DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

DECEMBER 2019

It is recommended that the report of this practical training provided

by

MUHAMMAD ZAIEFUL DANIAL BIN MOHD ZAIDI

2017206752

entitled

INSTALLATION OF CENTRAL AIR CONDITIONING SYSTEM

be accepted in partial fulfillment of the requirement for obtaining the Diploma in Building.

Report Supervisor	:	Dr. Sállehan Bin Ismail
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STUDENT'S DECLARATION

I hereby declare that this report is my own work, except for extract and summaries for which the original references are stated herein, prepared during a practical training session that I underwent at Global View Engineering Sdn Bhd for a duration of 20 weeks starting from 5 August 2019 and ended on 20 December 2019. It is submitted as one of the prerequisite requirements of BGN310 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

Name : MUHAMMAD ZAIEFUL DANIAL BIN MOHD ZAIDI

UiTM ID No : 2017206752

Date : 13/12/2019

ACKNOWLEDGEMENT

First of all, I would like to express my deepest appreciation to Global View Engineering Sdn. Bhd. Because give me the opportunity to do my practical training here. It's such an honor for me that able to work with this great company and a great staff. This is a great chance for me to gather new information and experience new thing when doing practical training at Global View Engineering Sdn Bhd in addition I have the opportunity to get exposed to field work, which is will be helpful for working experiences in the future. There is would be difficult for me to feel the experience of working without the chance given by this company.

Next, I want to give a big thanks to my lecturer, Dr. Sallehan Bin Ismail for sharing with me a very valuable information and knowledge during my practical semester. It would be difficult for me to complete and submit this report without his helps. He also has been supportive and always showing me the right information and taught me the valuable technique, method and the detail needed to write on my report. In addition, Dr. Sallehan also use a social media as a platform for him to keep in touch with me and other student under him and immediately answer all of our question and our doubt during our internship. With his guide, the report is properly made and smoothly done.

Lastly, I was very grateful to my practical training supervisor, Mr. Mohd Zalmie Bin Abdullah who is the Senior Engineering/Project Manager at Global View Engineering Sdn. Bhd. He assisted and helped me to get use to the environment of the work. He always gives his full commitment to her job at the same time he also has been supportive and sporting to me. Furthermore, he never tired of treating me and sharing his knowledge and answered all of my question and curiosity. I extend my sincere thanks toward him as he is taking care and help me with a lot of love. I would never be able to learn new experience and gather useful information without his helps.

ABSTRACT

Central air conditioning system that also known as centralized air conditioning usually been used for the large a usually can been used for the large area to support in cooled the whole area. The central air conditioning system is one of the economical air conditioner system for the commercial buiding. The main objective of this research are to investigate the method or procedure used when install an air-conditioning system, to determine the problems occurred and solutions taken to solve the problems, to investigate the time needed to install an air-conditioning at Kuala Lumpur Health Clinic at Taman Tasik Titiwangsa, Kuala Lumpur.

Next, all the data had been collected through an observation during the site visit, taking some photo, having an interview session with the project manager and do some document reviews for the data for the data. In addition, most of the data usually been gained based on the observation toward work that been done by the workers at the site. The overall result of the case study shown that the proper method installation of central air conditioning system at Kuala Lumpur Health Clinic was the best system to install for the large area such as this clinic. As a conclusion, this case study can be useful guideline for contractor that involved in construction industry to use the suitable method installation is a central air conditioning system.

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CHAPTER 1

1.1 INTRODUCTION

Air-conditioning is the process of removing heat and moisture from the interior of an occupied space to improve the comfort of occupants. Air-conditioning can be used in both domestic and commercial environments. This process is most commonly used to achieve comfortable interior environment, typically for humans and other animals. There are many methods to install the air conditioning, for example window unit and packaged terminal, split systems, air-only central air conditioning, central plant cooling and portable units.

The window unit packaged terminal method are installed in an open window. The interior air is cooled as a fan blows it over the evaporator. On the exterior the heat drawn from the interior is dissipated into the environment as a second fan blows outside air over the condenser. A large house or building may have several such units, allowing each room to be cooled separately. Then, split system come in two forms, mini-split and central system. In both types, the inside-environment heat exchanger is separated by some distance from the outside-environment heat exchanger. Next, air-only central air conditioning is a central ducted A/C provides temperature control and ventilation to an area by conditioning air within an air handler and distributing it to one or more zones. After that, central plant cooling is used to condition large commercial industrial or campus load. Lastly, portable unit can be easily transported inside a home or office.

Central air conditioning system is the main air conditioning system that used at Kuala Lumpur Health Clinic. Central air conditioning system is very suitable for commercial building such as this Kuala Lumpur Health Clinic and other large scale building. This system serves multiple spaces from one base location. These typically use chilled water as a cooling medium and use extensive ductwork for air distribution. Centralized system are defined as those in which the cooling is generated in a chiller at one base location and distributed to air-handling units or fan-coil units located throughout the building spaces. The air is cooled with secondary media. The work of the air conditioner compressor is what makes the whole process of air conditioning possible. The compression of the refrigerant gas enables it to discharge heat out of the house, which is how the cool air is created. In a

packaged central air conditioner, the evaporator, condenser, and compressor are all located in one cabinet, which usually is placed on a roof or on a concrete slab next to the house's foundation. Air supply and return ducts come from indoors through the home's exterior wall or roof to connect with the packaged air conditioner, which is usually located outdoors. Packaged air conditioners often include electric heating coils or a natural gas furnace. This combination of air conditioner and central heater eliminates the need for a separate furnace indoors.

The benefits of central air conditioning system are offer many space saving options, the central system is located outside of the building. This creates more space for the building inside and looking modern. After that, central air conditioning system also can reduce noise better than other air conditioning system. Next, this central air conditioning system conveniently cools multiple rooms at once or entire building just using less electricity than other system (Johnson Controls Technology Company, 2006). Then, one of the benefit using central air conditioning system is that it reduces the humidity levels throughout the building. Dehumidifying the air improves the indoor air quality and helps create a healthier environment by deterring the growth of mold and reducing the contaminants in the air (Matsushita Electric Works, Ltd, 2006). Lastly for the benefits is central air conditioning system require very little maintenance. With a simple annual inspection and routine service, it should operate at optimal levels for many years. If it needs minor repairs or replacement parts, you can take care of it before it becomes a major issue. The disadvantages of the central air conditioning system are common just like other air conditioning system, which is skin dryness. Spending amount of time in an air-conditioned building can make the skin lose its moisture, thereby becoming sensitive and dry. It can also cause irritation and dryness of the mucous membrane. Other than that, central air conditioning system can cause aggravation of respiratory problems. A sudden change in temperature has shown to exacerbate the symptoms of various respiratory diseases.

There are many types of air conditioning system, however the aim of this report is to discover the method installation of air conditioning system at Kuala Lumpur Health Clinic.

1.2 OBJECTIVE

Objective of this report are:

1) To investigate the method or procedure used when install an air-conditioning system in Kuala Lumpur Health Clinic.
2) To determine the problems occurred and solutions taken to solve the problems.
3) To investigate the time needed to install an air-conditioning.

