

DESIGN AND ANALYSIS A NEW SYSTEM FOR DUCT TESTING WITH THE
SMART INSTALLATION METHOD

SYUKUR BIN ABDUL KADIR

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Fakulti Kejuruteraan Mekanikal
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“I declare that I had read this thesis and in our opinion this thesis is sufficient from the aspect of scope and quality for the purpose to be awarded Degree of Bachelor Mechanical Engineering (Design and Innovation)”

Signature :

Name of Coordinator I : MR. NAZRI HUZAIMI BIN ZAKARIA

Date :

“I hereby to declare that this project report entitle Development and Characterization of Design and Analysis a New System for Duct Testing with the Smart Installation Methods written by me and is my own effort except the ideas and summaries which I have clarified their sources.”

Signature :

Author : SYUKUR BIN ABDUL KADIR

Date :

Special dedication to my family, supervisor, my friends and all that help me to finish my thesis.

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ABSTRACT

This research objective is to redesign an existing Duct Tester System with a smart installation that has been use in Quality Assurance at Salutory Avenue Company. To develop a new design from existing product need a process that relates to making a decision of deliberation in different of levels activity. The implementation from these process, it will create new design that can be more ergonomic with the worker that handling the system. This study was happened at the Industrial Training at Salutory Avenue Company. In three month period duration, the system is roughly understand the manually and the process details. From the acknowledgement and discussion with the supervisor, severalproblemsare identified from experience and complain from the customer. Therefore, from the problem taken, a solution of re-design the system which iswill be a body with smart installation. A smart installation here means the ability of the body part is more ergonomic while install the filter inside the body. Even the time taken to install the devices can be faster. At the end of this research, this design will be draw in details andwill beanalyze with computer software (FEA & CFD). These analysesmethod is used to measure and identified the strength and also the failure that may occur in the design detail drawing data. This process is important to make sure that the new design is safe to be use. Finally, the new concepts design is choose to be a best result following the methods that have been use in this project.

ABSTRAK

Penyelidikan ini adalah salah satu usaha untuk mereka bentuk semula sistem ujikaji lohong “Duct Testing” yang sedia ada dengan konsep pemasangan pintar yang mana sistem ini digunakan dalam Bahagian Kualiti di syarikat Salutory Avenue. Kaedah-kaedah untuk membangunkan reka bentuk baru ini adalah meliputi proses-proses yang berkaitan dengan membuat keputusan melalui kaedah perbandingan yang berbeza mengikut aktiviti setiap peringkat. Proses penambahbaikan ini akan mewujudkan reka bentuk baru yang lebih ergonomik dengan pekerjanya akan mengendalikan sistem tersebut. Kajian ini dilakukan berdasarkan permasalahan yang berlaku ketika tempoh 3 bulan Latihan Industri di syarikat ini. Semasa tempoh tersebut, segala pengetahuan mengenai sistem ini diperoleh dengan memahami manual dan butiran-butiran terperinci yang berkaitan. Setelah membuat beberapa perbincangan bersama Jurutera Kualiti merangkap penyelia, beberapa masalah dapat dikenalpasti daripada pengalaman dan aduannya daripada pelanggan. Oleh itu, berdasarkan masalah yang telah dikenalpasti, penjaan semula reka bentuk sistem yang baru akan dilakukan dengan mengaplikasikan sistem pemasangan pintar. Pemasangan pintar di sini bermaksud mempunyai bahagian badan yang lebih ergonomik di mana proses memasang penapis dalam badan dapat dilakukan lebih cekap dan cepat. Oleh itu, masa yang diambil untuk memasang penapis akan lebih cepat. Di akhir kajian ini, reka bentuk terperinci akan dilukis dan dianalisis dengan perisian komputer (FEA & CFD) ANSYS. Analisis ini adalah kaedah yang digunakan untuk mengukur dan mengenalpasti kekuatan dan juga kegagalan yang mungkin berlaku dalam reka bentuk lukisan terperinci. Proses ini adalah penting untuk memastikan bahawa reka bentuk baru adalah selamat untuk digunakan. Akhir sekali, reka bentuk sistem yang baru dipilih sebagai hasil yang terbaik berdasarkan kaedah-kaedah yang digunakan dalam projek ini.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND COMPANY

Salutary Avenue Manufacturing Services SdnBhd (SAM) is established in the early 90s with networks throughout the region and having its headquarters in Malaysia. The Company specializes in designing, manufacturing, installing and monitoring of filters for the application in the power and oil and gas industries.

