



**DEPARTMENT OF BUILDING
UNIVERSITI TEKNOLOGI MARA
(PERAK)**

**OPERATION AND MAINTENANCE FOR FIRE SAFETY
SYSTEM**

Prepared by:

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(PERAK)**

FEBRUARY 2022

It is recommended that the report of this practical training provided

By

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entitled

**MAINTENANCE OF FIRE ALARM SYSTEM AT KLINIK KESIHATAN
MUAR, KAMPUNG PARIT KEROMA, MUAR, JOHOR DARUL TAKZIM**

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

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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 stated herein, prepared during a practical training session that I underwent at MechyUnique Engineering for duration of 20 weeks starting from 23 August 2021 and ended on 7 January 2022. 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.

.....

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ABSTRACT

The fire safety systems deserves the highest level of care and maintenance achievable. However, the highly competitive environment and the expectation of unrealistically low prices by property owners often prevented maintenance contractors from delivering the expected level of service. As a result, the level of care and maintenance delivered may deteriorate to an extent that compromises the integrity of the system, thereby compromising the safety of occupants and property. In this report, the maintenance procedure for the fire safety systems that includes the equipments such as fire alarm system, portable fire extinguishers and hose reel system will be discussed. The example the check list for maintenance purpose and needs to be record as a maintenance record keeping are shown. Recommendations given in this report is the maintenance program which to be followed by the all types of building in Malaysia for safety purpose and requirement

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CHAPTER 1: INTRODUCTION

The fire start begins with three elements of fire needs to ignite which is heat, fuel and oxygen. Heat can be found at any hot surfaces, electrical equipment. Fuel mostly comes from any flammable liquid or gases, oil. Lastly, oxygen which available in the air. To ensure these three elements should be control all the time we need fire safety system to preventing and detecting the fire (Hadjisophocleous et al., 1998).

Fire safety is a collection of actions aimed at reducing the amount of damage caused by fire. Fire safety procedures include both those that are used to prevent an uncontrolled fire from starting and those that are used to minimise the spread and impact of a fire after it has started (White & Dietenberger, 1999). Fire safety are measures those that are designed during the construction of a building or implemented in existing structures, as well as those that are taught to the building's occupants. Without fire safety system, the lives of those who are inside the building will exposed to high risk in the event of emergency (Muckett & Furness, 2007).

Furthermore, fire safety system had divided into several parts. Firstly, fire detection system includes heat and smoke detectors. The second, fire suppression system includes assets such as fire extinguisher, fire pump, fire hydrants and water sprinkler. This system consists of three basic parts such as fire storage tank placed either at top or underground of the building, special water pumping system and large network pipes ending in sprinkler or fire hydrants. Next, fire alarm system equipment such as manual breaking glass/ call point, alarm bell and control panel. Lastly, fire egress system comes from signage or any related sign of dangerous like emergency lightning and emergency exit sign (Ahmed, 2018).

However, each system works differently with their function and all this system is recommend depends on the type of building, the floors, and the layout of the building construction. It is important for engineer or person in charge to understand the functional types of fire system to make sure building property and building's occupants safe(Association, 2014). All fire safety system design, installation and maintenance

must be in proper unit to make sure all equipment and components perform well to cover fire (White & Dietenberger, 1999).

Lastly, there are many types of fire safety system in building concept. However, the aim of this to discover the operation and maintenance fire detection and fire alarm system at Klinik Kesihatan Muar, Johor.

1.1 Objective

The objective of this study are:

1. To describe the function and work of fire safety system.
2. To identify the maintenance of fire safety system.
3. To identify the problems during the maintenance.

1.2 Scope of study

This study has been carried out to make sure that all fire alarm system working well at its place starting from the control panel system, bell ring, manual break glass call point and smoke detector. Testing and inspection fire safety system by using several methods starting testing all the alarm system, determine the problems occurred and fix the problem alarm system. Next, test and calibrate all the alarm sensors, such as smoke detector.

1.3 Research methods

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1. Observation

The operation and maintenance of fire safety system was observed on project site. Testing and inspecting fire alarm system components had been carried out during observation was 1 week. The types of observation components were smoke detector, fire alarm control panel, break glass call point and ring bell. The observation every single work carried out by the general worker with high experience in this field. All the data from observation were recorded by writing on observation diary. An addition, the photos was taken using Oppo 11 smartphone as references. Recorded data and photos will make easier to recall the observation work.