1.3 SCOPE OF STUDY

The study was carried out at Kuala Lumpur Health Clinic which is located at Taman Tasik Titiwangsa, Kuala Lumpur. This study focuses on the method installation of air conditioning system. This includes the material used and cost of the work. However, this study does not include matters related to labors and safety precautions as they are not within the interest.

1.4 METHOD OF STUDY

There are a few methods that were used to collect the data needed for this project which is by observation, interviews, and document review.

1. Observation

The observation was carried out at the Kuala Lumpur Health Clinic site while observing Mr. Roliwawi who is site supervisor and my practical supervisor at the site. The observation was done until all notes were taken.

2. Unstructured Interview

The interviews were performed at the site when they are doing the installation work. In order to understand more about the method installation, I personally have asked my supervisor at the site to explain more about method installation were used.

3. Document Reviews

The document review was done at the office of Global View Engineering which is all the document about method installation was kept at there. Spending my free time by study that document.

CHAPTER 2.0: COMPANY BACKGROUND

2.1 INTRODUCTION OF COMPANY

2.1.1 COMPANY HISTORY

Figure 1 Company Logo

(Source: Global view)

GLOBAL VIEW ENGINEERING SDN BHD (GVESB), formerly known as GLOBAL VIEW CONSTRUCTION & TRADING SDN BHD has been established since 19 September 2002. GVESB started making its move actively in engineering field and throughout its 17 years' presence in the industry. The company has always been improving and exploring new businesses. This motivation is driven by the vision of becoming one of the leading contractors within its relevant field.

This company has their own vision which is to be leading contractor for railway equipment trading, civil work services, steel work fabrication, network cabling and M&E services in Malaysia by year 2020. They also had a mission that they are dedicated and committed in ensuring customer satisfaction. Delivering good quality work that are certified by the respective authorities. Next, project quality management is another mission that they manage a good communication and supervision at site. Improve logistic support and delivery(tbc). After that, mission of this company is shown the professionalism of trained staff. For the last of company's mission is provides safety and health, before starting of work safety briefing were conducted.

Global View Engineering Sdn Bhd has provide a variety of services to make sure the clients are satisfied with the quality of services. Services that Global View Engineering provide were rail services and rail equipment trading (supply and install). Other than that, Global View Engineering also provides building and civil works as their services for the clients. Next, steel structure fabrication works, mechanical works, electrical works and piping works was the example that services are provides by Global View Engineering Sdn Bhd. Lastly, Global View Engineering Sdn Bhd is the one of the construction companies that provides renovation works as one of the services for the clients to choose with that variety of services.

Global View Engineering Sdn Bhd have their own assets as one of a construction company, the assets of the company were including company vehicles, equipment and tools for the services that Global View Engineering provides. For the company vehicles is Toyota Hilux Double Cap, Toyota, Toyota Hiace, Toyota Hilux Double Cap 2.5 AT, Toyota Van, Mitsubishi Canter FE83 Lorry 3 Ton, Mitsubishi Triton Lite Turbo, Nissan Vanette Pick-Up Lorry 1 Ton, Nissan Van and Lorry Hino. Global View Engineering also had their own tools and equipment or machineries as the assets for one of the construction company that provides variety of services. For the example of the tools and equipment that own by the company is water pump, concrete mixer, concrete vibrator, Makita rotary hammer, welding set, hot water pressure, pallet truck, air compressor, pipe trip machine and many more for the services.

The biggest achievement for Global View Engineering Sbh Bhd is awarded as the best contractor award grad G4 and has been given 3 star as the achievement of the company. With these two achievement, Global View Engineering became one of the trusted construction company choose by clients. Over past 17 years' presence in the industry, Global View Engineering Sdn Bhd has worked with many clients. Some of the clients are big company. For the example clients of the Global View engineering is Hospital Kuala Lumpur and Jabatan Agama Islam Wilayah these were example for the big company that Global View Engineering worked with the

