INTERNSHIP REPORT

ON

SILICON PROPERTIES

By

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Submitted to the

Department of Electrical and Electronic Engineering
Faculty of Sciences and Engineering
East West University

In partial fulfillment of the requirements for the degree of
Bachelor of Science in Electrical and Electronic Engineering
(B.Sc. in EEE)

Fall 2010

Approved By

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Department Chairperson

Approval Letter

To whom it may concern

This is to certify that Mehrin Hossain, student ID: 2006-3-80-015 has successfully completed the project work that was assigned to her as part of the internship program. I, AKM Ruhul Amin, on behalf of Silicon Properties, am recommending this work as the fulfillment for the requirement of EEE 499 Industrial Training. I wish her every success in life.

Silicon Properties Dhaka, Bangladesh

Engr. AKM Ruhul Amin

ACKNOWLEDGMENT

• The Silicon Group had offered a remarkable time to me, while I was working there. I feel great pleasure in expressing my deepest appreciation and heartiest gratitude to the staff of Silicon Group for their guidance and great help during the internship period.. The people there were very helpful and kind enough to allow me to finish my internship in their company. I whole-heartedly thank them for giving me this opportunity. I would like to personally thank Mr. Ruhul Amin, who was the chief engineer of the Silicon Group, and my mentor, who guided and supported me throughout my internship program.

I would also like to thank my Academic Advisor, Mr. Ishfaqur Raza, Associate Professor, Department of Electrical & Electronic Engineering, East West University (EWU), whose guidance and support had lead me to complete my internship report. I am very much grateful to him for sparing me his precious time, whenever I needed him. I would also like to thank, Dr. Anisul Haque, Chairperson & Professor of the Department of Electrical & Electronic Engineering, East West University (EWU) for being kind enough to allow

whom I worked at the Silicon Group. These people were Mr. Syed Zaeem Kabir, DMD (Deputy Managing Director), Silicon Group, Syed Nasrul Kabir, Managing Director of the Silicon Group, Mrs Nilufar Kabir, Chairperson of the Silicon Group.I thank them very much for giving me their precious time whenever I needed them. These people were very encouraging to me and they helped me a lot during my completion of my internship report.

I would like to express my deepest affection for my parents and my friends who prayed for my success and encouraged me during this internship period. I appreciate and acknowledge the patience, understanding and love provided by employees of the Silicon Group Last but not the least, I would love to express my gratitude to our Almighty Allah, with His Grace, I have been successful in completing my internship program.

EXECUTIVE SUMMARY

My intern report was based on the topics which I have covered during my BSc on EEE in the East West University. In my report I have mainly covered the topics on the Power system, the Substation, The wiring of a building, the light and electric appliances of a building, the protection of a building, the generator and lift of a building. I have learnt a lot regarding the topics mentioned above. During my BSc in engineering, the most of the things I learnt were theoretical; I had little chance to learn them practically.

This report includes nine topics, within which there are sub topics. The first chapter includes the objective of the internship, sources and methods of data collection, the benefit of study, the internship schedule and the limitations. Chapter 2 includes the Company profile of the Silicon Properties. Chapter 3 includes the load calculations of a room, an apartment and a building. Chapter 4 is about the Lift Installation in a Building. Under this topic, the subtopics are the agreements made before installing the lift, details of the general features of the lift, care of the building and guarantee.

Chapter 5 includes the inspection of a substation and the single-line diagram of the substation. Chapter 6 is all about the protection of a building, which includes the use of lightning rod, lightning arrestor etc. Chapter 7 involves the wiring of a building, the light and electrical appliance placements of a building. The chapter 8 is about the generator of a building, how it works and its placement. The last chapter which is chapter 9 is the conclusion of my internship report.

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1. INTRODUCTION

1.1. Objective of Internship:

The objective of the internship is to provide an opportunity to test my interest in my career before permanent commitments are made. I had the rare opportunity to complete my intern under the auspicious guidance of my advisor, Dr. Ishfaqur Raza, Associate Professor, Department of Electrical & Electronic Engineering, East West University. This task provides an opportunity for the university to relate academic training to job requirements. This provides a direct avenue through which the university can meet community needs. Through this program I have developed skills in the application of theory to practical work situations. This internship program had developed skills and techniques directly applicable to my career. This work will help me in adjusting from university to full-time employment. After completing my internship report, I will be prepared to enter into full-time employment in my area of specialization after the completion of my graduation.

1.2. Sources and Methods of Data Collection:

The Methodology of the data collection was rather simple due to the help from my mentor. He had guided me all the way through my internship period. The data was collected from different officers of the company regarding my related topic of my internship. However, all data have not been collected due to time constraints and sometimes the data was confidential to the company itself.

1.3. Benefit of Study:

The analysis of the report is basically based on the power distribution of substations, power distribution in a building and power distribution in a local area. This report will be very beneficial for the students who are willing to do their intern on the power system. I hope the students will be highly benefited and will appreciate my work as such.

1.4. Internship Schedule:

The schedule of the internship was divided into two slots. One was during the morning and the other half was during the afternoon. When my university was closed I used to work in both slots but when it reopened, I had to shift to the afternoon slot only. The stuff at Silicon was very helpful and thus it was very convenient for me to work in flexible timings. Each day I used to visit my mentor, Engr. Ruhul Amin and he used to guide me through my internship program. At first he used to give me a brief lesson on the topic to be discussed and then he used to take me to the practical field. Each day he used to give me task for home, that was to create worksheets done on each day. The brief lesson he gave me every day, worked wonders for me and I found it very useful for my everyday life. Through this internship, I learnt how to be more professional in real life how to actually deal with workers who are above and below your position. The routine of internship schedule is attached to this report in Table 1.

Table 1: The Internship Schedule

Date and time	Task	Supervisors
2-5-10 9am to 5 pm	Electrical load calculation of a flat	Mr. Ruhul Amin
3-5-10 9am to 5pm	Electrical load calculation of a high rise building	Mr. Ruhul Amin and Mr. Shahid
4-5-10 9am to 5pm	Lift installation in a building	Mr. Ruhul Amin and Mr. Shahid
5-5-10 9am to 5pm	Load calculation of a substation	Mr. Ruhul Amin
6-5-10 9am to 5pm	Single line diagram of a substation	Mr. Ruhul Amin
8-5-10 9am to 5pm	Earthing system of a building	Mr. Ruhul Amin and Mr. Shahid
9-5-10 9am to 5pm	Thunder protection of a building	Mr. Ruhul Amin and Mr. Shahid
10-5-10 9am to 5pm	Electrical switching and light placement	Mr. Ruhul Amin and Mr.Saluddin
16-5-10 9am to 5pm	Electrical wiring layout of a building	Mr. Ruhul Amin and Mr.Saluddin
22-5-10 9am to 5pm	Electrical meter connections	Mr. Ruhul Amin and Mr. Shahid
23-5-10 2pm to 5pm	Generator Inspection	Mr. Ruhul Amin and Mr. Shahid
24-5-10 2pm to 5pm	Generator load calculation	Mr. Ruhul Amin
25-5-10 2pm to 5pm	Lift control room inspection	Mr. Ruhul Amin and Mr. Shahid
29-5-10 9am to 5pm	Substation Inspection	Mr. Ruhul Amin and Mr. Shahid
30-5-10 2pm to 5pm	Security control system in a building	Mr. Ruhul Amin

1.5. Limitations:

The thesis has certain limitations, which must be mentioned for the sake of reader's understandability and achieving transparency. As most of the data were taken from the web sites, though the cross check was conducted; still the depth of reliability varies as by the nature of web sites. For data, most of the data used in this paper are accumulated from the stuff of the Silicon Properties, so the verification of this data was not possible. Lastly the constraint of my limited knowledge and authoring such report for the first time, has its effect on the paper.

1.6. Company Profile

The Silicon Properties started its journey on12th September 1998, portraying confidence, commitment and quality for building homes in the metropolitan city of Dhaka.

Silicon has successfully handed over 60 projects till December 2008. At present, 35 projects (500 Apartments) are under construction at the capital Dhaka, Port city Chittagong and Sea beach tourist city of Cox's Bazar. At completion these apartments will be handed over between year 2009, 2010 and 2011. Simultaneously, we are also prepared to start new projects with utmost dedication and aiming to gain the maximum satisfaction of our customers.

Silicon Properties is fully committed and dedicated to its clients. Projects of Silicon Properties are self financed and all projects are completed on time whether all apartments are sold or not.

Besides building apartments and selling them this Silicon Group is also interested in importing generators for the apartments and developing substations for the buildings. The Silicon Group is also member of the REHAB.

2. LOAD CALCULATION

2.1. Introduction:

The internship took place at the Silicon Properties head office at Baitul Aman Housing Society, Adabar from the 2nd of May until 30th of May' 2010. The main focus of my internship program was to cover the related topics studied in my bachelor degree of EEE (Electrical Electronic Engineering). In my report I have mentioned the topics which I have covered in my internship as each of the chapters. The topics also include some subtopics which are also mentioned in the content's page.

2.2. Load Calculation:

Under the article 3.2. I am going to discuss the load calculation of a room, an apartment and a building. Load calculation means how much power in Watt the electrical appliances in a room, apartment or a building are going to consume. The summation of the loads of different appliances is done in the calculations. [1]

2.2.1. Electrical Load Calculation of a Room

Table 2: Load Calculation of a Room

Fixtures	**Watt per Load**	
Fan	80	
Tubelight	80	
Dim light	5	
Bulb	100	
2-pin outlet	300	
3-pin outlet	1000	
Total load	**1565**	**Watt**

3. LIFT INSTALLATION

3.1. Lift Installation in a Building:

I visited a building in Shamoli, Adabar, rd 16, where I did the inspection of a lift in a building. I learnt how a lift is being installed in a building and how it operates. I also got to know about the agreements which are required to be fulfilled before installing the lift and I have mentioned them below.

3.2. The agreements made before installing the lift:

1. In consideration of the payment to be made to the contractor as herein provided he shall upon and subject to the said conditions and priced schedule of quantities.

2. The Silicon Group shall pay the contractor such sums as shall become payable hereunder at the times and in manner specified in the conditions.

3. The said conditions shall be read and form part of the agreement and the parties hereto will respectively abide by and submit themselves to the conditions and stipulations and perform the agreement on their parts respectively on such conditions contained.

Figure 1: The Lift Cabin

3.3. Details of the General Features of the Lift:

I have been introduced to a lift and now I am going to tell you about that lift. The brand name of the lift which I visited was ILC. The country of origin of this lift is Italy. The safety code which this lift follows is the European safety code, denoted as EN81.1. This lift has the weight capacity of 480kg or 6 persons; it is able to visit 7 floors and has a standard travel distance of 16 meters approximately. Its typical speed of travel is 1m/s. Its drive is 50% power saving with smoothness in motion. Its operation is full-collective and simplex. Inside the lift cabin, it has 7 segment display in the car and all landings. The lift cabin is shown in Figure 1. Its machine room is directly above the shaft.