2. Interview

The interviews had been done on site visits. Unstructured interview are simpler as it is casual which is the student will ask a question pointed to general worker at site visit. Usually, this interview session will involve with the supervisor or senior technician. As example, unstructured interview will be conducted with the supervisor regarding to the operation and maintenance work. All the data from observation were recorded by writing on observation diary.

3. Directly participation on the works

Can be state that it is the main things that are give a lot of knowledge and learn on how to do the works. Lesson given when conducting the works directly offer a lot of understanding better that other way. As example, understanding of reading and analysing the construction drawing are increase due to the participation with it.

CHAPTER 2: COMPANY BACKGROUND

MechyUnique Engineering was established in December 2012. It is a private company which located at Taman Universiti, Skudai, Johor Bahru, Johor by one individual with vast experience in technical and management skill as mechanical engineer. This company is expert in designing, installing and service air-condition system, firefighting system, booster pump system, sewerage pump system, and others mechanical works. The company offices is located at No.31A, Jalan Kebudayaan 15, Taman Universiti, 81300 Skudai, Johor.

The company name was MechyUnique Engineering. The company own by En. Khairudin Bin Khalid, who graduated from Universiti Kebangsaan Malaysia in Bachelor of Mechanical Engineering. The company main services are operation and maintenance fire safety system and booster pump system. The company also doing maintenance and servicing sewerage system. Mainly assigned as a sub-contractor company but also been assigned as a main-contractor for some project as it is a specialist company for fire safety system. MechyUnique Engineering are G2 grade construction company.

This company is registered as full Bumiputra mechanical engineering contractor. Their customers include private sector, statutory agencies and government. MechyUnique Engineering company is supported by proactive teams to complete their job with fully satisfied by the customers. Excellent quality and timely are their priority in serving customer need.

2.1 Completed Projects

MechyUnique Engineering has completed many government and non-government projects by contract or non-contract. Latest list of completed projects during 2021 as shown in Table 1.

Table 1: Completed Projects

Project's Name	Price (RM)	Duration	Started	Finished	Client
(Contract) Maintenance sewerage system at Depoh Tahanan Imigresen Pekan Nenas	20,000.00	9 months	1.04.2021	31.12.2021	Imigresen Johor
(Contract) Maintenance air-con system at Kuarters Jabatan Imigresen Negeri Johor	9,360.00	3 years	1.04.2021	31.03.2024	Imigresen Johor
Checking and testing fire fighting system at IPK Johor & sewerage system at Sk Pendas Laut, JB	350.00	1 day	19.05.2021	19.05.2021	Jasman Salim
Maintenance and repair fire safety system at Dewan Kg.Melayu Majidee and Dewan Sri Tebrau belongs to Majlis Bandaraya Johor Bahru	10,350.00	4 weeks	11.05.2021	10.06.2021	Aezy Aircon & Electric Service
Supply and installation new water tank at Taman Orked belongs to Majlis Bandaraya Johor Bahru	19,950.00	4 weeks	11.05.2021	10.06.2021	Jasman Salim IN202100046
Maintenance work air conditioning at Pejabat Imegresen Kukup, Pontian	1,760.00	2 weeks	29.06.2021	13.07.2021	Pejabat Imigresen Negeri Johor
Maintenace fire prevention system at SM Sains Sultan Iskandar, Mersing	17,130.00	3 weeks	14.07.2021	4.08.2021	MUE Construction Inden no. 53000002
Upgrade system air conditioning and ventilation at Mahkamah Majistret Yong Peng, Johor	82,930.00	4 weeks	5.07.2021	1.08.2021	MUE Construction
Checking and testing sprinkler pumpset at IPK Johor	8,580.00	4 weeks	29.07.2021	28.08.2021	Jasman Salim

Replacing air filter 1hp, repairing air conditioning wire (4 unit), repairing refrigerant pipe 3.5hp at Kuarters Jabatan Imigresen Negeri Johor, Bandar Baru Uda	650.00	2 weeks	25.07.2021	16.08.2021	MUE Construction Inden no. 53000155
Maintenance and replace fire extinguisher at Pejabat Daerah Kulai	2,340.00	2 weeks	20.08.2021	26.08.2021	Pejabat Daerah Kulai

2.2 Ongoing Project

MechyUnique Engineering has monitoring ongoing government projects under main contract as shown in Table 2.

