

NAME: ERIC MUINDE MULWA REG NO: E021-01-0694/2019 .



DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY

STUDENTS' EXTERNAL ATTACHMENT REPORT



RELCON POWER SYSTEMS LIMITED

316 UPPERHILL CHAMBERS TOWER SITE,

UPPERHILL, SECOND NGONG AVENUE, NAIROBI

P.O BOX 38744, NAIROBI

OFFICIAL STAMP: **DATE:**

STUDENT'S PARTICULARS

Name of student: **ERIC MUINDE MULWA**Registration No. of the student: **E021-01-0694/2019**Department: **ELECTRICAL AND ELECTRONICS ENGINEERING**Course of study: **BSC ELECTRICAL AND ELECTRONICS ENGINEERING**Year of study: **YEAR THREE SEMESTER THREE**Company Attached: **RELCON POWER SYSTEMS LIMITED**Station Attached: **316 UPPERHILL CHAMBERS TOWER SITE**Company Address: **P.O BOX 38744, NAIROBI**Directions to the Attachment: **RELCON SITE THEN LOCATED AT 2ND NGONG****AVENUE UPPERHILL, NAIROBI**Name of Company Supervisor: **MR. WESLEY CHEPKWONY**Cell Phone of Company Supervisor: **+254714332331**Duration: From: To:

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Official rubber stamp: { }

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**An Industrial attachment training report submitted in partial fulfillment of the
requirements for the degree of Bachelor of Science in Electrical and Electronics**

Engineering of Dedan Kimathi University of Technology.

DECLARATION

I, ERIC MUINDE MULWA, do hereby declare to the best of my knowledge that this attachment report is my original work done at RELCON POWER SYSTEMS LIMITED site located at 2ND NGONG AVENUE UPPERHILL, NAIROBI. This report is prepared with no other than the indicated sources and support and has not been presented in any University or institution for a degree or any other reward.

SIGNED: **DATE:**

NAME: ERIC MUINDE MULWA **REG NO:** E021-01-0694/2019

SUPERVISOR

SIGNED: **DATE:**

NAME: WESLEY CHEPKWONY

ACKNOWLEDGEMENT

First of all, I would like to thank Almighty God for His blessings and for granting me charitable time, strength, aptitude and protection to magnificently complete my attachment at RELCON POWER SYSTEMS LIMITED. I could have done nothing if it wasn't for His will power. I would like to express my heart-felt gratitude to.

1. My family for their moral and financial support every time I needed it throughout the attachment period. All the token of encouragement kept me focused. May God`s blessings be upon you.
2. My supervisor and the site Foreman, Mr. WESLEY CHEPKWONY and all other Electrical Technicians for their guidance, support and selfless utilization of their time and resources in guiding me to the best of their knowledge to be a bright and well equipped Electrical and Electronics Engineer in the field of Single and Three-phase Electrical Installation. May God bless you so much and stir you up to the next level of greatness.
3. My fellow course mates, TOM MUTUA and ANDREW KAPORA attached together at 316 CHAMBERS 2ND NGONG AVENUE UPPERHILL, NAIROBI. I greatly thank you for the team work and words of encouragement. In deed we learned a lot together.

I also thank senior human resource & admin officer Mr. ABDUL and RELCON POWER SYSTEMS LIMITED company for granting me the chance to be attached at the company, I really appreciate.

More appreciations go to my Institution supervisor and the Attachment Coordinator MR. EDWIN KIMANI for his guidance and assessment during the attachment period.

DEDICATION

I wish to dedicate this work to:

- ✓ All men and women of every land, who are not afraid of themselves, who trust so much in their own souls that they dare to stand up in the might of their own individuality to meet the tidal currents of the world.
- ✓ To Grandma, for having so much faith in who I was and who I will ever be.

