INTERNSHIP REPORT

ON

MANUFACTURING PROCESS OF SUBSTATIONAL EQUIPMENT AND TESTING AT ENERGYPAC ENGINEERING LTD

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)

Spring, 2012

Approved By

_____	_____
Academic Advisor	Department Chairperson
Mohammad Mojammel Al Hakim	Dr. Khairul Alam

Approval Letter

To whom it may concern

ENERGYPAC®
এনার্জিপ্যাক®

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EELF/Admin/East West/TR/2012-01(05)
Date: 23.01.2012

TRAINING CERTIFICATE

This is to certify that **Pizus Biswas**, Bearing **Roll No.2008-2-80-019**, is a Student of Electrical and Electronic Engineering Department of East West University, Dhaka, Bangladesh. He was offered an Industrial training, which was programmed from 26-12-11 to 11-01-12 at Energypac Engineering Ltd., Baruipara, Savar, Dhaka, Bangladesh. During his Industrial attachment he has taken some practical experience about Power Transformer, Distribution Transformer, Instrument Transformer (Both CT & PT), Impulse, Isolator, Switchgear Items (LT, HT & PFI), Circuit Breaker etc. He has also gathered some knowledge on Machine Shop, Fabrication, CNC, Powder Coating and Liquid Paint.

Nothing has been recorded against his character and conduct during his attachment.

I wish him every success in life.

26/1/12

Engr. Md. Shafique Uddin Khan
AGM (Admin & Utility),
Energypac Engineering Ltd.

ENERGYPAC ENGINEERING LTD. SAVAR, DHAKA

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Date: 23.01.2012

TRAINING CERTIFICATE

This is to certify that **Mashiur Rahman**, Bearing **Roll No.2008-1-80-048**, is a Student of Electrical and Electronic Engineering Department of East West University, Dhaka, Bangladesh. He was offered an Industrial training, which was programmed from 26-12-11 to 11-01-12 at Energypac Engineering Ltd., Baruipara, Savar, Dhaka, Bangladesh. During his Industrial attachment he has taken some practical experience about Power Transformer, Distribution Transformer, Instrument Transformer (Both CT & PT), Impulse, Isolator, Switchgear Items (LT, HT & PFI), Circuit Breaker etc. He has also gathered some knowledge on Machine Shop, Fabrication, CNC, Powder Coating and Liquid Paint.

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This is to certify that **Md.Zunayed Akram**, Bearing **Roll No.2008-2-80-046**, is a Student of Electrical and Electronic Engineering Department of East West University, Dhaka, Bangladesh. He was offered an Industrial training, which was programmed from 26-12-11 to 11-01-12 at Energypac Engineering Ltd., Baruipara, Savar, Dhaka, Bangladesh. During his Industrial attachment he has taken some practical experience about Power Transformer, Distribution Transformer, Instrument Transformer (Both CT & PT), Impulse, Isolator, Switchgear Items (LT, HT & PFI), Circuit Breaker etc. He has also gathered some knowledge on Machine Shop, Fabrication, CNC, Powder Coating and Liquid Paint.

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Acknowledgment

All the praises are for the almighty, Allah who bestowed us with the ability and potential to complete this Internship. We also pay our gratitude to the Almighty for enabling us to complete this Internship Report within due course of time.

We had a very remarkable time during our internship at Energypac. We are very grateful to Energypac Engineering Limited for giving us the opportunity to complete our internship in their organization. We want to specifically mention Mr. Munirul Huda, who is the Sr.Engineer, EMR & QC of Energypac Engineering Ltd. for his support and guidance during the internship program at Energypac.

We are grateful to our honorable supervisor Mohammad Zakir Alam, Lecturer, Department of Electrical & Electronic Engineering, East West University (EWU) and Mohammad Mojammel Al Hakim, Associate Professor, Department of Electrical & Electronic Engineering, East West University (EWU) for providing us much needed assistance and important time constraints and also to encouraging us to prepare the internship report.

We also appreciate the cordial co-operation from all our Internship Supervisors in the different departments of EELF for providing us requisite information and knowledge for compilation of our complete Internship, all the employers of EELF, especially Engr. Asaduzzaman, Add.GM, Production, EELF, Engr. Asim Kumar Bhakta, Manager, Testing & Finishing, EELF, Engr. Syed Muztaba Ali, DGM, Production, EELF, Engr. Mozaharul Islam, DGM, Production, EELF, Engr. Moniruzzaman, Manager, Production, EELF, Engr. Belal Hossain, Manager, Production, EELF who helped us a lot in performing all the activities and in gaining the practical knowledge of industry. They gave us the best environment and knowledge to enhance our skills.

Executive Summary

We recently have done our internship in Energypac, in which we got training from its Transformer, Switchgear, CT/PT, Breaker & Isolator and Fabrication units.

In this report we have given a very brief review of what we have seen and learnt during our internship. We have mentioned all these as we have made an internship as according to the schedule. This report will give its reader knowledge about the EELF and about transformer and other substation equipment unit. We have made it possible to write each and every thing that we have learnt here. We have all our practical efforts in the form of this manuscript that's the asset for our future career.

The internship report consists of nine chapters including introduction and conclusion.

The chapter 1 on introduction displays company profile including its history, strategic business units, business partners and products and services. Besides, it delineates the objective, scope and methodology of the internship report.

The Chapter 2 spells about transformer – the core product of Energypac. The Energypac has five departments to process the transformer. These are coil winding, core assembly, core-coil assembly, tank-up and transformer tank. The chapter gives a detailed description of each department so that the readers get a transparent idea about transformer made by Energypac.

The Chapter 3 delineates about switchgear, its types and characteristics, structure and mechanism.

The Chapter 4 tells about instrument transformer and its principles. It provides a comparison of theory and practice.

The Chapter 5 and 6 provides details of breaker and isolator produced by Energypac. The scenario of Energypac with regard to breaker and isolator has been recorded. Energypac mainly manufactures vacuum circuit breaker, load break switch and isolator. Their principles as well as operational mechanisms have also been incorporated.

The chapter 7 provides the fabrication process and also how a transformer or switchgear panel has to color.

DETAILS OF TRAINING SCHEDULE

Date	Section	Duration	Contact Person
26.12.11 – 31.12.11	Transformer & Impulse	5 days	Engr. Asaduzzaman, Ad. GM Engr. Asim Kumar Bhakta,Manager
01.01.12 – 04.01.12	Switchgear	4 days	Engr. Syed Muztaba Ali, DGM
05.01.12 – 08.01.12	CT/PT	3 days	Engr. Mozaharul Islam, DGM
09.01.12 – 10.01.12	Isolator & Breaker	2 days	Engr. Moniruzzaman , Manager Engr.AtaulGoni,Asst.Engineer Manager
11.01.12	Fabrication, CNC, M/C Shop, Powder Coating Paint.	1 day	Engr.Md.Munirul Huda,Sr.Engineer Mr. N.M Habibullah, Dy. Manager Engr.Azimussan Abbasi,Asst.Engine

Working Time: Saturday to Thursday
09:00 AM to 05:00 PM (1 PM to 2 PM Lunch & Prayer)

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1. INTRODUCTION

In the spring semester of 2012 got an opportunity to complete the industrial training in Energypac Engineering Ltd. Energypac is one of the top engineering companies in Bangladesh. It is contributing greatly to the development of the power sector in the country. Energypac is one of the most desirable places to obtain practical knowledge substation equipment's.

1.1 Vision, Mission and Strategy:

Their vision is to become the country leader for Power Solutions and establish as the largest and most lucrative service provider in the global market.

Their mission is to provide total power solutions to enhance the business of their customers, concurrently creating better technologies that benefit both the customers and the environment

Their strategic aim is to strengthen the leading position in markets, and to ensure continued growth.

1.2 Quality Commitment and Certification:

Energypac Engineering Ltd is committed to provide Quality Products and Services by:

- Ensuring continual improvement in all fields of activities.
- Ensuring total customer satisfaction for all time.
- Adopting updated and latest technology in the field.
- Ensuring best utilization of human resources.
- Adhering to applicable legal & regulatory requirements.

Energypac Engineering Ltd is committed to protect the natural environment and provide clean, safe and healthy facilities and work practices. This commitment includes:

* Compliance with Environmental Legal Requirements.

* Health Protection, Health Promotion, Risk Reduction, Prevention and Resource Management.

* Effective Communication Mechanism.

* Concept of Continuous Improvement.

1.3 Type Test and Certification:

For compliance of design, quality and performance, competence to sell products in local and foreign market, Energypac is in continual process of testing its products in its own lab, as well as reputed institutions like: CPRI - Central Power Research Institute, India and BUET - Bangladesh University of Engineering and Technology, Bangladesh.

1.4 Achievement:

- Successful sales of Largest B-Engine in Bangladesh which is First in ASIA
- Largest market share of Power Business in the Private Sector
- Total Turnkey Project Implementation of 9.99 MW Plant
- Total O & M Contract of 9.99 MW Plant
- Guascor Genest Sales Crossed 150 Units
- FG Wilson DEG Sales Crossed Record 2300 Units

1.5 Objective of Internship:

Out internship program was guided by certain objectives which we have written down here. These objectives are listed below.

- Provide us the opportunity to test our interest in Transformer, switchgear, instrument transformer before permanent commitments are made.
- To review the process of making a transformer and establishment of a switchgear.
- Idea about substation equipment.
- Observe the application of theory to practical design, manufacture, and implementation.
- Develop skills and techniques relevant to our careers.

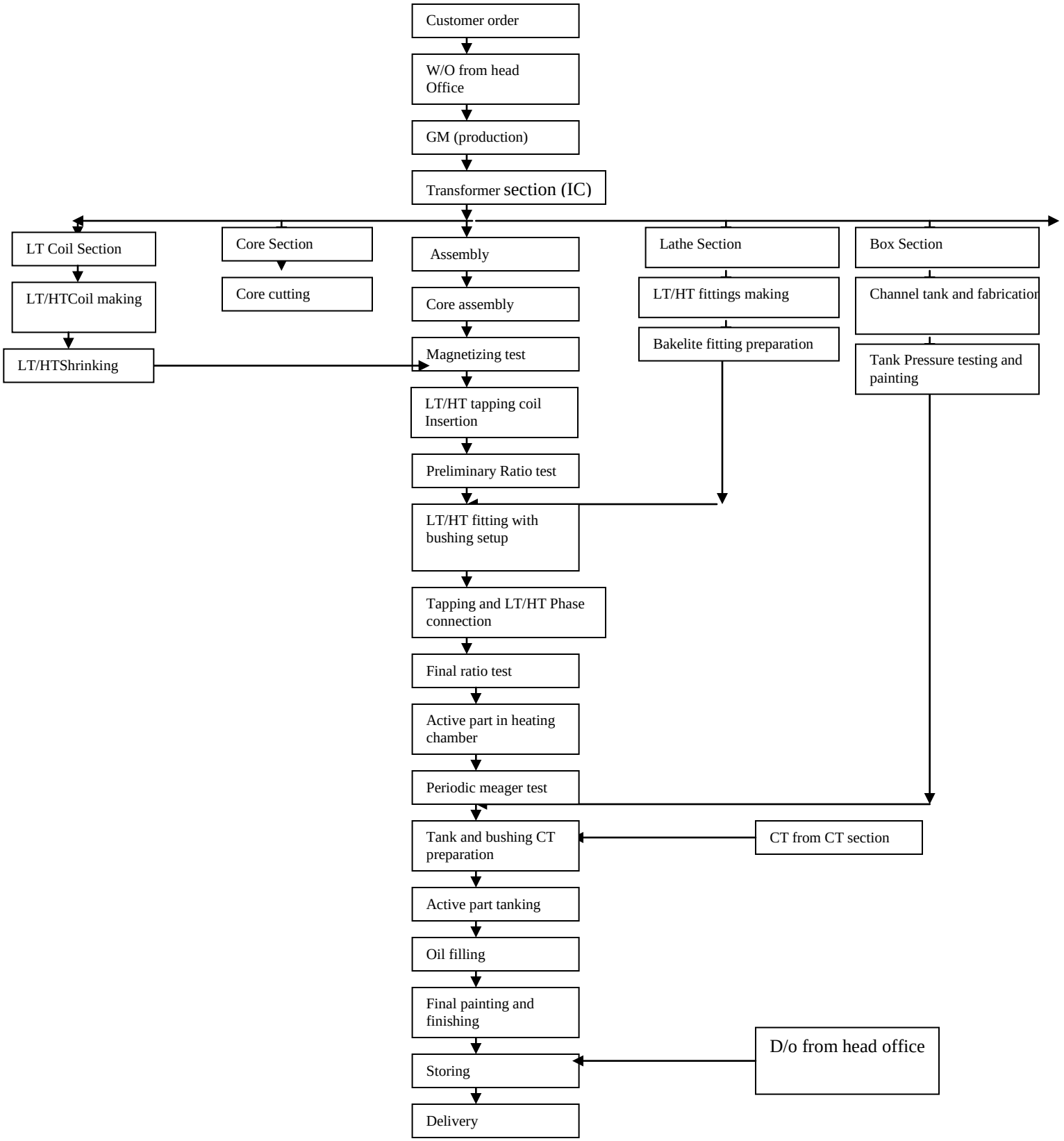
- To know the duty and responsibilities of an Engineer in real life job.
- To know about company management
- Idea about safety and protection.
- Idea about risk in factory.