Table 2: Ongoing Projects

Project's Name	Price (RM)	Duration	Started	Finished	Client
Maintenance cleaning sewerage tank at Depoh Tahanan Imigresen Pekan Nenas, Pontian	20,000.00	9 months	10.04.2021	31.12.2021	MUE Construction JKR/CKMNJ/I MIGRESEN /01/2021
Inspection, service and maintenance air conditioning system at Pejabat Tanah Daerah Kulai		10 months	1.02.2021	30.11.2021	Pejabat Tanah Kulai
Repair work 2 units scour valve at Empangan Gunung Pulai Besar, Kulai, Johor	495,700.00	10 weeks			JKR CKMJ

2.3 Organization chart

The organizational chart helps to illustrate the data management for employee in workplace. It shows the task that need to be performed and easily make people understand the design of organizational chart. Based on the number of levels and the position of each employee as shown in Figure 1.

The company organization chart started from the owner of the company which is top on the company chart. The director, Mr. Khairuddin Bin Khalid, plays an important role of this organizational chart, where he acts as monitor and conduct all works done by following specification. He planned, responsible and carried out for maintenance and installation work for customers. Everything about work has been conduct by himself to make sure all works runs smoothly and perfectly.

The senior clerk, Mrs. Nor Aisyah Binti Abd Rahim is responsible in office management such as handle staff relations and manage all the document and client that come to seek company's services.

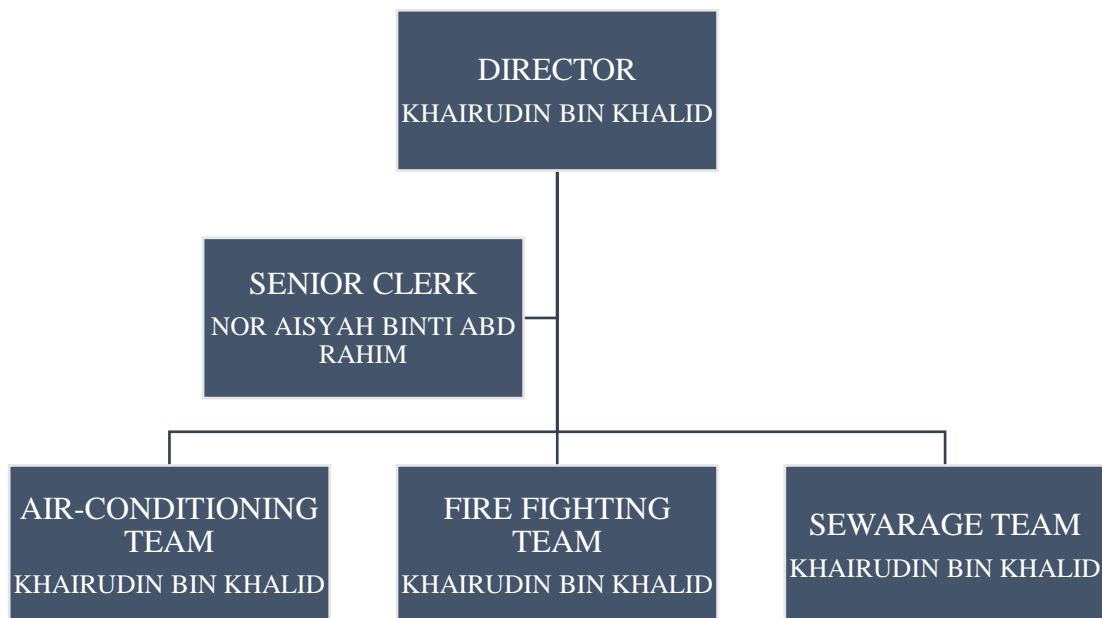


Figure 1: Main Office Organizational Chart

CHAPTER 3: CASE STUDY

The case study are held at Klinik Kesihatan Muar. The project site is located at Kampung Parit Keroma, 84000 Muar, Johor Darul Takzim. The location of government clinic is strategic with surrounded by residential area and easily found.

Testing and inspection fire safety system is an important part before the fire alarm safe to use for new building. The project testing and inspection of fire safety system which is located at Klinik Kesihatan Muar is a second government clinic in Muar as the first one is located at Bandar Maharani

Muar. This clinic was built to helps patient that far from the city to get treatment. The cost to build this clinic is RM21,809,100.70 started date of this project is 17 September 2017 and estimated to finish 22 April



Figure 2: The view left side of Klinik Kesihatan Muar



Figure 3: The view right side of Klinik Kesihatan Muar

2020. It takes 2 years above to complete this project but Pandemic Covid 19 make it delayed. Contractor needs to stop the project for a while until the government allows all the construction works working back as usual and the

construction still ongoing today on interior works.