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ATTACHMENT WORKING SCHEDULE

DAY	DATE	WEEK	ACTIVITY
Monday to	21/02	1	PIPING
Saturday	26/02		
Monday to	28/02	2	PIPING
Saturday	05/03		
Monday to	07/03	3	PIPING
Saturday	12/03		
Monday to	14/03	4	CABLE TRAYS INSTALLATION
Saturday	19/03		
Monday to	21/03	5	SURFACE TRUNKING INSTALLATION
Saturday	26/03		
Monday to	28/03	6	SURFACE TRUNKING INSTALLATION
Saturday	02/04		
Monday to	04/04	7	POWER CIRCUITS & CABLES INSTALLATION
Saturday	09/04		
Monday to	11/04	8	POWER CIRCUITS & CABLES INSTALLATION
Saturday	16/04		
Monday to	18/04	9	LIGHTING & CABLES INSTALLATION
Saturday	23/04		
Monday to	25/04	10	LIGHTING & CABLES INSTALLATION
Saturday	30/04		
Monday to	02/05	11	FINISHING
Saturday	07/05		
Monday to Sat	09/05 – 14/05	12	FINISHING

INTRODUCTION

Industrial Attachment was introduced to inspire the students with practical and technical skills, as a partial fulfillment for the award of a Certificate, Diploma or a Degree and to introduce the students into working life. The training time allows the students to link the theoretical principles learnt in higher learning institutions and the real life professional and technical application. It gives the students the practical skills and the work environment philosophy, to use their skills and principles learned in class to serve the institutions and the society in general. Due to the above reasons, Dedan Kimathi University of Technology has organized 12 weeks of training in any institution of students' choice to give every student an opportunity to apply the skills and knowledge achieved during the course of study and to acquire new skills in managing relationship and carrying out the jobs assigned. This is the reason why I joined RELCON POWER SYSTEMS LTD to be trained in order to get practical skills and cut a niche for myself in the field of Electrical Installation.

PURPOSE

The industrial attachment program is a partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronics Engineering of Dedan Kimathi University of Technology. This report therefore provides a summary of the activities and duties carried out, as well as experience gained during the attachment period.

ABOUT THE COMPANY

Relcon Power Systems is owned and operated by Kenyans from Nairobi and Mombasa. The company is situated on Kolobot Road, off Forest Road in Nairobi where its Head office is located comfortably in their own premises. And in Mombasa, their branch office is spaciouly located in Vish Tower on Machakos Road. The Company was registered in April 1991 and since then it has fully participated in the electrical engineering industry in Kenya and also in the neighboring countries. The purpose of the company as the name suggests is to give reliable and quick power systems to clients while extending professional advice on electrical systems and assistance to them. The philosophy of the company is quality service to all customers at affordable and competitive rates. The company has Guardian Bank and CFC banks as their main Bankers and the qualified and certified auditor company that used by the company is Devani-Devani & Company of Mombasa.

DIRECTORS OF THE COMPANY

C.SHAH (Chairman) M.I.E.E.E, A.I.E.E.I.E.

As the Chairman of Relcon Power Systems Ltd. and Vish-electric, he guides both the companies with his expert knowledge and over 40 years of experience in power and lighting management makes him the invaluable asset of the group of companies. He is in charge of tendering, office management, banking and executive matters of the company.

Mr. Mahesh Shah (Director) B.Eng. Honors

Having honors degree in Electrical and Electronics Engineering from Sunderland, U.K., Mr. Mahesh Shah is the director and operator of Relcon Power Systems with over 23 years of experience in handling all kinds of electrical installations and design works.

The above-mentioned directors are Class “A” licensed Electricians.

Mr. Paresh Shah (Director) M.B.A.

Successfully running Vish-electric Limited for more than 20 years, providing Kenya and neighboring countries with the best light fittings available in the market with having international affiliations from Europe and Asia. He also furnishes his expert advice on administration and sales to their directors and thus helping in making executive decisions.

About Relcon

The purpose of the company as the name suggests is to give reliable and quick power systems to clients while extending professional advice on electrical systems and assistance to them.

Talk to them

Do you have a question about their services or any enquiry? Their team is ready for you.