2.2 COMPANY PROFILE

2.2.1 COMPANY STRUCTURE

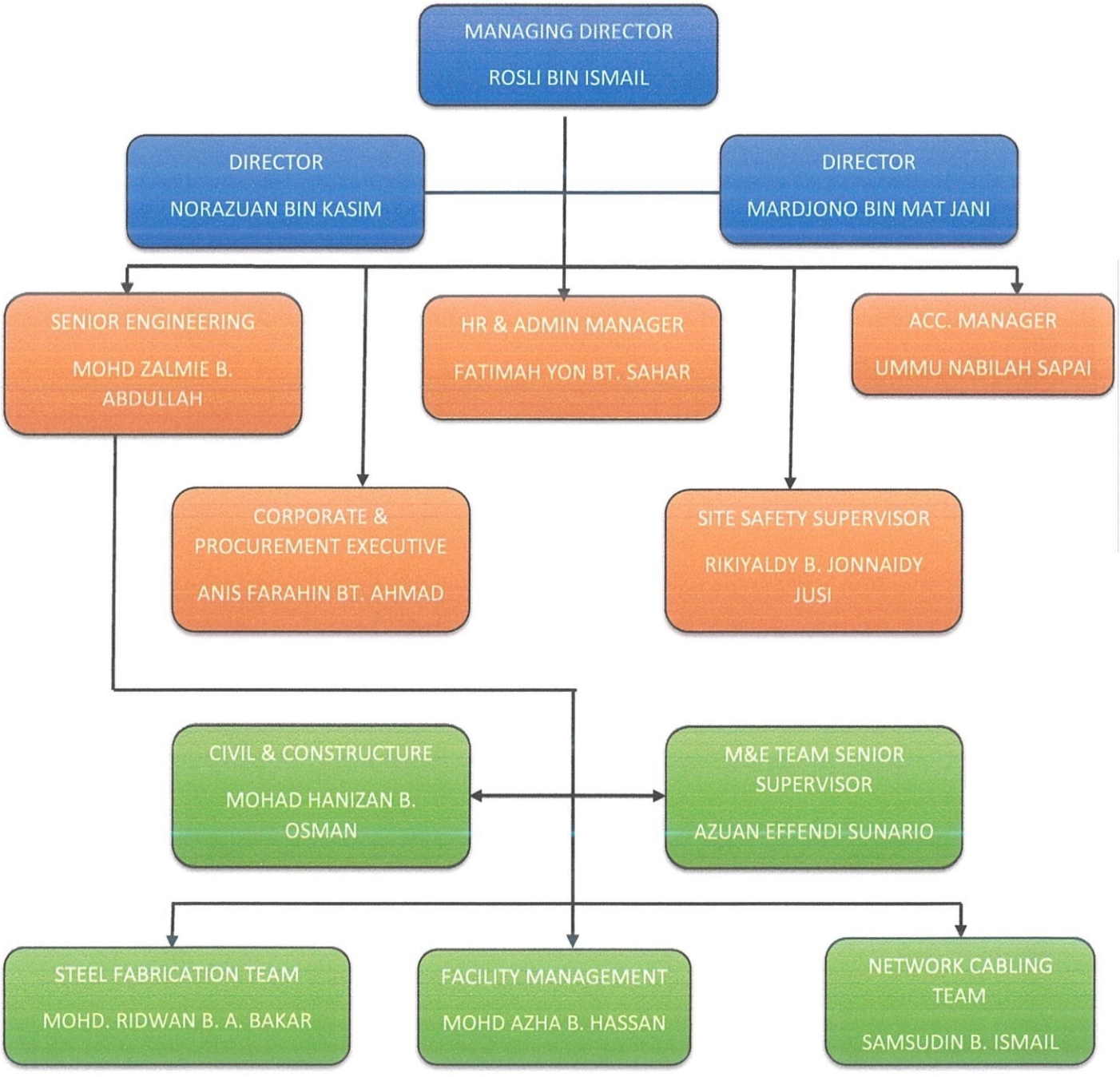

Figure 2: Company structure

2.3 LIST OF PROJECT

2.3.1 COMPLETED PROJECT

Table 1: Completed project

PROJECT	DATE	QUOTATION
PROPOSED DESIGN AND BUILD FOR UPGRADING AND REFURBISHMENT OF EXISTING MAINTENANCE PIT M6 M7 TO HEAVY MAINTENANCE PIT AT SUBANG DEPOT	**17 APRIL 2017**	**RM 2,393,6922.00**
PROPOSED DESIGN AND REMEDIAL WORKS OF RAIL CONCRETE PLINTHS AND INSTALLATION OF ADDITIONAL BASEPLATES AT ELEVATED TRACKS BETWEEN PWTC TO SENTUL LRT STATION OF AMPANG LINE	**21 JUNE 2017**	**RM 9,556,033.92**
CADANGAN KERJA-KERJA MENYELENGGARA SISTEM PENYAMAN UDARA DAN PERALATAN YANG BERKAITAN UNTUK BANGUNAN-BANGUNAN MILIK DEWAN BANDARAYA KUALA LUMPUR BAGI TEMPOH 3 TAHUN	**28 SEPTEMBER 2015**	**RM 500,000.00**

REMOVE, COLLECT, REFURBISH, TESTING AND INSTALL 19,518 UNITS OF EXISTING POWER RAIL INSULATOR POST AND INCLUSIVE SUPPLY AND DELIVER POSITIVE AND NEGATIVE POLARITY SLIDER CLAWS FOR KELANA JAYA LINE TRACKS NETWORK SYSTEM.	**DECEMDER 2013**	**RM 4,850,000.00**
KERJA-KERJA PENYELENGGARAAN SISTEM LAMPU ISYARAT (ITACA) SERTA KERJA-KERJA BERKAITAN DI PUSAT PENGURUSAN BANDAR RAYA, TALIAN FIBER OPTIK DAN PAPAN TANDA GATEWAY WILAYAH PERSEKUTUAN PUTRA JAYA UNTUK TEMPOH SATU TAHUN.	**11 APRIL 2018**	**RM 2,615,985.25**

2.3.2 PROJECT IN PROGRESS

Table 2 Project in progress

PROJECT	DATE	QUOTATION
REPLACEMENT OF WOODEN SLEEPERS TO CONCRETE SLEEPERS BETWEEN KUALA LUMPUR AND BANGI RAILWAY STATION.	29 JUNE 2018	RM 1,786,170.00
MAINTENANCE AND ADMINISTRATION SERVICES FOR MDEC AND ITS SATELLITE BUILDINGS	19 JULY 2018	RM 158,892.00
DESIGN, FABRICATION, SUPPLY, BUILD, INSTALLATION, TESTING & COMMISSIONING OF LIFT STRUCTURE AND ONE PASSENGER LIFT AT ECELLENCE DEVELOPMENT CENTER (EDC), TUANKU JA'AFAR POWER STATION BAHAGIAN, TNB	22 JULY 2019	RM 930,330.00
PERKHIDMATAN SOKONGAN KLINIK (PSK) KEMENTERIAN KESIHATAN MALAYSIA DI WILAYAH PERSEKUTUAN KUALA LUMPUR & PUTRAJAYA	9 MAY 2019	RM 24,016,274.00

CHAPTER 3: INSTALLATION METHOD OF AIR CONDITIONING SYSTEM AT KUALA LUMPUR HEALTH CLINIC

3.1: PROJECT BACKGROUND

3.1.1: PROJECT DETAIL

Title of Project	:	Perkhidmatan Sokongan Klinik (PSK) Kementerian Kesihatan Malaysia Di Wilayah Persekutuan Kuala Lumpur and Putrajaya.
Tender Price	:	RM 22,656,863.00
End User	:	Kuala Lumpur Health Clinic, Jalan Temerloh, Taman Tasik, Titiwangsa, 53200 Kuala Lumpur, Wilayah Persekutuan Kuala Lumpur.
Client	:	Kementerian Kesihatan Malaysia Bahagian Peroleh Dan Penswastaan Aras 4 & 7, Blok E7, Kompleks E, Presint, Pusat Pentadbiran Kerajaan Persekutuan 62590 Putrajaya.
Name of Contractor	:	Global View Engineering Sdn Bhd Unit No. B-4-10, Block B, Plaza Dwitasik, Jalan Sri Permaisuri< Bandar Sri Permaisuri, 56000 Kuala Lumpur.
Original Contract Sum	:	RM 24,016,274.78
Provision of Services Tax	:	RM 1,359,411.78
Site possesince date	:	I June 2019
Date of Completion	:	31 May 2022
Contract Period	:	3 years

