UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN & DEVELOPMENT OF OIL DISPOSAL SYSTEM FOR GREASE TRAP USING PUGH METHOD

This report submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honors

By

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DECLARATION

I hereby, declared this report entitled "Design and development of oil disposal system for grease trap using Pugh method" is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honors. The member of the supervisory is as follow:

……

(Mr.Mohamed Saiful Firdaus bin Hussin)

ABSTRAK

Pada zaman kini di restoran- restoran kecil, minyak gris tersumbat dalam perancangan sinki dan juga mencemarkan sistem perparitan, yang akan menyebabkan kerugian kepada mereka dari segi wang dan masa. Pada masa yang sama, perlu membersihkan minyak di dalam perangkap gris, jadi ini adalah satu sebab untuk mewujudkan projek ini. Projek ini adalah untuk membuang FOG (lemah, minyak & gris) daripada air sisa dengan pelupusan minyak secara automatik. Tujuan projek ini adalah untuk bentuk dan membangunkan pelupusan minyak untuk perangkap gris dengan menggunakan kaedah Pugh untuk mengelakkan paip tersumbat, parit pencemaran sistem serta melupuskan minyak secara automatik. Dalam usaha untuk memastikan objektif tercapai, perangkap gris itu direka menggunakan kaedah Pugh. Kemudian, keluli lembut telah dipilih sebagai bingkai perangkap gris. Untuk memerangkap zarah pepejal daripada air sisa dengan menggunakan span dan penapis dalam perangkap gris. Maka minyak yang mempunyai ketumpatan yang rendah, ia akan terapung di atas air yang mempunyai ketumpatan yang tinggi dan minyak akan mengalir ke bahagian menyimpan minyak. Apabila minyak dalam bahagian menyimpan minyak penuh, minyak akan melupuskan ke dalam bekas. Air akan mengalir keluar melalui talian paip output.

ABSTRACT

Nowadays in small restaurants, the problem of pipeline clogging often arises, causing trouble in the cooking station. At the same time, it also causes the drainage system to pollute and results in big loss to them in term of money and time. Concurrently, they have to clean the oil in the grease trap, so this is the reason for this project to be conducted. This project is to remove the FOG from waste water and with automatic oil disposal system. The purpose of this project is to design and develop the oil disposal system for grease trap by using Pugh method to avoid pipe clogging, drain system pollution and dispose oil automatically. In order to ensure the objective is reached, the grease trap was designed using Pugh method. Then, mild steel was selected as the frame of the grease trap. To trap the solid particles from the waste water is by using the sponges and the filter in the grease trap. Then the oil with less density will float on the water which has high density and the oil will flow to another partition. Once the oil in that partition is filled, the oil will be dispose oil to the container. The water will flow out through the output pipe line.

DEDICATION

My supervisor,

and to all my friends,

Thank you for all the support and ideas.

ACKNOWLEDGMENTS

Throughout the time I worked on this project, I met many people who had been my advisers and showing me their support to successfully complete this project up to this stage. Firstly, I would like to thank my project supervisor, Mr.Mohamed Saiful Firdaus bin Hussin, for the support and ideas he has given me throughout this task. Furthermore, I am also very thankful to my family who has been so helpful to me by giving recommendations and a few thoughts to enhance my project. A debt of gratitude is in order for their consolation, love and enthusiastic backings that they had given to me. Besides, my incredible gratefulness is committed to my 4BETM course mates, especially to my group mates and the individuals who include specifically or in a roundabout way with this project. Their perspectives, tips, backing and help with different conditions are valuable without a doubt.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

FOG	-	Fat Oil & Grease
GPM	-	Gallons Every Moment
AGRU	-	Automatic Grease Removal Unit
LDPE	-	Low-Density Polyethylene
HDPE	-	High-Density Polyethylene
PVC	-	Polyvinyl Chloride
VCM	-	Vinyl Chloride Monomer
QFD	-	Quality Function Deployment
PM	-	Pugh Matrix
MOE	-	Ministry Of Environment
MPK	-	Majlis Perbandaran Klang
MPSA	-	Majlis Perbandaran Shah Alam
MPHTJ	-	Majlis Perbandaran Hang Tua Jaya

CHAPTER 1
INTRODUCTION

1.0 Introduction

This section consists of the project background, problem statements, objectives, and the work scope.