The lift supplies a power of 400± 5% Watt in 3-phase with a frequency of 50 Hz & 220± 5%Watt with a frequency of 50 Hz in single phase. It has an operating voltage of 380 to 440 Volts in 3 phase. The lift cabin dimensions are as follows:

1050mm width X1200mm depth X 2300 height for 1000kg and

1100mm width X1600mm depth X 2300 height for 800 kg

It has a ceiling with light, fan, handrail, mirror and push buttons. The floor is covered with hard rubber and the cabin walls are finished with plastic laminated steel. The size of the door is 800mm width X 2100mm height and it opens automatically at the center with two panels and sliding power doors. The machine of the lift can consume a power of 5.5kW at three phase and has a gear traction machine. The controller of the lift has the microprocessor which is PLC based controller with programmable parameters.

3.4. The Machine and Controller used:

I mention the details about the machine and the controller of the lift which I had inspected. The machine and the controller were in a room at the rooftop of the building. Inside that room I have seen the controller and the traction machine of the lift. [2]

3.4.1. Traction Machine:

The traction machine which I saw was world famous, made in Italy and these machines were made with a High Precision alloy with a very Compact shape in design, quiet running, efficient, energy saving traction drive system with a high traveling comfort is achieved with the components of highly powerful gear reducer, matching property with motor, special inverter drive with high gear efficiency (98%), low heat generation, extremely low noise level & very small starting currents. The traction machine with the inverter is made to match the elevator. I have included a picture of the traction machine below which I saw.

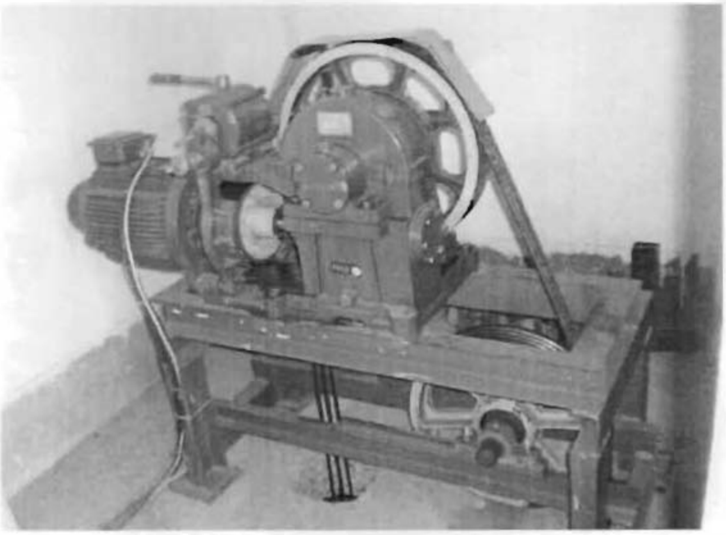

Figure 2: The Traction Machine of the Lift

3.4.2. Controller:

I have also seen the controller of the lift and have also included a picture of the controller below (Figure 3). Intelligent real time control provides strict safety protection for the passengers. Intelligent load is able to raise the automatic compensation which makes you feel more comfortable when the elevator is in move. The advanced micro-computer network selective collective control system exactly realizes the circular group supervision. The core of the controller EDVF micro computer controller, is a multi level SMT main board made in Italy which includes 1 to 3 unit 32 BIT CPUs. The controller is designed with all safety parameters according to the EN-81 safety rules for elevator. The controller is able to determine the call registering system with full collective simplex, duplex, triplex and up to 12 elevators are operated in the group. The electricity consumption management system is also built-in with this controller.

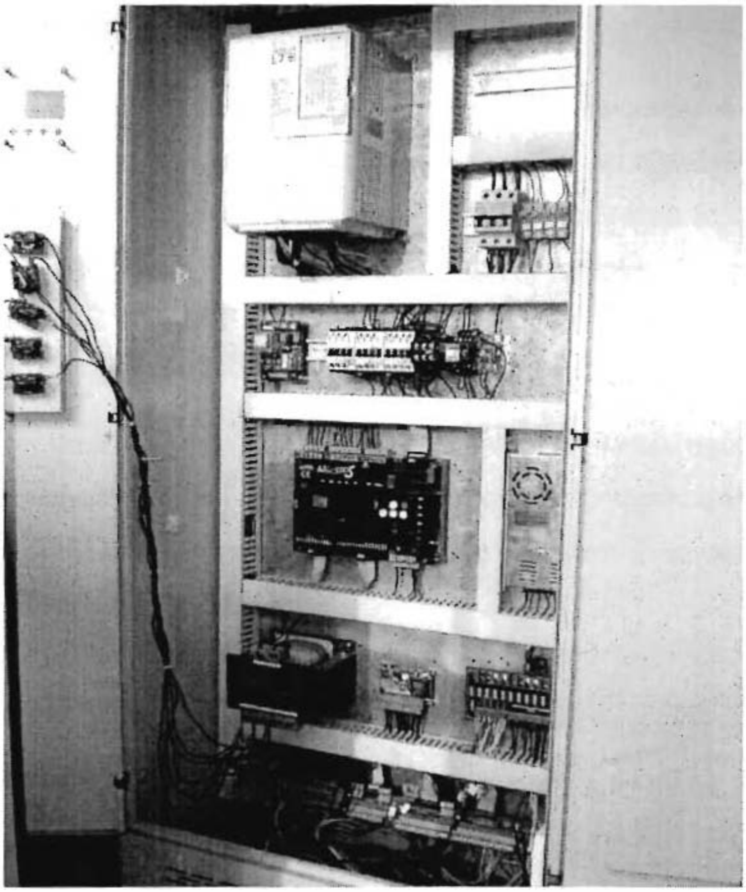

Figure 3: The Controller of the Lift and the Inverter

3.4.3. Inverter:

I also saw the inverter of the lift (Figure 3). Fully digital inverter drive with field oriented control, also known as Vector control. It gives vibration free operations at low motor revolutions. The inverter is able to maintain the motor at zero speed with brake open, even at full load, independent of the selected direct ion of rotation. Separate mobile, hand-held programming terminal.

The inverter provides the following functions:

- 50% savings of power consumption for the elevator.
- Comfortable starting and stopping of the cabin at all floors.
- Make equipment life longer due to work with less power.

3.5. Storage and Custody of Materials:

The lift machine room may be used for storage of sundry materials and erection equipments if available or else the agency has to make its own arrangement. No separate storage accommodation shall be provided by the department. Watch and ward of the stores and their safe custody shall be the responsibility of the contractor till the final taking over of the installation by the Silicon Properties.

3.6. Care of the Building:

Care shall be taken by the contractor while handling and installing the various equipments and components of the work to avoid damage to the building. He shall be responsible for repairing all damages and restoring the same to their original finish at his cost. He shall remove at his cost all unwanted and waste materials arising out of the installation from the site of work.

3.7. Performance Guarantee:

The supplier shall guarantee among other things, the following

(a) Quality, strength and performance of the materials used.

(b) Safe mechanical and electrical stress on all parts under all specified conditions of operation.

(c) Satisfactory operation during the maintenance period.

3.8. Guarantee:

All equipments shall be guaranteed for a period of 12 months from the date of taking over the installation by the department against unsatisfactory performance and/or break down due to defective design, workmanship of material. The equipments or components, or any part thereof, so found defective during guarantee period shall be forthwith repaired or replaced free of cost, to the satisfaction of the Engineer-in-Charge. In case it is felt by the department that undue delay is being caused by the contractor in doing this, the same will be got done by the department at the risk and cost of the contractor. The decision of the Silicon's architect in this regard shall be final.

3.9. Power Supply:

The Contractor will make self arrangement for three phase electric connection on metering basis with consultation with Assistant Engineer (Electrical) of Silicon Properties. The charges of actual electric consumption charges as per prevailing rates of Slicon Group, Dhaka will be deposited by the contractor on monthly basis.

3.10. Water Supply:

The contractor will make his own arrangement for Water supply required for construction and other purpose for this work.

3.11. Extent of Work:

The work shall comprise of entire labor including supervision and all materials necessary to make a complete installation and such tests and adjustments and commissioning as may be required by the department. The term complete installation shall not only mean major items of the plant and equipments covered by specifications but all incidental sundry components necessary for complete execution and satisfactory performance of installation with all layout charts whether or not those have been mentioned in details in the tender document in connection with this contract.

Minor building works necessary for installation of equipment, foundation, making of opening in walls or in floors and restoring to their original condition, finish and necessary grouting etc. as required.

Maintenance is observed (Routine & preventive) for one year from date of completion and handing over.

The work is turnkey project. Any item required for completion of the project but left inadvertently shall be executed with-in the quoted rates.

3.12. Inspection of lift components

As I have inspected the components of the lift, I have also come across the copies of documents regarding the routine check up and type test certificates of the equipments of the lift.

3.13. Inspection and Testing:

Copies•of all documents of routine and type test certificates of the equipment are carried out at the manufacturers' premises and these shall be furnished to the Architect engaged by the Silicon Group and consignee.

After completion of the work in all respect the contractor shall offer the installation for testing and operation.

3.14. Maintenance:

Sufficient and experienced staff shall be made available to meet any exigency of work during the guarantee period of one year from the handing over of the installation. The maintenance, routine as well as preventive for one year from the date of taking over the installation as per manufacturer's recommendation shall be carried out and the record of the same shall have to be maintained.

Safety Features:

The safety features of the lift which I visited are mentioned below:

Closing force limiter to prevent accidents

It means that the door closing speed is controlled by a limiter which will prevent from an accident may occur from the door edge heated any person or any part of the body.

Emergency unlocking by a key

The landing doors can be opened during evacuation of passengers or any other emergency by a special triangular key and this key remains to trained professionals only. It is designed such as any person cannot open it without that key.

During power failure, opening of car doors from inside of the car is possible

As passengers trapped inside the cabin communicate the landing easily

Not contact electronic photocell

The photocell will create an instant back speed of the doors from closing when the photocell can sense any obstacle in its way.

Door reversal failure in case of failure of photocell signals

Terminal / Final Limit Switch

There are limit switched fitted in the shaft indicating the upper limit and lower limit. That means, the lift cannot travel beyond those limits. If the lift run beyond those limits, then signals from those switches automatically stops the controller from functioning.

Oil Buffers

Buffers with property of springs are fitted at the Pit. These buffers are designed as the maximum force that can be produced if the cabin runs beyond the below level or can rest the cabin with the passengers if the cabin fallen down.

Emergency Stop

There is an emergency stop switch with the cabin which is used to stop the cabin and this key is exclusively used in the maintenance procedure. The switch board in the cabin is shown in Figure 4.