All forms of works are based on the drawing that have been supplied. For the first stage of the works, wire works are been withdrawal and installed. The wire are distributed based on the drawing where it will connected to the system that referred to the drawing plan. Wire that are distributed around the building then are centred on the main control panel where all works or damage on the system can be detected on the

main control panel. The system that are connected then are been tested several times

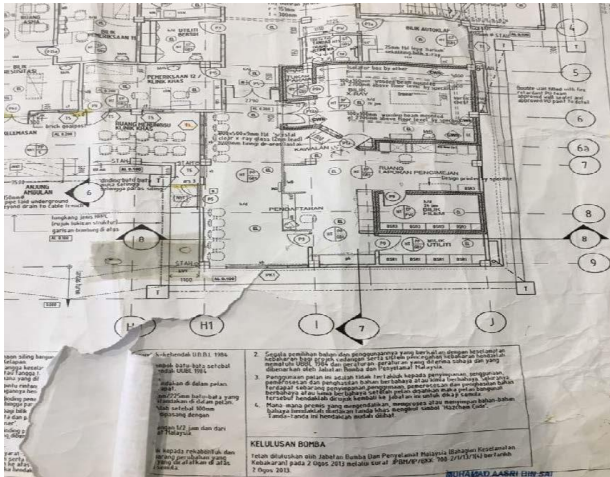


Figure 4: Layout plan

to ensure that the system are works perfectly.

The case study of this report is an operation and maintenance project on fire safety system. The project covers all aspect that related in the maintenance works. Case study are been investigate at the several site through all the observation,

investigation, interview and direct involvement in works.

3.1 The function and work of fire safety system

Fire alarm systems are works to protect property, occupants, and assets. But it needs a maintenance same just like any other system, components, and electronic devices can compromise the system's operation and degrade over time. Dirt, dust and other contaminants can cause problems to smoke detector. The things such as remodelling, vandalism and improper maintenance procedures can also damage fire alarm components. Therefore, by doing a proper inspection, testing, and maintenance it will keeps fire alarm system at optimum operating performance. The process of testing and inspection is not that hard but it needs an experience and knowledge to avoid from short circuit or wrong wiring from happening.

Next, a fire safety system accomplishes two things as an example; first, they enable manual or automatic detection of a developing fire, and second, they alert building occupants to a fire condition and the need to evacuate. Another frequently performed function is transmitting an alarm notification signal to a fire department or other emergency response organisation. Additionally, they can be used to shut down electrical, air handling, or special process operations and initiate automatic suppression systems. This section will discuss the fundamental concepts underlying fire detection and alarm systems in the topic of the fire safety system. The details of

each type function and work of fire safety system used at Klinik Kesehatan Muar are as follows:

3.1.1 Fire alarm control panel

A control panel is designed as a wall mounted device that allows controllers full access to an alarm system. The fire alarm control panel contains the electronics that supervise and monitor the fire alarm system. The initiating and indicating circuits are connected directly into this panel. Control panel known as addressable system which means all each devices (manual call point, smoke detector, heat detector, alarm bell and water sprinkler) can transmit a signal to fire control panel to a specific location where the devices actual located. Fire control panel can be center point between devices can link between equipment that detect fire or danger and devices that warn people about