3.1.2 PROJECT ORGANIZATION CHARTS

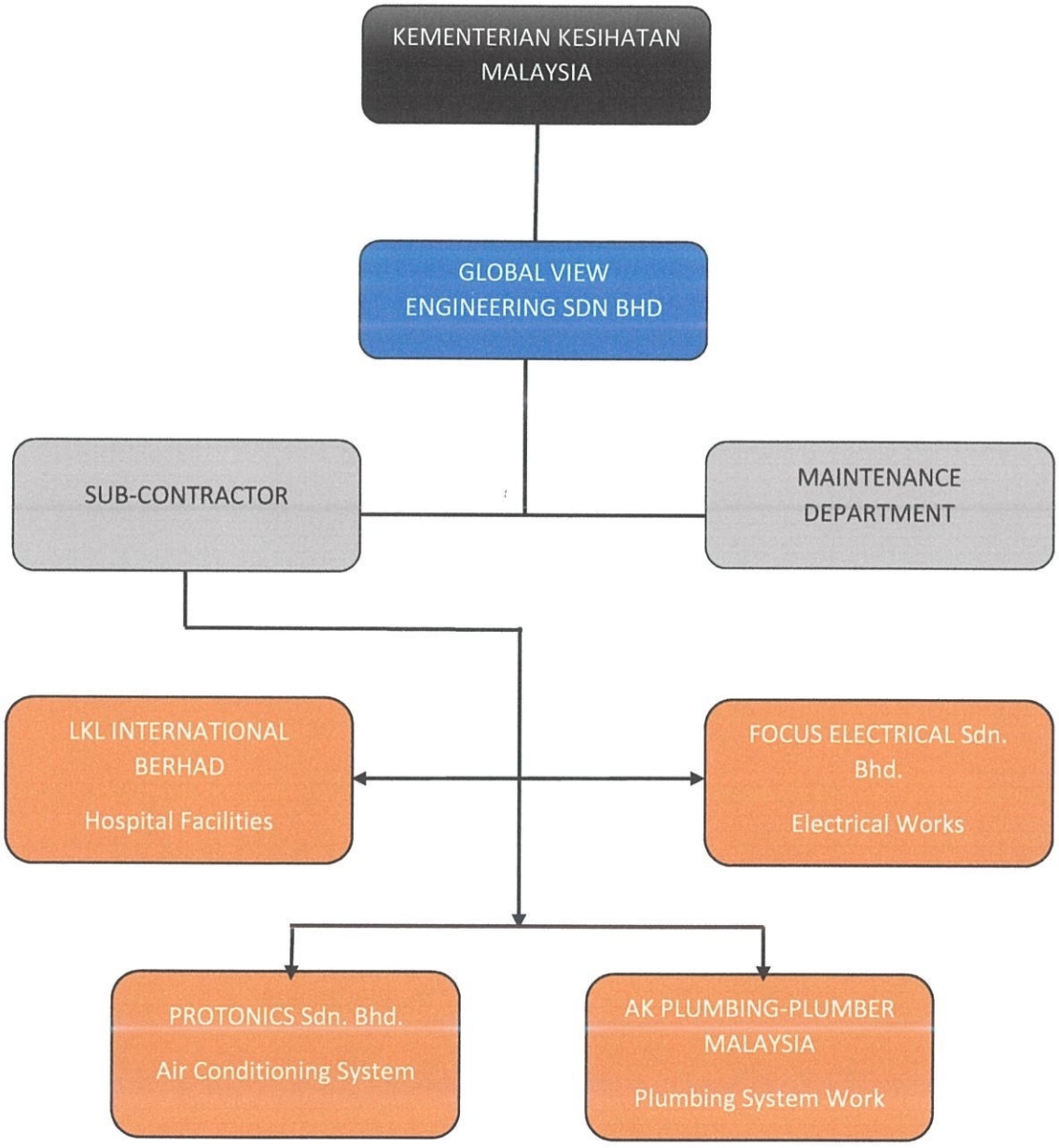

Figure 3: Project organization

3.2 AIR CONDITIONING SYSTEM

3.2.1 IMPORTANT OF AIR CONDITIONING SYSTEM

Air conditioning system is the one of the most important thing that should be install in the large scale area to make sure the whole building gets the fresh air even it's a lot people in that building. This is especially important for people who suffer from allergies and asthma because it minimizes the irritants that trigger an attack. Air conditioners circulate and filter air, removing and mold from the air. Keeping cool with an efficient air conditioner is the best means of preventing heat-related deaths and illnesses that causing by the heat. The air conditioner system can also keep out insects with the filters and it is being far more effective than a screen in an open window. Insects also can be a dangerous to people with allergies.

The other importance of installation air conditioning system in the building is to improved work force efficiency. When offices are air conditioned, the worker are able to work better and make better decisions. Then, when the mercury rises the tempers also increase because it's not just the brain that suffer from the heat. This will lead to an aggressive behavior; the cool environment is a key to maintain the peace at surrounding. Next, air conditioner also makes an easier sleep because one's core body temperature is also a critical factor in getting to and staying asleep. Natural temperature regulation which is the best at between 65 and 75 degrees. After that, it also can protect the furniture because heat especially the humidity can wreak havoc on furniture of all kinds.

Other than that, installing the air conditioner could prevent electronic devices from overheating. Electronic devices can serious meltdown when the temperature increase includes computer server, can completely destroyed if not kept it cool enough. Besides that, this could be a better security when install the air conditioner. Using a window or door as a ventilation isn't safe to secure valuables things from the unpleasant side of humankind.

3.2.2 TYPE OF AIR CONDITIONING SYSTEM

Figure 4: Central Air Conditioning

(Source: hoggmechanical, 2005)

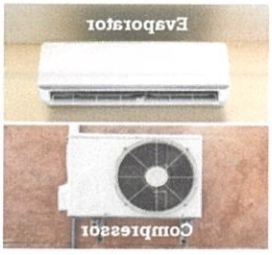

Figure 5: Ductless Mini Split Air Conditioner

(Source: homeairguides,2012)

There are many types of air conditioning system was providing to installed, for the example is central air conditioning system. This air conditioning system is the most common and preferable for larger buildings due to its ability to cool efficiently. Installing a central air conditioning system requires a lot of planning and preparation as sizing is crucial to the functionality of the system. Second is ductless or mini-split air conditioner system, this system most common in parts of the home that have been retrofitted. These systems have an outdoor compressor and an indoor handling unit same as central air conditioning system. Each zone allowed to adjust the temperature for each room accordingly.

Figure 6: Window Air Conditioner

(climatastic, 2013)

Figure 7: Portable Air Conditioner

(Source: acson, 2016)

Then, one of the air conditioner system that available is a window air conditioner. This system is installed in the window of the room, it is also known as a "unitary unit" and this window air conditioner system was a compact unit for cooling only one particular room. This window air conditioner system would not be ideal for a larger area because it is best for those who live in small spaces. Next, portable air conditioner system are one of the type air conditioning system. These types air conditioning system are considered as the next generator of window unit.

Figure 8: Hybrid Air Conditioners

(Source: alibaba, 2008)

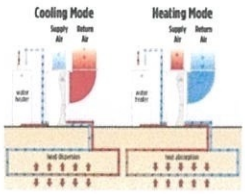

Figure 9: Geothermal Heating and Cooling

(Source: cairhvac, 2009)

After that, another type of air conditioning system is hybrid air conditioners. This system makes a less worried about rising energy prices because the system intelligently chooses between the two energy sources to save money and energy. These hybrid air conditioners is a convenient system that can save the energy. Lastly, the type of air conditioning system that can be installed is geothermal heating and cooling system. These system has a long lifespan, less energy used and the energy is sustainable. The process to cooling the building is, heat is extracted from the building and distributed back into the ground.

3.3 INSTALLATION OF CENTRALISED AIR CONDITIONING SYSTEM

Air conditioning system that used at Kuala Lumpur Health Clinic was a central air conditioning system. This central air conditioner circulates cool air through a system of supply and return duct. Supply ducts and registers opening in the walls, floors or ceilings covered by grills carry cooled air from the air conditioner to the building. This cooled air becomes warmer as it circulates through the building, then flow back to the central air conditioners through return ducts and registers. The bulk of the equipment are located in the plant room and air handling unit room. There are two type of systems that are being implement in most buildings. They are the direct or the indirect type. Kuala Lumpur Health Clinic are using the indirect type, which is uses chilled water system from the refrigeration plant that is circulated through the cooling coil which is located in the air-handling unit (AHU).

In the chilled water system, the compressor and its motor the water-cooled condenser and the chiller are all assembled in a huge structured steel framework. It forms a complete and compact refrigeration plant known as a chiller package. The refrigeration piping, thermostatic expansion valve, liquid line solenoid valve and line shut off valve are all compacted together. The chilled water that has been cooled is distributed to all the rooms by using pipes. There are fan coil units in each room which basically consists of a fan, coil for heat exchange and a thermostat. The warmer return air from the room is forced to contact the coils that cooled it before being discharged to the room. The coils are connected to the fins that provide bigger surface area for heat exchange to take place. The fan speed of the fan can be controlled and temperature of the room is regulated by using a thermostat. The valve will open to let the chilled-water flows when cooling is required and will stop when the temperature of the room has been achieved.

These air conditioning system was installed step by step to make sure the air conditioner is perfectly works. All product must be installed according to manufacturer's installation instructions and safety guidelines. When performing the installation step, needed to wear proper safety equipment to prevent accidents. It's a priority to follow all the instructions to get good results.