Address: Kolobot Road, off Wangari Mathai Road

Call: 0703647573 / 0712539527 / 0777813965

Email: info@relconpowersystems.com

Their Affiliate

VISH ELECTRIC imports from most parts of Europe and Asia their own various types of light fittings for every type of installations.

CHAPTER 1:

ELECTRICAL PIPING

First, $25mm^2$ and $38mm^2$ PVC conduits were laid for the power supply in the Executive Office, Office 1, 2 and 3, Library and the Boardroom. The conduits went through walls while others were passed under the floor to supply power to the floor boxes. The work was then completed after laying the power supply conduits in the Waiting Area, Printing Station, Meeting Room and the Reception Office. A $20mm^2$ PVC conduit was laid for the lighting in the Executive Office, Offices 1, 2 and 3, Library and the Boardroom. The conduits were mounted on above the ceiling using saddles, wall plugs and wood screws. The lighting schedule was completed after laying $20mm^2$ PVC conduits in the Waiting Area, Printing Station, Reception Office and the Meeting Room.

All the switch PVC conduits were terminated with socket boxes for holding the switch outlet plates and also the power supply conduits with socket boxes for holding the socket outlets. The lighting circuit PVC conduits were connected to the Distribution Board for power supply sourcing. The Live, Neutral and the Earth cables would supply power to the respective destinations according to the piping layout via these conduits. The final connection was made for power supply circuit in each and every office to the main Three-phase Distribution Board.

The WIFI Router $25mm^2$ PVC conduit was laid from the Server Room to the Executive Office, Boardroom through the Meeting Room to the Reception Office WIFI Router location. The Smoke Detectors PVC conduits were also laid from the Reception Office through the Printing Station to the Executive Office. A $25mm^2$ PVC conduit was laid for the Heat Detector in the

Break Out Area. The Speakers 25mm² PVC conduits were also laid in the Boardroom, Printing Station and along the corridor running from the Library via Office 3 to the Executive Office.

The PVC conduits measured 13 feet long and occasionally had to be joined together using Couplers and PVC joining glue. On encounter with corners, the Elbow bend would be used especially with the 38mm² PVC conduit. For smooth floor finish, the conduits were held down using Binding wires and steel nails. The conduits were bend using Spring benders and this was specifically for 20mm² and 25mm² PVC conduits.

SOME SITE PICTURES



CHAPTER 2:

CABLE TRAYS INSTALLATION

The process involved drilling 50mm deep pairs of holes on the upper slab for holding Rawl Bolts. The Rawl Bolts would be hammered into the holes and then unfastened from them leaving the Nut and the casing for holding the threaded metal rods. The threaded metal rods would be cut in a way that they would not protrude below the ceiling board. The Cable tray work started in the Reception Office to the Printing station. The drilled pairs holes were normally 1m apart and 30mm between each hole to the paired one. Threaded metal rods would be fastened on these pairs of holes and fastened together as a pair using metal brackets. The created holder would then hold the cable tray after it is placed on the bracket. These holes were drilled using a drilling machine running on M12 drilling bit.

Cable trays started from the extreme end of the Reception Office going through the corridor to the printing station. Another tray formed a T-joint with the main cable tray coming from the reception area and diverted towards the Meeting Room. This first T-joint was exactly at the second Exit sign position according to the Power and Data layout. The cable tray then continued from the Printing Station to the third Exit sign position where it formed another T-joint with the cable tray running from the Library towards the Server Room. There was another T-joint formed near the server Room by another cable tray which approached from the far end of Office 3 running direct to the Server Room. This cable tray formed another T-joint with the cable tray running from the Library towards the Server Room.

The cable trays measured 12.6 feet long and 300mm wide. Occasionally, two cable trays would be joined together along a long path using cable tray Connectors and Roofing Nuts and Bolts.

The connectors were designed in such a manner that they would perfectly fit in the sideways of the cable trays and align the bolt holes. The bolts would then be placed and fasten the cable trays together using a pair of Pliers.