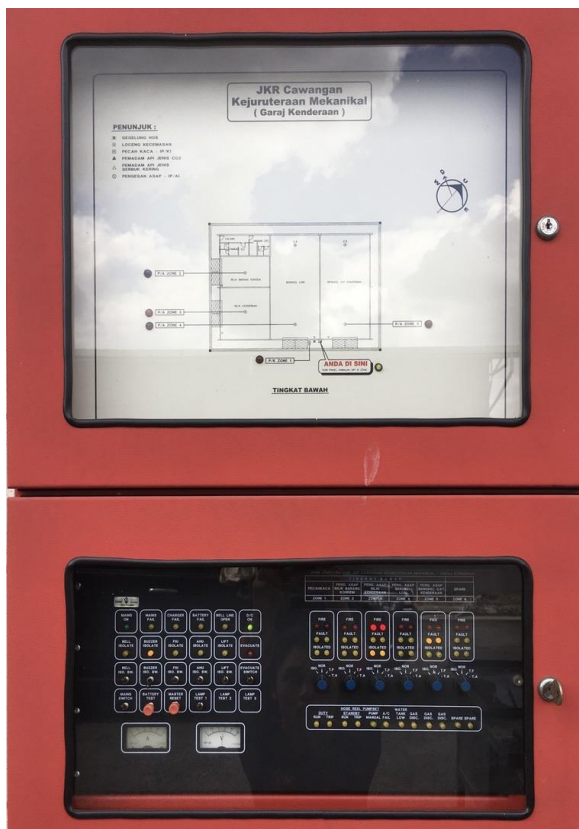


Figure 5: Fire alarm panel

danger or fire protection system difficulties. The size of control panel depends on how many channels configured with the digital display and the input options of other appliances.

As example, smoke detector or heat detector is activated. Automatically, the devices will transmit a signal through electrical current to the control panel by active a red LED by zone. Usually there is a plan circuit that have zone listing that divided into several zones. This zone division will provide information by pinpoint where the devices are located. Other than that, the function for the control panel can

be detected all the appliances whether it works or damage. Good condition devices work can be check by electrical current.

3.1.2 Smoke detector

Smoke detector is an electronic fire alarm sensors that senses the presence of smoke, generally act as indicator of fire and give warn to building occupants. Smoke detector is a must fire alarm sensor that need to be installed in every commercial building and workplace. Sometimes heat detector also installed in residential building such as apartment and hotel. However, installing smoke detector must considered several things such as avoid from combustion particles produced. This particles comes from something burns such as kitchen, furnace rooms, and garage. Keep the sensors at least 6 meters from the sources of combustion particles produced. Smoke detector operates by an element detection that can activate when it reaches an extreme increasing temperature or a fixed temperature occurred. Smoke detector comes with two types, photoelectric and ionization.



Figure 6: Inspecting smoke detector

In Klinik Kesehatan Muar, the contractor use photoelectric smoke detector. Photoelectric smoke alarms are rarely used nowadays in any building. It is quicker and respond better at sensing smoldering fires compared to ionization smoke alarms. This alarms operates using light source and photoelectric sensor. It consists a light sensitive sensor and light emitting diode where located inside the sensing chamber. When smoke flow into chamber space and crosses path of light beam, the light will scattered when the smoke crosses into it then the alarm triggered.



Figure 7: Smoke detector location

3.1.3 Fire hose reel

Cylindrical spindle made of metal. A hose reel system is a high pressures hose that carries fire retardant such as water. The hose reel system is a fire response device for immediate use by the public to easily limit the spread of the fire. If a person is prepared to use this fire-fighting equipment, life and property, including him/hers, can be saved. This hose reel interior has been designated for coverage range 30m for each reel. For each reel has been calculated for every 800 m² space area.



Figure 8: Fire hose reel

The hose reel located along escape routes and beside exit door or staircases with minimum discharge by each hose reel 30 l/m and 6mm jet length. Diameter for the rubber hose should be 25mm and 30m in length. For the nozzle, use adjustable type with diameter 8mm. Last but not least, pipework is commonly 50mm diameter and the pipe feed to individual hose not less than 25mm diameter.

Hose reel system use draw water from fire water storage tank with two sets of pumps which one use for on duty (use electric to run motor) and the other for standby (use diesel engine driven). The water can deliver a flow rate of 120 litre/min at a running pressure of minimum 2 bars for any four hose reels operating at the same time. The standby hose reel pumpset should be supplied with power from the emergency generator that is available. Standby pumpset can be use if the power supply was off. When the pressure



Figure 9: Fire water storage tank upper level 1



Figure 10: On duty and standby duty pump

gauge at lower bar, the standby pumpset motor will turn on and give high pressure to make the water hose reel running in high pressure.

Generally, hose reel system started by opening the valve of the hose for allow water entry from the water tank. Then, for allow showering water just adjusts the hose valve.

3.1.4 Fire curtain

Fire curtain is a wide range of fire protection to provide boundary protection. Fire-resistant curtains serve three main purposes in a building which is to prevent the fires from spreading throughout the building, to limit the initial development of a fire and to protect escape routes. An effectively fitted fire curtain can help to suppress the growth and development of a fire and smoke within a building and can be last between 1 to 3 hour fire.