Intercom

There will be an intercom system through which a person in the cabin can communicate with the attendant in the lobby in case of any emergency arise.

Figure 4: The Switch Board inside the Lift Cabin

Busbars are typically either flat strips or hollow tubes as these shapes allow heat to dissipate more efficiently due to their high surface area to cross-sectional area ratio. The ski effect makes 50–60 Hz AC busbars more than about 8 mm (1/3 in) thick inefficient, so hollow or flat shapes are prevalent in higher current applications. A hollow section has higher stiffness than a solid rod of equivalent current-carrying capacity, which allows a greater span between busbar supports in outdoor switchyards.

A busbar may either be supported on insulators, or else insulation may completely surround it. Busbars are protected from accidental contact either by a metal earthed enclosure or by elevation out of normal reach. Neutral busbars may also be insulated. Earth busbars are typically bolted directly onto any metal chassis of their enclosure. Busbars may be enclosed in a metal housing, in the form of bus duct or busway, segregated-phase bus, or isolated-phase bus.

Busbars may be connected to each other and to electrical apparatus by bolted or clamp connections. Often joints between high-current bus sections have matching surfaces that are silver-plated to reduce the contact resistance. At extra-high voltages (more than 300 kV) in outdoor buses, corona around the connections becomes a source of radio-frequency interference and power loss, so connection fittings designed for these voltages are used.Busbars are typically contained inside of either a distribution board or busway.

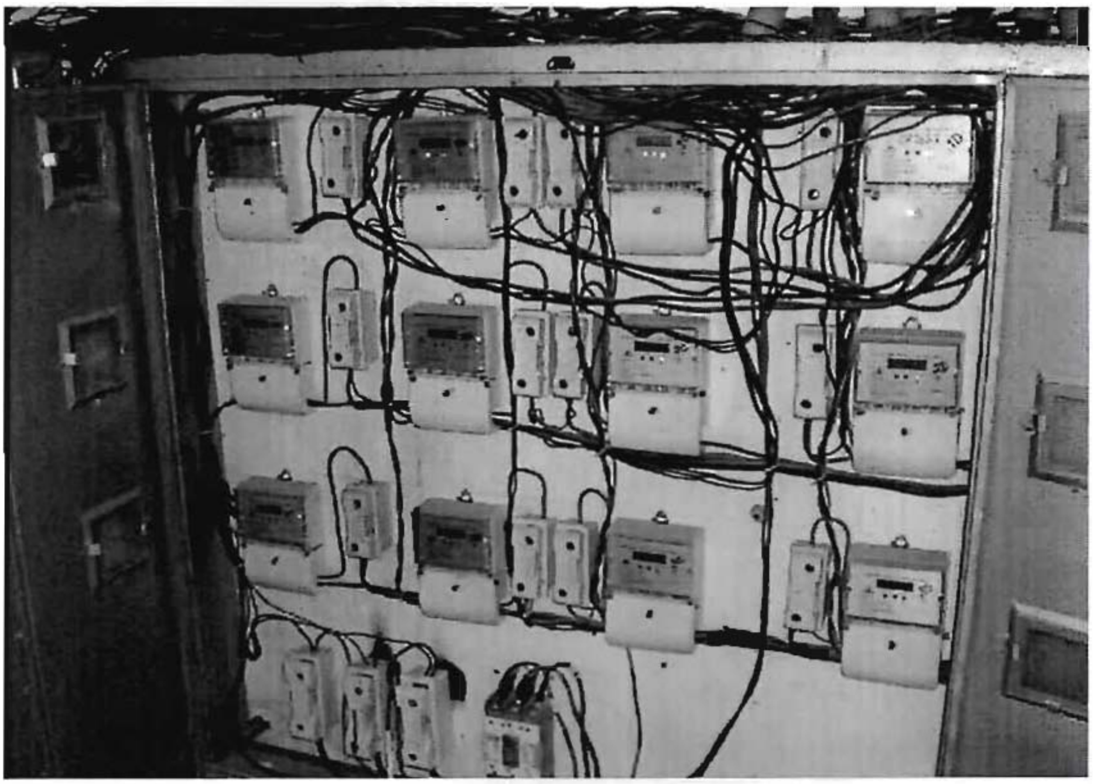

Figure 11: The Electrical Meter Board of the Building

Phase Failure

If any phase of the main power supply is cut off (absent), the protection switch does not provide supply to control circuit and the lift does not start.

Phase Reversal

If the phase are changed by any external subject such as PDB etc, for the safety of the lift & its passenger this protection switch off the main power supply to the control circuit and the lift does not start.

Gap between Car and Landing doors

The gap between the car door sill and landing door sills are not more than 30mm.

Emergency Evacuation during Power Failure

During power failure the car will manually move to the nearest higher or lower landing and the doors will be opened to facilitate evacuation of passengers.

4. VISIT TO A SUBSTATION

4.1. Inspection of a substation:

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I visited an apartment building in Adabar, Shamoli, which included a substation. In this report I have included all the pictures of the substation equipments to help the reader understand what actually lies inside the substation room.

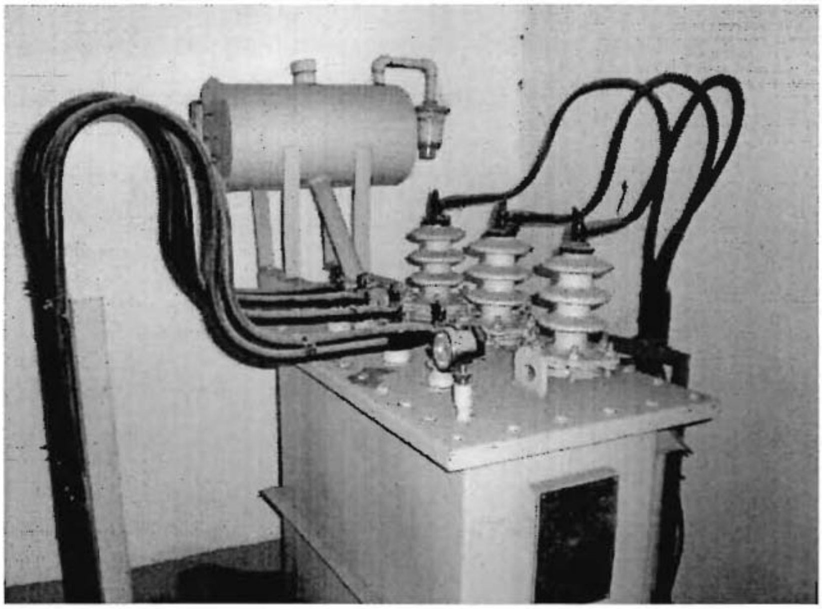

Figure 5: The Three-Phase Transformer

The three phase transformer which I saw is shown above in Figure 5. Three phase transformers are used throughout industry and for residential purposes to change values of three phase voltage and current. Since three phase power is the most common way in which power is produced, transmitted and used, an understanding of how three phase transformer connections are made is essential. In this section, Figure 09 shows a practical view of the three phase transformer.

The three phase transformer which I saw was constructed by winding three single phase transformers on a single core. These transformers are put into an enclosure which is then filled with dielectric oil. The dielectric oil performs several functions. All the details about the three-phase transformer was described to me by my supervisor, Mr. Ruhul Amin. Since it is a dielectric, a nonconductor of electricity, it provides electrical insulation between the windings and the case. It is also used to provide cooling and to prevent the formation of moisture, which can deteriorate the winding insulation. [3]

Three-phase has properties that make it very desirable in electric power systems:

- The phase currents tend to cancel out one another, summing to zero in the case of a linear balanced load. This makes it possible to eliminate or reduce the size of the neutral conductor; all the phase conductors carry the same current and so can be the same size, for a balanced load.
- Power transfer into a linear balanced load is constant, which helps to reduce generator and motor vibrations.
- Three-phase systems can produce a magnetic field that rotates in a specified direction, which simplifies the design of electric motors.

Figure 6: The Transformer Line Distribution Box

Figure 6 shows the picture of the outer view of the transformer line distribution box. Inside this box lies the distribution board capacitor, the transformer output circuit board, the transformer board fuse, the bus-bar and the electrical meters of all the apartments. On the left hand side of Figure 6, the door opens to the transformer distribution board capacitor, as shown in Figure 7.

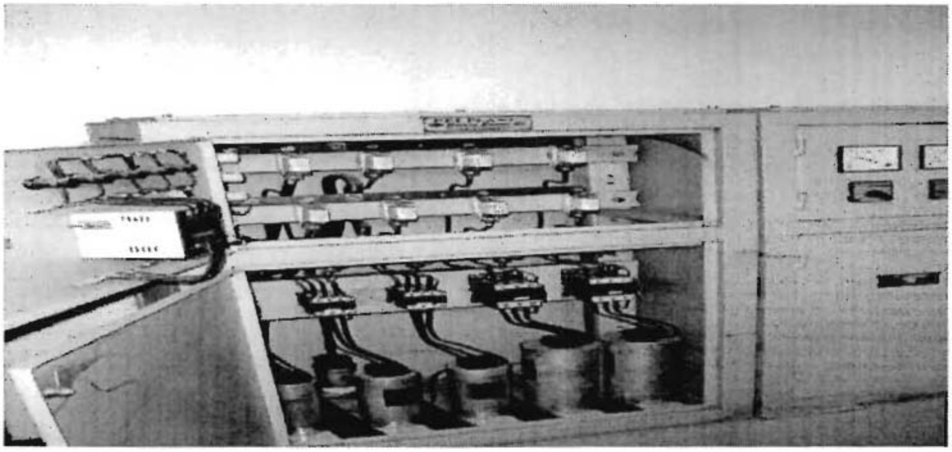

Figure 7: The Transformer Distribution Board Capacitor

The majority of the load in a typical AC power system is inductive - that is it causes the voltage to lead the current. Since the voltage and current are out-of-sync, this leads to the emergence of a "useless" form of power known as reactive power. Reactive power is still lost during transmission but it does no useful work at the end-points because it simply bounces back and forth between the reactive power source and load. This reactive power can be provided by the generators themselves but it is often cheaper to provide it through capacitors, hence capacitors are often placed near inductive loads to reduce demands on the power system infrastructure. In the case of a modern home that contains a fridge and air conditioner (both appliances that use motors), a capacitor would often be installed at the local zone substation (where the transmission system is fed to the distribution system) to counter-act the inductive loads of several thousand such homes. This capacitor would then be automatically switched in depending upon load conditions.

One of the problems with both circuit breaker switched capacitors and reactors is that they are designed to be on or off for several minutes at a time. This leads to a far clunkier response to reactive power variations when compared with generators. A solution comes in the form of static VAR compensators and static synchronous compensators. Briefly, static VAR compensators work by switching in capacitors using thyristors as opposed to circuit breakers allowing capacitors to be switched-in and switched-out within a single cycle. This provides a far more refined response than circuit breaker switched capacitors. Static synchronous compensators take it a step further by achieving reactive power adjustments using only power electronics.