- Step to install the central air conditioning system.

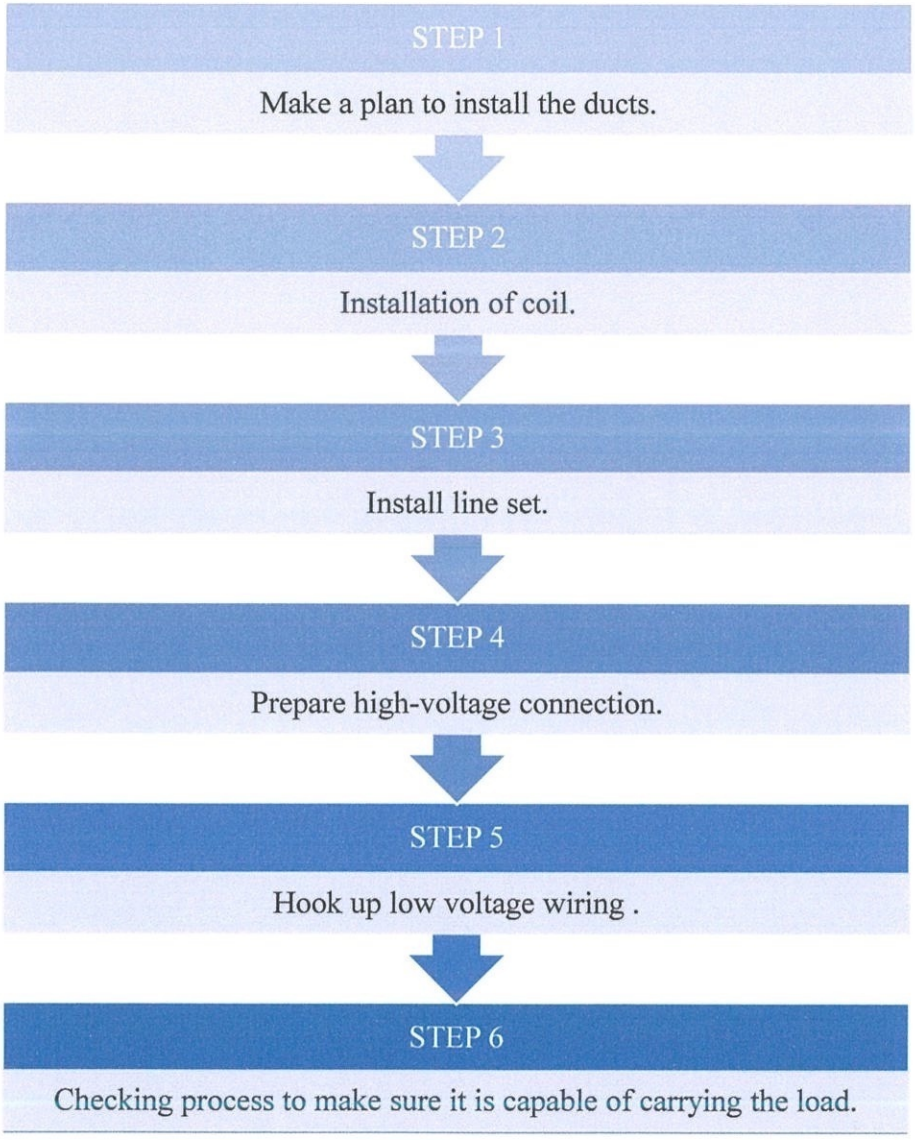

Figure 10: Flow Process

STEP 1: Make a plan to install the ducts

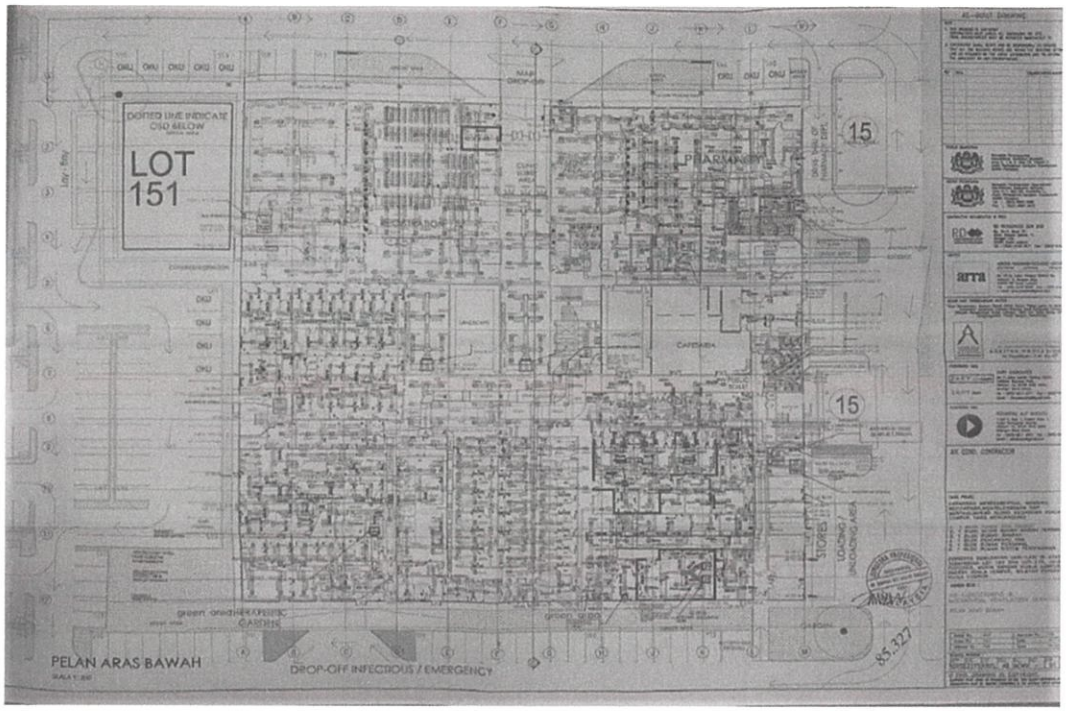

Figure 11: Air conditioning system floor plan

Choose a spot for the ducting to be placed, some locations are better than other. The ducting unit can't be positioned directly under a gutter or where excessive water easily pours down on it. The ducting unit needs to place in clearance around it for adequate air cooled flowing. The supply air duct installation continues by connecting the metal ducts to the start collars. As the square ducts are installed, it is a good to measure and cut holes in the top of the duct for the branch duct takeoffs. These branch duct takeoffs will be fittings that are attached to the top of the main duct and they fit in between the floor joists. Their base is square and their outlet is round. Like the main duct takeoffs, they have metal tabs to bend over to connect them. A screw was added to each corner to make it more secure. Periodically, a piece called a transition were being installed. This piece is used to go from one size of duct to a smaller size. The ducts are supported about every eight feet with metal hangers. The ducts are connected to each other by a system known as "s" and "drives".