1.6 Methodology:

The report is based on secondary research. The secondary data has been collected from

1. Different papers of Company
2. Updated website of Energypac Engineering Ltd.
3. Report submitted by several internship students.

1.7 Energypac Engineering organization process:



2. TRANSFORMER

2.1 Introduction:

In this section our in charge was Engr. Asaduzzaman, Ad.GM. When we reached in the transformer section we introduced with. Engr. Asim Kumar Bhakta, Assistant Engineer (Transformer, Production). At first he gave us some theoretical summary about their working principals and knowledge then he showed us different section in brief. A transformer is essentially static electromagnetic device .It changes ac electric power at one voltage level to at another voltage level through the action of electromagnetic magnetic field.

Figure 1: Power Transformer

2.2 Manufacturing:

Energypac Engineering Limited manufactures two types of transformer

- Power Transformer up to 75MVA
- Distribution Transformer 4.5 MVA (11/0.415 kV)

It was found that Energypac manufacture up to 75 MVA transformers. There future target is 100MVA, 132/33KV Power Transformer.

2.3 Transformer Construction Process:

2.3.1 Construction:

In transformer section we saw that transformer consists of the following parts . These are

- Transformer coil
- Transformer core
- Transformer windings
- Transformer tank
- Transformer radiators

2.3.2 Coil:

Coil is the basic raw material of transformer. It was found that Energypac use electrolyte copper coil for winding. Three types of coil are necessary, these are high voltage (H.V) coil, low voltage (L.V) coil and tap changing coil. H.V coil is thin, because in H.T (high tension) side voltage is high and current is low so, the coil have to carry low rate of current. L.V coil is thick, because in L.T (low tension) side voltage is low and current is high so, the coil have to carry high rate of current. This coil is also used for tap changing. The coil size is of H.V coil, L.V coil and tap changer depends on voltage rating, KVA or MVA rating and design issues.

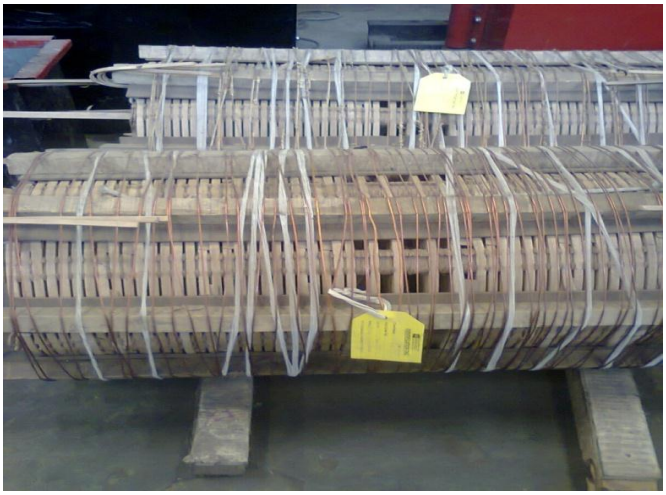


Figure 2: Transformer LT coil

2.3.2.1Coil selection:

Disc coil:

Energypac use disc type of coils for coil winding. Disc coils consist of flat conductors wound in a spiral form at the same place spiraling outwards. Alternate discs are made to spiral from outside towards the center. Sectional discs or continuous discs may be used. These have excellent thermal properties and the behavior of the winding is highly predictable. Winding of a continuous disc winding needs specialized skills. We saw in this section that disc coil is used for HT coil of power transformer.

Working step for Disc coil:

Disc coil (High power transformer):

In this section the workers are strictly maintained the following steps that are provided by the Enenrgypac. These are

- Copper strip is used for this type of coil and make is dust free by using sand paper.
- It is made straight by using roller.
- DPC (Double paper covering) paper is used roller for insulation.
- A large wooden forma is used to make a coil.
- Its size is pre calculated according to the transformer power.
- Starting and ending point of the coil is bended separately.

2.3.2.3. Working principle of Coil winding machine

The following instructions are given in this section that are provided by the Energypac. These are

- The collapsible forma no is found by observing the KVA ratings of HT coli and LT coil.
- That forma is connected with the machine then the metal jacket is added with forma. The diameter of its outside is equal to the diameter of HT or LT coil inside diameter.
- By following the design an insulation copper strip is chosen for a fixed size or shape.
- After a fixed turn or Disc a tapping lead must be get out.
- After completing the winding the outside diameter is must be measured.

Caution:

- The axial length of Inside diameter and outside diameter must be same.
- The Insulation must be in correct form

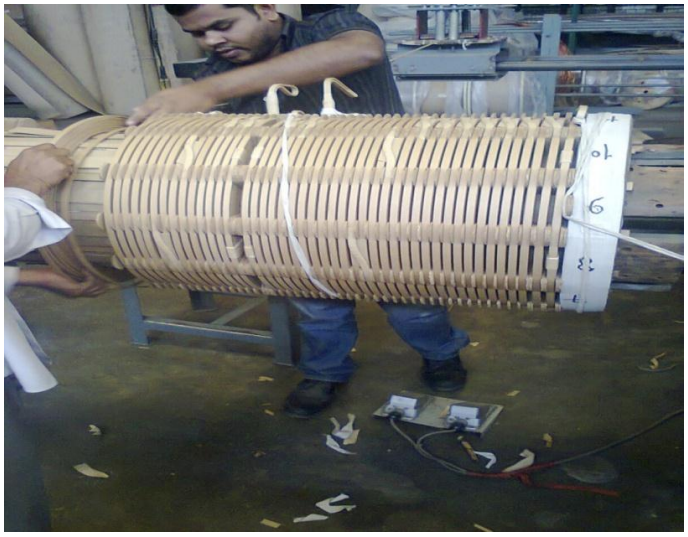


Figure 3: Coil winding (using coil winding machine)

2.3.3 Core:

Core is important parts of the transformer. It was found that Energypac use silicon sheet for core. The transformer cores are made of high permeable cold rolled grain oriented electrical steel insulated on both sides. It is very conductive. It reduces no load losses, no load current and reduces noise level.

2.3.3.1 Core selection:

The core can be designed in different way as per requirement .Energypac used automatic core cutting machine. It is operated by computer. So they divided the core in three classes. These are class A, class B, class c. The complete core structure is given below:

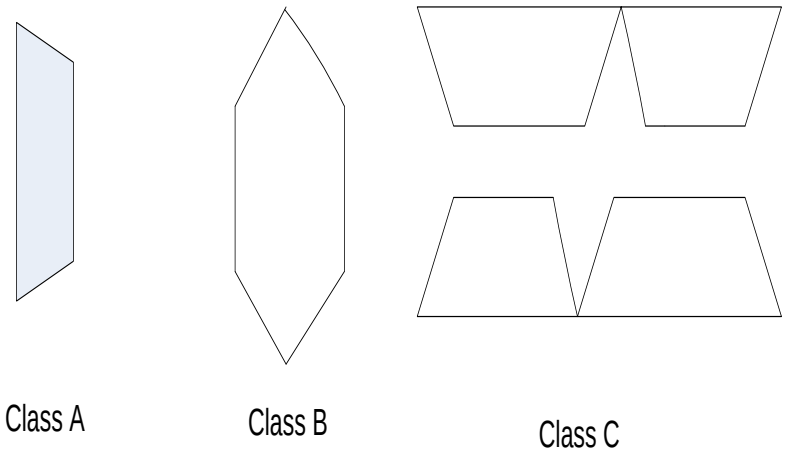


Figure 4: Transformer Core Shape

After joining different parts, the complete core structure creates. This structure is look like as given picture.

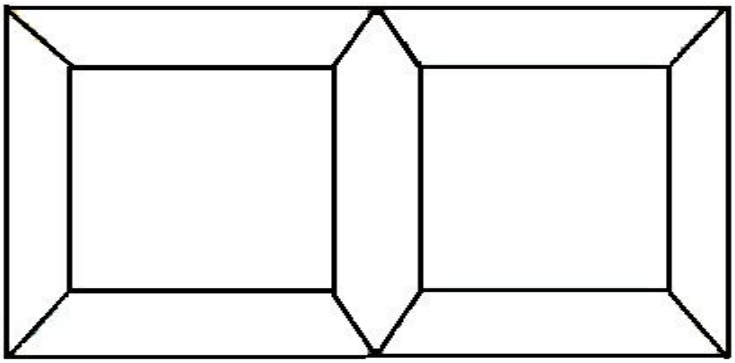


Figure 5: Transformer core structure

2.3.3.2. Core Cutting Machine:

It was found that Energypac uses automatic core cutting machine which is automatic operated by computer. The name of the core cutting machine is Micro Tool and Machine (MTM). In this machine core are cutting in three class, they are class A, class B and class C. The core is cut thin sheets because it reduces eddy current loss. Here, A shape is called corner shape and B shape is called Benoze shape. Normal core cutting is used for CT and PT because their power rating is not very high. Auto core cutting or 45^0 angle cutting is used for power and distribution transformer. In auto core cutting flux cut higher than normal core cutting

Figure 6: Computerized core cutting machine

2.3.4 Insulation:

The supervisor informed us that, Insulation is very necessary part of the transformer. Without insulation the active part and body will be shorted. Mainly insulation is used to protect active part of the transformer. Insulation is required for both HT and LT side of the transformer. In HT side high voltage and low current is flowed. Here the insulation must be higher than LT side insulation. Energy Pac uses or DPC (Double paper covering) paper as gas insulation both HT side and LT side.

2.3.5 Tap Changer and Tap Switch:

The supervisor informed us that, tap changing means the changing of voltage by a switch. Transformer often requires operation under changing primary voltage or a secondary voltage. Taping can be provided in HT side or LT side to vary voltage level and it is done by customer's choice. Energypac normally use two types of tap changers. One is off load tap changer and another is on load tap changer. Off load tap changer changes the primary side of a step down transformer. On load tap changer is usually located on the secondary side of the transformer. They are used to control the current and voltages as the load varied. When any fault occurs it can be turn off. Above 3000KVA taping is on load tap changer.

2.4 Fittings:

As per customer's specification, the Optional Fittings as listed below are provided for the additional protection operation of a transformer.

a) Oil Temperature Indicator

b) Winding Temperature Indicator

c) Gas & Liquid Operated (Buchholz) Relay

d) Conservator for ratings below 11kV & 2500kVA

e) Marshalling box for all wiring

2.5 Protection Purpose of the Transformer

2.5.1 Cooling

For large transformer Energypac used water cooling. They mostly used cooling system that are ONAN (Natural Air Cooling with Radiators), ONAF (Radiators Additionally Cooled by Fans) in which cooling air is blown to the radiators by fans, is also used.

Figure 7: Radiator

2.5.2 Gas Insulation Relay

Energy Pac uses Buchholz Relay as gas insulation relay.It is very important for safety of a transformer. Buchholz Relay was explained by Engr. Asim Kumar Bhakta .the buchholz relay is connected in the pipe work between transformer tank and conservator. If a valve is fitted to isolate the conservator, the buchholz relay is usually on the transformer tank side of the valve. Under normal condition the relay is full of oil.With an incipient fault, gas is produced at a very slow rate and the upper float switch will operate after a specified volume of gas has collected. The upper float switch will also indicate the low oil level of the conservator. When a major fault occurs, the gas is produced rapidly resulting in sudden surge of oil up to the conservator thereby operating the lower float switch. The lower float switch will also indicate the drained oil level of the conservator. The alarm and trip terminals are clearly marked for function and polarity, which should be set at service position before energizing the transformer.

2.5.3 Oil Temperature Indicators and Winding Temperature Indicators

Oil temperature measurement was also explained by Engr. Asim Kumar Bhakta. Transformer oil must stay at a reasonable temperature for good performance. A thermometer is essential to indicate the transformer oil temperature. A dial type contact thermometer is used to indicate actual top-oil temperature. Winding temperature was explained by Engr. Asim Kumar Bhakta. He told us that the Winding temperature increases when load increases. Therefore to protect the transformer winding the temperature must be managed. The winding temperature indicator is used for that.

Recommended Maximum Temperature Setting is:

a) Oil Temperature Indicator 85°C for Alarm 95°C for Trip

b) Winding Temperature Indicator 105°C for Alarm 115°C for Trip

2.5.4 Bushing

The leads are taken from the primary and secondary windings. It is brought through the tank to a terminal connection. The bushing insulator is constructed to minimize the stress. Main purpose of outdoor busing is for insulation of HT and LT. The length of bushing depends on the length of HT and LT terminal.

Figure 8: Transformer bushing

2.5.5 Silica Gel

Silica gel is used for reducing moisture. At night when the oil goes to transformer from the conservator some air also enter or exists the conservator depending on expansion and extraction of the oil. Silica gel is used to absorb the moisture from air. Normally the color of silica gel is pink. But when it absorbs the moisture color is changed. Then it it's contains brown color.