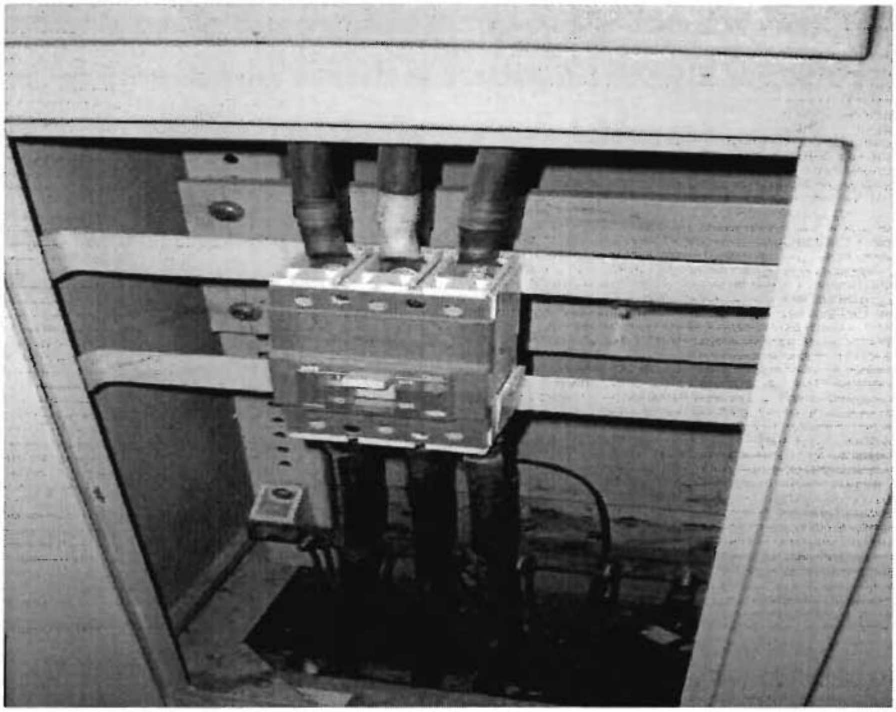

Figure 8: The Transformer Output Circuit Board

Figure 8 shows the transforrner output circuit board of the substation. As the picture demonstrates the transformer circuit board consist of three cables which are marked with different colored tapes.

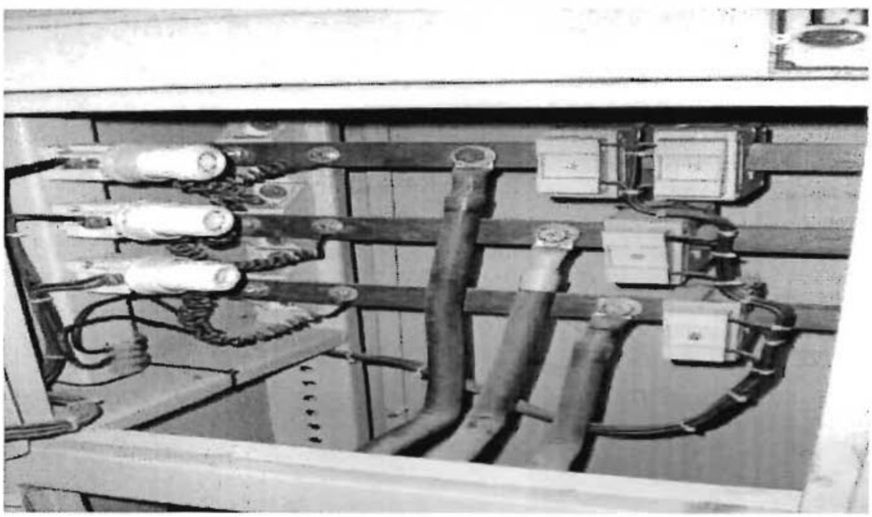

Figure 9: The Transformer Distribution Board Fuse

Figure 9 shows the transformer distribution board fuse. The white round outlets on the left are the fuses. Residential dwellings almost always take supply from the low voltage distribution lines or cables that run past the dwelling. These operate at voltages of between 110 and 260 volts (phase-to-earth) depending upon national standards. A few decades ago small dwellings would be fed a single phase using a dedicated two-core service cable, one core for the active phase and one core for the neutral return. The active line would then be run through a main isolating switch in the fuse box and then split into one or more circuits to feed lighting and appliances inside the house. By convention, the lighting and appliance circuits would be kept separate so the failure of an appliance would not leave the dwelling's occupants in the dark. All circuits would be fused with an appropriate fuse based upon the wire size used for that circuit. Circuits would have both an active and neutral wire with both the lighting and power sockets being connected in parallel. Sockets would also be provided with a protective earth. This would be made available to appliances to connect to any metallic casing.

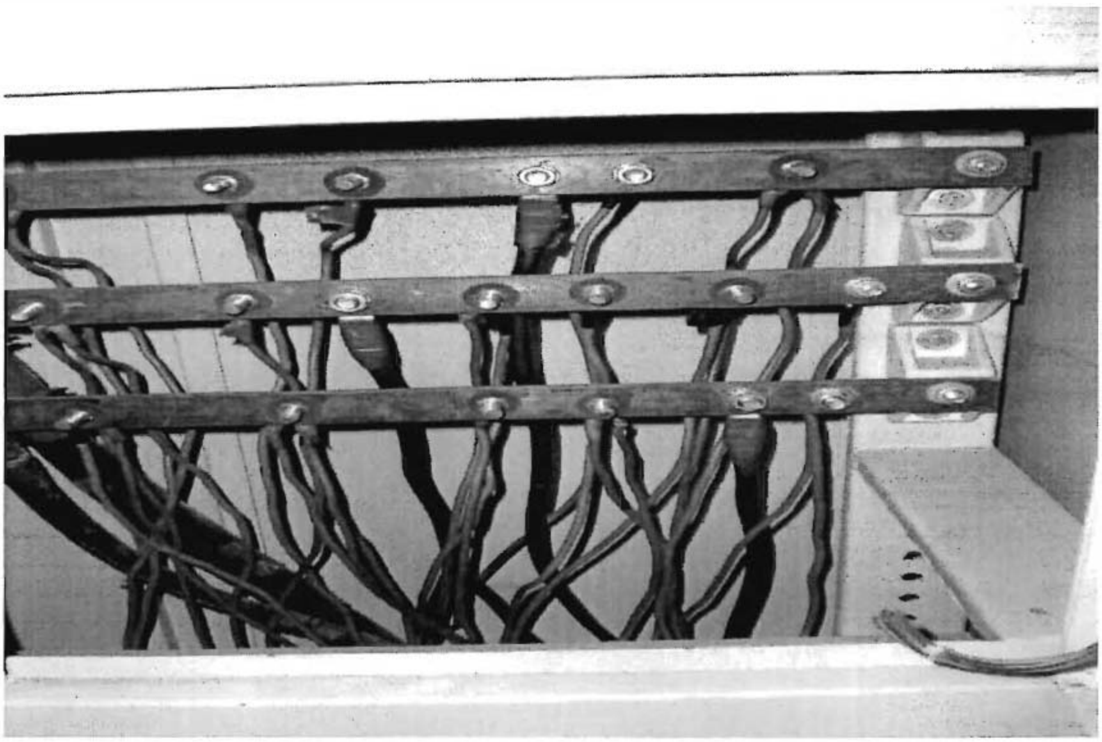

Figure 10: The Bus-Bar in Transformer Distribution Board

Figure 10 shows the bus bar in the transformer distribution board. As the figure shows the busbar is a thick strip of copper that conducts electricity within the distribution board of the substation. Busbars are used to carry very large currents, or to distribute current to multiple devices within switchgear or equipment. For example, a household circuit breaker panel board will have bus bars at the back, arranged for the connection of multiple branch circuit breakers.

The size of the busbar is important in determining the maximum amount of current that can be safely carried. Busbars can have a cross-sectional area of as little as 10 mm^2 but electrical substations may use metal tubes of 50 mm in diameter (1,963 mm^2) or more as busbars.

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ɾ may either be supported on insulators, or else insulation may completely surround it. Busbars are d from accidental contact either by a metal earthed enclosure or by elevation out of normal reach. busbars may also be insulated. Earth busbars are typically bolted directly onto any metal chassis of :losure. Busbars may be enclosed in a metal housing, in the form of bus duct or busway, segregated- ıs, or isolated-phase bus.

; may be connected to each other and to electrical apparatus by bolted or clamp connections. Often etween high-current bus sections have matching surfaces that are silver-plated to reduce the contact ce. At extra-high voltages (more than 300 kV) in outdoor buses, corona around the connections s a source of radio-frequency interference and power loss, so connection fittings designed for these s are used.Busbars are typically contained inside of either a distribution board or busway.

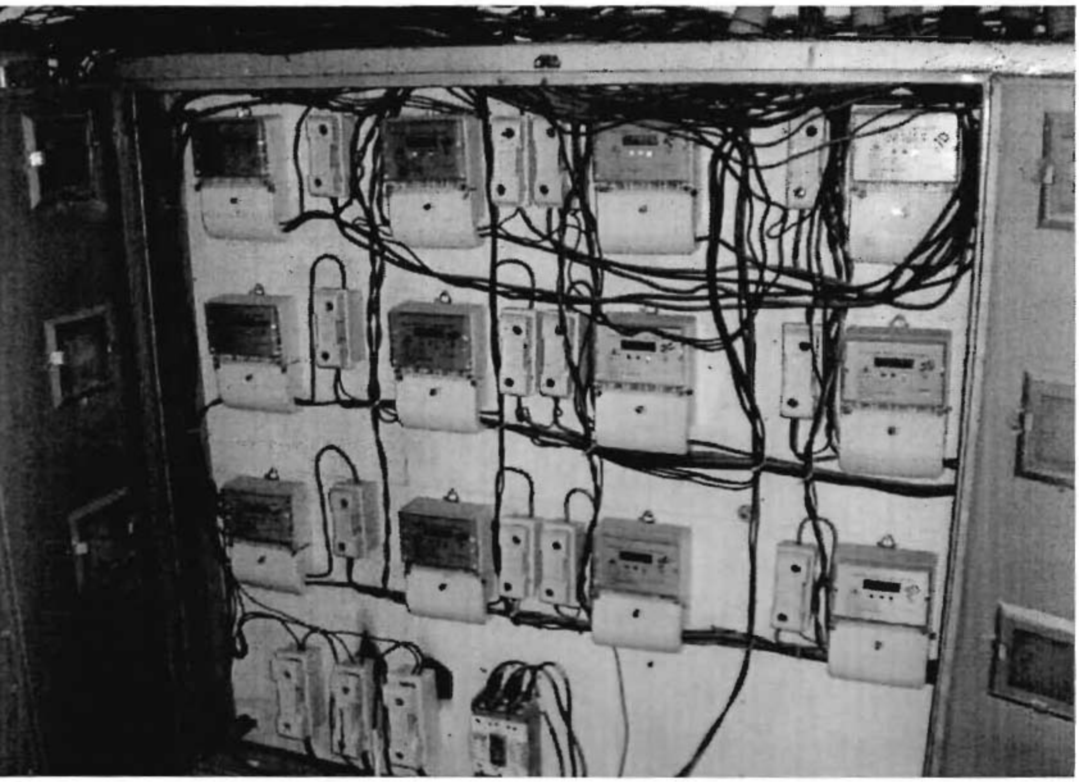

Figure 11: The Electrical Meter Board of the Building

igure 11 shows an electrical meter board of a building. The meter which has been shown in the figure is igital meter. An electric meter is a device that measures the amount of electrical energy consumed by a esidence, business, or an electrically powered device.

lectric meters are typically calibrated in billing units, the most common one being the kilowatt hour. eriodic readings of electric meters establish billing cycles and energy used during a cycle.

n settings when energy savings during certain periods are desired, meters may measure demand, the naximum use of power in some interval. In some areas, the electric rates are higher during certain times of lay, to encourage reduction in use. Also, in some areas meters have relays to turn off nonessential equipment.