1.1 Project Background

Restaurant drain waste waters into open sewers have been an issue for a long time, yet have turned into a more important issue with the substantial number of full administration and fast food restaurant being assembled both in vast urban communities and country groups. These restaurant ordinarily release huge measure of fat, oil and grease that would decrease the limit of open sewers after some time. The customary treatment for this waste preceding release into people in general sewer is oil traps that causes partition of the floatable and settle capable materials. Generally, release from a grease trap originates from the reasonable zone made by this division procedure. Despite the fact that it is known as a reasonable zone, the water from this zone as a rule contains a lot of moderately low particular gravity suspended solids and high particular gravity. However, when FOG enters the sewer lines, it cools, hardens and adheres to the inner parts of the funnels, catching sustenance particles and different flotsam and jetsam. After some time, this strong mass keeps on developing until it blocks the stream of waste water and causes sewage to move down. The simplest approach to take care of this issue is to keep FOG from entering the sewer framework. Grease traps can be compelling in controlling FOG. Legitimate size, establishment, utilize, and support of an oil trap will guarantee partition and maintenance of FOG from wastewater before it enters the sewer framework. A grease trap is device to set

on kitchen cleaning apparatuses, for example, sinks, woks, and whatever other channels that gather grease. Grease trap otherwise called grease interceptor, grease recuperation device and grease converter is a plumbing device intended to catch most oils and solids before they enter a waste water transfer framework. Regular waste water contains little measures of oils which go into septic tanks and treatment offices to shape a skimming rubbish layer. This filth layer is gradually processed and separated by microorganisms in the anaerobic assimilation handle. Be that as it may, a lot of oil from nourishment generation in kitchens and eateries can overpower the septic tank or treatment office, bringing about an arrival of untreated sewage into nature. Additionally, high thickness fats and cooking oils, for example, fat cement when cooled, and can consolidate with other arranged solids to shape blockages in deplete channels. At the same time, grease traps are plumbing gadgets intended to catch most oils and solids before they enter a wastewater transfer framework. Normal wastewater contains little measures of oils which go into septic tanks and treatment offices to shape a gliding filth layer. This filth layer is gradually processed and separated by microorganisms in the anaerobic absorption prepare. In any case, a lot of oil from sustenance creation in kitchens and eateries can overpower the septic tank or treatment office, bringing about an arrival of untreated sewage into the earth. Additionally, high thickness fats and cooking oils, for example, fat set when cooled, and can join with other arranged solids to frame blockages in deplete funnels. Although, the effectiveness of disposing FOG by automatic from the grease trap is still a questionable because a study done by Arthur & Blanc (2013), there are number of problems that will occur when FOG entering wastewater system and the grease have to be clean manually.

There are many types of grease trap, hydromechanical is a type of grease trap. These units depend on the standards of warmth and gravity to isolate the FOG from the waste water. Regularly these units are carbon steel or plastic. hydromechanical oil traps control the stream of water permitting the high temp water to cool. The confuse gets the FOG and keeps it inside the oil trap. These oil traps must be cleaned physically and regularly. The estimating of the hydromechanical units are communicated in poundage and in gallons every moment (GPM) stream. The Automatic Grease Removal Unit (AGRU) is also another type of grease trap. This kind of oil trap uses

mechanical and electrical parts to really skim FOG out of the water. These frameworks are littler yet very proficient. Most AGRU units can take out 99% of FOG from water. Most have an inside gathering devices for sustenance particles, a warming component and an outer FOG accumulation unit. The AGRUs are more costly than the other two, yet one can obviously observe that they are lower support and high effectiveness. Measuring of these units fluctuates incredibly and can come in sizes sufficiently little to put under a sink or sufficiently expansive to oblige a whole restaurant. For these grease traps all have to service or clean the FOG manually follow the schedule.

1.2 Problem Statement

There are few common problems that is faced by a grease trap, which can prevent it from operating effectively. One of the problem is clogging in pipeline, this occurs when FOG or debris build up in the crossover pipeline between the two compartments. If the crossover pipe is clogged, the liquid level in the first compartment will be too high while the level in the second compartment will be normal. The water may even be overflowing in the first compartment. A study by Wallace et al. (2017), There are numerous of problem occurred when FOG enters the wastewater system, that they clog the system by restricting capacity, blocking and damaging pipes. Due to these, it will rise both money and time that needed for maintenance or cleaning. Also, if it is not fully treated and take out, the FOG will consume oxygen in obtaining waters. The extra range and energy is needed at wastewater treatment acts to managing the extra FOG that entering the system. By the same token, clog in outgoing also another common problem which interrupts the flow. If there is a clog in outgoing line of grease trap, the grease trap will start to overflow in both compartments. The clog in the outgoing line can become very serious. If never pump the waste on cycle, it will cause clog and make sure to dispose the wastewater on cycle.