Klinik Kesihatan Muar using automatic fire curtain because its part of a comprehensive fire control system in response to fire alarm alert. Automatic smoke curtains operate as an essential part of the fire control system and are deployed at various points automatically. This could



Figure 11: Fibreglass fire curtain

contain emergency power supply or batteries, as well as sensors that allow them to communicate with a central fire system control panel. Some curtains are specifically designed to keep a certain area or pathway free of smoke, while others are additionally classified as fire barriers. Smoke curtains are frequently used to confine and redirect smoke to regions where emergency ventilation systems can pump it outdoors.

Fire curtains were located at a special room that houses patients and equipment such as ‘bilik utiliti, bilik ruang asma, bilik pemeriksaan khas, ruang kecemasan, bilik x-ray’. Fire curtains are installed at casement door and casement window. The size depends on the sizing door or window. Fire curtains are made from fire resistant fibreglass and manufactured to fit in a compact head box.

3.1.5 Emergency Exit Sign

Emergency exit sign is a device in a public facility such as aircraft and building that located on the closest emergency exit with safe evacuation route. Emergency exit signs are usually green and white, with rectangular size. Green is often employed to symbolize emergency escape and no threat, and the most effective way for people to leave a building in an emergency is through the signs. Commercial buildings owners and managers are obliged to ensure that everyone understands the simplest, most effective evacuation methods in order to ensure that they are as fast and safe as possible. The ideal way to do that are fire exit signs.

The bottom of the exit sign for doors and corridors shall be no more than 80 inches (6'8") above the top edge of the egress aperture. The bottom of floor proximity exit signs must be positioned no less than 6" from the floor and no more than 18" above the floor. Exit signs must be powered by the local lighting circuit (E). If you choose to use the exception, they must be connected to a dedicated circuit with breaker lock. To ensure that all escape route signs can be seen and understood, they must be well-lit. They should also be



Figure 12: Emergency exit sign 'Keluar'

visible in the event of a power outage, which may necessitate the use of artificial lighting. This sign using a battery that is wired to the building's power supply for continuous charging to provide power for the lightning. There are light components inside the sign, a battery, a circuit board, and a transformer. This does not imply that the sign should be 'illuminated.' Emergency exit signs are located at 'pintu utama, tangga kecemasan (2), pintu anjung ambulans'.

3.1.6 Portable fire extinguisher

Can be state as the common fire retarder that easily operate by most people. It is the easiest fire safety protection device that is used to control small fires. The fire extinguisher is located at place that can be spotted easily or crowded place. Extinguishers should be fixed on brackets or in wall cabinets with the carrying handle located 3 to 5 feet above the floor to prevent them from being moved or damaged. Larger fire extinguishers should be installed at a lower height, around 3 feet from the floor, with the carrying handle. Near potential fire hazards, such as an electrical room or cafeteria, fire extinguishers should be placed. It's critical not to place the extinguisher so close to the fire that it's unreachable in the event of a fire, or to put the operator in jeopardy in the event of a fire. Fire extinguishers must be kept at least four inches above the ground, which means they can't be kept on the floor.



Figure 13: Portable fire extinguisher

Step shows the proper way to use fire extinguisher. Pull out safety pin and depress the operating lever. The lever pushes on an actuating rod which presses the spring mounted valve down to open up the passage to the nozzle. The bottom of the actuating rod has a sharp point which pierces the gas cylinder release valve. The compressed gas escapes applying downward pressure on the fire suppressant material. This drives the material up the syphon and out the nozzle with considerable force.

3.1.7 Fire alarm bell

Fire alarm is a multi-device unit that uses visual and sound signal to warn people about potential fire, smoke, or carbon monoxide in the coverage area. Fire alarms in residential or commercial buildings are typically placed in fire alarm systems. The alert signal is either loud siren or a blinkered light, or both. Wall-mounted bells are used in conjunction with a number of fire safety devices. The optimal placement of these and other audio notification devices varies due to the variety of purposes for these and other audible notification devices, which range from prompting evacuation to attracting firefighters' attention. Installers can mount the device at different heights as long as the alarm bell or other audible notification appliance can generate the required sound pressure level and meets the rest of the standard's requirements.



