : 3.11 Lighting arrester

Chapter 4

Power Factor Improvement

4.1 Power Factor Loss:

The system loss is defined as subject to the usual distributed losses production and transmission processes. We can calculate system loss,

System loss= [(Total generation-total distribution)/ total generation] * 100%

At the first stage of generations and distribution there was a lot of system loss in our system. For reducing these losses a team was built up for training at united state of America. They thought that because of the wire we used before, there were a lot of losses and for reducing that they were learning about the American wiring system. At that time we used covered wire to distribute electricity, the cover of the wire made the losses. Engineers saw that in America they use open wire and for that there would be a low system loss. The team came back and through that knowledge they started supplying electricity at rural areas.

4.2 Power Factor Monitoring & Upgrading

Power factor monitoring is one of the most important factors in power system. Because poor power factor impose low effects on power generation. At Kabirpur Grid substation we have seen the power factor was about 0.97=0.98, but usually the average is about 0.95. Inductive load is responsible to degrade the power factor. We are Know that power factor is defined as the ratio of KW of KVA. But we can see that the cause of low power factor is large KVAR. And we know that the magnitude of KVAR is proportional to inductive load includes:

Transformer, Induction motor and Energy saving light. Reactive power increases the amount of apparent power. This increases the reactive power and as a result apparent power creates large angle (θ) between KW and KVA and large angle produces poor power factor (pf=$\cos\theta$).

4.3 Effect of Low Power Factor:

Poor power factor affects the power distribution system, loss in distribution network and voltage drop in feeder line. Excessive voltage drop may cause over heating in distribution network. Poor power factor also affect the generation plant. The power generators act as an induction machine. The reactive power comes from these power generators. Poor power factor means more reactive power. More reactive power overloads the generators.

4.4 Methods for power Factor Improvement

The following device and equipment's are used for power factor Improvement.

1. Static Capacitor
2. Synchronous Condenser
3. Phase Advancer

1. Static Capacitor

We know that most of the industries and power system loads are inductive that take Jagging current which decrease the system power factor (See Disadvantages of Low Power factor). For Power factor improvement purpose, Static capacitors are connected in parallel with those devices which work on low power factor.