On the T-joint, the skilled Technicians would direct on the way forward. Mostly a cable tray would be measured and the position of the joint identified and then the side would be cut out according to the width of the cable tray using a sharp cutting disc fixed on a grinder. The cable tray would then be raised and fixed together normally with the other cable tray and then fastened together with connectors and leveled using brackets. A particular interesting scenario happened with the cable tray diverting from the reception towards the Meeting Room. It happened that the water pipes messed its level with the other cable tray running from the Reception Office towards the Third Exit sign light point. The two cable trays had a level difference of 90mm. The solution to this traumatizing event was to cut the cable tray on top in such a way that a grade of a particular degree would be introduced for the cable tray to be able to fit with the other cable tray and allow cables to pass through without strain.

SOME SITE PICTURES ON CABLE TRAYS



CHAPTER 3:

SURFACE TRUNKING

The Surface Trunking installation operation took its course on week 5 and followed the outline according to the Power and Data layout. The installation work started on the extreme end of the library where we installed one and half trunks. The process involved the utilization of the atmospheric pressure levelling technique by using a horse pipe filled with water in order to achieve a good leveled trunking system. The Horse Pipe would be held by two people in such a way that the water level meniscus on each end stops shifting. A marked point using a tape measure was used as the reference point for a starting trunking system. After marking the points, a trunk would be picked and the initial holes marked on the trunks for passing Roofing Nuts marked against the wall and in the event the points coincided with the main concrete wall, drilling would be carried out using the M8 drilling bit. After drilling the marked holes on the concrete wall, Wall Plugs would be forcefully pushed into them to support the wood screw which would be used to fasten the trunk. For the points that happened to coincide with the gypsum walls, the position of the Aluminum bars supporting the wall would be identified and then the already marked points on the trunk would be ignored and new holes drilled so that they coincide with the gypsum wall supporting Aluminum bars. The trunks would then be fitted on the identified positions with the help of a spirit level. The trunks were joined together using surface trunking Connectors and Roofing Nuts to fasten the connectors against the inside sides of the joining trunks. The connectors were inserted on the inside extreme compartments. The connector on the bottom would be regularly fastened together with Earthling clips to ensure continuity of the earthing line along the trunking system. The trunks were made of steel with three compartments. They measured 200mm by 50mm and had a clip-on powder coating.

SOME SITE PICTURES ON SURFACE TRUNKING



CHAPTER 4:

POWER LAYOUT AND CABLES INSTALLATION

Power Layout Circuits and Cables Installation venture on the 7th week of the attachment period.

The installation work started by first supplying the Library – Executive office surface Trunking with power via the underfloor concealed PVC conduits. The PVC conduits were three in number measuring $25mm^2$ which were initially laid during piping work. 3 *by* $2.5mm^2$ cables were drawn through the conduits from Reception Office to the Middle Office where they were terminated inside the trunking system along the wall. These three conduits tapped power from the main Three-phase Distribution Board and fed the Trunking system at different locations. This move ensured that in case one of the conduits grew faulty, it would not affect all the power points along the trunking system.

The cables were pulled through the PVC conduits using Steel tape and draw wires. After the cables reached the Middle Office trunking line, 3 *by* $2.5mm^2$ cables from the conduits were directed towards the Library through the trunks on the top compartment. Along that trunking line there were only five power socket outlets and the cables had to be looped at each of the points. At Office 2, a diversion was made using underfloor PVC conduits which supplied power to the floor box in the middle part of the Office where a Desktop provision would be made. This was completed by passing new cables (3 *by* $2.5mm^2$), Live, Neutral and Earth cables from the 300 *by* 250 *by* 75 mm deep floor box point through the $25mm^2$ PVC conduit to the Surface Trunking and specifically on the punched socket outlet trunking plate.