In addition to metering based on the amount of energy used, other types of metering are available. Meters which measured the amount of charge (coulombs) used, known as ampere-hour meters, were used in the early days of electrification. These were dependent upon the supply voltage remaining constant for accurate measurement of energy usage, which was not a likely circumstance with most supplies.

Some meters measured only the length of time for which charge flowed, with no measurement of the magnitude of voltage or current being made. These were only suited for constant-load applications. Neither type is likely to be used today.

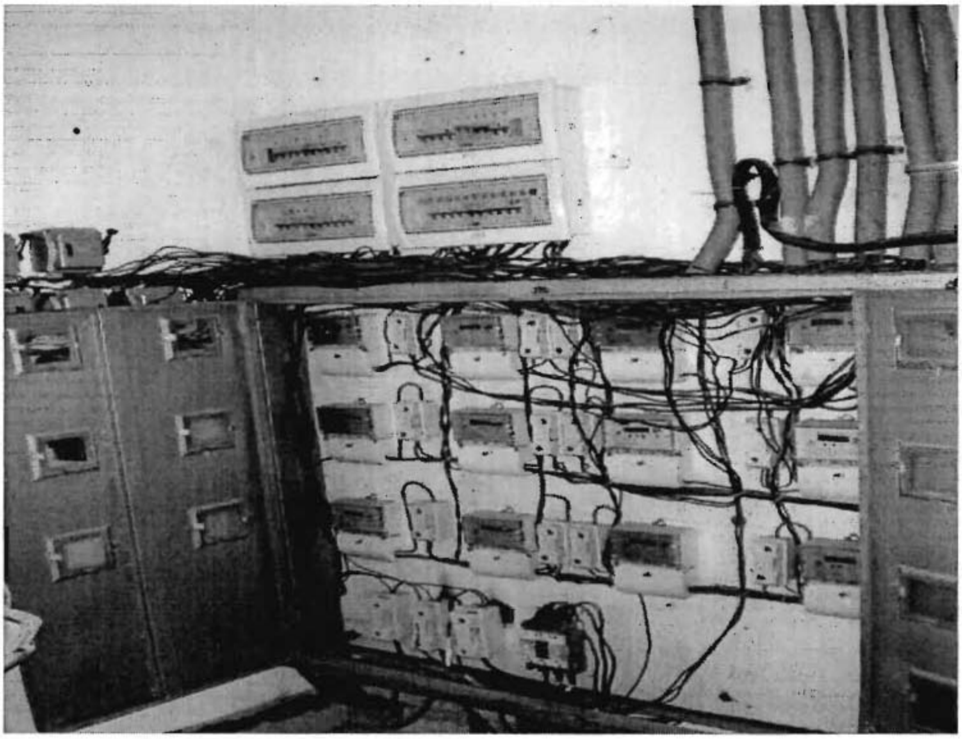

Figure 12: The Electrical Meter Board and the Circuit Breaker

Figure 12 displays the electrical meter board along with the circuit breaker. The circuit breaker is located just above the electrical meter board as shown in the figure. A circuit breaker is an automatically-operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit. Its basic function is to detect a fault condition and, by interrupting continuity, to immediately discontinue electrical flow. Unlike a fuse, which operates once and then has to be replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation.

Circuit breakers are made in varying sizes, from small devices that protect an individual household appliance up to large switchgear designed to protect high voltage circuits feeding an entire city. All circuit breakers have common features in their operation, although details vary substantially depending on the voltage class, current rating and type of the circuit breaker. The circuit breaker must detect a fault condition; in low-voltage circuit breakers this is usually done within the breaker enclosure. Circuit breakers for large currents or high voltages are usually arranged with pilot devices to sense a fault current and to operate the trip opening mechanism. In the figure, there are four circuit breakers which are connected to the main distribution board for the safety of the household.

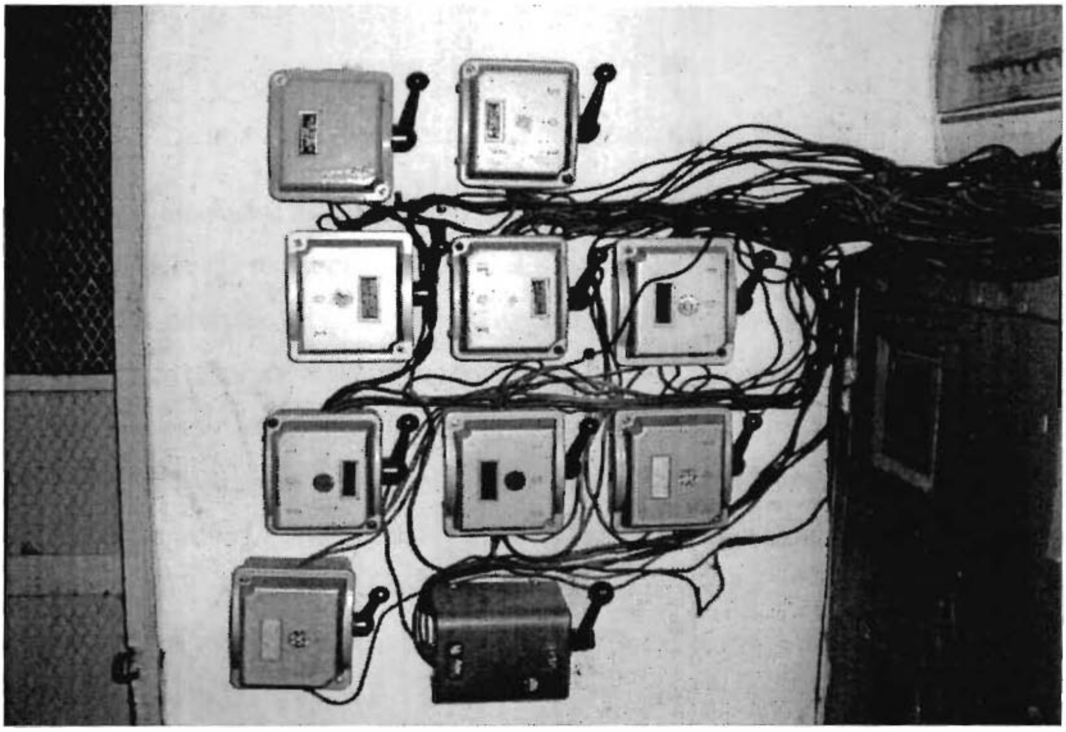

Figure 13: The Generator Line Change Over

A diesel generator is the combination of a diesel engine with an electrical generator (often called an alternator) to generate electric energy. Diesel generating sets are used in places without connection to the power grid or as emergency power-supply if the grid fails. Small portable diesel generators range from about 1 kVA to 10 kVA may be used as power supplies on construction sites, or as auxiliary power for vehicles such as mobile home.

The packaged combination of a diesel engine, a generator and various ancillary devices (such as base, canopy, sound attenuation, control systems, circuit breakers, jacket water heaters and starting system) is referred to as a generating set or a genset for short. In Figure 13, the generator line change over is shown which I saw, while I visited the substation.

Set sizes range from 8 to 30 kW (also 8 to 30 kVA single phase) for homes, small shops & offices with the larger industrial generators from 8kW (11 kVA) up to 2,000 kW (2500 kVA three phase) used for large office complexes, factories. A 2,000 kW set can be housed in a 40 ft ISO container with fuel tank, controls, power distribution equipment and all other equipment needed to operate as a stand along power station or as a standby backup to grid power. These units, referred to as power modules are gensets on large triple axle trailers weighing 85,000 lbs or more. Combination of these modules are used for small power stations and these may use from 1 to 20 units per power section and these sections can be combined to in volve 100's of power modules.

4.2. Single line diagram of a substation:

Figure 14 displays the single-line diagram of a substation. At first, the voltage reaches the transmission lines from there it moves to the HT meter. From the HT meter the voltage is transferred to the HT switchgear. The input for a distribution substation is typically at least two transmission or sub-transmission lines. Input voltage may be, for example, 115 kV, or whatever is common in the area. The distribution voltages are typically medium voltage, between 2.4 and 33 kV depending on the size of the area served and the practices of the local utility. From the switchgear, the voltage is transferred to the transformer, from the transformer the voltage is introduced into the LT switchgear. From the LT switchgear the voltage is carried into the PFI and the MDB. From the MDB it is distributed to the SDB, water pump and the lift. Besides change the voltage, the job of the distribution substation is to isolate faults is either the transmission or distribution systems.