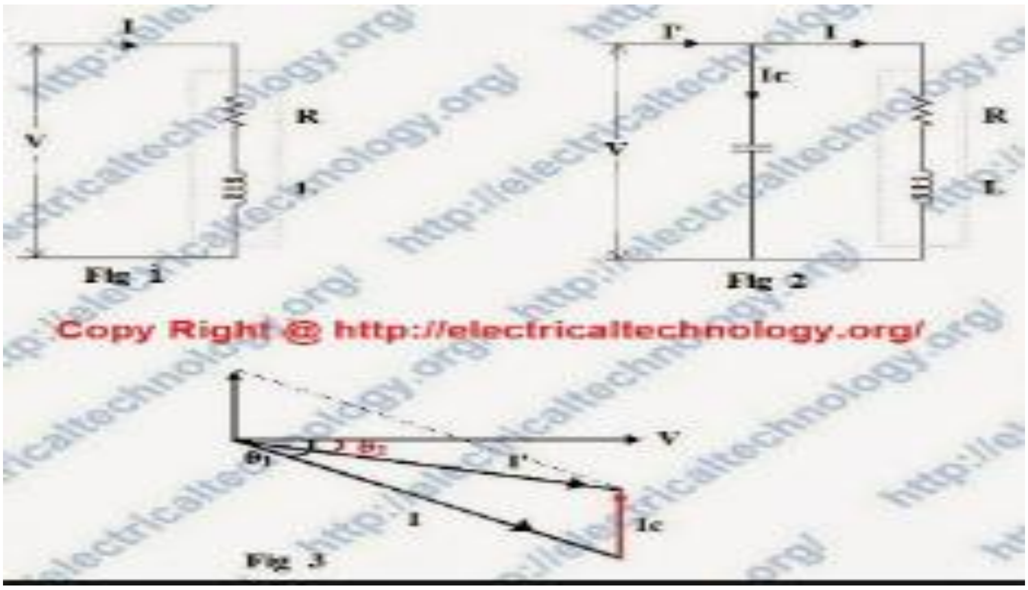


Figure: 4.1 Static Capacitor

The static Capacitors Provides leading current which neutralize (totally or approximately) the lagging inductive component of load current (i.e. leading component neutralize or eliminate the lagging component of load current) thus power factor of the load circuit is improved. These capacitors are installed in Vicinity of large inductive load e.g Induction motors and transformers etc., and improve the load circuit power factor to improve the system or devises efficiency.

Suppose, here is a single phase inductload which is taking lagging current (I) and the load power factor is $\cos\theta$ as shown in fig

In fig-2, a Capacitor (C) has been connected in parallel with load. Now a current (le) is Owing through Capacitor which lead 90° from the supply voltage (Note that Capacitor provides leading Current i.e., In a pure capacitive circuit, Current leading 90° from the supply Voltage, in other words, Voltage are 90° lagging from Current). The load current is (I). The Vectors combination of (I) and (le) is (I') which is lagging from voltage at $\theta 2$ as shown in fig 3.

It can be seen from fig 3 that angle of $\theta_2 < \theta 1$ i.e. angle of θ_2 is less than from angle of θ_2. Therefore Cos $\theta 2$ is less than from Cos $\theta 1$ (Cos $\theta 2$> Cos $\theta 1$).Hence the load power factor is improved by capacitor. Also note that after the power factor improvement, the circuit current would be less than from the low power factor circuit current. Also, before and after the power factor improvement, the active component of current would be same in that Circuit because capacitor eliminate only there-active component t of current. Also, the Active power (in Watts) would be same after and before power factor improvement.

<u>Advantages:</u>

- Capacitor bank offers several advantages over other methods of power factor improvement.
- Losses are low in static capacitors
- There is no moving part, therefore need low maintenance
- It can work in normal air conditions (i.e. ordinary atmospheric conditions)
- Do not require a foundation for installation
- They are lightweight so it is can be easy to installed

Disadvantages:

- The age of static capacitor bank is less (8-10 years)
- With changing load, we have to ON or OFF the capacitor bank, which causes switching surges on the system
- If the rated voltage increases, then it causes damage it
- Once the capacitors spoiled, then repairing is cosφ

Suppose, here is a single phase induct load which is taking lagging current (I) and the load power factor is $\cos\theta$ as shown in fig

In fig-2, a Capacitor (C) has been connected in parallel with load. Now a current (le) is Owing through Capacitor which lead 90° from the supply voltage (Note that Capacitor provides leading Current i.e., In a pure capacitive circuit, Current leading 90° from the supply Voltage, in other words, Voltage are 90° lagging from Current). The load current is (I). The Vectors combination of (I) and (le) is (I') which is lagging from voltage at $\theta 2$ as shown in fig 3.

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4.5 Synchronous Condenser

When a Synchronous motor operates at No-Load and over-exited then it's called a synchronous Condenser. Whenever a Synchronous motor is over-exited then it provides leading current and works like a capacitor. When a synchronous condenser is connected across supply voltage (in parallel) then it draws leading current and partially eliminates the re-active component and this way, power factor is improved. Generally, synchronous condenser is used to improve the power factor in large industries.