According to the Gross et al. (2017), clog in incoming line also one of the common problem that faced by a grease trap. So, clog in the incoming line cause the restaurant's lowest plumbing fixture to become backed up. At the heart of this issue is

an excessive buildup of debris and FOG in the line that channels everything into trap. Essentially, this type of blockage stops the entire grease trap system from working. At the same time full grease trap also another common problem, when FOG from primary compartment is not pumped in a timely fashion, this will eventually have a full grease trap which the waste from the first compartment spills over into the second one. This will clog the crossover, incoming, and outgoing lines. In this can check if the depth of the grease cap by using pole and if goes all the way to the bottom, it is the time for pump the grease. Mattsson et al. (2015) suggests that blockage "hot spots" can be grouped into three categories, grease loading, design or structural issues and sewer cleaning effectiveness. The FOG source control measures such as grease trap, FSE inspections and education would be most effective for type 1 "hot spot".

The main problems that occur in this project, is that there is no other designs such as mechanical passive grease trap that dispose oil automatically. Around the world, there are no grease trap with automatic disposal to be designed or made. So, as the solution to this sort of problem, the design will be made to build this kind of grease trap that can be used in small restaurants.

1.3 Objectives

To oblige the primary test issue articulations, the accompanying destinations were built up to discover ideal arrangements. The goal of this set will be the reason for critical thinking, and additionally rules and references for setting up this review. The destinations are as per the following:

1. To conduct a survey in obtaining, customers need to design grease trap with oil disposal system.
2. To design the concept of automatic oil disposal grease trap by using Pugh method.
3. To fabricate the grease trap with the automatic oil disposal system.

1.4 Work Scope

In order to achieve the objectives, the scopes are prepared as shown below:

1. A survey was conducted by interviewing 51 owners of small restaurants.
2. The concept was designed using HOQ, M-chart and Pugh method.
3. The developments for grease trap oil disposal system.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

Chapter 2 is discusses more about the difference in the materials and methods that can be used for this project. Furthermore, there are some past related projects or researches related to this project.

2.1 The Steps to Conducting a Survey

Kalsbeek (1995) states that a survey is a method of gathering data that represents the perspectives of the entire community or group of people who are intrigued. However, conducting surveys should be done in a very simple way, or even in a more complicated manner, depending on how much is needed to be asked in the survey and the quantity of individuals to whom it is controlled. There are three main important ways of doing surveys, case study surveys, sampled surveys and census surveys (Kalsbeek, 1995). In case study survey, which gather data from a part of a community, without trying to pick them for overall representation of the bigger population. It may need to conduct a few of these before we get a sense of how the bigger group would react to the survey. Case study surveys only give particular data about the community studied. On the other hand, sampled survey which are the type we will be concentrating on in this area, is conducted by asking a sample portion of a group to answer the questions. On the off chance that done well, the outcomes for the sample will reflect the result that would have gotten by surveying over the whole group. For example, suppose it is needed to know the percentage of individuals in the country that would make use of an adult literacy program. Getting each individual in

a country with 10,000 individuals to fill out a survey would be a huge undertaking. Rather than, choose to survey a sample of 500 individuals and discover what they think. For the sample to precisely represent the bigger group, it must be carefully picked. Census Survey, in which it give the survey questionnaire to each individual from the population that we want to find about. This will give the most precise data about the group, yet it may not be exceptionally pragmatic for extensive group. A Census is best done with smaller group, the majority of the customers of a specific office, for example, as opposed to all of the residents of a city. Fink (1985) state that the surveys are typically composed, although sometimes the surveyor reads the questions out loud and records the responses for another person. Though, they can be appropriated via mail, fax, email, through a web page, or the questions can be asked via telephone or face to face. Surveys gather data in as uniform way as conceivable, asking every respondent the similarly questions in similar way so, it guarantee that the answers are most impacted by the respondents experiences, not because of how the interviewer words the questions.

2.1.1 The Suitable Timing to Conducting a Survey

Fink (1985) state that a survey will be the best choice when there is need of a fast and effective way of getting information from the respondent. However, the survey should be reach in large quantity of people to ensure data is gathered about the practices, needs, and opinions. By the same token, need statistically valid data on large number of people is needed. Surveys can be used to find out attitudes and responses, to measure customer fulfillment, to gauge feelings about different issues, and to add credibility to the examination. Surveys are an essential wellspring of data. That is, straightforwardly approach someone for a response to an inquiry, as opposed to using any secondary sources like composed records. From this we can use surveys to quantify thoughts or opinions about community issues identified with initiative. For example, people might need to know the number of individuals who use their administrations, what user consider about services what new users anticipate

from their services, and whether users are happy with what they provide. However, choosing whether to conduct a survey, there are points of interest in doing survey, yet people ought to consider whether a survey will be the most ideal method for acquiring the data that require. Even though survey are a helpful strategy for gathering data, they are not the only way. We should be able to decide whether a survey will produce the data that is required. Tasaki et al. (2017) highlight the data that need might be obtained through other, for example, casual unstructured discussion that happens over the span of another action, statistics figures, and meeting with individuals in the community, interviews or observation. There are few pros and cons on written surveys. The pros are, the large number of individuals can give their opinions, low surveying cost, individuals can respond at their convenience, inclination interview bias, provides a simple list or arrange responses, training is not necessary for interviewing and extensive variety of respondents. Though, the cons are, regularly has low return rate, may not really represent of the whole group, and respondent may skip sections.