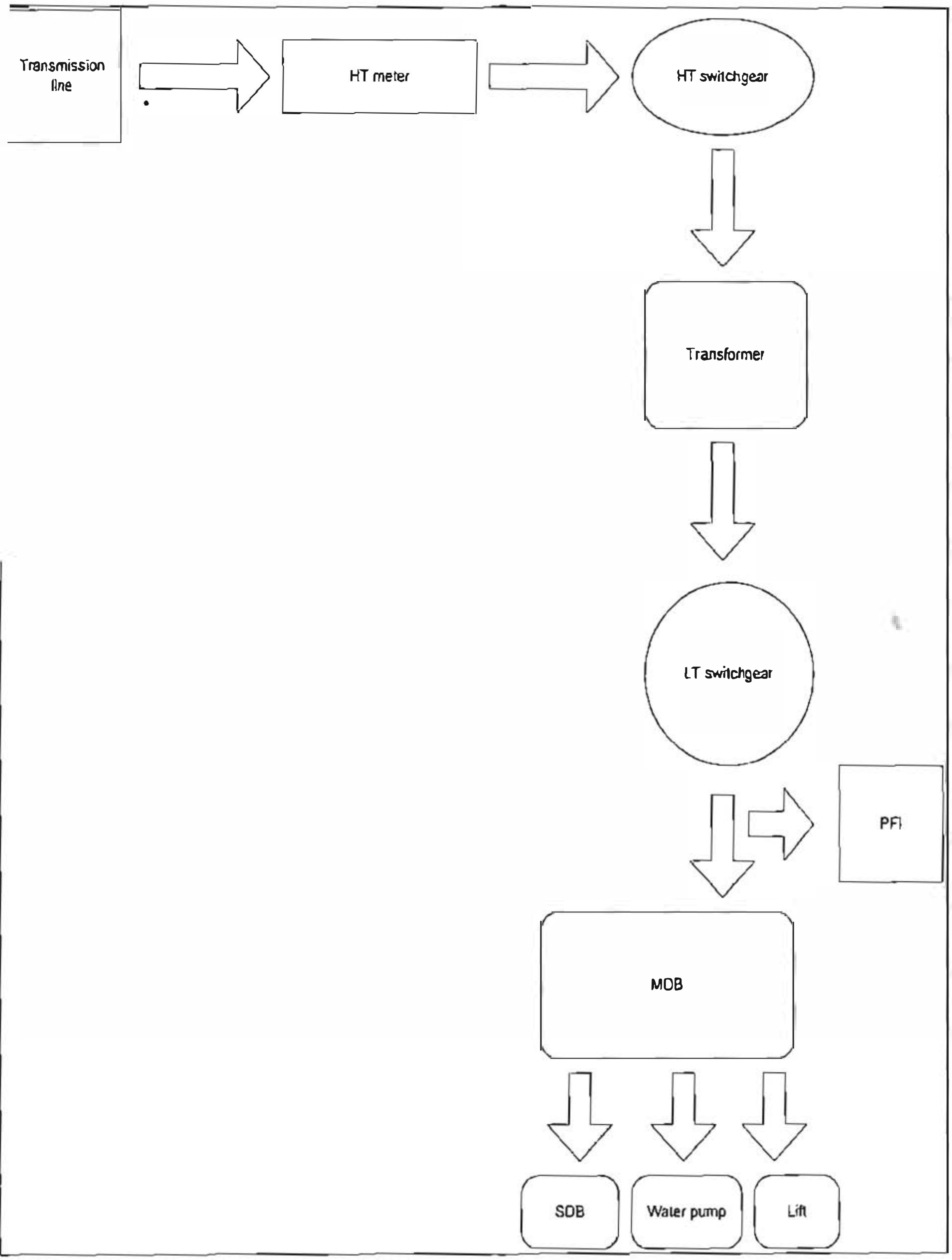

Figure 14: Single-line Diagram of a Substation

5. BUILDING PROTECTION

5.1. Protection of building

While I was doing my internship at the Silicon Properties, I visited a building in Rd-4, Shamoli, Adabar. As we know, current always seeks the most efficient way to go to ground, that's why large buildings use grounded lightning rods for lightning protection. When it strikes, the lightning rods on the higher levels of the building direct the electrical current to ground, bypassing the building. The building which I saw had a lightning rod for the protection of building against lightning and thunder. The lightning rod was located at the top level of the building. It was a thin rod about 3 feet tall.

It's the same thing with the home's electrical wiring system. I was shown the wiring system of an apartment of a building in Adabar, Rd 16. My supervisor also described to me how a bare electrical wire inside a metal food preparation appliance comes in contact with the metal case. The metal case of the appliance got electrically energized. Now suppose the cook touches the appliance with one hand and the sink faucet, which is grounded, with the other hand. Now potentially lethal current will flow through the cook. The cook becomes the shortest route to ground. To prevent this, GFCI (Ground Fault Circuit Interrupter) receptacles are used. [4]

5.2. Testing Ground Fault Interrupters

Although we did not get a chance to observe a smoke detector, however I was introduced to it verbally. Like home smoke detectors or fire extinguishers, ground fault interrupters should be tested for functionality on a regular basis. The government recommends testing them after first installing them, and then every month thereafter. Here are the steps –

1. There are two buttons on the GFCI; Reset (usually red), and Test (usually blue). First, plug a light into the receptacle. It should light up.
2. Press the Test button.

The light should go out, and the Reset button should pop out.

3. If Reset pops but the light stays on, the receptacle is likely wired wrong. It should be rewired.
4. If Reset doesn't pop out, this is a signal that the GFCI is defective; throw it out and replace it.
5. If everything tested properly in step 3, everything's fine. Press Reset and repeat next month!

5.3. Thunder Protection of Building

The lightning rod or lightning conductor which I saw was a metal rod mounted on top of a building and lectrically connected to the ground through a wire, to protect the building in the event of lightning. If ghtning strikes the building it will preferentially strike the rod, and be conducted harmlessly to ground hrough the wire, instead of passing through the building, where it could start a fire or cause electrocution. A ightning rod is a single component in a lightning protection system. In addition to rods placed at regular ntervals on the highest portions of a structure, the lightning protection system typically includes a rooftop etwork of conductors, multiple conductive paths from the roof to the ground, bonding connections to netallic objects within the structure and a grounding network. The rooftop lightning rod is a metal strip or od, usually of copper or aluminum. Lightning protection systems are installed on structures, trees, nonuments, bridges or water vessels to protect from lightning damage. Individual lightning rods are ometimes called finials, air terminals or strike termination devices.

5.4. Security Control System in a Building

was also introduced to security control system in the building and I have mentioned below the details about t. A lighting control system consists of a device that controls electric lighting and devices, alone or as part of daylight harvesting system, for a public, commercial, or residential building or property, or the theater. Lighting control systems are used for working, aesthetic, and security illumination for interior, exterior, nd landscape lighting, and theater stage lighting productions. They are often part of sustainable architecture nd lighting design for integrated green building energy conservation programs.

Lighting control systems, with an embedded processor or industrial computer device, usually include one or more portable or mounted keypad or touch screen console interfaces, and can include mobile hone operation. These control interfaces allow users the ability to remotely toggle (on-off) power to ndividual or groups of lights (and ceiling fans and other devices), operate dimmers, and pre-program space ighting levels.

A major advantage of a lighting control system over conventional individual switching is the ability to control ny light, group of lights, or all lights in a building from a single user interface device. Any light or device can e controlled from any location. This ability to control multiple light sources from a user device allows complex "light scenes" to be created. A room may have multiple scenes available, each one created for lifferent activities in the room. A lighting scene can create dramatic changes in atmosphere, for a residence or ne stage, by a simple button press. In landscape design, in addition to landscape lighting, fountain pumps, vater spa heating, swimming pool covers, motorized gates, and outdoor fireplace ignition; can be remotely r automatically controlled.

Other benefits include reduced energy consumption, and power costs through more efficient usage, longer oulb life from dimming, and reduced emission carbon footprints. Newer, wireless lighting control systems provide additional benefits including reduced installation costs and increased flexibility in where switches and sensors can be placed.

6. WIRING OF A BUILDING

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6.1. Building Wiring

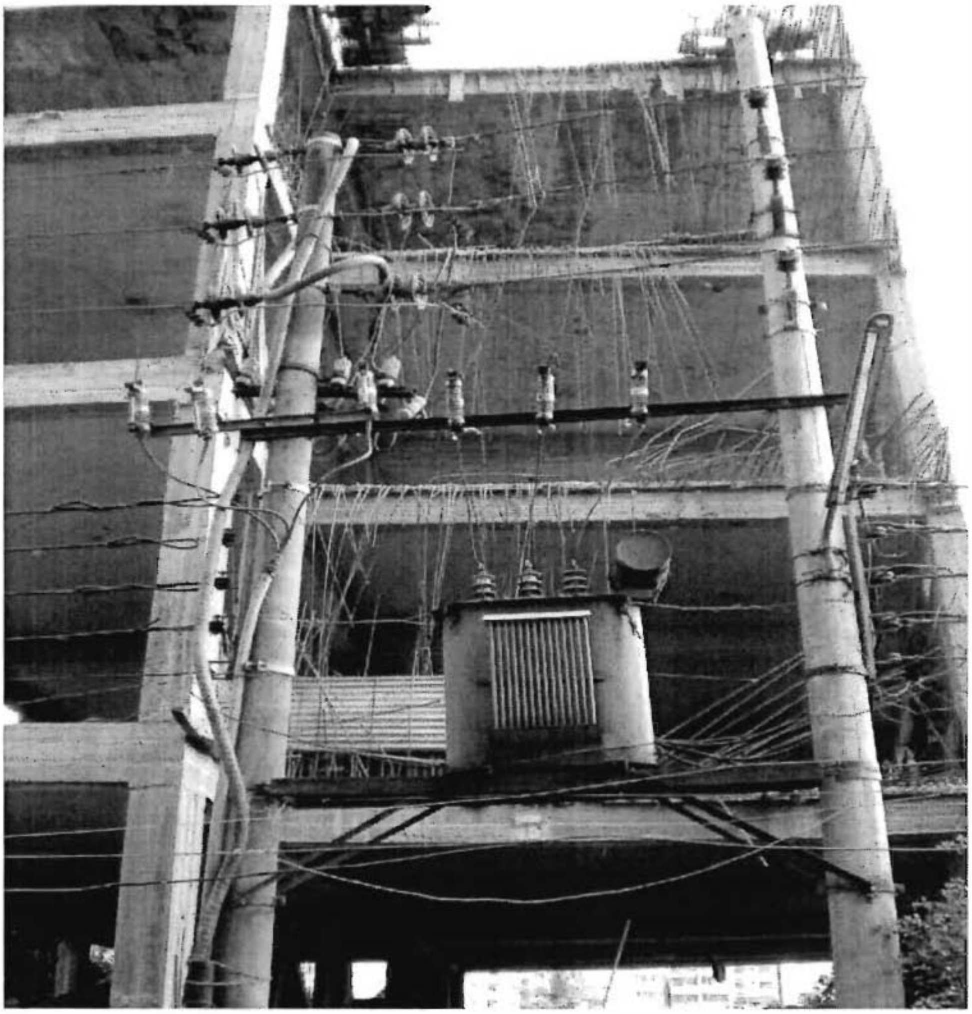

Figure 15: DPDC Transformer and Cable

the 20th of May, 2010 I visited an under construction building of the Silicon and saw the DPDC nsformer and cable there. I also saw different types of wiring and their applications. Electrical wiring refers insulated conductors used to carry electricity, and associated devices. This report describes general aspects electrical wiring as used to provide power in buildings, which is commonly referred to as building wiring. gure 15 shows the DPDC transformer and cable. The picture was taken in front of a building including a ostation. The transformer includes four cables- one for neutral and the other three are for the phases. [5]

aterials for wiring interior electrical systems in buildings vary depending on:

- Intended.use and amount of power demand on the circuit
- National and local regulations
- Environment in which the wiring must operate.