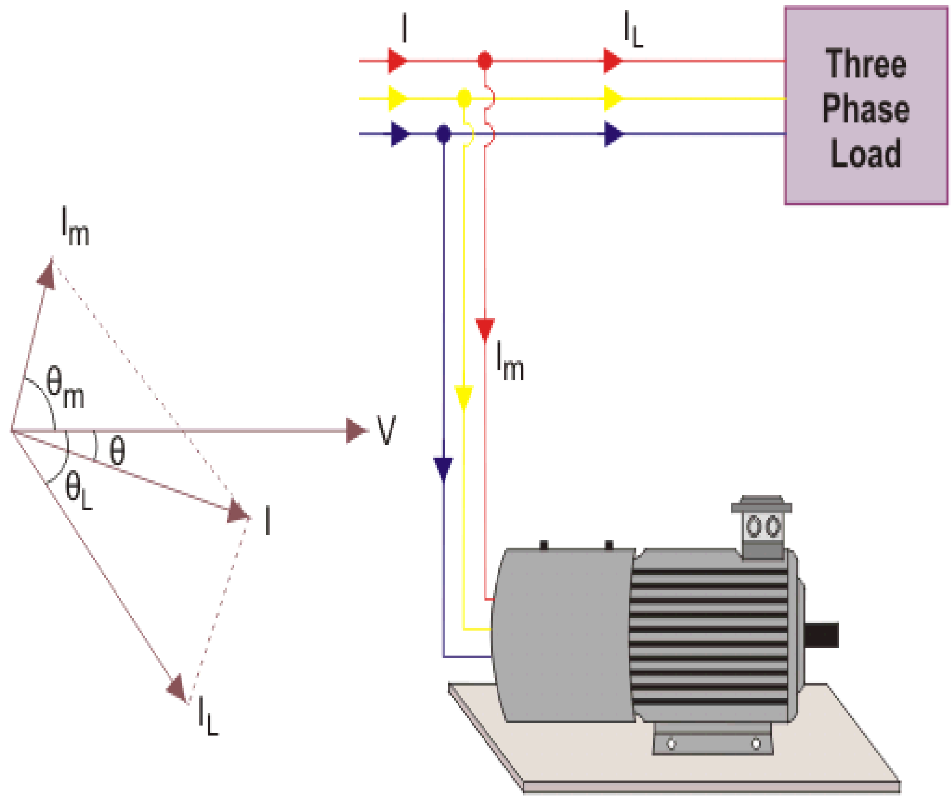

Figure: 4.2 Synchronous Condenser

Advantages:

- Long life (almost 25 years)
- High Reliability
- Step-less adjustment of power factor.
- No generation of harmonics of maintenance
- The faults can be removed easily
- It's not affected by harmonics.

Require Low maintenance (only periodic bearing greasing is necessary)

Disadvantages:

- It is expensive (maintenance cost is also high) and therefore mostly used by large power users.

  An auxiliary device has to be used for this operation because synchronous motor has no self-starting torque
- It produces noise

4.6 Phase Advancer:

Phase advancer is a simple AC exciter which is connected on the main shaft of the motor and operates with the motor's rotor circuit for power factor improvement. Phase advancer is used to improve the power factor of induction motor in industries. As the stator windings of induction motor takes lagging current 90° out of phase with Voltage, therefore the power factor of induction motor is low. If the exciting ampere-turns are excited by external AC source, then there would be no effect of exciting current on stator windings. Therefore the power factor of induction motor will be improved. This process is done by Phase advancer.