2.5.6 Conservator

Conservators are used to separate the tank to minimize the contact between the transformer oil and the outside air. The oil flows from tank to conservator or from conservator to tank through the pipe between cover and conservator. Depending on expansion and extraction of the oil, air enters or exist the conservator through a dehydrating breather equipped with silica gel particles. As the temperature of insulating oil increases or decreases, there is a corresponding rise / fall in the oil volume. To allow for this, an expansion vessel (conservator) can be connected to the tank to limit the amount of air to be in contact with insulating oil. While assembling the conservator, ensure that internal surface, all openings, pipe works, valves, etc, are clean & free from moisture and all gasket joints are oil tight.

Figure 9: Conservator tank

2.4 Tank Construction

The tank is a body of a transformer which gives protection to the internal equipment of transformer. We did not see the construction procedure of the tank of a transformer, but Engr. Moniruzzaman explained the whole procedure to us. According to him the tank is manufactured by forming and welding steel plate. This part is going to be used as a container for holding the core and coil assembly together with insulating oil. The base and the body are connected through bolt. The windings and core are fixed together in such a way that no parts can move during vibration. In addition, the tank is designed to support total vacuum during the treatment process.

2.4.1 Tank Up

The core-coil assembly and tank supplied by the fabrication department are taken into tank-up stage. The procedure is:

- The core-coil assembly is taken out from the vacuum dry plant
- The tanks, supplied by fabrication department are brought to tank-up department duly painted.
- Fittings like drain valves, HV& LV Bushings, conservator, oil level indicator and others are fitted in the tanks
- The Core-coil assembly is then placed into the tank and properly locked up

- Connections of primary and secondary to the terminal bushings are made. Operating handle for ratio switch that means tap changing is also fitted with the tank
- After that the tank is filled by pure transformer oil.

2.5 Painting

All metal parts are properly cleaned, suitably surface treated and given three coats of high quality paint before dispatch from the works. The first, which is applied to the neat metal surface, is a primary coat, followed by an intermediate coat and then a final finishing coat as per relevant specification. If the paint-work has been damaged during transit or erection, touch-up painting should be carried without delay to avoid any possible rusting of metal. Failure to attend to paintwork damage will result in considerable deterioration of metal surfaces of equipment during storage or service. For further guidance, the following information is provided:

a) Surface to be repainted should be thoroughly cleaned to remove any rust.

b) Dry Film Thickness (DFT) shall be 25 to 35micron for the first coat, 50 to 60micron after the second coat and 75 to 80micron after the finishing coat.

c) For normal environment, high quality alkyd resin based paint is recommended.

And for polluted environment, paint as recommended by paint

2.6 Testing Section

List of the tests and description are given as follows:

1. In Process Test
    - Magnetic Balance Test
    - Excitation Current Test

    Vector Group Test
2. Routine Test
    - Insulation Resistance Test
    - Winding Resistance Test
    - Winding Ratio Test

- No Load Loss Test
- Full Load Loss Test
- High Voltage Test
- Double Voltage Double Frequency Test

3. Type Test and Special Test
    - Lighting Impulse Test
    - Switching Impulse Test

Measurement of Acoustic Sound Level Test

2.6.1 Winding Resistance

This test measures the resistance of the HV & LV winding. The values of resistance should be balance for all three phases and should match the designed values. The Digital Resistance Meter is used in this test.

2.6.2 No Load Test

The no load test is performed, when power supply is given in HT side while the other winding is supplied with rated voltage at rated frequency. No-load current and loss shall be measured as well as the mean value and the effective value of the voltage.

2.6.3 Full Load Test:

This test measures the power consumed by the transformer when the LT winding is short circuited and the rated current is passed through the HT winding. This test is done by wattmeter or power analyzer

2.6.4 Lighting Impulse Test

The purpose of impulse Voltage test is to confirm that the transformer insulation's withstand the lightning over voltages which may occur in service. The Power Transformers used in high voltage systems at any time may be affected by the atmospheric discharges. The magnitudes of the lightning

over voltages always depend on the impulse current and impulse impedance where the lightning impulse occurs. This value is several times of operating voltage. In the transformer, maximum seven times greater voltage is applied to check its insulation. High voltage is applied in the HT side.

Figure 10: Impulse generator

Applied voltages are:

- 415V ----- No voltage
- 11KV----- 75KV
- 33KV----- 170KV
- 132KV----650KV

3. SWITCHGEAR

3.1 Introduction

According to training schedule our training was in switchgear section on 01.01.12 to 04.01.12. It was allocated four days for switchgear section. In switchgear section, first we introduced with our supervisor engineer Mahbub. Then the supervisor gave us a guideline about switchgear section and what we should see at switchgear. He told that, switchgear is related to safety of the transformer. Everyone is familiar with high voltage switches and rewirable fuses. Every electric circuit needs a switching device and a protective device. Switching and protective devices have been developed in various forms. Switchgear essentially consists of switching and protecting devices such as switches, fuses, circuit breakers, relays etc. The main functions of switchgear are:

- Electrical protection
- Electrical isolation of sections of an installation
- Local or remote switching

3.1.1 Manufacturing

The supervisor mentioned that, switchgear is needed to protect the large power transformer on both the high and low voltage side in a substation. Switchgear panel is required in order to operate, control and maintain the switchgear. EnergyPac normally manufacture two types of switchgear panel.

- Low Tension Panel (LT Panel)
- High Tension Panel (HT Panel)

He also explained us about construction, function and operation of both panel in details. The explanation of both LT and HT are given below:

3.2 Low Tension Panel (LT) Switchgear

3.2.1 Feature of LT Panel

Energypac manufactures low voltage switchgear (called LT Panel) which is applied for power control and distribution systems of AC 50Hz, rated working voltage up to 415V (Phase to Phase)and 220 V(Phase to Neutral). Energypac maintains the standard of IEC439; GB7251 to design LT panel. Energy Pac LT Panel switchboards are well steel sheet fabricated, fully enclosed, floor mounting,

vermin and dust proof. All these are supplied with factory fitted relevant components and copper bus bars, internal wiring, terminal block etc. We saw that, Energy Pac LT switchgear could operate by both manually and automatically. It is mainly used in:

- Power station,
- Industrial enterprise,
- Commercial/Residential Buildings for power distribution and
- It can be used to control, protect and inspect the circuit.

Energypac LT switchgear consists of the followings component:

- LT metering panel up to 415V (phase to phase)
- Distribution box
- Motor control panel
- Power factor improvement plant (PFI plant)

Figure 11: LT switchgear panel

3.2.2 Construction

The essential components in LT switchgear panel used in Energypac Engineering Limited:

- Molded Case Circuit Breaker (MCCB)
- Miniature Circuit Breaker(MCB)
- TP(Triple pole)
- DP(Double Pole)

- SP(Single Pole)
- Bus-bar
- Ring CT from Energy pac
- Ammeter, Voltmeter, Indicator lamps.

3.2.2.1 Molded Case Circuit Breaker (MCCB)

Structure:

EnergyPac used Molded Case Circuit Breaker, which is Tmax series and triple pole. This company does not manufacture this circuit breaker. The sheet steel structure of MCCB is extremely compact, considerably reducing overall dimension. Safety is improved by adopting double insulation for the live parts and total segregation between phases.The sizes have the same height and depth for all of the circuit breakers in each version. The current rating of this circuit breaker is 16A to 1600A. MCCB are used to Protect and control electrical machineries from

- Overload
- Short-circuit
- Ground fault

Figure 12: Molded Case CB

Field of Application:

- Industrial and civil low voltage plants with service currents from 1 to 1000 A
- Direct and alternating current distribution switchgear.
- Motor protection (Motor Control Center), generators, capacitors

3.2.2.2 Miniature Circuit Breaker (MCB):

We saw that, EnergyPac used miniature circuit breaker in LT switchgear panel. This circuit breaker is not repairable. The operating voltage is 230V-440V. During overloads or faults it automatically trip off. The tripping mechanism is actuated by magnetic and thermal sensing. It is small in size and easy mechanism. The panel includes three numbers of rings CT for current measuring purpose. Also, there are three ammeter and one voltmeter to monitor current and voltage value. The ammeters are connected in the bus-bar through CT because the ammeter can measure current from 1A-5A. But the voltmeter is directly connected to bus-bar because the internal resistance of voltmeter is very high. When fault occur like over-current, short-circuit, earth-fault etc. initially MCB trips and then the MCCB operates and if fault occur in the bus-bar then only MCCB trips; then the whole system will be disconnected. If any fault occurs in any phase, the whole phase will disconnect instantly. In LT panel, there are some indicator lamps which indicate the panel on/off, trip signal, spring charge lamp.

(i) SP(Single Pole) (ii) DP(Double Pole) (iii) TP(Triple pole)

Figure 13: Three types of MCB

3.2.2.3 Bus-bar:

Our supervisor told us that, Bus-bar is the terminal where incoming and outgoing current lines are connected. The bus-bar is designed to carry normal current continuously. The size of bus-bar depends on the rated normal current and temperature rise. We found that, EnergyPac bus-bar is made with electrolytic copper with high conductance and copper bus bars are colored with red, yellow and blue. The standard of bus-bar is IEC431.

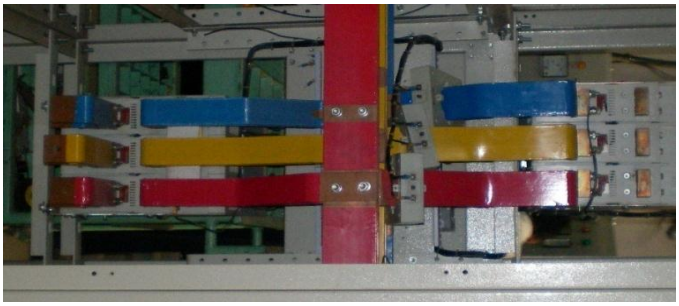


Figure 14: Bus-bar

3.3 Field of application of LT panel:

- Power station
- Industrial enterprise
- Residential Buildings for power distribution and can be used to control, protect and inspect the circuit.

3.4 Technical Data of LT switchgear panel:

Technical data means the nameplate value or the ratings. EnergyPac LT switchgear panel has the following technical data:

- Metal clad, sheet steel
- Rated voltage: up to 415 V
- Rated frequency: 50Hz
- Rated Breaking current: up to 100KA
- Rated making current: 130 KA
- Short circuit duration: 1 or 3 seconds

3.5 High Tension Panel (HT) Switchgear

3.5.1 Feature of HT Panel:

Energy Pac manufacture high voltage switchgear panel (HT panel) and applied for power control and distribution systems of AC 50Hz according to the standard of IEC. Energy Pac's HT Switch gear equipped with Load Break Switch (LBS), Vacuum Circuit Breaker (VCB), etc. To meet individual requirement, it has features of long service life reliability and high degree of quality safety

HT switches are suitable for inexpensive electrical sub-station with transformer feeder, measuring, sectionalizing Auto change over and motor protection.

3.5.2 Voltage Range of HT Switchgear:

- 11KV
- 33KV
- 132KV
- 230KV

3.5.3 Products under HT Switchgear:

- HT metering panel up to 230KV
- Load Break Switch (for 11KV substation)
- Vacuum Circuit breaker (Indoor-Outdoor, up to 33KV
- Control, Metering and relay panel up to 230KVg

3.5.4 Construction:

The essential components of HT switchgear panel are following:

- Bus Bar
- Ammeter
- Voltmeter
- Magnetic coil
- Counter
- Indicator flags
- Vacuum Circuit Breaker (VCB)
- Relay
- Ring CT (current transformer)
- Potential Transformer

3.5.5 Field of Application of HT Switchgear

- Power station
- Industrial enterprise
- Commercial industry and Transmission can be used to control, protect and inspect the circuit.

3.5.6 Technical Data of HT Switchgear Panel

Technical data means the nameplate value or the ratings. EnergyPac HT switchgear panel has the following technical data:

- Rated Voltage: 12KV & 33KV
- Rated Current: 630A, 800A, 1250A
- Short time current rating for 3Sec: 20kA
- Basic impulse level: 75kV
- Making Current: 50kA
- Rated Frequency: 50Hz

3.6 Relay

It was found that Energypac Engineering Limited uses relay which is manufactured by Areva Company. Relay senses the fault and send trip signal to circuit breaker. The relay senses directional/non-directional earth fault, three phases over current, Watt metric protection, Undercurrent, negative phase sequence over current, thermal overload, under voltage, over voltage etc fault. To operate relay first the relay should be set for pacific values. This relay includes IDMT (Inverse/Definite Minimum Time) characteristics. IDMT relays have such tripping characteristics, for a particular range of low values of current the tripping time varies inversely with the value of current. But beyond a certain current limit the tripping time becomes constant (definite) and causes tripping in minimum time.

3.7 PFI (Power Factor Improvement Plant)

3.7.1 Construction

The supervisor informed us that, PFI plant has been designed to meet the needs of all forms of power factor correction by capacitor banks from small unit to a large plant. The purpose of using PFI plant is to save thousands of taka on electricity bills. It minimizes power loss and wastage. PFI Plant is used to improve the power factor of the inductive loads of the system's network by Capacitor Banks. All control & indicating devices are located on the front door of the panel for easy viewing from the operator's desk. Then we saw the construction and operating mechanism of PFI plant. Energypac have microprocessor based PFC (Power Factor Correction) relay up to 16 stages. The Capacitors that

are used of different ratings (2.5, 5, 10, 20, 25, 50 KVAR….etc) and corresponding Magnetic Contactor for suitable stepping of the Capacitor bank.