"S" cleats are pieces of metal that are folded over themselves to make a slot for two ends of separate ducts. Each duct slides into a separate slot. They are usually installed on the top and bottom of the piece of duct. "Drives" are pieces of metal folded over on themselves and they slide on the sides of the duct to hold them together. Tabs on the drives are bent over after installation to hold them in place. At the end of the supply duct, a piece called an end cap will be installed. The process is repeated for the other main supply ducts. The basement was having its own supply and return ducts. The branch ducts were being connected to the registers with a small piece of flexible duct when a dropped ceiling is used. The air duct installation process continues by installing the branch ducts. These are usually round pipes that are attached to the takeoffs on the top of the main duct. The pipe is snapped together and installed starting at the main duct. The joints are screwed together using three metal screws. The ducts are supported by brackets at about eight foot intervals. The final piece for a particular branch duct is cut to length and an elbow boot is attached to it. The elbow boot is a fitting that changes the round duct into a square duct and accepts the register. The boot is installed in the hole in the subfloor and nailed flush with the top of the floor.

The next part of the air duct installation process is connecting the return air system. It starts with a return air package. This consists of a metal elbow that has a slot in it for the air filter, duct to connect it to the main return air duct and a start collar. The main return air duct usually has one end capped and the other open. It is put into the proper position and held by metal brackets. The metal elbow is connected to the furnace air inlet using the tabs and screws. The duct is connected to it and the start collar is mounted to the main return air duct. The final piece of duct may need cut to length. The main return air duct is connected in much the same way as the supply duct. At the appropriate places, holes are cut in the top of the duct to allow for connection to the branch ducts. The branch ducts are usually the spaces between the floor joists. Pieces of metal, called panning, are attached to the bottom of the joists to create a closed duct. At the supply duct, the panning is attached to the supply duct. On the opposite side of the main duct the joist space is closed off with panning. Finally, the end of the joist space is closed in with panning when you get past the return air holes that were cut into the subfloor.

STEP 2: Installation of coil

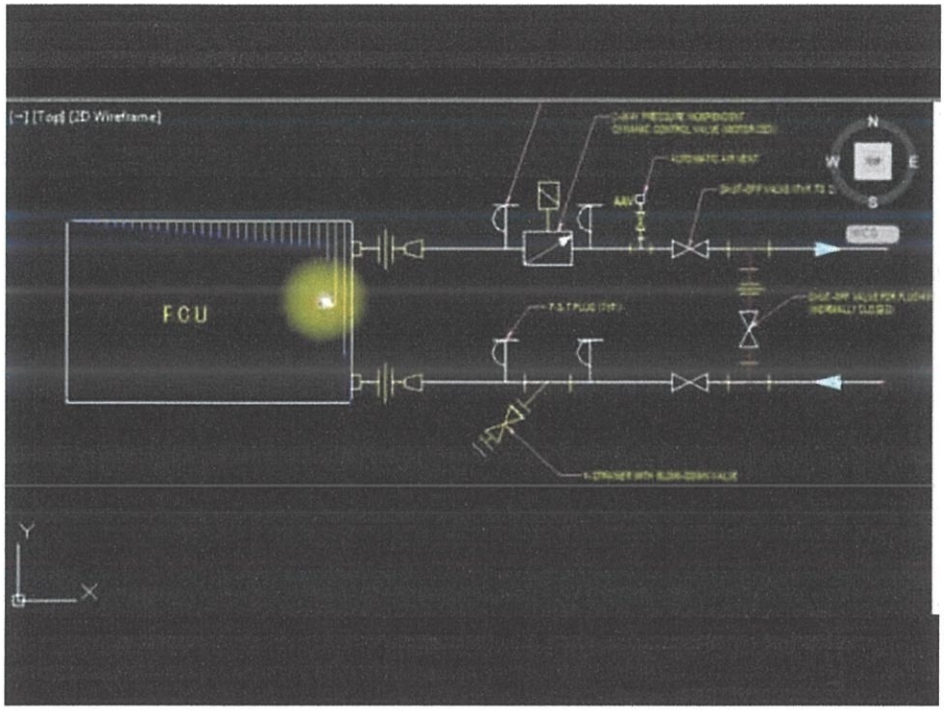

Figure 12: Coil

(Source: Wiring.Coil, 2015)

Measure the width of the evaporator coil at its widest point. Then, add one and half inch to the width. This is the measurement for the width of the rectangle that cut out of the supply plenum. Next, measure the height of the evaporator coil at its highest point and add one half inch to the height. This is the measurement for the length of the rectangle that cut out of the supply plenum. Using a marker and L-square to mark the correct dimensions on the side of the supply plenum. After that, use a drill to cut a hole out in the corner of the rectangular outline that has been drew. Using a sheet metal shears and then cut along the rectangular outline that being drew on the supply plenum. The sheet metal shears are extremely sharp, there is need full focus when handling this work. Remove carefully discard the rectangle that has been cut out of the supply plenum.

Build sheet metal shelves inside supply plenum so that evaporator coil can be sated centered inside plenum. Four sheet metal shelves are supplied with supplies package. Each is larger than what will needed and are designed to cut to fitted the sized exact application. Then, trim the shelves so they fit inside the plenum, but do not block airflow into the bottom of coil. All the shelves and coil was mounted inside the supply plenum. To ensure that water runs forward to the drain hole in the plastic tray on the bottom of the coil, the back shelf has been positioned ½" higher than the front shelf. This will create ½" forward pitch on the coil and allowed the water to drain out of the plastic tray.

STEP 3: Install the line set

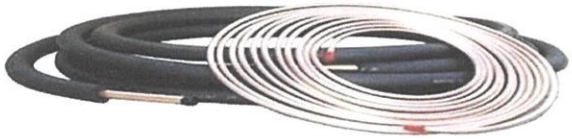

Figure 13: Line set

(Source: Line.Tube air cond, 2002)

The line set consists of two refrigerant lines that connect to the evaporator coil. To complete this part of the installation, connect the line set to the unit and run it inside along the ceiling toward the evaporator coil. This work was being completed the installation by the EPA-certified contractor. Firstly, roll out suction line while holding one end down with the foot. Peel back a few feet of insulation on one end of line and cut off with knife and it is the same length as the distance between the hole and the condensing unit.

Then, push enough of the suction line through the hole in the building to reach the condensing unit. Run the suction line along the ceiling towards the evaporator coil and secure suction line to ceiling using line set mounting brackets, use two screws on each side of bracket to hold in place. Use a tube cutter, cut the suction line near the hole in the building. The length of the suction line is long enough to reach the condensing unit. After cut the suction line, attached the suction line with either a 90-degree or 45-degree copper fitting to the end of the suction line where it protrudes from hole in building. This copper fitting is used to redirect the suction line to the condensing unit. Redirect the pipe to the condensing unit and press the suction line into the suction line surface valve on the condensing unit. Keep suction and liquid lines clean inside because cleanliness and dryness are important for proper air conditioning operating. When bending copper, be careful not to crimp or kink it. If you do accidentally crimp or kink it, the pipe is not unsalvageable. Straighten out the piping, splice it with the tube cutter and rejoin the cut ends with a copper coupling.

Inside the building, run the smaller liquid line which is smaller than the two lines in line set out through hole in building. Run the liquid line along the suction line and through the same line set mounting brackets already secured in place. Outside, use slight pressure to bend the liquid line and run it towards the condensing unit. Copper fittings are not necessary to bend the liquid line. Attach the liquid line to the liquid line surface valve on the condensing unit by pressing it into place. Back inside, trim liquid line with a tube cutter several inches longer than necessary to reach the evaporator coil. Using a knife, cut the insulation off the end of the suction line. Trim suction line with tube cutter several inches longer than needed to attach to evaporator coil. Lastly, solder connections of refrigerant lines carefully to make sure that air conditioning in a proper condition.