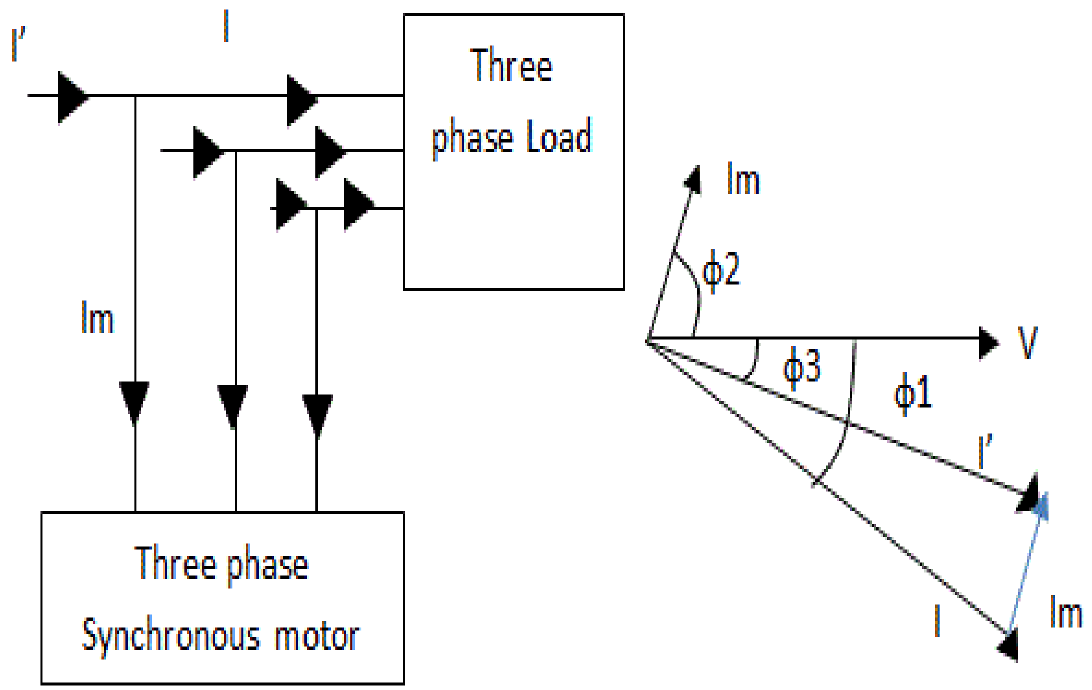

Figure: 4.3 Phase Advancer

Advantages:

Lagging KVAR (Reactive component of Power or reactive power) drawn by the motor is sufficiently reduced because the exciting ampere turns are supplied at slip frequency (fs).

The phase advancer can be easily used where the use of synchronous motors is Unacceptable

Disadvantage:

Using Phase advancer is not economical for motors below 200 H.P. (about 150kW

Chapter-5

Up-Gradation, Rehabilitation, and, Inetnsification of Distribution System,Dhaka, **Mymensingh**, Chittagong ,and Sylhet Division. Line Construction Annual Procurement Plane Of Year Wise.