Figure 14: Fire alarm bell

3.1.8 Manual fire alarm

Very common initiating devices, the manual fire alarm boxes usually are referred to as manual pull stations. These are simple devices which operate manually, i.e., they require that a person operate the mechanism. These are found throughout building hallways, near exits, and at other strategic locations such as a nurse's station or security center. The manual fire alarm devices provide a means of manually activating the fire alarm system and are used in all types of fire alarm systems. They may be the only initiating devices provided, or they may be used with automatic initiating devices, such as heat or smoke detectors. Manual fire alarm generally are located near main exits from a



Figure 15: Manual break glass alarm

building or from a floor of a multistory building and in certain work areas containing unusual fire hazards, valuable equipment, or records subject to fire damage.

3.2 Identify the maintenance of fire safety system

The building manager or person in charge shall ensure all required inspections, operational test and maintenance are performed.

Fire alarm panel system maintenance need to check if they was in normal operational condition without any trouble or fault. All fire alarm or devices are in properly installed. The manufacturer’s installation and user instructions for the system control panel, smoke or flame detectors and other specialized components. The “as built” drawings of the system

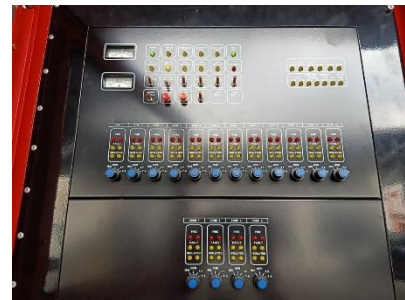


Figure 17: Control panel interface



Figure 16: Technician repairing diode and checking electric current

which should include location of all devices, wiring methods, and sequence connections between devices and control equipment. Any records of tests previously performed as well as the record from test at system start up to allow a comparison of the electrical measurements being taken with those recently observed. Such comparisons can be a valuable aid for rapid trouble shooting. Additionally, future faults may be prevented by finding the source of a difference in an initiating device circuit resistance, voltage, or current at control unit terminals and resistance to ground.

Smoke detectors require periodic maintenance. All smoke detectors should be physically tested functionally at least semi-annually. Calibration test should be conducted after one year and then on alternate years thereafter in sensitivity is not changing. Smoke detectors are sensitive electronic devices. The specific detector manufacturer's literature should be followed in performing any test or maintenance procedure. Failure to follow the manufacturer's instructions could damage the detector permanently.



Figure 18: Checking rate of rise smoke detector

Fire hose reel maintenance should be carried out by persons authorized to do so by the inspecting authority and having qualifications and experience suitable for the work on which they are engaged. Firstly, inspect on hose for any leaks and inspect fitting and test swing arm. Test whole length of hose to check if water can flow and check any damage. Two automatic electric driven pumps and diesel driven pump shall be provided to feed the hose reel system, one of the electric driven pump shall be as duty pump, and the second electric driven pump shall act as a booster pump where the water pressure in hose reel mains needs to be boosted. The diesel driven pump (standby pump) shall be so arranged that it will operate automatically on a failure for any reason of the electric driven pumps. All pumps shall be capable of being started and stopped manually. Both electric and diesel driven pumps shall be sited in fireprotected positions and the electrical supply to them shall be an exclusive circuit with the cables following a route of negligible fire risk or will be provided with adequate protection. The electric driven pumps shall come into operation automatically on a drop in pressure or a flow of water. Both pumps shall be automatically primed at all times.



Figure 19: Testing hose reel



Figure 20: On duty and standby pump ready to use

Fire curtain, the first step is to ensure the area underneath the curtain is kept clear. Anything placed beneath the curtains such as shelves, bins, chairs, tables and other items in the way need to be removed. You should also make sure that the curtains extend fully from the ceiling to the floor. Any obstacles can restrict the fire curtains from doing their job efficiently and can lead to costly repairs if damaged. While you are working through the testing stage, it's a good idea to check any signs of wear and tear of your fire curtain system as an additional safety checkpoint. After a while, if not checked, fire curtains could be damaged, torn or perhaps have potential blockages preventing them from working to their full potential. A full inspection will fix any issues to ensure the curtains are working properly.



Figure 21: Inspecting fire curtain box

Emergency sign exit, inspect the lighting system to determine whether it is in service and in satisfactory condition in accordance with NFPA standards. Adjust the PC board float voltage to ensure extended life of the batteries and other key components. Inspect all bulbs and lamp heads to ensure they are operational and meet lighting requirements. Survey the emergency lights and exit signs for proper placement. Check the energy efficiency of the bulbs and lamps.