Figure 15: PFI Plant

It was found that Energypac manufactured PFI Plant for improving the degraded Power Factor of the system. PFI plant consists of:

- Power factor correction (PFC) relay
- H.R.C fuse
- Miniature Circuit Breaker(MCB)
- Magnetic Contactor
- Bus Bar
- Capacitor bank
- Ammeter, Voltmeter and Wattmeter
- HRC fuse
- CT
- PT
- Magnetic coil
- Breaker
- Indicator flags

3.7.2 PFC Relay

It was found that Energypac uses PFC relay which manufactured from German. It is used for sensing low power factor and power factor should not be less than 0.95. When power factor will be less than 0.95 the relay starts operation.

3.7.3 H.R.C Fuse

In electrical system fuse acts as protection device and depending on application different types of fuses are select. Out of these different types of fuses HRC is also one of these types of fuse and it stands for "High Rupturing Capacity". This type of fuses normally used where some delay is acceptable for protecting system. HRC fuse link is a very common, simple and effective electrical protection device against over load and short circuit current.

The main advantage of using an HRC fuse is, when a fault occurs, a tremendous amount of heat is created within the fuse. That heat melts the silica sand filling of the fuse into glass. Glass, being an insulator, suppresses any arc-over and breaks the circuit instantaneously.

Figure 16: H.R.C fuse

3.7.4 Capacitor Bank

In PFI panel, a capacitor bank is a grouping of several identical capacitors interconnected in parallel or in series with one another. Energypac imports capacitor bank from Cali-lab Company, India.

Figure 17: Capacitor Bank

Features of the capacitor bank

- Capacitor's terminal predigests the parallel application form.
- Prevent tip-and-run protection.
- Building-in discharge resistance and safety installation, the use of safe and reliable.

3.7.5 Magnetic Contactor

When electricity flows through the magnetic contactor then causes the electromagnet to generate a strong magnetic field. This field pulls the iron core into the coil, and creates an electrical arc. When electricity passes through one contact then the moving contact and fixed contacts get attached. Energypac imports magnetic contactor from German.

Figure 18: Magnetic contactor

In the Switchgear section, we saw both indoor and outdoor type vacuum circuit breaker.

- Indoor Vacuum Circuit Breaker, up to 33KV
- Outdoor Vacuum Circuit Breaker, up to 33KV

3.8 Indoor Vacuum Circuit Breaker, (Up to 33 kV)

Energypac manufactures up to 33 kV Indoor Vacuum Circuit Breaker.

Figure 19: Indoor Type Vacuum Circuit Breaker

Energypac is the first and only company in Bangladesh which introduce horizontal isolated, horizontal draw out type vacuum circuit breaker in the country since 1998. Today large numbers of these circuit breakers are in operation in Bangladesh and other parts of the world. The vacuum circuit breaker is designed to meet the requirement laid down by IEC 60056.

3.9 Outdoor Vacuum Circuit Breaker, (Up to 33 kV)

We saw outdoor type vacuum circuit breaker at EnergyPac in Switchgear section.

Figure 20: Outdoor type vacuum circuit breaker

Normally EnergyPac manufactures up to 33KV outdoor type vacuum circuit breaker. We saw that, Pioneering zeal of Energypac Power created the first indigenously made outdoor porcelain clad vacuum circuit breaker in the country .With further innovative skills, Energypac made the circuit breaker to meet highly demanding needs for performance from all sections of people like Consultants, Contractors, and Industries & Utilities.

3.10 TESTING

3.10.1 Testing for LT Switchgear

- MCCB/ ACB performance Test
- CT Test
- Ammeter and Voltmeter performance Test
- Insulation Resistance Test

- Performance Test
- Wiring Test

3.10.2 Testing for HT Switchgear

- Vacuum circuit Breaker Test
- Load Break Performance Test
- IDMT Relay Test
- CT & PT Test
- Insulation Resistance Test
- Ammeter and Voltmeter performance Test
- Wiring Test
- Magnetic Contactor Performance Test
- Relay Operating Test
- Fuse Test

4. INSTRUMENT TRANSFORMER

4.1 Introduction:

During our internship we worked in the instrument transformer section from 5th January to 8th January, 2012 in Energypac. The supervisor of this section was Engr. Mozaharul Islam, DGM. The Instrument Transformer has two sections that are current transformer (CT) and potential transformer (PT). Energy-Pac manufactures outdoor/indoor, oil cooled/cast resin Current Transformers (CT) ranging from 11 kV to 230 kV. Energy-Pac manufactured instrument transformers in accordance with latest IEC/ANSI standards.

4.2 What is Instrument Transformers?

Our internship supervisor gave us a idea about instrument transformers. The function of instrument transformer is to transfer voltages or currents in the power lines to values which are suitable for the operation of measuring instruments and relays. There are two basic types of instrument transformers: current transformers (CT) and voltage transformers (VT) also called potential transformer (PT).

4.3 Current Transformer (CT):

During in the instrument transformers section, our supervisor told us about the basic function of the current transformer. The basic functions were

- To reduce the line current to a value which is suitable for standard measuring instruments, relays etc.
- To isolate the measuring instruments namely meters, relays, etc. from high voltage side of an installation.
- To protect measuring instruments against short circuit currents.
- To sense abnormalities in current and to give current signals to protective relays to isolate the defective system.

Figure 21 : Outdoor Current Transformer

4.4 Potential Transformer (PT):

Our supervisor told us about the basic function of the potential transformer. The basic functions were

- To reduce the line voltage to a value which is suitable for standard measuring instruments, relays, etc.
- To isolate the measuring instruments, meters, relays, etc. from high voltage side of an installation.
- To sense abnormalities in voltage and give voltage signals to protective relays to isolate the defective system.

Figure 22 : Indoor Potential Transformer

Figure 23 : Outdoor Potential Transformer

4.5 Types of CT and PT:

Energypac manufactures two types of CT and PT based on construction

Indoor type (Epoxy resin cast type):

Energy- Pac uses one indoor type of instrument transformer. This is Epoxy resin cast type. In this transformer there have no oil expansion chamber.

Outdoor type (Epoxy resin cast type and oil merged type):

Energy-Pac uses Oil merged type transformer for outdoor type. CT and PT are of different types depends on their design. Energy-Pac manufactures two types of CT:

- Live tank
- Dead tank

EnergyPac manufactures two types of Single phase electromagnetic PT:

- Single Pole (between lines & earth)
- Double Pole (between line-to-line)

The types of products that Energypac build in this section are

- Outdoor type oil cooled CT up to 230 KV
- Outdoor type oil cooled PT up to 230 KV
- Indoor type resin cast CT up to 11 KV
- Indoor type resin cast PT up to 11 KV

Figure 24 : 11kV Indoor Type CT & PT

4.6 Construction:

4.6.1 Construction of Current Transformers:

According to our supervisor the process of making CT coils are

- Core winding
- Core insulation
- Coil winding
- Rock oil test
- Insulation
- Polarity test
- Zalar
- Tanking
- Oil filling
- Gas pouring
- Final test
- Final product

Now we will describe the whole process in a brief form:

- High permeability CRGO silicon steel is used as core material
- Primary winding is braided electrolytic copper conductors with double cotton covering
- Secondary winding is done automatically and distributed equally on the periphery of the core to minimize leakage reactance.

- Toroidal cores from continuous strips are made there and annealed in controlled atmosphere to achieve best quality secondary cores.
- High quality crepe insulating paper is used to build up main insulation of the CT.
- Varnished fiber glass sleeve is provided as an additional insulation on this conductor.
- Craft paper is also used for insulation.
- Brown/white glazed porcelain bushing with different shade profiles to suit different pollution conditions are used.
- These bushings are hollow cylindrical type conforming to bushings.
- Different types of oil used in current transformer for insulation like

➢ Insulating Oil
➢ Transformer oil
➢ Mineral oil
➢ Pironol oil

4.6.2 Maintenance:

The CTs do not require maintenance apart from occasional cleaning of bushings and checking of nitrogen pressure.

4.6.3 Selection of CT:

Our supervisor told us that it is important to specify correct parameters of CT while ordering for optimum design. Following are main factors for selecting CT.

- Service Voltage
- Installation
- Atmospheric Conditions:
- Insulation Level
- Rated Primary Current
- Continuous Primary Current
- Rated Secondary Current
- Short Time Current and its Duration
- No. of Cores , Burden and Accuracy
- Secondary Resistance and Excitation Current

4.6.4 Construction of Potential Transformers:

The mechanisms of potential transformers are very similar to current transformer. The Potential Transformer consists of primary and secondary windings, electromagnetic core, bottom tank, oil expansion chamber, and porcelain bushing, etc which are similar to current transformers.

According to our supervisor the whole process are describe following in brief form.

- CRGO silicon steel is used for building up electromagnetic core.
- Shell type construction is used to minimize leakage reactance.
- Primary is wound with multilayer and graded insulation.
- Secondary is separately wound and inserted in the primary winding as per the requirement.
- Brown/white glazed porcelain bushing with different shed profiles to suit different pollution condition is used. These bushings are hollow cylindrical type conforming to IEC 815/IS 5621
- High quality electrical grade Kraft paper and crepe paper is used for insulating primary and secondary of PT.

4.6.5 Maintenance:

The PTs do not require maintenance apart from occasional cleaning of bushings and checking of nitrogen pressure.

4.6.6 Selection of PT:

It is important to specify correct parameters of PT while ordering for optimum design. Following are main factors for selecting PT.

- Service Voltage
- Installation
- Atmospheric Conditions:
- Insulation Level
- Rated Primary Voltage
- Rated Secondary Voltage
- Voltage Factor
- No. of Secondary Windings , Burden and Accuracy

4.7 Multi-Ratio Current Transformer:

Energypac manufactured multi-ratio current transformer. Multi-ratio current transformers mean it has multiple secondary outputs and multiple primary inputs. It is multi-ratio; tapping type CT. Maximum supply current is 1000 A. There are different lines for different current, such as 200 A, 500A, 1000 A.

4.8 Testing for CT and PT:

Energypac must ensure these types of tests. These tests are:

1. Routine test
2. Partial Discharge test
3. High voltage test
4. Quality test
5. Polarity test
6. Zalar

Our supervisor didn't tell us elaborately about the tests. But he gave a short brief on some tests.

4.8.1 Routine Test:

Routine tests are conducted on each transformer before dispatch. The routine tests include the following tests:

1. Verification of terminal markings and polarities.
2. High voltage power frequency voltage withstand test on secondary.
3. No load test.
4. Full load test
5. Over-voltage inter-turn test
6. Determination of errors and accuracy class.

From the above routine tests our supervisor told us one or two tests. The tests are

Over-voltage inter-turn test:

In this test the secondary winding is open circuited. Rated frequency, rated primary current is flowed through primary for about one minute. The secondary winding is then checked to see if the insulation has passed the test. If the insulation is failed then the gap between the turns are shorted.

Polarity test:

It is very important to know the polarity of transformer. If we do not identify polarity of the transformer we cannot identify direction of current and voltage. It gives the relative instantaneous direction of currents in the primary and secondary leads. They marked the following polarity for current transformer.

4.8.2 Partial Discharge:

Partial discharge test is used for checking and decreasing the charge carrier between the winding. If there have any bubble between HT and LT Winding, it create Charge carrier. This situation is very harmful for a transformer. To avoid this first time a high voltage (approximately 200 KV) is applied to the primary side and the secondary side is shorted. Now if we increase the voltage, the capacitance or the charge carrier is discharging between primary and secondary side.

The instrument transformers when manufactured in factory, due to its manufacturing process workmanship, some voids are present. These voids over a period of time start increasing in size due to overvoltage in system or ageing. When a voltage is applied to the object the gaseous particles start getting ionizing. At a particular stage the void size increases causing the apparent charge value to increase and finally cause failure of the instrument transformer. The failure or increase in Partial discharge value can also be due to moisture or contamination on the external surface of the equipment which may cause tracking with respect to earth.

4.8.3 High Voltage Test:

High voltage test is used for checking the insulation property between Primary to earth, Secondary to earth and between Primary & Secondary winding. High voltage test means applying high voltage (approximately 28 KV) on Primary side for 1 minute and the other side that means the low voltage side must be neutral and grounded.

5. ISOLATOR & SWITCH

5.1 Introduction:

For breaker and isolator, we did work in two sections. One was isolator and switch section and the other was switchgear section. We worked on isolator & Breaker Section on 8th January to 9thJanuary, 2012. In breaker Section our Supervisor was Engr. Moniruzzaman, Manager. He helped us to knowing information about breaker and isolator. Switch and isolator are used for proper distribution of generating power. If any fault is happened in the supply line, then to save the transformer or other important electrical devices and recovering the fault switch & isolator are used. Actually those are used to connect and disconnect the supply line in various purposes.