SL No.	Financial Year	Sub-Package No	PBS_Name	KM	Cost in Taka
	1	3	5	6	10
1	2017-18	URIDS(E)-COM-04-UL-57-03	Comilla-04	23	2,641,680.04
2	2017-18	URIDS(E)-COX-UL-58-02	Coxbazar	15	1,759,942.44
3	2017-18	URIDS(E)-COM-02-UL-48-02	Comilla-02	28	4,046,405.95
4	2017-18	URIDS(E)-COX-UL-58-01	Coxbazar	15	1,774,820.45
5	2017-18	URIDS(E)-COX-UL-58-03	Coxbazar	15	1,821,550.32
6	2017-18	URIDS(E)-Farid-UL-07-01	Faridpur	20	3,705,218.31
7	2017-18	URIDS(E)-Jamal-UL-07-13-01	Jamalpur	25	1,866,616.79
8	2017-18	URIDS(E)-MUNSHI-UL-18-01	Munshiganj	25	5,115,981.17
9	2017-18	URIDS(E)-Narayan-01-UL-24-04	Narayanganj-01	25	3,719,965.08
10	2017-18	URIDS(E)-Narayan-02-UL-26-01	Narayanganj-02	11	2,694,059.35
11	2017-18	URIDS(E)-Narayan-02-UL-27-04	Narayanganj-02	25	5,550,990.12
12	2017-18	URIDS(E)-Netro-UL-30-03	Netrokona	25	4,363,482.11
13	2017-18	URIDS(E)-M Bazar-UL-65-01	Moulovibazar	25	4,879,359.89
14	2017-18	URIDS(E)-M Bazar-UL-68-1	Sylhet-1	14	1,265,391.40
15	2017-18	URIDS(E)-Hobi-UL-64-03	Hobigonj	20	4,601,956.53
16	2017-18	URIDS(E)-Syl-2-UL69-01	Sylhet-2	25	4,764,779.22
17	2017-18	URIDS(E)-Hobi-UL-64-04	Hobigonj	20	4,116,515.78
18	2017-18	URIDS(E)-Sunam-UL-67-2	Sunamgonj	20	3,737,205.95
19	2017-18	URIDS(E)-Sunam-UL-67-01	Sunamgonj	20	3,619,778.84
20	2017-18	URIDS(E)-B-Baria-UL-36-01	B-Baria	10	1,318,367.98
21	2017-18	URIDS(E)-DHK-3-UL-03-04	Dhaka-03	26	5,153,382.96
22	2017-18	URIDS(E)-DHK-3-UL-03-04-04	Dhaka-03	27	4,367,826.78
23	2017-18	URIDS(E)-GAZI-UL-10-01	GAZI-02	25	3,401,100.56
24	2017-18	URIDS(E)-Sherpur-UL-33-01	Sherpur	20	1,757,893.70
25	2017-18	URIDS(E)-COM-04-UL-57-02	Comilla-04	22	3,098,368.20
26	2017-18	URIDS(E)-Sherpur-UL-33-01	Sherpur	15	1,925,493.25
27	2017-18	URIDS(E)-Narshi-01-UL-28-02	Narshindi-01	10	1,875,629.42
28	2017-18	URIDS(E)-Narshi-01-UL-28-03	Narshindi-01	10	1,875,629.42
29	2017-18	URIDS(E)-Narshi-01-UL-28 -01	Narshindi-01	10	2,498,419.05
30	2017-18	URIDS(E)-Chad-02-UL-27-01	Chad-02	30	3,512,160.51
31	2017-18	URIDS(E)-Chad-03-UL-55-01	Comilla-03	10	2,304,502.24
32	2017-18	URIDS(E)-MUNSHI-UL-18-02	Munshiganj	25	47,13,253.98
33	2017-18	URIDS(E)CTG-03-UL-45-01	Chittagong-03	25	26,25,287.61
34	2017-18	URIDS(E)-MUNSHI-UL-18-03	Munshiganj	25	46,16,114.96
35	2017-18	URIDS(E)-DHK-02-UL-03-01	Dhaka-02	25	47,17,301.63
36	2016-17	URIDS(E)-SHERPUR-UL-33-01	Sherpur	20	17,57,893.699
37	2017-18	M.Bazar-URIDS(E)-UL-65-Lot-02	Moulovibazar	25	52,79,534.09
38	2017-18	URIDS(E)-Dhk-04-UL-06-01	Dhaka-04	25	46,89,843.78