The companies were awarded the prestigious ISO 9001:2000 in August 2003 by Lloyd's Register Quality Assurance and the scope of Quality Management System is applicable to design, development and manufacture of intake air filter and liquid filter. SAM possesses the technical know-how and manufacturing capabilities to produce top quality filters to cater for customers' requirements. The R&D teams are categorized into three divisions namely:-

- i. Product Improvement Team looks into the ongoing improvements of existing products
- ii. New Product Development Team develops new filter ranges which are widely used by our customers or required by them in order to solve existing problems
- iii. Product Marketing and Promotion Team is responsible to create awareness to customers on the new developments in the R&D by conducting presentations, road shows and site visits

This company has close collaborations with local institutions for updating and developing latest technologies and utilizing their facilities. The company also have own in-house testing facilities which conform to international standard. Several plants with an overall land area of 60,000 sq. feet, equipped with machinery, fittings and related facilities. The existing production capacity today is 800,000 units yearly and able to facilitate further for twice the existing capacity and also provide technical and consultation services as follows:-

- i. Technical presentation on filter fundamentals, awareness and knowledge to educate engineers and end-users
- ii. Perform data analysis on filter efficiency and savings on cost of energy
- iii. Continuous technical support and professional advice on filter

The company also offers packaged services such as monitoring and inspection of the filters so as to ensure their consistent maximum performance. Monitoring is crucial

- i. To eliminate any unnecessary maintenance to gas turbine and turbo compressors
- ii. To ensure low power consumption cost by reducing maintenance cost resulting from premature shut down of gas turbine

1.2 QUALITY MANAGEMENT SYSTEM

The aims of the Quality Department are to get things right the first time every time and to provide a platform on which consistent improvement can be developed. These include the establishment of a good quality management system and the assessment of its adequacy, the auditing of the operation of the system, and the review of the system itself. The application of a quality management system is seen to be a useful framework, which can provide better control and significant improvements of all activities.

The management of Salutory Avenue is committed to the design and production of filter that is fit for its purpose, highest quality consistent with its performance and offers safety and reliability at the optimum price and product availability. This is achieved by operating and maintaining a comprehensive quality control system based on ISO 9001:2000. The system is fully documented and has taken place in three stages as categorized below:-

- Quality Inspection
 - A group of inspectors and checkers is available to perform tests and comparison of the product with the standard. This was applied at all stages covering the raw material received, production process and delivery. The purposes of the inspection is to identify defects found during inspection and segregates them for scrapped, reworks or degrade to second products.

- Quality Assurance
 - Quality Assurance contains all the previous stages in order to provide sufficient confidence that our product or service satisfy customer's needs. Other activities such as comprehensive quality manuals, analysis of data, development of process controls and auditing of quality systems is also developed. At this stage there was also an emphasis of chance from detection activities towards prevention of bad quality products.

1.3 DUCT TESTING SYSTEM

Air filter test rig dust feeder fitted with vibrating tray to add measured quantity of the dust. 200mm dia. Ducting will be used in test equipment. Duct fitted with piezometer ring on the upstream and downstream for measurement of pressure drop across the test filter. Provision is for the mounting of test filter. Test filter housing suitable to mount filter of 980mm height. Ducting mounted on trolley for easy mounting of test filter and loading and unloading of HEPA filter. Provision is for the mounting of HEPA filter with conical duct at both ends. Airflow measuring unit is apply with orifice plate and pressure tapping across it. And the Butterfly valve is to adjust different flow rate. Blower impeller directly mounted on the shaft of the motor. Tapping for particle counter fitted with solenoid valve for taking upstream and downstream count. Control panel for the above. Air filter test rig. The performance air filter test rig that is designed to serve various industrial applications. Outfitted with various attributes, this fuel filter testing rig is manufactured from high quality material.

During the test, the particle size efficiency is determined on the flat sheet filter medium using the particle counting method. Specimens of the sheet filter medium are fixed in a test filter assembly and subject to the test air flow corresponding to the prescribed filter medium velocity. The test aerosol from the aerosol generator is conditioned then neutralized, mixed homogeneously with filtered test air and led to the test filter assembly. In order to determine the efficiency, partial flows of the test aerosol are sampled upstream and downstream of the filter medium. Using a particle counting instrument, the number concentration of the particles contained is determined for the various particle sizes. The results of these measurements are used to draw a graph of penetration against particle size for which the penetration is a maximum.



Figures 1.1: Filter testing with existing Duct System



Figures 1.2: Testing area with equipment

1.4 PROBLEM STATEMENT

The data problem statements are getting from the customer complaint with Salutory Avenue Company and from the experience while handling the system in my Industrial Training. For the complaint document is not provide in this report because it be the confidential.

The major problem is the time taken while handling the system which in term of installing the filter, running the test and collecting data. The time process are not ergonomics that means the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.

To complete the testing procedure or step, it must need at least three people to in charge the process. The new target for the new ducting system will capable running only uses 2 or 1 person. By reducing man power it also affected the cost in implementation the quality testing.

Another problem that occurs in the duct testing system is the design problem. The old design have difficult problem in maintenance. For the maintenance, after completing the dust and water testing the problems happen in cleaning up the body. And the leaking problem in piping also occurs after the test.

The body is capable to test only 2 stage filter, meanwhile the customer request the process are in 3 stage in one time process which is include pre, fined and HEPA filters.

Due to the problem, a study and analysis for the existing product must be done to make the improvement of duct testing design with smart installation. A new design is expected to solve the problems that happen earlier.

1.5 OBJECTIVES

The objectives of this study are to design and analysis a new duct system testing with a new concept of duct system by focusing on smart installation method.

1.6 SCOPE OF PROJECT

The scopes for this project are:

- i. Study and analyze the existing design of ducting system.
- ii. Design a new concept of duct testing system with smart installation method.
- iii. Analyze the CAD data for the critical point (joint part) in body