6.2. Electrical Switch and Light Placement:

gure 16 includes a table for symbols of the electrical appliances, which I used while working on an ıartment's electrical appliance layout.

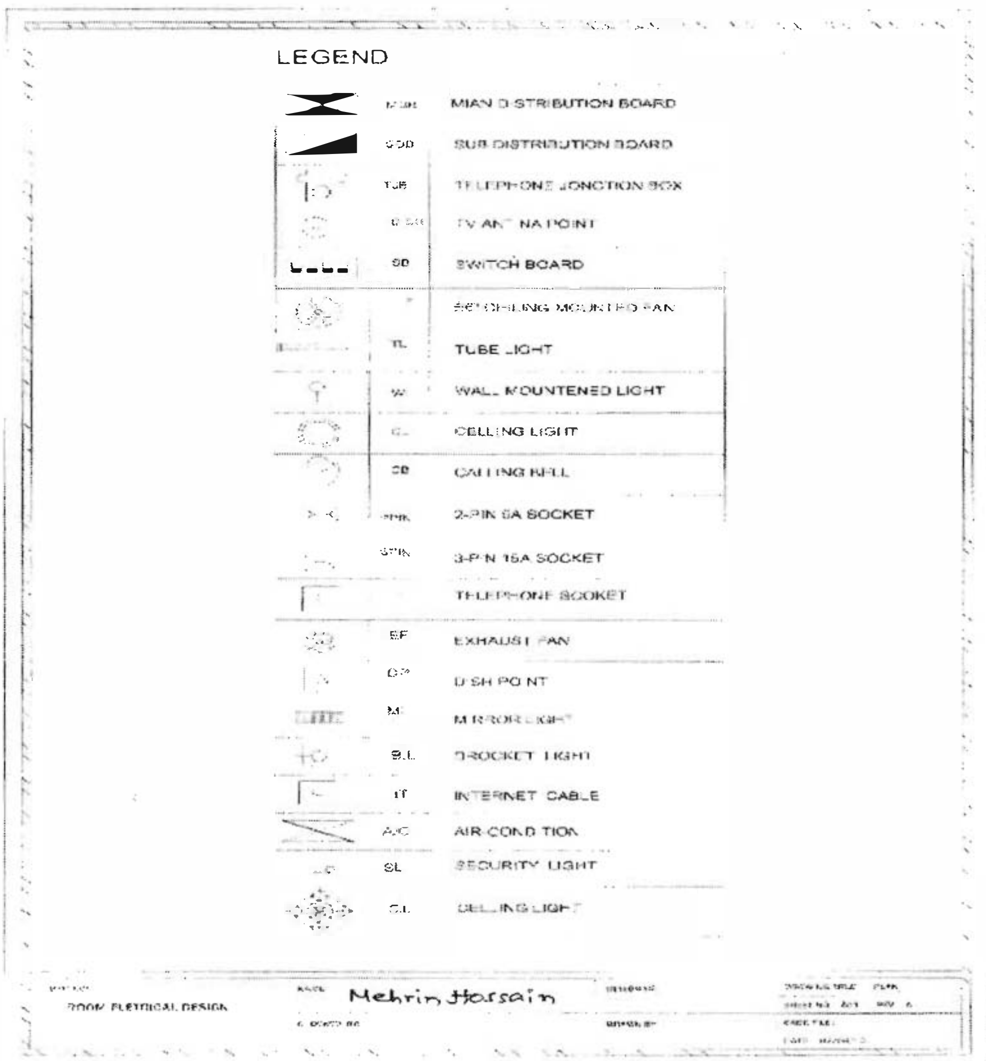

Figure 16: The Electric Symbols

I was asked to work with the symbols mentioned in Figure 16 as part of my internship job. Figure 17 shows the placement of the electrical appliances and the switches of an apartment which I worked on.

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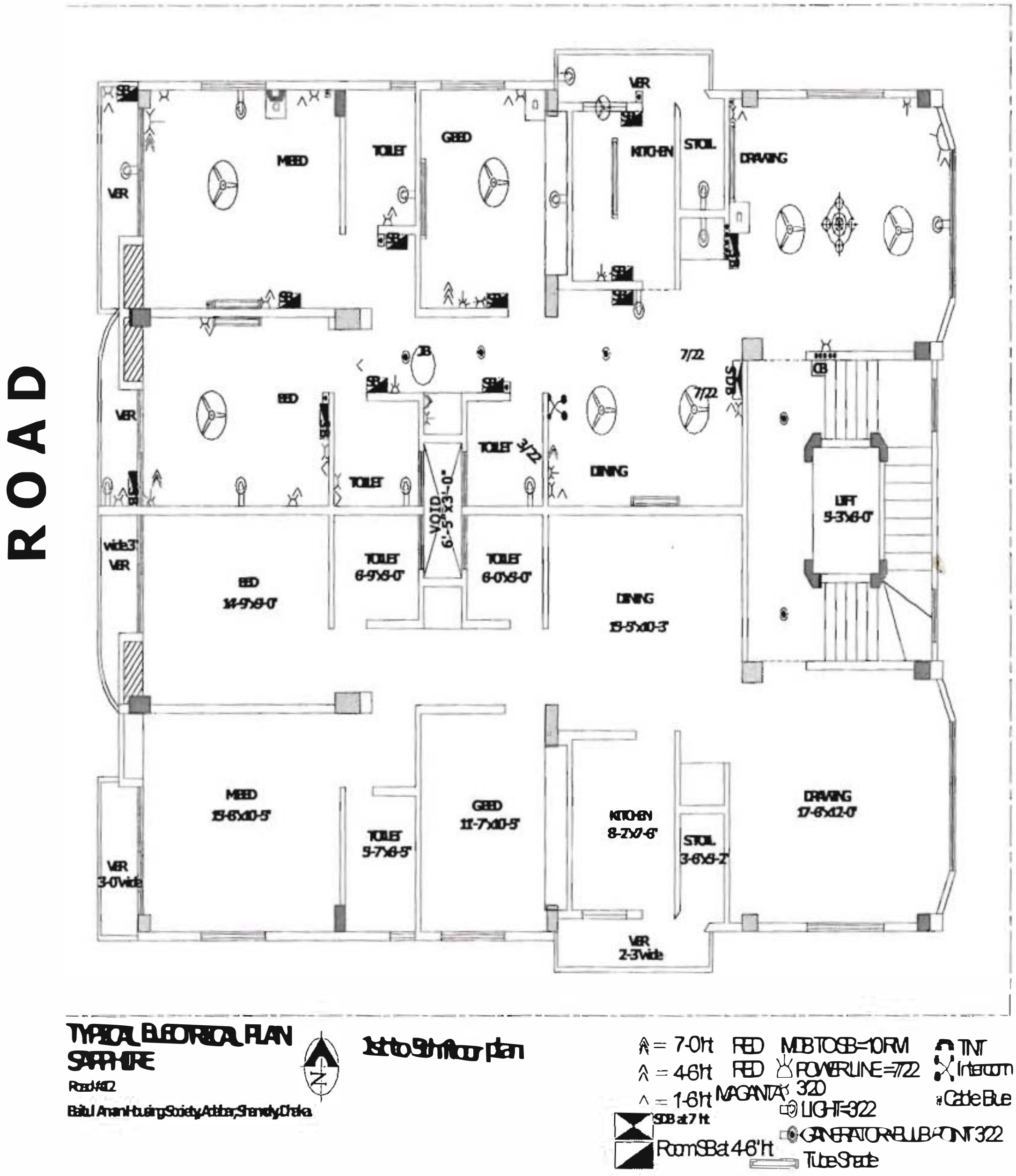

Figure 17: The Electrical Switch and Light Placement of an Apartment

6.3. Electrical Wiring Layout of an Apartment

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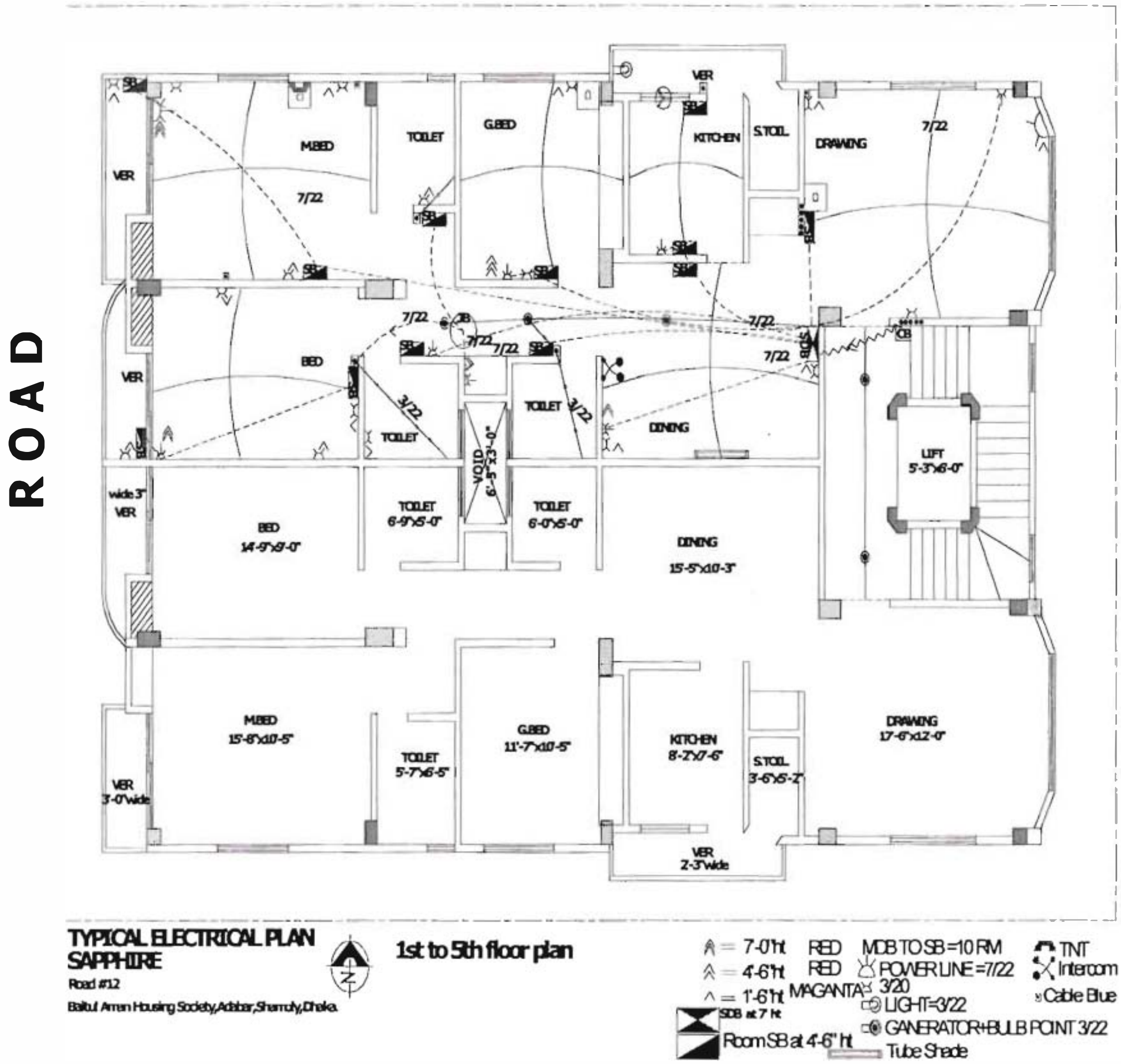