39	2016-17	Syl-1-URIDS(E)-UL-68-Lot 0	Sylhet-1	14	10,25,335.32
40	2017-18	URIDS(E)-B-Baria-UL-36-04	B-Baria	18	39,68,497.78
41	2017-18	URIDS(E)-Kishor-UL-14-01	Kishorgonj	25	51,24,002.78
42	2017-18	URIDS(E)-CTG-2-UL-125-01	Chittagong-02	25	3,423,493.83
43	2017-18	URIDS(E)-Sariyat-UL-32-02	Sariat	23	3,872,597.12
44	2017-18	URIDS(E)-Madar-UL-16-01	Madaripur-01	25	6,219,664.56
45	2016-17	URIDS(E)-Farid-UL-07-04	Faridpur	26	3,831,831.23
46	2016-17	URIDS(E)-Gopal-UL-12-01	Gopalgonj	24	13,66,141.23
47	2017-18	URIDS(E)-Feni-UL-59-03	Feni	29	52,78,950.58
48	2017-18	URIDS(E)-Feni-UL-59-02	Feni	28	44,24,601.10
49	2017-18	URIDS(E)-MYMN-3-UL-23-02	Mymen-3	25	15,26,612.79
50	2017-18	URIDS(E)-MYMN-1-UL-20-03	Mymen-1	25	45,41,540.81
51	2017-18	URIDS(E)-Hobi-UL-64-05	Hobigonj	20	5,074,341.90
52	2017-18	URIDS(E)-M.Bazar-UL-65-03	Moulovibazar	25	5,470,976.01
53	2017-18	URIDS(E)-Sunam-UL-67-03	Sunamgonj	20	3,387,201.09
54	2017-18	URIDS(E)-B-Baria-UL-36-04	B-Baria	18	3,080,203.46
55	2017-18	URIDS(E)-MYMN-3-UL-23-03	Mymen-3	25	1,406,833.07
56	2017-18	URIDS(E)-MYMN-3-UL-23-04	Mymen-3	25	1,231,172.08
57	2017-18	URIDS(E)-JAMAL-UL-13-02	Jamal	25	3,981,000.00
58	2017-18	URIDS(E)-B-Baria-UL-115-01	B-Baria	25	4,787,005.46
59	2017-18	URIDS(E)-B-Baria-UL-36-05	B-Baria	17	2,944,320.65
60	2017-18	URIDS(E)-Feni-UL-59-04	Feni	29	4,341,470.74
61	2017-18	URIDS(E)-Feni-UL-59-05	Feni	29	4,565,780.03
62	2017-18	URIDS(E)-DHK-1-UL-01-02	Dhaka-1	29	3,234,498.10
63	2017-18	URIDS(E)-DHK-3-UL-05-02	Dhaka-3	25	5,608,303.29
64	2017-18	URIDS(E)-DHK-3-UL-05-03	Dhaka-3	25	5,611,139.69
65	2017-18	URIDS(E)-DHK-3-UL-05-04	Dhaka-3	25	5,106,614.69
66	2017-18	URIDS(E)-Farid-UL-07-05	Faridpur	26	41,14,421.75
67	2016-17	URIDS(E)-Farid-UL-08-01	Faridpur	26	34,70,952.82
68	2016-17	URIDS(E)-Rajbari-UL-31-05	Rajbari	20	33,20,188.76
69	2016-17	URIDS(E)-Com-3-UL-55-02	Comilla-3	25	40,34,130.61
70	2016-17	URIDS(E)-Manik-UL-17-01	Manikganj	20	48,97,494.51
71	2016-17	URIDS(E)-Manik-UL-17-02	Manikganj	20	50,51,043.52
72	2016-17	URIDS(E)-Sherpur-UL-33-02	Sherpur	20	2,334,971.97
73	2016-17	URIDS(E)-Jamal-NL-08-02	Jamalpur	25	3,880,070.86
74	2016-17	URIDS(E)-Kishor-UL-14-03	Kishorgonj	25	6,784,268.11
75	2016-17	URIDS(E)-Kishor-UL-14-02	Kishorgonj	25	5,021,470.54
76	2016-17	URIDS(E)-Noa-UL-62-02	Noakhali	27	45,56,910.61
77	2016-17	URIDS(E)-Noa-UL-62-01	Noakhali	27	49,41,706.54
78	2017-18	URIDS(E)-B.Baria-UL-115-01	B.Baria	25	53,49,719.26
79	2017-18	URIDS(E)-B.Baria-UL-36-04	B.Baria	18	32,70,825.76
80	2017-18	URIDS(E)-B.Baria-UL-115-03	B.Baria	20	41,12,646.46
81	2017-18	URIDS(E)-B.Baria-UL-36-05	B.Baria	17	32,86,174.25
82	2017-18	URIDS(E)-Narshi-01-UL-28 -04	Narshindi-01	25	45,26,447.02
83	2017-18	URIDS(E)-COX-UL-152-01	Coxbazar	22	26,13,007.47
84	2017-18	URIDS(E)-CTG-2-UL-125-03	Chittagong-2	25	33,34,845.79
85	2017-18	URIDS(E)-CTG-2-UL-125-02	Chittagong-2	25	39,64,647.70
86	2017-18	URIDS(E)-COX-UL-58-05	Coxbazar	20	35,18,589.03