5.2 Isolator:

At first our supervisor told us briefly about isolator. Isolator (disconnecting switch) operates under no load condition. Isolator is an off load device (disconnecting switch) which is used for isolating the downstream circuits from upstream circuits for the reason of any maintenance on downstream circuits. It is manually operated and does not contain any solenoid unlike circuit breaker. Isolator should not be operated while it is having load. Its main purpose is to isolate one portion of the circuit from the other and is not intended to be opened while current is flowing in the line

5.3 Types of Isolator:

Energy-pac Engineering Limited manufactures outdoor offload Isolators of the following types:

- Pantograph
- Centre Break
- Double Break

The characteristics of this type of isolators are described below:

5.3.1 Pantograph Isolators:

Our supervisor said that the pantograph isolator has very low civil engineering profile. It has four point contacts**.** The trapeze contact is fixed to suit upper bus arrangement. This type of isolator is very flexible for different bus bar layouts. A current transformer is connected through multi finger

hinge contacts. It has individual pole operation. This type of isolator is also known as single break isolator. Our supervisor told us the basic functions of single break isolator. These were

- Very low civil engineering profile.
- Trapeze contact fixing to suit upper bus arrangement.
- 4 point contact
- Available for flexible / rigid busbar layouts.
- Individual pole operation.
- Structure to suit requirements.

The ratings of single break isolator that was told to us are

- Rated voltage from 12 kV to 245 kV
- Rated current up to 3150 Amps
- Short time current rating up to 50 kA.

Figure 25 : Single Break type Isolator

5.3.2 Centre Break Isolators:

Our supervisor said the mechanism of centre break isolator is similar to double break isolator. The break is done in the center position of the isolator. Breaking is done automatically but closing is manually. Similarly the double break isolator it has turned and twisted contacts. The terminal is vertical and horizontal. Simultaneous operation of 3 poles by single operating mechanism is up to 245 kV. The basic functions of centre break isolator that we were told by our supervisor.

- Very low operating torque

- Self wiping contacts
- Simultaneous operation of 3 poles by single operating mechanism up to 245 kV.

  Structure to suit requirements

The ratings of centre break isolator according to Energy-pac are

- Rated voltage from 12 kV to 245 kV.
- Rated current up to 3150 Amps
- Short time current rating up to 50kA.

Figure 26 : Centre Break type Isolator

5.3.3 Double Break Isolators:

Double break isolator has turned and twisted contacts. The terminal is vertical and horizontal and totally enclosed by actuator assembly. But here we see it has simultaneous operation of 3 poles by single operating mechanism at up to 245 kV. The basic functions of double break isolator are

- Turn and twist contacts
- Vertical/Horizontal terminal take off
- Totally enclosed actuator assembly
- Simultaneous operation of 3 poles by single operating mechanism up to 245 kV.
- Structure to suit requirements.

The ratings of double break isolator according to Energypac are

- Rated voltage from 12 kV to 245 kV.
- Rated current up to 3150 Amps

- Short time current rating up to 50kA.

Figure 27 : Double Break type Isolator

5.4 Construction of Isolator:

Our supervisor just told us just only the materials that are needed to making a isolator

- Copper bus bar
- Insulator
- Mild steel parts
- Fasteners(Nut-bolt, stainless steel)
- Casting material (Brass casting, aluminum casting)

5.5 Types of Switches:

Energypac manufactures different types of switches. Our supervisor told us the name of the switches and its ratings that were made in this section. He didn't tell us the making process or its internal descriptions. The switches and its ratings are

1) 34.5 KV Air breaker switch with load interrupter.
2) 34.5 KV Disconnecting switch.
3) 34.5 KV Drop out fuse holder.
4) 15.5 KV Auto voltage regulator switch (AVR).
5) 15.0 KV Disconnecting switch.
6) 15.0 KV Voltage regulator switch.
7) 15.0 KV Auto circuit re-closer switch (ACR).

These are some disconnecting switches that our supervisor didn't explain to us. He just showed the equipment so that in future we could easily identify the switches.

Figure 28 : Air Break Switch with Load Interrupter

Figure 29 : Dropout Fuse Holder

Figure 30 : Auto Circuit Reclosure Switches

Figure 31 : Auto Voltage Regulator Switches

5.6 Tests:

Energy-Pac follows the standard of ANSI, CPRI, IEC and also BUET for testing isolators .Our supervisor told us about some types of routine tests names that energy-pac follows for the isolator.

- Insulation test
- Contact-Resistance of main circuit test
- Power frequency voltage withstand test
- Mechanical operation test
- Temperature rise test
- Lighting impulse withstand test

6. CIRCUIT BREAKER

6.1 Introduction:

We worked on Circuit Breaker Section on 10thJanuary, 2012. In Circuit breaker Section our Supervisor was Engr.AtaulGoni,Asst.Engineer Manager. He helped us to knowing information about Circuit Breaker. During operation of power system, it is necessary to switch on/off the various circuits under normal and abnormal condition. For doing this circuit breaker, isolator, load break switch, fuse and other equipment are necessary.

A circuit breaker is equipment which can open or close a circuit under normal condition as well as fault conditions. It is so designed that it can be operated manually under normal condition and automatically under fault conditions.

Energy-Pac manufactures two types of vacuum circuit breaker. These circuit breakers are

1. Indoor type VCB (11kV)
2. Outdoor type VCB (33kV)

6.2 Vacuum Circuit Breaker (VCB):

There is no significant difference between Indoor and outdoor vacuum circuit breaker. Both type circuit breakers have three main parts:

- Fixed contact
- Movable contact
- Vacuum interrupter from Cutler-Hammer (Eaton), USA

Vacuum circuit breakers are very durable and they are designed to last for an extended period of time. Our supervisor told that, vacuum circuit breakers are medium-voltage circuit breakers. It is rated between 1 and 72 kV which is assembled into metal-enclosed switchgear line ups for indoor use or individual components are installed outdoors in a substation. Inside a vacuum circuit breaker, two electrical contacts are enclosed in a vacuum. One of the contacts is fixed, and one of the contacts is movable. When the circuit breaker detects any discontinuity, the movable contact pulls away from the fixed contact, interrupting the current. Because the contacts are in a vacuum, arcing between the contacts is suppressed, ensuring that the circuit remains open. As long as the circuit is open, it will not be energized. Vacuum reclosers will automatically reset when

conditions are safe again, closing the circuit and allowing electricity to flow through it. Reclosers can usually go through several cycles before they will need to be manually reset.

Figure 32 : Vacuum Interrupter

Figure 33 : Outdoor VCB

Vacuum circuit breakers with rated current up to 3000 A, these breakers interrupt the current by creating and extinguishing the arc in a vacuum container. They are generally applied for voltages up to about 35,000 V, which corresponds roughly to the medium-voltage range of power systems. Vacuum circuit breakers connect into the circuit by bolted connections to bus bars or wires, especially in outdoor switchyards.

If someone suddenly pushes the breaking button, a fault or any problem can be occurred. So using this safety system is fault can be control. Energy-Pac used three types of safety process in VCB. These are:

Mechanical lock:

It means the locking system of the machine or device. If the system is mechanically locked, the device can’t operate.

Electrical lock:

It means the locking system of the Breaker part. If the system is electrically locked, the Breaker part can't operate.

Socket:

Socket is used for Breaker on or off. If the socket is not connected the breaker remains shut off.

6.3 Application:

Energy-Pac indoor type vacuum circuit breakers are used in:

- Power stations
- Transformers
- Different industry
- Cold storage and building power supply
- Operation counter
- Local on/off switch
- Local/remote switch
- All necessary fuses and wiring

Energy-Pac indoor vacuum circuit breaker is designed for switching:

- Short circuit current
- Cables overhead lines under load and no load conditions
- Ripple control system
- Capacitor banks
- Transformers and generators under load and no load conditions

6.4 Features of VCB:

Key features of Energy-Pac indoor type vacuum circuit breaker**:**

- Long maintenance free operation
- Fully metal clad design
- Horizontal isolation
- Bus-bar system fully insulated
- Manual or motor charged main closing mechanism

- Fully rated with switches
- Complete set of interlocks and padlocking facilities
- Isolatable voltage transformer
- Ample current transformer accommodation
- Extensive use in tropical environments
- Safety interlocks

6.5 Basic information:

Technical Particulars	11KV	33kV
Applicable standard	IEC 60056	IEC60056
Type Designation	HHV-12	HHV-36
Normal Voltage	11kV	33kV
Rated Voltage	12kV	36kV
Frequency	50 Hz	50Hz
Normal rated current	630/1250/1600/2000 Amps	1250/1600/2000Amps
Short circuit breaking capacity	20kA/25kA/31.5kA	25kA
Withstand Voltage	28	75kV Pms
Rated impulse withstand voltage	75	170kV Peak
Auto reclose	0-0.3 Sec-Co-3 Min-Co	0-0.3Sec-co-3Min
Normal	0-3 Min-Co-3 Min-Co	0-0.3Sec-co-3Min

6.6 Low Voltage Breaker:

Energypac used Miniature Circuit Breaker (MCB) as low Voltage Breaker. They don't manufacture this MCB. They imported MCB from Germany. They used it in Switchgear**.** Protection and control of the circuits against overloads and short-circuits, protection people and big-length cables in TN and IT systems.

6.7 Medium Voltage Breaker:

Energypac used Molded Case Circuit Breaker (MCCB) as medium Voltage Breaker. They don't manufacture this MCCB. They imported MCCB from Italy. They used in switchgear items. Protection and control of electrical machineries against overloads, short-circuits and ground fault protection.

The molded-case circuit-breakers are used in industrial and civil low voltage plants with currents from 16 to 1600A. They are used in D.C. & A.C. switchgear, for motor protection, generators, capacitors etc.

6.8 Testing for Breaker:

To test the circuit breaker Energy-Pac follows the standard of ANSI, CPRI, IEC and also BUET. They has certification from the above mentioned organizations. EnergyPac normally performs five different types of test to the circuit breaker, but we have only seen the high voltage test and mechanical endurance test. A brief discussion of the five tests is given below:

- **Mechanical Endurance test:** In this test, it is observed that after 100 times operation the full setup of the device is damage or not. This test is also called physical test.
- **Insulation Resistance test:** This test is used to cheek the insulation level. This test is also known as Megger test.
- **Contact Resistance test:** Terminal and interrupting have 6-7 contacts. The contact range for this test is 25 to 35μΩ, but considered up to 65 μΩ.
- **High voltage test:** In this test, normally 2.5 times more rated voltage is applied for 1 minute and observe that the breaker can sustain or not. This test is also one kind of

insulation test. When the breaker is ON, there should no voltage in the breaker body. But if any how shorted, then resistance is zero. Initially resistance is like mega ohm range.

- **Auxiliary test:** Normally a circuit breaker become ON within (30-40) ms and OFF within 30ms. In this test, it is check whether the breaker ON and OFF within the range.

6.9 Load Break Switch (LBS):

EnergyPac manufactured indoor type load break switch protective equipment used at 11 kV sub-station. Load break switch serve the following requirements:

- Breaking rated currents
- Making rated currents
- Making specified short circuit currents
- Carrying specified short circuit currents
- Interrupt small inductive, capacitive currents.

Figure 34 : Load Break Switch

6.10 Interrupter Switch

Energypac produces load interrupter switches. The load interrupter switch is compact, economical, flexible and easy to use. Load interrupter switches are available with a choice of two standard mechanisms.

- Three-phase gang operated quick-make, quick-break with Snap Action mechanism
- Three-phase gang operated quick-make, quick-break with Stored Energy mechanism

Figure 35 : Interrupter Switch

7. FABRICATION PROCESS

The last day of our industrial training was on 11th January, 2012. That day our training schedule was in CNC and Fabrication section. In this section our supervisor was Mr. N.M Habibullah, Dy. Manager . The supervisor told us that, EnergyPac has a fabrication process for their own products. He also informed us that, EnergyPac follow seven steps to powder coating the steels. They have seven tanks to complete the powder coating, which are:

- **Decreasing Tank:** In decreasing tank, they were doing powder coating on the steel path. After finishing the powder coating the steel path was fell down in the decreasing or acid tank. In this tank temperature is about 55-60º C (degree Celsius).

- **Rinse Tank:** Then the steel path needs to drop in rinse tank which is filled with normal water. In this tank Energypac used Gardo clean 444.

- **Drastic Tank:** Then the steel path fell into the drastic tank. In this tank EnergyPac used Gardo clean 201M and 206AA.

- **Washing Tank:** After that, the steel path in fell into washing tank to wash the steel path.

- **Surface Activation Tank:** Then the steel path in fell into this surface activation tank.

- **Phosphate Tank:** Again the steel path dropped into phosphate tank. In this tank they used Gardo.
- **Dry-Off Oven Tank:** Finally, the steel path was sending in dry-off oven. The powder sprays process done by electrically in dry- off oven tank. Generally EnergyPac spray the barzer powder. The temperature of the dry-off oven must be at 180-200º C. The process takes time 13-15 minutes.

7.1 Sand Blasting Process:

In sand blasting process section we saw that, without switchgear all are liquid plant. We also saw that, there is a radiator tank where sandblasting is done. For completing sandblasting they mixed sand with air and this put at air blasting tank about 730kg. There is a nozzle in the tank. For completing the sandblasting they spray the sand by nozzle.