The final conduit supply 3 *by* $2.5mm^2$ cables running direct from the main Three-phase Distribution Board were directed towards the Executive Office via Office 3. Along this path

there were exactly 13 twin socket outlets and all had to be fed by these cables. The 3 by 2.5mm^2 cables were passed through the top compartment of the surface trunking while occasionally getting looped at each and every point a socket outlet point was encountered until the end of the trunking line. The task was also accompanied by ICT and Data cables specialists installing CAT 6 Giga net cables on the lower compartment of the surface trunking system. They also looped the Giga net cables at each and every point they encountered a punched outlet plate for data. Unlike the power socket outlet plates, the data outlet plates had single outlet while the power sockets plates had double or twin outlets.

The TV power access point was also supplied with clean power in the Executive Office and a Coaxial cable measuring 60m per point was used from the Server Room. The power twin socket outlet for the TV was located was located in the middle of the Gypsum wall partitioning Office 3 and the Executive Office. Some late adjustments on the data and power layout diagram were made and provided for new trunking points along the Gypsum wall partitioning Office 2 and Middle Office and another at the Middle Office and Office 3. The new adjustments had to be implemented with immediate effect. The process did not take long though and soon cables were installed and linked to the main trunking system for power tapping. The two trunking lines had 2 twin socket outlet plates accompanied by other 2 single Data/Telephone outlet plates. The middle compartment of the trunking system was used to pass the Audio/Video high grade cable for speakers towards the Server Room.

SOME SITE PICTURES ON POWER LAYOUT AND CABLES INSTALLATION



CHAPTER 5:

LIGHTING LAYOUT AND CABLES INSTALLATION

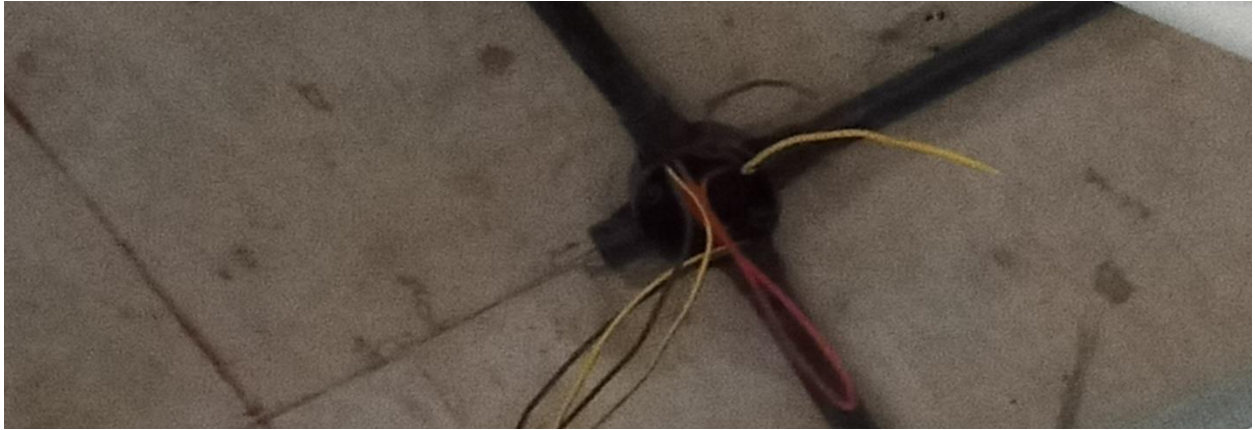
The scheduled task for the week was the to install lighting circuits cables and terminating them.

The lights were supplied with 3 *by* $1.5mm^2$ SC – PVC – CU cables according to the Electrical installation regulations.