Figure 18: The Electrical Wiring of an Apartment

gure 18 shows the wiring of the apartment which I worked on. There are different types of wiring as the gure shows. The wires are of different thicknesses, and this is mentioned along with the wires' usage in the ble below:

Table 3: The thicknesses of wires with their application

ecification	Application
; Re	Earthing
:2	Lighting and fittings
:0	2-pin socket
:2	Power line
;/4.2	Telephone wire
Rm	Meter to flat
'/U	Dish Cable
Rm	Pole to meter

7. INSPECTION OF GENERATOR

7.1. Generator of Building:

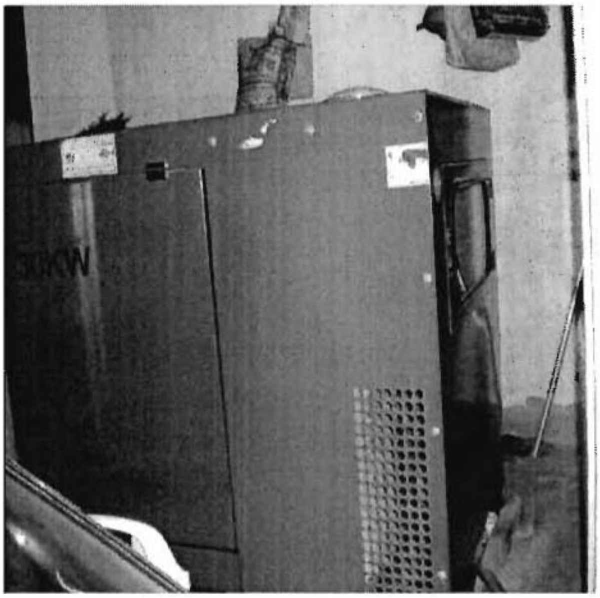

Figure 19: The Generator Box

igure 19 shows the generator box in the electric room of a building which I visited. I have taken pictures of e inside of the generator box and have included them in this report. Inside the generator box lies the motor the generator and the generator starting button with ammeter, voltmeter and other meters. Figure 20 emonstrates the generator meter button along with the meters. Figure 21 shows the motor of the generator.

he DOING Company sells large-sized portable (over 400 cc) generators designed for powering household ems as well as contractor electric power tools. DOING Industries Generators have a distinctive design and ature set. They are especially noted for the remote control electric start features, digital control panels, and ver-sized muffler systems for quiet operation. DOING Industries Generators reflect the styles of premium ower equipment with their glossy finish, fully enclosed casings and upgraded wheel assemblies. DOING dustries has established itself as a successful Honda Small Engine OEM, utilizing the popular Honda X200 engines on its portable Air Compressors and Pressure Washers. These have received favorable views from end users and industry critics alike.

OING Industries is developing a loyal brand community which keeps active through a myriad of websites nd user forums, all provided at no charge by the company.

ı addition to manufacturing power equipment under its own name, DOING Industries' divisions include ustomer Service, Parts, Warranty Repair and Distributor Relations/Development. D-I currently offers quipment nationwide through a network of Distributors, and plans to open business in Canada and Mexico ı 2010. [6]

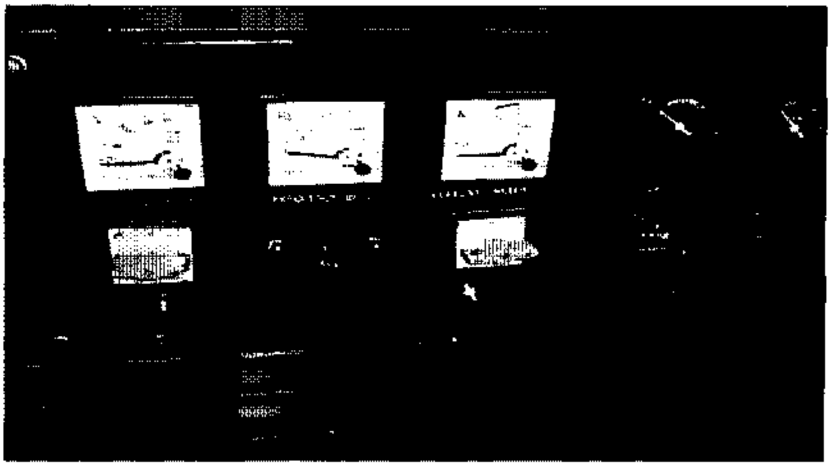

Figure 20: The Generator Starting Button

he electric motor consists of a rotor spinning in a magnetic field. The magnetic field may be produced by ermanent magnets or by field coils. In the case of a machine with field coils, a current must flow in the coils o generate the field; otherwise no power is transferred to or from the rotor. The process of generating a nagnetic field by means of an electric current is called excitation.

or older and very large power generating equipment, it has been traditionally necessary for a small separate xciter generator to be operated in conjunction with the main power generator. This is a small permanent-nagnet or battery-excited generator which produces the initial current flow necessary for the larger generator ield to function.

is important to not shut the generator down with a load connected to it. This tends to demagnetize the rotor nd can cause it to not self-energize. That is, the motor will turn, but it will not produce voltage. It is not a erious problem since the rotor can be remagnetized.

he capacitors used must be the type designated as "running" capacitors and not "starting" capacitors. tarting capacitors are used for a very short time, usually less than a second or two, and would be destroyed y being connected across the AC line continuously. Running capacitors are designed to be connected while ie motor is powered.

OTE: Make sure the caps say, "NO PCB's". PCB's aren't used anymore for capacitor construction because was a dangerous chemical composition. If the caps are old, and you are not sure, don't use them. Be safe!

/ell, there is no active voltage regulation, but keeping it within a tested load rating can keep it within any oltage parameters that you set. I feel that a voltage range between 105 and 126 volts is perfectly reasonable.

ι motor converted to an induction generator will not start another squirrel cage motor unless that motor is bout 1/10 of the horsepower of the induction generator. In other words, a 1 horsepower motor used as an nduction generator will start a 1/10 horsepower or less, squirrel cage motor. It is best to NOT use an nduction generator to drive motors. The added inductance of the motor will cancel out the capacitive eactance of the capacitors and cause the generator to quit producing electricity.

The two main parts of a generator or motor can be described in either mechanical or electrical terms:

Mechanical:

1.Rotor: The rotating part of an electrical machine

2.Stator: The stationary part of an electrical machine

Electrical:

Armature: The power-producing component of an electrical machine. In a generator, alternator, or dynamo the armature windings generate the electric current. The armature can be on either the rotor or the stator.

Field: The magnetic field component of an electrical machine. The magnetic field of the dynamo or alternator can be provided by either electromagnets or permanent magnets mounted on either the rotor or the stator.

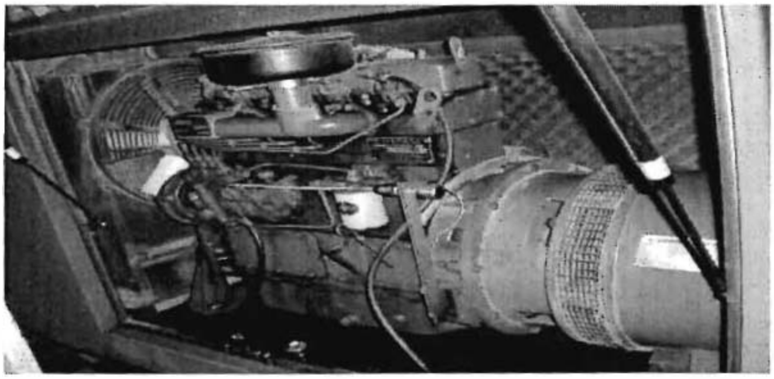

Figure 21: The Motor of the Generator

8. CONCLUSION

Working at the Silicon Properties has been a wonderful experience for me. I got an excellent opportunity to have a practical glance at the things I have learnt theoretically. Through this report I was able to blend my theoretical knowledge with the practical knowledge. The way I have written this report, I am sure it will be very much helpful to the students who are willing to do internship on power system or generators, lift or a substation. This report will also be helpful for the students who are willing to do work on electrical building layouts- the wiring and light placement of a building. This report had offered great help to me and I am sure it will help them too.

I would once again thank my Academic Advisor for supporting and helping me out whenever I seek his help, without his support and helpfulness I would not have been able to complete my work so effectively. Moreover, I would once again like to thank the people with whom I worked at the Silicon Group. These people were Mr. Syed Zaeem Kabir, DMD (Deputy Managing Director), Silicon Group, Syed Nasrul Kabir, Managing Director of the Silicon Group, Mrs Nilufar Kabir, Chairperson of the Silicon Group. I thank them very much for giving me their precious time whenever I needed them. These people were very encouraging to me and they helped me a lot during my completion of my internship report.

I would like to express my deepest affection for my parents and my friends who prayed for my success and encouraged me during this internship period. I appreciate and acknowledge the patience, understanding and love provided by employees of the Silicon Group Last but not the least, I would love to express my gratitude to our Almighty Allah, with His Grace, I have been successful in completing my internship program.

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[4] Charles R. Miller, "*2005 NEC Volume 2 Commercial and Industrial Pocket Guide (National Electrical Code (Nec))*", Delmar Cengage Learning; 1 edition, Dec 14, 2004.

[5] H. P Richter, "*Practical electricity and house wiring;: A practical book of instruction covering in detail every branch of electrical work as applied to the wiring of small buildings*", Published by F.J. Drake, 1952.

[6] Steve Chastain, "*Generators and Inverters: Building Small Combined Heat and Power Systems For Remote Locations and Emergency Situations*", Chastain Publishing, Sept. 7, 2006

10. APPENDIX

Acronyms

• DPDC	Dhaka Power Distribution Company
• KWh	Kilo-Watt-Hour
• MDB	Main Distribution Board
• SDB	Sub Distribution Board
• PFI	Power Factor Improver
• HT Switchgear	High Tension Switchgear
• LT Switchgear	Low Tension Switchgear
• ILC	International Lift Company