7.2 Coloring Assembly:

- Two types of color are used like AD zinc phosphate primer (light gray) and other is fenile (dark gray)
- Fenile is used after 12 hours later of zinc phosphate.
- T6 fenile is used for mixing
- Mixing ratio is 4:1 where 4 liters color is used for 1 gallon fenile.
- They also used epoxy primer where color is light gray and it is a curing agent of epoxy primer. For this purpose they use T7 fenile where color ratio is 2:1:2 that mean 2% color, 1% curing and 1% fenile. They use epoxy enamel after 24 hours later. Color is verge gray and curing agent for epoxy enamel. Mixing ratio is 2:1:1 where 2% color, 1% curing and 1% fenile. Also use T7 fenile.

7.3 Machine Shop

In this section we found that, EnergyPac uses different machines in machine shop, which are:

1. Lathe machine: EnergyPac use the lathe machine for following works.
    - Turning
    - Facing
    - Threat cutting
    - Hole enlarging
    - Tapping
2. Milling Machine: This machine is use for.
    - To make gear on the shaft and key way on the outside of the shaft
3. Shaper machine:
    - To make key way on the inside of the shaft
4. Chaser machine: Use for:
    - To Cutting a threat only outside and for ring type elements
5. Drill machine:
    - Only used for making a drill on the path
6. Surface grinding machine:
    - Used only for smoothing job surface

7. Power Saw machine:

- Only for cutting metal plate, shaft, rod etc.

7.4 CNC Machine

The full meaning of CNC is computer numerical control. The operating system is electrically. CNC machine has the given assembly.

- Third generation scream manufacturing and fabrication
- It has hydraulic punch and capacity is 30 ton
- All are control by CNC
- Sheet thickness can be punch 1.6 mm to 6mm
- Usable software is AP100 includes cat, cam, and programming caesural dataset.

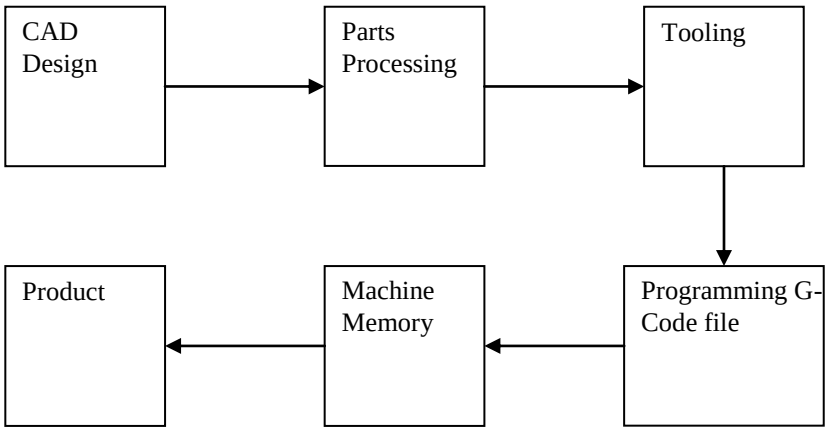


Figure 36: CNC programmed process diagram

7.5 Used Software

Common software's used are

- AP-100 Integrated CAD CAM
- FAST CAM
- SOFT SERVO etc.

Here the software used is AP-100 Integrated CAD CAM.

8. PROBLEMS AND RECOMMANDATION

8.1 Problems

During our internship, we have faced many problems that are described below

- First of our entire internship program held for very short time. Its duration only 15 days. If the internship program is little bit longer than 15 days then we could gather more practical knowledge and experience.
- In Energy Pac we could not involve of any kind of work because it is not within the policy of Energy Pac. Practical participation in different works in Energy Pac would gave us more experience.
- During our internship we could not see any kind of test in any section of the Energypac. Our supervisor just gave short information on different kinds of test. Because the tests are very risky and it is not allowed to see the test to the outsider.
- There were many things that we didn't know before going to our internship like different kinds of transformer tests. We didn't learn any protection test in our course that we were taught.
- We could take enough pictures that we were observed in the Energy Pac because it is not in the policy of Energy Pac.

8.2 Recommendations

There are some recommendations that we should propose in this report.

- East West University is a very well-known private university in Bangladesh. They should arrange internship facilities to the students. So we should not have to use our personal link to arrange our internship. It is a very concern matter that should be discuses immediately.
- The courses that offered in our curriculum should need slightly changes. In our course curriculum there is no course about transformer protection. It is very important for engineer lo learn about the protection of the transformer.

9. CONCLUSION

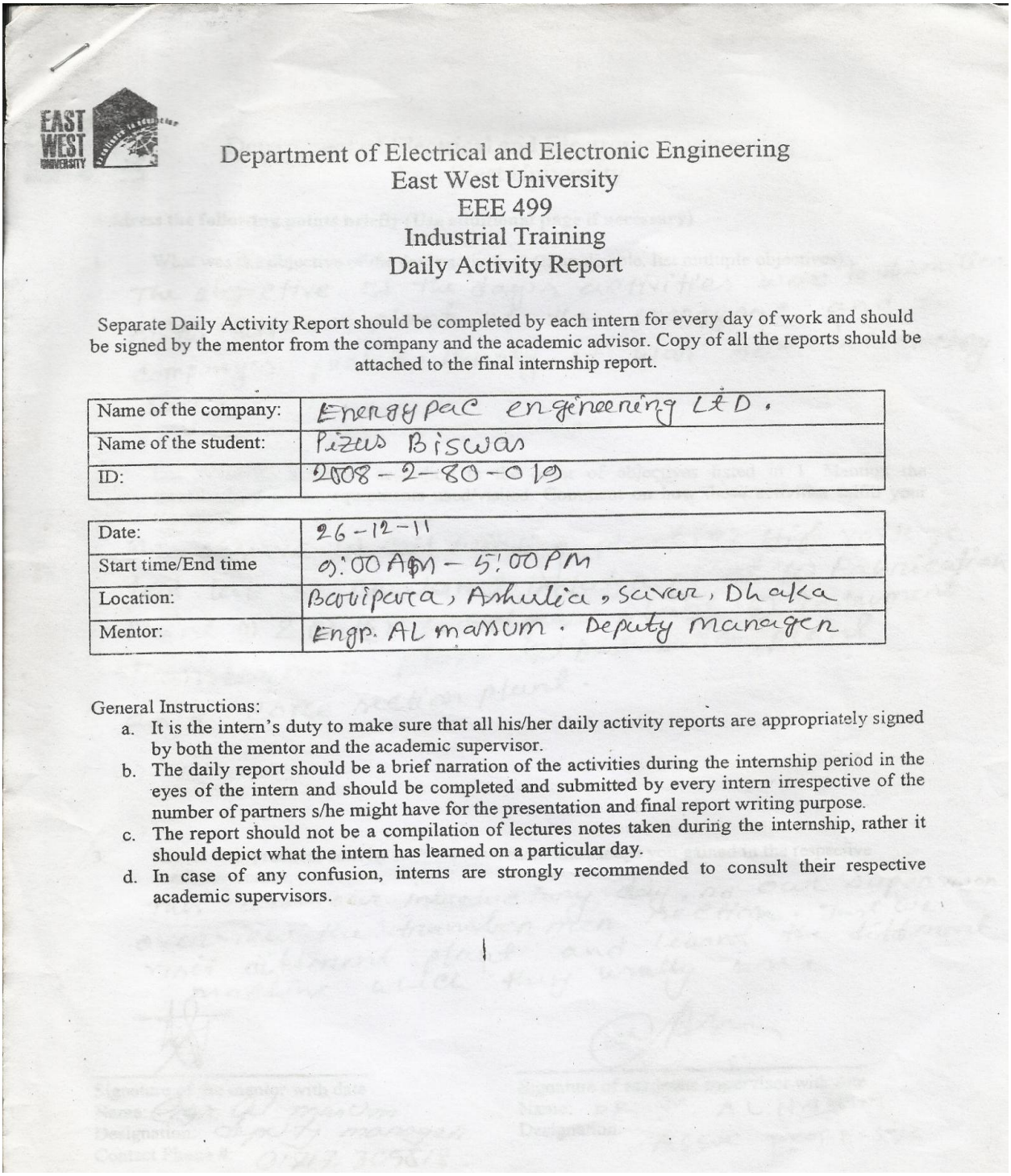
Energypac Engineering Limited plays an important role in power sector by supplying various electrical equipments in Bangladesh. It can play more effect on economic development of the country by raising the production rate with better productivity. For this reason, the inventory system of this factory should be improved. The inventory must be less as possible. So that proper production planning and forecasting should be introduced. As a result the total loss will be reduced as well as the factory can earn more profit. To increase the overall production rate and productivity more number of machine, manpower, better layout and good understanding between the worker and owner should be maintained.

We are very happy to do the industrial attachment with the Energypac Engineering Limited. This is one of the greatest industries in Bangladesh which supplies all kinds of electrical equipment used in substation and its manufacturing capacity is up to 75 MVA. Energypac is an established company and has a good reputation. Here Engineers plays greatest contribution on the production. This attachment makes strong our theoretical knowledge. Within the short time we have tried our best to acquire knowledge about the production system, production planning, safety management and inventory system of the factory. Both Engineer and supervisor in all sectors were helpful to us. We hope that the practical experience which we have gain from Energypac will effective for our future job sector. We believe that our industrial attachment with Energypac is successful.

Energypac could be regarded as the practical ground of the Electrical and Electronic Engineering Department of East West University. We consider ourselves very much lucky to have our internship program with a reputed company like Energypac. It gave us an opportunity to apply our theoretical knowledge in practice. Our achievements from EnergyPac are:

- Industrial training provided by Energypac has enriched our practical knowledge.
- It has widened our knowledge about engineering manufacturing companies of Bangladesh.
- It has increased our confidence to face interview in future.
- Energypac gave us the unique experience of observing the equipment.

APPENDIX



Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Energypac engineering Ltd.
Name of the student:	Pizus Biswas
ID:	2008-2-80-019

Date:	26-12-11
Start time/End time	09:00 AM – 5:00 PM
Location:	Bashipara, Ashulia, Savar, Dhaka
Mentor:	Engr. AL mamun. Deputy Manager

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day's activities was to familiar with different plant of the energypac and the company's probile. Mainly it was our introductory day.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

we observe (1) coil winding plant (2) High voltage test lab (3) Breaker & isolator plant (4) Fabrication Plant (1 & 2) (5) switchgear plant (6) Instrument Transformer plant (7) Distribution plant and core section plant.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

This was our introductory day, so our supervisor overview the transformer section. Just we visit different plant and learnd the different machine which they usally use.

Signature of the mentor with date
Name: Engr. Al. Mamun
Designation: Deputy manager
Contact Phone #: 01717-305818

Signature of academic supervisor with date
Name: DR M. ALHAKIM
Designation: ASSOC. PROFESSOR

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Energy Pac Engineering LTD
Name of the student:	Pizuo Biswas
ID:	2008-2-80-019

Date:	27-12-11
Start time/End time	09:00 am - 5:00 PM
Location:	Barmipara Ashulia, Savar, Dhaka
Mentor:	Engr. Asim Kumar Bhakta, Manager

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day's activities were to know about the coil core section, winding section, insulation process of the transformer. and also know physical structure of the transformer. Transformer section consists of LT/HT coil section, core section, Assembly, Lathe Section, Box section.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

Equipments :- (1) coil (electrolyte copper coil)
(2) core (silicon sheet)
(3) Insulation (crape peper for H.T & DPC paper for LT)
(4) coil winding (automatic winding machines)
(5) core cutting machines (micro tool & micro machine)
(6) vacuum pressure dying plant

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

Our theoritical knowledge was the basic of transformer OR ideal transformer. But core winding, core assembly, core cutting is not include our theoritical knowledge. But it was helpful to increase our practical knowledge. we learn core winding, core assembly, core cutting etc.

ABhakta
12-01-12

Signature of the mentor with date
Name:
Designation:
Contact Phone #:

Signature of academic supervisor with date
Name:
Designation:

Department of Electrical and Electronic Engineering
East West University
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Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Energy Pac Engineering LTD
Name of the student:	Pizus Biswas
ID:	2008-2-80-019

Date:	28-12-11
Start time/End time	09:00 AM - 5:00 PM
Location:	Baruipara Ashulia, Savar, Dhaka
Mentor:	Engr. Asim Kumar Bhakta, Manager

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
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East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The main objective of the days activities were to know the physical structure, internal connection, winding mechanism and core selection. They produce 1 KVA to 2000 KVA distribution transformer. And also know the procedure of the producing distribution transformer.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

(1) Appropriate forma of LT & HT coil
(2) core (appropriate according to design criteria)
(3) Insulation (copper strip)
(a) core cutting machine (5) making 3 phase connection
(6) According to the KVA rating, select appropriate LT forma and it connect to the LT winding m/c. Then 10 mill insulation is apply to the LT forma. The outside and inside of LT coil is almost equal. According to the design appropriate copper strip is selected. For 200 KVA or above transposition is important part for distribution transformer.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

In theoretical we learnt how to distribution transformer used in transmision line but i saw how a distribution transformer made and basic principle of design a distribution transformer.