Some of the installation made include:

- TV coaxial outlet plate complete with coaxial cable measuring 60m per point.
- PAVA outlet points complete with draw wires
- CCTV outlet points complete with draw wires
- Final fire Alarm circuit from the Directional Alarm Panel in a cable conduit comprising of concealed PVC conduit, 2 – Core red $1.5mm^2$ Pirelli FP 200 Gold Fire Resistant cables to BS 5339 – 1: 2002 from the Reception to all Smoke Detectors points.
- Power Supply cables termination at the Main Three-Phase Distribution Board.
- 3 *by* $1.5mm^2$ SC – PVC – CU cables through a $20mm^2$ concealed Hg PVC conduit to the round boxes for lights.
- Terminated the all the cables at the lighting points and sensors.
- 2 gang 1 way switching points in all offices.
- 4 *by* $1.5mm^2$ SC – PVC – CU Red cables for a 3 Gang 1-way switch according to the Lighting layout.
- 1 way 1 gang switching points with 2 *by* $1.5mm^2$ SC – PVC – CU for light switches according to the Lighting layout.

SOME SITE PICTURES ON LIGHTING LAYOUT AND CABLES INSTALLATION



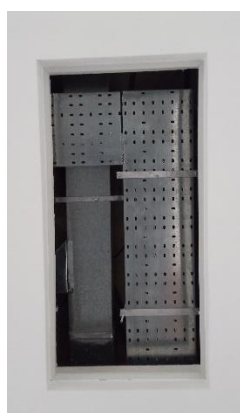
CHAPTER 6:

BULBS, FLOOR BOXES & SOCKET INSTALLATION

The finishing of the 7th floor involved the installation of:

- 13A twin socket outlets for all the points along the concrete walls, Gypsum walls and the Surface Trunking system.
- 240/50 Hz 1000 Watts rated 360° ceiling mounted Passive Infrared Occupancy Sensor with a circular detection zone coverage of 6m and a maximum of 8m, time lag range of 5 seconds to 15 minutes and a selectable manual override switch according to the Lighting Layout.
- Different types of Downlighter, Pendant lights, Snake lights, Chandeliers and 600mm by 600 mm Recessed LED Panel Lights according to the Lighting Layout.
- Switch Outlets according to the Lighting Layout.
- Ultra-Slim White Aluminum Bodied non-maintained LED EXIT sign Lights with engraved flame-retardant acrylic sign blade for suspended use.
- Installed and tested Final Fire Alarm circuit from detection and Alarm Panel.
- Installed 1 Loop Addressable Fire Alarm Panel complete with emergency Batteries.

SOME SITE PICTURES ON BULBS, FLOOR BOXES & SOCKETS INSTALLATION





PROBLEMS ENCOUNTERED

Some of the problems encountered at the site include;

- Late delivery of site materials due to traffic jam which prolonged scheduled work.
- Ongoing site drawings corrections which added new components and removed already installed components.
- Rainy weather and Traffic jam along Jogoo road which made it difficult to start site work in the scheduled time.
- Rushed work due to ceiling carpenters covering the top before we could install all conduits and round boxes and also dropping flex cables for mounting lights.
- Shortage of enough technicians in the beginning of the site which prolonged working hours.

CONCLUSION

Having completed my 12 weeks industrial attachment at RELCON POWER SYSTEMS LIMITED, I have gained a lot of skills and experiences that will enable me work effectively as far as Electrical Installation is concerned. The skills I gained were through learning and training daily under the directives of my supervisor and other Technicians who guided me through the attachment period as well as my self-drive and my curiosity to learn more.

I am therefore confident that RELCON POWER SYSTEMS has given me skills and experience required to venture into the Electrical job market.

RECOMMENDATION

I would like to make the following recommendations to RELCON POWER SYSTEMS LIMITED company;

- ✓ Electrical lighting layouts and data & power layouts diagrams should be thoroughly cross-checked before they are brought to the site for implementation. This will save the technicians a lot of time and it will see the company through early completion of site contracts.

REFERENCES

Ngatia and Associates Lighting layout, Piping layout, Power and Data layout diagrams.

APPENDIX

Site Photos: *ERIC MULWA (Left) alongside ERIC MUSHORI (Right) Electrical Technician at RELCON POWER SYSTEMS LTD. (Leaving for Lunch Break).*



Site photos: *Entrance Corridor to the Library (Left) and a Front View of The Server Room.*



SITE PHOTOS: ERIC MULWA working on the Fire Alarm Control Panel.