87	2017-18	URIDS(E)-COX-UL-58-04	Coxbazar	20	57,06,775.45
88	2017-18	URIDS(E)-Sariyat-UL-32-05	Sariyatpur	23	41,53,277.52
89	2017-18	URIDS(E)-Sariyat-UL-32-04	Sariyatpur	23	38,43,998.28
90	2017-18	URIDS(E)-Sariyat-UL-32-03	Sariyatpur	23	31,00,356.44
91	2017-18	URIDS(E)-Narshi-01-UL-28-05	Narshindi-01	25	49,17,369.27
92	2017-18	URIDS(E)-M Bazar-UL-40-02	M. Bazar	17	42,28,734.25
93	2017-18	URIDS(E)-M Bazar-UL-65-04	M. Bazar	25	48,84,682.51
94	2017-18	URIDS(E)-B.Baria-UL-115-02	B.Baria	25	43,86,545.62
95	2017-18	URIDS(E)-M Bazar-UL-40-01	M. Bazar	18	54,50,492.84
96	2017-18	URIDS(E)-Sunam-UL-67-04	Sunamgonj	25	44,54,501.33
97	2017-18	URIDS(E)-Munshi-UL-18-05	Munshiganj	25	37,20,097.62
98	2017-18	URIDS(E)-Munshi-UL-18-04	Munshiganj	25	36,70,011.74
99	2017-18	URIDS(E)-Gazi-UL-10-03	Gazipur-1	25	45,45,022.60
100	2017-18	URIDS(E)-Gazi-UL-10-02	Gazipur-1	25	43,33,386.74
101	2017-18	URIDS(E)-MYMN-1-UL-20-04	Mymensingh-1	25	43,03,141.32
102	2017-18	URIDS(E)-Feni-UL-60-01	Feni	29	45,03,424.75
103	2017-18	URIDS(E)-Feni-UL-60-02	Feni	29	44,33,847.80
104	2017-18	URIDS(E)-Narshi-2-UL-29-01	Narshindi-02	30	49,47,729.22
105	2017-18	URIDS(E)-Dhk-4-UL-06-02	Dhaka-4	25	66,83,339.10
106	2017-18	URIDS(E)-Dhk-4-UL-06-03	Dhaka-4	20	29,64,040.03
107	2017-18	URIDS(E)-Dhk-3-UL-05-05	Dhaka-3	25	50,72,401.74
108	2017-18	URIDS(E)-Dhk-3-UL-74-01	Dhaka-3	25	45,08,806.90
109	2017-18	URIDS(E)-B.Baria-UL-115-02	B.Baria	25	38,94,576.12
110	2017-18	URIDS(E)-Kishor-UL-14-04	Kishorgonj	25	34,57,339.07
111	2017-18	URIDS(E)-Madar-UL-16-02	Madaripur	25	57,06,695.37
112	2017-18	URIDS(E)-Kishor-UL-14-05	Kishorgonj	25	43,27,906.84
113	2017-18	URIDS(E)-Kishor-UL-15-01	Kishorgonj	25	47,60,852.32
114	2017-18	URIDS(E)-Dhk-3-UL-05-01	Dhaka-3	25	49,73,544.95
115	2017-18	URIDS(E)-Sunam-UL-67-05	Sunamgonj	25	41,88,121.21
116	2017-18	URIDS(E)-Kishor-UL-15-03	Kishorgonj	25	60,19,225.80
117	2017-18	URIDS(E)-Kishor-UL-15-02	Kishorgonj	25	57,38,198.92

Under the Description Of Full meaning this here by
NOA- Notification of award
BOQ- Bill of Quantity
DPP-Development Procurement Plane

Name of the Project : URIDS (DMCS)