Abhakta
02-01-12

Signature of the mentor with date
Name:
Designation:
Contact Phone #:

Signature of academic supervisor with date
Name:
Designation:

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Energypac Engineering LTD
Name of the student:	Rizvi Biswas
ID:	2008-2-80-019

Date:	29-12-11
Start time/End time	09:00 AM - 5:00 PM
Location:	Barripara Ashulia, Savar, Dhaka
Mentor:	Engr. Asim Kumar Bhakta, Manager

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the days activities were power transformer internal and physical structure of the transformer. Now They produce 75 MVA power transformer and the future target is 100 MVA power transformer. Also know the LT & HT coil of power transformer and winding mechanism ~~of power transformer~~ & Insulation type of power transformer

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

Equipment:- (1) core
(2) coil (LT & HT)
(3) winding mechine
(4) core cutting mechine
(5) Insulation
(6) vaccum pressure dying chamber

Test: (1) routine test
(2) Type test

physical ~~structure~~ structure/equipment
(1) conservator
(2) Driving box
(3) marking box (OTI, WTI)
(4) breather box (silica gel)
(5) Buchholz relay
(6) Radiator (cooling purpose)
(7) HT & LT bushing

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

Theoretical knowledge and practical knowledge in different but similar. power transformer protection are similar to our theoretical knowledge.

ABhatta
02-01-12

Signature of the mentor with date
Name:
Designation:
Contact Phone #:

Signature of academic supervisor with date
Name:
Designation:

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Energypac engineering LTD
Name of the student:	Rizu Biswas
ID:	2008-2-80-019

Date:	31-12-11
Start time/End time	09:00 AM – 5:00 PM
Location:	Barmipara, Ashulia, Savar, Dhaka
Mentor:	Engr. Asim Kumar Bhakta, manager

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
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Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objectives of the day's activities were high voltage testing lab. In this lab transformer routine test and transformer type test are performed. There are nine routine test and three type test.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

Equipments:- (1) Switchgear (LTZHT)
(2) PFI
(3) compensator
(4) Implux generator
(5) High voltage machine
(6) voltage Divider
(7) Single phase transformer
(8) Chopper

Type test:- (1) Implus test
(2) Lighting test
(3) Meggartest.

routine test
(1) No load test
(2) Full load test
(3) High voltage test
(4) Double voltage double frequency test
(5) Insulation resistence test
(6) winding resistence test
(7) Dielectric test
(8) On load tap changer
(9) winding test.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

Type test and routine test was similar to our theoretical knowledge. We compare practical knowledge and theoretical knowledge but some testing equipment was not familiar.

Ashakta
02-01-12

Signature of the mentor with date
Name:
Designation:
Contact Phone #:

Signature of academic supervisor with date
Name:
Designation:

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Energy Pac Engineering Ltd.
Name of the student:	Mashiur Rahman.
ID:	2008-1-80-048.

Date:	01-01-2012
Start time/End time	9.00 a.m – 5.00 P.m.
Location:	Barcilpara, Ashulia, Savar, Dhaka.
Mentor:	Engr. Syed Muztaba Ali, DGM.

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
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d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

In this day we learn about the LT switchgear and the power factor improvement (PFI).

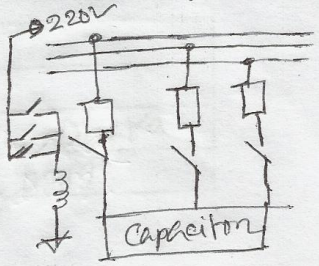
2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

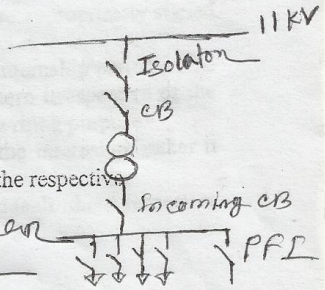
PFI instrument

1) Bus bar
2) Fuse
3) Magnetic contact (MC)
4) Auxilary contact (AC)
5) NO & NC contact
6) CT & capacitor.

LT switchgear instrument

1) Bus bar
2) Isolator
3) Circuit Breaker (CB)
4) Incoming CB.
5) PFI
6) Transformer.





3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

Theoretically we only know about LT switchgear and PFI. but practically we gained vast of knowledge about PFI & LT switchgear and construction procedure.

Signature of the mentor with date
Name: Mahbub
Designation: Dy. Manager
Contact Phone #: 01712231139

29.1.12

Signature of academic supervisor with date
Name: MOHAMMAD ZAKIR ALAM
Designation: LECTURER

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

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Name of the company:	Energy Pac Engineering Ltd.
Name of the student:	Mashiur Rahman.
ID:	2008-1-80-048

Date:	02-01-2012
Start time/End time	9.00 a.m. - 5.00 p.m.
Location:	Switchgear Plant
Mentor:	Engr. Syed Murtaba Ali, DGM

General Instructions:

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Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

Today we know about the working process and internal process on structure about the vaccum circuit breaken (VCB).

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

The vaccum circuit breaken are used for protection of earth fault and over current fault.

There are two kinds of VCB's —

1) Trip coil / OFF coil — 110V DC

2) close coil / ON coil — 110V DC

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

Theoretical knowledge and practical knowledge are almost same.

Signature of the mentor with date
Name:
Designation:
Contact Phone #:

29.1.12

Signature of academic supervisor with date
Name: MOHAMMAD ZARIF ALAM
Designation: LECTURER

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Energy Pac Engineering Ltd.
Name of the student:	Mashiur Rahman
ID:	2008-1-80-048

Date:	03-01-2012
Start time/End time	9.00 a.m – 5.00 P.m.
Location:	Switchgear Plant
Mentor:	Engr. Syed Murtaba Ali, DGM

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day's activities was to learn about the protection of transformer line such as 33KV Transformer panel and 33KV incoming panel and bus coupler.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

33 KV incoming panel used for maintaince and control incoming line.
Bus coupler used for changing line bay panel to one line to another.
33KV x-former panel used for maintaince the line.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

Here, I just know about the 33KV incoming panel and bus coupler that are almost similar to the theoretical knowledge.

Signature of the mentor with date
Name: Mahbub
Designation:
Contact Phone #:

Signature of academic supervisor with date
Name: MOHAMMAD TARIK AZAM
Designation: LECTURER

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

me objective of the day's activities was to learn about the protection of transformer line such as 33KV Transformer panel and 33KV incoming panel and bus coupler.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

33 KV incoming panel used for maintaince and control incoming line.
Bus coupler used for changing line bay panel to one line to another.
33KV x-former panel used for maintaince the line.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

more, we just know about the 33KV incoming panel and bus coupler that are almost similar to the theoretical knowledge.

Signature of the mentor with date
Name: Mahbub
Designation:
Contact Phone #:

Signature of academic supervisor with date
Name: MOHAMMAD ZAKIR HOSSAIN
Designation: LECTURER

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Energy Pac Engineering Ltd.
Name of the student:	Mahium Rahman.
ID:	2008-1-80-048

Date:	04-01-2012
Start time/End time	9.00 a.m – 5.00 p.m.
Location:	Switchgear Plant
Mentor:	Engr. Syed Murtaba Ali, DGM

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day's activities was to learn about the transformer relay and different kinds of load break switch and their operation.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

Load break switch:- for protection purpose it is used and it has a fuse. when the fuse cut the higher touch of the contact and trip the breaker. It is used for low voltage.
Transformer Relay:- It is also used for protection and how it sense the abnormal condition of transformer. and it contains test terminal block, O/C → B/F Relay, differential relay, Trip Relay, earth switch.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

Through theoretical knowledge we can easily knowing about the load break switch and Relay of the x-former practically.

Signature of the mentor with date
Name:
Designation:
Contact Phone #:

29.1.12
Signature of academic supervisor with date
Name: MOHAMMAD ZAKER ALAM
Designation: LECTURER

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Energy pac Engineering LTD
Name of the student:	MD. ZUNAYED AKRAM
ID:	2008-2-80-046

Date:	05-01-12
Start time/End time	09:00 A.M -
Location:	Instrument Transformer plant
Mentor:	Eng. Mozahorul Islam, DGM

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
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East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable, list multiple objectives)

The objective of the day's activity was to introduce with the instrument transformer - ① current transformer and ② voltage transformer. We learned its building material and process of current transformer (CT)

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

CT - making process

① Core winding
② Core insulation
③ Coil winding
④ Raw - coil test
⑤ Insulation
⑥ Polarity test
⑦ ZALAR test
⑧ Taping
⑨ Oil filling
⑩ Gas pouring

* Raw - coil test is used for checking the coil turn for correcting the

These are two types of test for CT
① Routine test
② Advance test

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

In theoretical I did not learned more about instrument transformer, I just learned when

05/01/2012

Signature of the mentor with date
Name:
Designation:
Contact Phone #:

29.1.12

Signature of academic supervisor with date
Name: MOHAMMAD ZAKIR ACAM
Designation: LECTURER

Ans to the Q no 2

turn ratio for accuracy and reduce the error (≈0.1%).

Comment:

Today I learned more details about instrument Transformer, its design, making and test.

Ans to the Q no. 3

and how current and voltage transformer is used But today I similar with many new terms like polarity test, oil filling, tanking, ZALAR test.

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Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Energypac Engineering LTD.
Name of the student:	MD. ZUNAYED AKRAM
ID:	2008-2-80-046

Date:	02-01-12
Start time/End time	~~0-3~~ 9.50 AM -
Location:	Instrument Transformer plant
Mentor:	Engr. Mozaharul Islam, DGM

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day's activity was to know about the potential transformer (PT), its making process.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

process:
(i) core cutting
(ii) Coil winding
(iii) core assembly
(iv) Insulation
(v) ZADAR
(vi) Tanking
(vii) Oil filling
(viii) Gas pouring

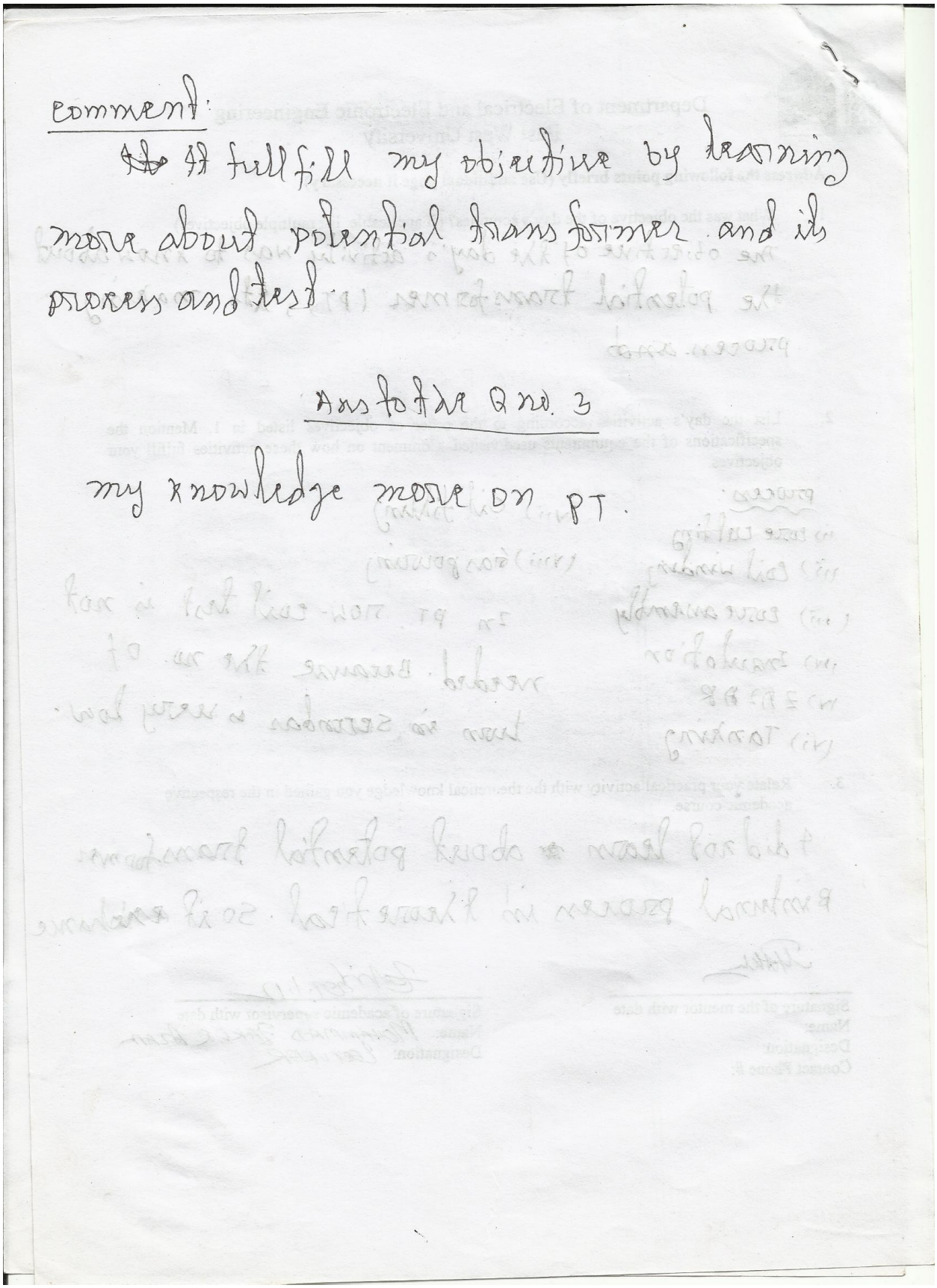
In PT, flow-coil test is not needed. Because the no. of turn in secondar is very low.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

I did not learn about potential transformer internal process in theoretical. So it enhance

Signature of the mentor with date
Name:
Designation:
Contact Phone #:

Signature of academic supervisor with date
Name: MOHAMMAD ZAKER KHAN
Designation: LECTURER



comment:

It fullfill my objective by learning more about potential transformer and its process and test.