Portable fire extinguisher are important to fire prevention as most fire start from small and can be effectively extinguished by the used of suitable portable fire extinguisher. Fire extinguishers are designed to operate easily by any one who follows simple instructions labelled on all extinguishers. Fire extinguisher should be located inside metal hanging box, hangers or in brackets supplied where they will be readily accessible visual and available in the event of fire. To make sure all portable fire extinguisher well planned, maintenance should be conducted not more than one year apart. Usually do inspection of damage on fire extinguisher. The extinguisher has not been physically damage and does not have

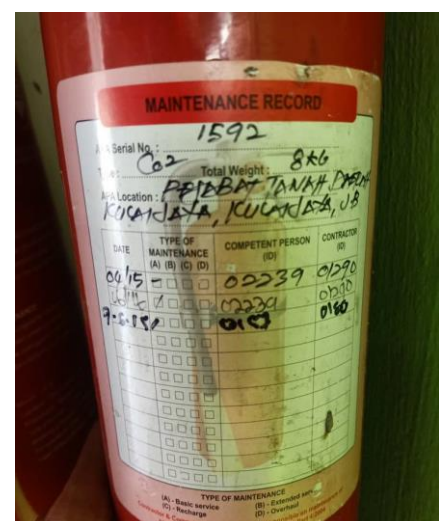


Figure 22: Maintenance record

defects such as clogged nozzle, corrosion, leakage and damage hose. All maintenance or checking must record at tag record. Personal charged with the inspection of extinguishers should keep records. It is desirable to provide a durable inspection tag, attached to the extinguisher, to record that an inspection has been made.

Alarm bell, their coils thereby causing a striker to contact a steel gong shell and produce vibrating bell sounds. Maintenance of contacts and gap spacing should be adjusted to the specification of the bell manufacturer. The distance between the gong striker and the steel gong shell require infrequent attention. Normally the bell movement is fastened to the base by two or four screws in elongated holes thereby permitting the striker to be adjusted closer or further away from the gong shell.

Manual call point maintenance on manual fire alarm break glass boxes, with or without the pre signal feature, should include periodic operation tests, replacement of broken “break glass” windows or breakable elements, and checking terminal connections for loose or corroded connections. In supervised fire alarm systems, a broken connection should sound a trouble signal.



Figure 23: Electric wire connect to manual call point

3.3 Identify the problems during the maintenance

3.3.1 Disturbing building occupant during weekdays

Because the Muar Health Clinic is still under construction, the fire safety system maintenance work can still be done well, the work environment does not interfere and even facilitates the maintenance work. Thus, I took some examples of problems when maintenance in other places such as in JKR Elektrik dan Elektronik at Gelang Patah. Maintenance work is difficult to do because the occupants at that time were working. The maintenance and inspection work on the alarm bells and smoke detectors was quite disturbing to the occupants due to the sound of the alarm bells.

3.3.2 Limited spacing work area

The maintenance work of the smoke detectors was complicated due to the limited space and the position of the smoke detectors on the ceiling caused us to have to ask the working residents to move to other areas to facilitate the work.

3.3.3 Maintenance work cannot be done on the same day

Another problem during maintenance is that the work cannot continue to be repaired as we need to record the entire problem of the device for us to get the goods from the supplier.

CHAPTER 4: CONCLUSION

Overall after involvement in operation and maintenance fire safety system, fire alarm systems are works to protect property, occupants, and assets. This section will discuss the fundamental concepts underlying fire detection and alarm systems in the topic of the fire safety system at Klinik Kesihatan Muar, Parit Keroma. Therefore, by doing a proper inspection, testing, and maintenance it will keeps fire alarm system at optimum operating performance. Knowing the maintenance history and system's age will helps technician determine the steps that must be taken to maintain its operational readiness. Component inside the sensors systems less than five years old should require little effort to maintain. Meanwhile for new systems, problems are usually due to marginal installation like environmental factors or improper grounding. This system using several methods such as testing, determine, and fixing. Fire alarm need to be test at least once a month. Firefighting system is really important to warn occupants in building when fire occurs. This system consists fire alarm sensors that link to panel system. The sensors linked to send a signal to panel system. Thus, it will ease the occupants in the building or firefighter to find the exact location of fire and evacuate it from spreading. The sensors of fire alarm usually use heat and smoke detector. These sensors work simply where consist detection element inside it and automatically activates when it reaches a fixed or an extreme increase temperature. The device consists two heat-sensitive thermocouples which is the one detects ambient temperature and the other one detects heat. The alarm will set off when the temperature of the heat-detecting thermocouple crosses that of the second thermocouple.

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