STEP 4: Prepare high-voltage connection

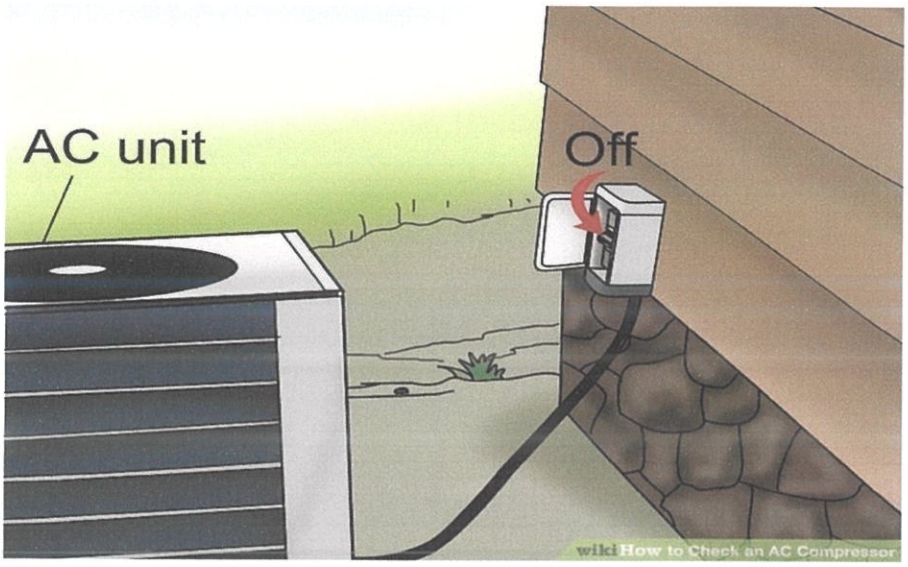

Figure 14: Switch box

(Source: wikihow.com, 2012)

Central air conditioners require a 220-volt or 240-volt, dedicated circuit for operation. When a central air conditioner starts up, it may require up to 5,000 watts of electricity, making it one of the largest consumers of electric power in the building. An air conditioner's cooling capacity is measured either in British thermal units (BTUs) or in "tons." The greater the number of BTUs or tons, the greater the cooling power of the unit. A larger unit also requires more electrical power. Only a skilled contractor was complete the high-voltage wiring, inexperience can cause electrical shock or damage to the equipment or property. The correct selection for thickness of wire and corresponding breaker based on the condensing unit is very important. Wires are rated by gauge, the higher the gauge number, the thinner the wire. The first step to preparing the high-voltage connections is to install the disconnect. Electrical codes require a disconnect switch to be located near the condensing unit. The disconnect will have two electrical whips running in and out of it: one runs from the condensing unit to the disconnect and the other runs from the building's electrical circuit panel to the disconnect.

Firstly, select a spot on wall to mount disconnect box and locate it near to the hole in the building. Place it high enough up to keep it out of water on ground, for more specific on where to locate the disconnect must refer an electrical code. Pull cover off of disconnect box to see inside, then find a spots to attach wires and small holes to mount the box with screws. Remove the On-Off switch and punch out one pre-stamped hole on each side of disconnect box. Punch out the holes that are properly-sized for the electrical whips. One electrical whip will be inserted on each side. Mount the box to the wall with screws and drill, then slide whips through holes in box and tighten the nuts. One whip has a 90-degree bend and one has a straight end. Use the whip on each side that best fits the application. Hook wires up inside the disconnect box. The green wires are the ground wires. Cut the two green wires to size and strip back ½" of insulation. Hook up both wires, each one under either lug in center of disconnect and tighten down with screwdriver. For the whip closest to condensing unit, hook up the red and black wires inside box at the load terminals. Cut the red and black wires to size and strip off ½" of insulation. Hook up each wire under either lug. Tighten lugs down with screwdriver. High voltage needs a good, solid connection.

On the other whip, cut the red and black wires to size and strip back ½" of insulation. Hook up the red wire to the terminal closest to the red wire just installed and tighten down with screwdriver. Hook up the remaining black wire to the terminal closest to the black wire just installed and tighten down with screwdriver. The whip needs to be mounted to the ceiling, wires connected to it and the wires run to home's electrical circuit panel. Mount the whip and wires on the ceiling. Use a standard 4x4 junction box to mount whip and wires. Punch out appropriately-sized holes on both sides of junction box. Run whip into junction box on side closest to hole in house. Run flexible wire from junction box to building's electrical panel and use the correct wire gauge. Use spade connectors to make an easy connection. Slip spade connectors over end of red and black wires. Crimp end of spade connectors with spade crimpers or pliers. Press red and black wires with spade connectors, one on each side.

STEP 5: Hook up low voltage wiring

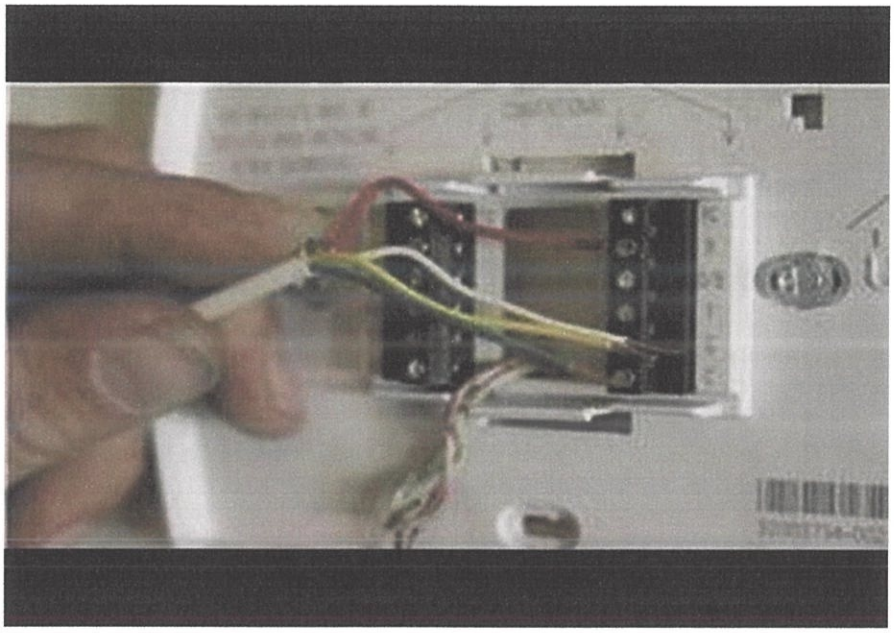

Figure 15: Thermostats

(Source: marmite.wiring,2015)

Hook up Two-Conductor, 18-Gauge wire to condensing unit. Run wires out hole in side of house. Outside, pull wires through hole and run towards condensing unit. Run wires up through low-voltage electrical hole in front of condensing unit. Strip ½" of insulation from end of both wires. Use two blue wire nuts to connect the two incoming 24-volt wires with the 24-volt wires already attached to the condensing unit. Make sure all four wires are stripped ½". Secure wire nuts by squeezing on ends of wires. Replace access panel on condensing unit. Run 24-Volt wire along same line and secure with additional tie wraps. Wait to do this until it can replace the insulation. Inside, run the 24-Volt wire alongside the line set and secure with plastic tie wraps. The power to the furnace or air handler is turned OFF. Remove the access panel on the front of the furnace or air handler. For a standard gas furnace, the control wiring area displays five or six terminals. Terminals are labeled C, Y, Gc, Gh, R and W or C, Y, G, R and W.