Ans to the Q no. 3

my knowledge more on PT.

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Name of the company:	Energypac Engineering LTD.
Name of the student:	MD. ZUNAYED AKRAM
ID:	2008-2-80-046

Date:	08-01-12
Start time/End time	9.50 AM.
Location:	Instrument Transformer plant
Mentor:	Engr. Mozahasul Islam, DGM

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures/notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day's activities was to know about the routine test of current and potential transformer.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

Routine test

(i) verification of terminal marking.
(ii) polarity test
(iii) Inter-turn over voltage test
(iv) Insulation level test
(v) Partial discharge measurement
(vi) Accuracy test of errors (ratio, phase)

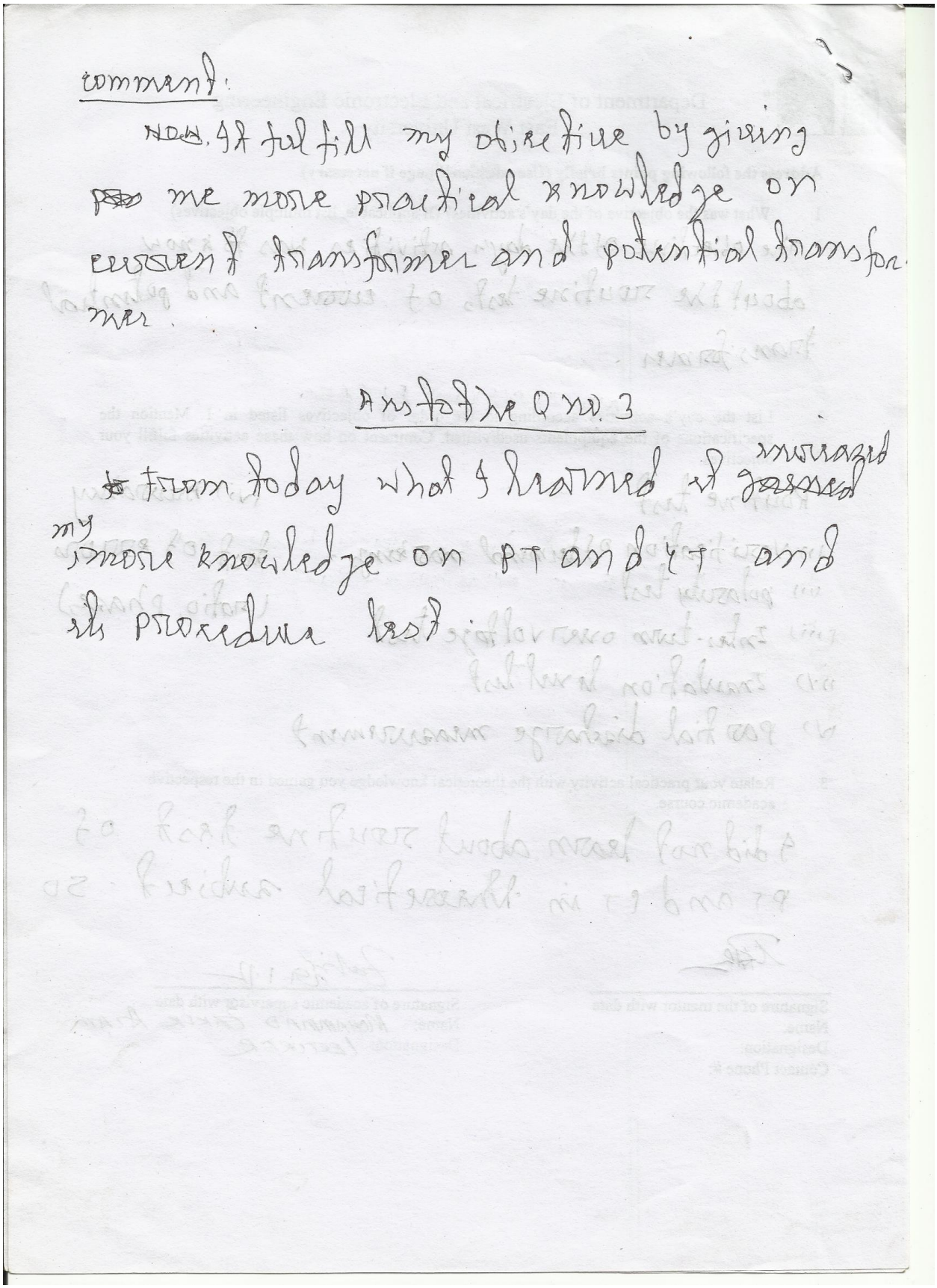
3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

I did not learn about routine test of PT and CT in theoretical subject. So

Signature of the mentor with date
Name:
Designation:
Contact Phone #:

9.1.12

Signature of academic supervisor with date
Name: MOHAMMAD ZAKIR ALAM
Designation: LECTURER



comment:

Now, it fulfill my objective by giving me more practical knowledge on current transformer and potential transformer.

Ans of the Q no. 3

From today what I learned it increased my more knowledge on PT and CT and its procedure test.

Department of Electrical and Electronic Engineering
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Name of the company:	Energypac Engineering LTD.
Name of the student:	MD. ZUNAYED AKRAM
ID:	2008-2-80-046

Date:	09-01-12
Start time/End time	9.50 A.M
Location:	Isolator & Switch plant
Mentor:	Engr. Moniruzzaman, Manager

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day's activities was to know about switch and isolator. We learnt different types of isolator and its construction. Also we learnt about different types of routine test

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

Material for Isolator:
(i) copper bus bar
(ii) Insulator
(iii) mild steel posts
(iv) Fasteners
(v) casting material

kinds of isolator
(i) Single blade
(ii) double blade
(iii) Central blade

(iii) power frequency voltage withstand test
(iv) Mechanical operation test
(v) Temperature rise test

Routine test
(i) Insulation test
(ii) contact-resistance test

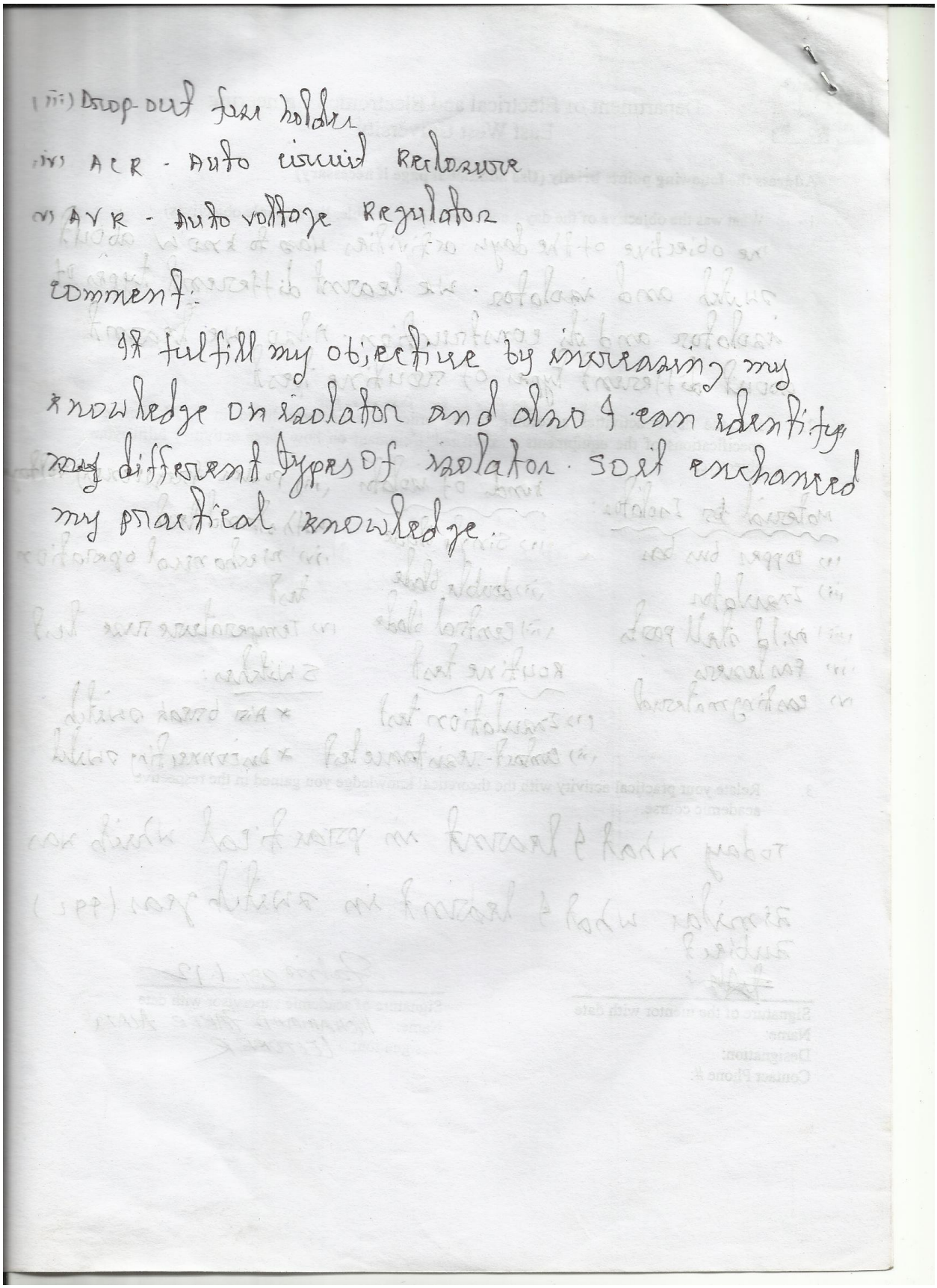
Switches:
* Air break switch
* Disconnecting switch

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

Today what I learnt in practical which was similar what I learnt in switch gear (EEE) subject.

Signature of the mentor with date
Name:
Designation:
Contact Phone #:

Fakir 29.1.12
Signature of academic supervisor with date
Name: MOHAMMAD FAKIR ALAM
Designation: LECTURER



(iii) Drop-out fuse holder
(iv) ACR - Auto circuit Reclosure
(v) AVR - Auto voltage Regulator

comment:

I fulfill my objective by increasing my knowledge on isolator and also I can identify different types of isolator. So it enchanced my practical knowledge.

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Name of the company:	Energypac Engineering LTD
Name of the student:	MD. ZUNAYED AKRAM
ID:	2008-2-80-046

Date:	10-01-12
Start time/End time	9.00 AM
Location:	Switch gear plant
Mentor:	Engr. Monirruzzaman, Manager

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day's activities was to * learn about the construction and working process of 11kV and 33kV vacuum circuit interrupter.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

Routine test
* Insurance test
* contact-resistance test
* Megger test
* High voltage test
* Analyzing on timing test

Indoor - 11kV (V&B)
Outdoor - 33kV (V&B)

~~working process~~
construction
ii). housing
iii) shaft (operating)
iiii) spring operated (3 kinds)

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

What I learnt today which is similar that I learnt in theory.

Tawhid 10.01.2012
Signature of the mentor with date
Name:
Designation:
Contact Phone #:

10.1.12
Signature of academic supervisor with date
Name: MOHAMMAD ZAKIR ALAM
Designation: LECTURER

(a) closing spring (on)
(b) off spring (off)
(c) contact spring
(iv) Limit switch for off the motor.
(v) Limit switch for safety
(vi) fixed contact
(vii) Moveable contact [flexible copper]
(viii) Vacuum ~~voltage~~ interrupter.
(ix) Jaw connector.
(x) Epoxy resin
(xi) Electrically on/off switch
(xii) Manually on/off switch
(xiii) Trip coil
(xiv) Motor

comment:
It fulfill my objective by enchanced my practical knowledge.

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Name of the company:	Energy Pac Engineering Ltd.
Name of the student:	Mashiur Rahman
ID:	2008-1-80-048

Date:	11-01-2012
Start time/End time	9.00 a.m - 5.00 p.m.
Location:	fabrication, CNC, powder coating & paint
Mentor:	Mr. N.M. Habibullah, Dy. Manager

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day's activities was to know about the computer numerical control (CNC), fabrication, powder coating and paint section.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

In CNC section, they are using AP-100 software and CAT, CAM software. The machine are used in CNC is the CNC turrient punch machine.

In fabrication plant there are several machine for cutting.

In powder coating, surface activation tank, phosphating tank, chemical reaction, Dry off oven, powder coating, curing oven.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

We gain much better knowledge than theoretical knowledge about CNC, Fabrication, powder coating and paint. All of these things are used for making of transformer.

11.1.2012

Signature of the mentor with date
Name: N.M. Habibullah
Designation: Deputy Manager (CNC)
Contact Phone #: Easternmac Engineering Ltd. Savar-Dhaka.

09.1.12

Signature of academic supervisor with date
Name: MOHAMMAD ZAKIR HOSSAIN
Designation: LECTURER

References

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