2.1.2 The Preparation of a Survey

Williamson (2017) are decide on the purpose of the survey, to prepare a survey there must on the off chance that have chosen to do a survey, should first make sure exactly why it is need to do. What questions would they like to reply to get a general thought of the demographics of their zone. To discover what people think about a particular issue or thought or, then again is there another reason to considering about a survey. Regardless, should remember the purpose for the survey in all through the process, as it will impact the selection of questions, the survey population, and even the way the survey is conveyed. Based on a study by Fink (2013), choose with whom to conduct the survey. The following stage is discovering who has the solutions to your question or questions. In other word, it's the ideal opportunity to decide the respondent, the general population who can best answer the questions that initiative needs to

ask. Who are the target for survey, is it the overall population, the present program beneficiaries, people in a particular neighborhood or fragment of the community, Potential individuals and so on. All overviews depend on sampling, which is, recognizing a segment of your population that fulfils the characteristics that are attempting to survey, as opposed to endeavoring to do a census (Fink, 2013). To have a really illustrative sample, make sure that each individual from the gathering you need to survey has an equivalent possibility of being in the sample, as well as you should have a fairly large sample. It's important to ensure that the sample size that pick is sufficient and not unreasonably extensive or little. If too substantial, it might be difficult to survey everyone successfully and within the financial plan but if too little, you believably may endure. A general rule to remember is that the bigger the sample size, the more precise and impression of the entire it will be. According to Edwards et al. (2016), potential traps sampling is a test to leading great surveys, however there are different entanglements. For instance, when people volunteer to respond to survey, they are self-chosen. These individuals may have a special interest for answering your survey, so their answers may not be genuinely illustrative of the group that are occupied with. There are methods for managing self-selected of people, for example, just to select a random determination of their surveys when just self-selection is included. A research by Briskron and Dienstknecht (2017), choose what method will use to collect your survey data. Will the survey be composed or oral? Is there going to be a number where individuals can call to enroll their result? Is there going to be a a post office box to which finished survey should to be sent, it has to be decided whether it will be directed by individuals known to the audience and whether it will be done face to face, by telephone, or by mail. Keep in mind that the more individual you make it, the higher the return rate will be. Surveys that are conveyed cold have a return rate of only a few percent, unless they're on an exceptionally interesting issue for the community who are surveying. Remember whom you need to survey. Does your public feel easier with writing or talking. Will it be proficient to leave surveys some place for individuals to pick up at their will, or would it be advisable for you to accomplish a comment beyond any doubt, if the survey is to be regularly orally, will individuals feel

respected or irritated about being asked for their feelings and so on. Sent polls or mailed questions are an extremely helpful tool in the data gathering sack of tools. It is a substantially less expensive alternative to different sorts of data get-together and it enables to get data from many individuals crosswise over long distance without paying high telephone bills. In case about doing a sent survey, make sure to check with local post office for data on mailing controls, mass mail rates, and so on.

2.1.3 The Important Element of a Survey

A study by Salvati (2017), deciding the length of the survey, keep in mind that less would be ideal. The more it is, the less likely it is that individuals will take an opportunity to do it. Individuals get exhausted with long survey, and generally won't much try to look at a survey that is more than a page and a half long. Additionally, requiring long answers may lose your respondent. Through altering and condensing, should attempt to keep the survey down to one page. What is need to know and the technique for survey (e.g., phone survey, mailed survey) will also impact the length of your survey. Phone survey, for instance, can take much longer to finish. Fink (2013) state that setting up the questions may take many structures. Questions may be, Open-ended, designed to prompt the respondent to provide you with something more than just one or two word reactions. These are regularly "how" or "why" questions. closed-ended (additionally in some cases referred as constrained choice questions), specific questions that prompt “yes” or “no” answers multiple choices, allow the respondent to choose one answer from a few possible decisions. On the other hand is the Likert scale, each respondent is made a request to rate item on a reaction scale. For example, they could rate every item on a 1-to-5 reaction scale where: 1 = emphatically oppose this idea, 2 = oppose this idea, 3 = undecided, 4 = concur and 5 = emphatically concur. However, there is a need to weed out natural and undecided reactions can use an even-numbered scale with no middle “neutral" or "undecided" choice. In