Zone	Name of PBS	As per DPP (Km)2016-17		Received BOQ				NOA/Contract				Progress (Km)	
				UP		New		UP		New			
		UP	New	Km	Nos	Km	Nos	Km	Nos	Km	Nos	UP	New
Dhaka-North	Dhaka PBS-1	1015	60	88.455	3	60.878	2	59.183	2	60.879	2	0	86.3
	Dhaka PBS-3	935	45	384.613	15	57.735	3	308.66	12	22.895	1	50.45	50.53
	Gazipur PBS-1	650	102	154.787	6	73.424	3	154.462	6	73.424	3	10	42.5
	Gazipur PBS-2	255	98	99.125	4	0	0	49.288	2	0	0	9	0
	Manikgonj PBS	70	115	41.121	2	101.763	4	41.121	2	101.763	5	0	76.07
	Tangail PBS	1175	195	81.428	3	84.543	3	81.428	3	84.543	3	0	41.78
Total		4100	615	849.529	33	378.343	15	694.142	27	343.504	14	69.45	297.18
Dhaka South	Dhaka PBS-2	135	25	80.349	3	10.278	1	108.963	4	10.278	1	0	41.21
	Dhaka PBS-4	90	10	70.716	3	10.129	1	70.716	3	10.029	1	0	48.83
	Munshigonj PBS	440	120	355.253	14	30.327	1	355.253	14	30.327	1	57.45	109.64
	Narayongonj PBS-1	560	90	267.576	10	25.815	1	275.599	11	23.023	1	0	45.66
	Narayongonj PBS-2	550	145	256.656	10	0	0	250.514	10	0	0	44.6	7.54
	Narshingdi PBS-1	110	50	100.278	7	0	0	110.155	6	0	0	2	40.67
	Narshingdi PBS-2	85	35	30.55	1	5.05	1	30.55	1	5.05	1	8.64	24
Total		1970	475	1161.378	48	81.599	5	1201.75	49	78.707	5	112.69	317.55
Faridpur	Faridpur PBS	1020	340	177.678	7	0	0	203.511	8	0	0	34.28	0
	Gopalgonj PBS	275	250	97.078	4	0	0	47.318	2	0	0	0	117.955
	Madaripur	135	250	75.386	3	25.452	1	75.386	3	25.452	1	0	2.7
	Rajbari PBS	305	440	256.904	10	24.297	1	249.594	10	24.297	1	0	19.402
	Sariatpur PBS	360	150	228.98	9	35.045	2	250.646	10	35.045	2	11	4
Total		2095	1430	836.026	33	84.794	4	826.455	33	84.794	4	45.28	144.057
Mymensingh	Jamalpur PBS	155	50	180.078	7	25.221	1	153.4	6	51.899	2	0	22.92
	Kishorgonj PBS	400	290	271.533	11	45.826	2	254.062	10	25.328	1	0	40.67
	Mymensingh PBS-1	205	160	51.958	2	111.152	5	76.607	3	10.04	1	7.5	10.2
	Mymensingh PBS-2	160	110	31.897	2	138.962	8	52.031	3	50.526	3	14	3
	Mymensingh PBS-3	145	240	139.185	6	50.192	2	139.185	6	0	0	34.18	0
	Netrokona PBS	185	110	186.259	10	71.143	4	167.887	9	50.582	3	0	26.2
	Sherpur PBS	140	50	97.738	5	85.222	5	37.883	2	33.476	2	0	21.702
Total		1390	1010	958.648	43	527.718	27	881.055	39	221.851	12	55.68	124.692
Sylhet	B.Baria PBS	135	150	196.304	10	46.313	2	117.017	6	0	0	49.72	0
	Hobigonj PBS	290	100	131.299	6	30.962	1	62.335	3	0	0	48.5	0
	Moulvibazar PBS	395	65	269.126	10	17.242	1	126.576	5	35.553	2	41.95	0

Chapter-6

- Conclusion

Bangladesh Rural Electrification board and palli bidyut samite is joined organization of different category BREB is a government organization and palli bidyut is semi government organization. Power is a small word but makes our life easy and comfortable. This easy word is the beauty and gift of science. The administration who gives this facility in the rural places of our country is Palli bidyut samity who has already very profound name among the people of Bangladesh and we are very happy to get a chance for the internee in there. There we have seen power transmission, distribution protection, system ,repair of various power equipment like transformer CT, PT, Distribution Line etc and we have also seen power up-gradation and new line construction

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