Next, Trim the two 24-Volt wires so that they are long enough to reach the terminals. Strip both wires back ½". Hook up either of the two wires to terminal C and tighten down with a screwdriver. Hook up the other wire to terminal Y and tighten down with a screwdriver. Hook up the thermostat to the condensing unit so that it can turn the air conditioning on and off. At least it needed a total of four wires to run from the thermostat to the furnace/air handler to make the air conditioning run. The wire hooked to the R and W terminals should be four-conductor wire. The two extra wires should be protruding from the wire casing. Hook the extra green wire to the G or Gc terminal and the extra yellow wire to the Y terminal. Replace access panel on furnace or air handler. Inside the thermostat, hook up the white wire to terminal W, the green wire to terminal G, the yellow wire to terminal Y, and the red wire to terminal R. Replace the thermostat cover.

Step 6: Checking process to make sure it is capable of carrying the load.

In this final step it is just a simple, after all installation work was done the air conditioning were tested with ON the all air conditioner in the building for test the power and the efficiency of air conditioning system for the whole building. The contractor was checking in all area to identify if there is a problem with the air cool flowing to the whole building. After all has been confirm the report was submit to the project manager.

3.4 THE PROBLEM AND THE SOLUTION

Central air conditioning system at the Kuala Lumpur Health Clinic was installed by human worker, any unexpected and unwillingly things may appear because all work is complete by human. When installing the central air conditioning system at Kuala Lumpur Health Clinic, there is many problems appear that the contractor has to face it and solve it. These is several problems that arise during the installation of central air conditioning system at Kuala Lumpur Health Clinic and the solution to solve the problem that arise.

Weather factor is one of the problem that arise while install the central air conditioning system at Kuala Lumpur Health Clinic. It is not all the condition of weather that effect the process installation of central air conditioning system which is if there are the rainy day it doesn't give an effect to the process of installation. This installation of central air conditioning system is installed after the roof work are fully complete, so when it is a rainy day the installation of air conditioning system was continued. The problem is when it was a sunny day and the temperature is high, that was the real problem for the worker to face it. When that day became so hot, all the worker is getting tired and that make the estimating work progress delayed. For the solution of this weather problem, the contractor counters it with supply the ventilation system that take out the heat from inside and make the environment cooler.

After that, the other of problems that arise when installing the central air conditioning system at Kuala Lumpur Health Clinic is employee mistake. When installing the central air conditioning system, the worker was monitored by the senior super visor that has an experience in air conditioning system but the worker still makes a small mistake. The mistake that the worker overlooked is such as the surroundings area of work place was not clean and tidy so it makes the dangerous accident that arise to the worker and hurt they self. When the accident happens during work time it will delayed the installation work because the contractor need to settle the producer when the worker was accident at the workplace. To solve this problem that arise during the installation of central air conditioning system, the worker was given a briefing about the safety at the workplace. The worker always been giving the advice about the safety to keep the worker always be careful at the workplace to avoid the dangerous accident happen.

Then, insufficient power supply also being the problem that arise during the installation of the central air conditioning system at Kuala Lumpur Health Clinic. When installing the air conditioning system, it requires a lot of power to use the equipment when install the air conditioners. For the installation central air conditioning system at Kuala Lumpur Health Clinic, it need a lot of equipment to install the air conditioner because clinic is a large area for central air conditioning system. The power supply while working on installation the air conditioners was not enough for the employee to working and use all the equipment at the same time. The contractor was build a new distribution board to get more power supply at the Kuala Lumpur Health Clinic for the installation of central air conditioning system.

Other than that, the problem was arise while installing the air conditioning system at Kuala Lumpur Health Clinic is a leaking liquid in ducting. When it came to the process installing the ducting for the central air conditioning system at Kuala Lumpur Health Clinic, a leaking at the ducting happened because the liquid line that along with the suction line tube was leaked. It is stuck or the worker didn't mount the liquid line tube in a proper way. The solution is, the worker need to take out the damage liquid line tube and mount the new liquid line tube to prevent the liquid leak through the ceiling.

Different ducting size from supplier is the last problem that arise when installing the central air conditioning system at Kuala Lumpur Health Clinic. This is the most unwanted problems that the contractor wants to avoid it because that will delay so much time of installing the air conditioning system.at Kuala Lumpur Health Clinic. The ducting size that has been order from the supplier was not the same size as in the Clinic Management requirement. The contractor thinks a solution for this problem is they need to cut it and welding it back to get the exact size, the contractor doesn't want the supplier to replace it because that will take a long time to get a new one and that will cost a lot of money if the work is delayed.

3.5 THE TIME NEEDED FOR INSTALLATION

The installation of central air conditioning system was a long process for the contractor to install at Kuala Lumpur Health Clinic. There are many factor that influence the time taken to install this central air conditioning system such as the size of the area which is larger area take more time to install it than a smaller area that take less time to install the central air conditioner. Second, the factor is the type and location of the air conditioner being installed make huge different of the time taken to install the central air conditioning system. The surrounding of the installation need to make a easier for the contractor to install the air conditioner. Lastly, it is install a new central air conditioning system and it make the process to be much longer. The technicians need to install everything such as the ductworks, the thermostats and more. That all the installation of central air conditioning system being the influence of the time taken to complete the installation. The real time that take by the contractor to install the central air conditioning system at Kuala Lumpur Health Clinic is, as long as one month and one week. That is the time that taken by the contractor to complete and make sure that air conditioner was in proper condition and fully operating to cooled the whole clinic.

CHAPTER 4: CONCLUSION

Based on the study and observation conducted about the method installation of central air conditioning system, the problem with it solution during the installation and time needed to install the central air conditioning system at Kuala Lumpur Health Clinic. There were several steps in the installation of central air conditioning system for the building. Therefore, as a contractor they need to pay more attention in the installation of central air conditioning system at clinic to avoid the failure of the air conditioner system from happen.

Based on the observation that has been done, in every installation process they always be a problem going to happen that cause by the human factor or nature factor during the installation. Therefore, the worker and their supervisor must always alert during installation process to avoid any major problem to happen. For example, the problem from the human such as the installation of liquid tube has not been install in proper way by worker that cause a leaking in ducting so the contractor need to be prepared in solving that kind of problem.

Next, installation of the central air conditioning system for the large area take a long time to complete that task. The contractor must prepare a work program to estimate the time to install the central air conditioning system at Kuala Lumpur Health Clinic. Estimating the time needed is to avoid the delaying the process of installation.

As a conclusion, the aim of the report in producing a better central air conditioning system installation to other had been achieved that been shown by the method that been used to install the central air conditioning system. In addition, all the people that involved in installing the air conditioner must seriously play their role to come out with a good installation progress.

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