UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Critical QA and QC Process Procedure In Pressure Vessel Fabrication

Thesis submitted in accordance with the requirements of the Malaysia Technical University of Malacca for the Bachelor Degree of Manufacturing Engineering in Manufacturing Process

By

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is the results of my own research except as cited in references.

Signature	:	…….
Author's Name	:	RADEN AHMAD MUHAIMIN BIN HUMAIDI
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APPROVAL

This PSM submitted to the senate of UTeM and has been as partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Process). The member of the supervisory committee is:

……

(Engr. Sivarao A/L Subramonian)

ABSTRAK

Projek ini mendedahkan berkenaan kritikalnya jaminan kualiti (QA) dan kawalan kualiti (QC) dalam kaedah dan proses bagi memastikan penghasilan pegandung tekanan yang berkualiti. Kawalan kualiti amat penting dalam pembuatan pengadung tekanan ini kerana tanpa pemeriksaan yang teliti ia boleh menyebabkan kegagalan pada pengandung tekanan yang dihasilkan. Projek ini dijalankan dengan kerjasama Akra Engineering Sdn.Bhd sebagai salah sebuah syarikat pengeluar kelengkapan minyak dan gas di Malaysia. Projek ini menggunakan kod *AMERICAN SOCIETY MECHANICAL ENGINEERING (ASME)* sebagai rujukan iaitu *ASME BOILER* dan *PRESSURE VESSEL CODE VIII*. Proses jaminan kualiti dan kawalan kualiti ini terbahagi kepada enam peringkat. Proses ini bermula dengan mengulaskan dokumen, kawalan bahan, proses mereka, pemeriksaan dan ujian. Pemeriksaan yang dijalankan bermula dengan meneliti dokumen dan kemudiannya memperbaiki setiap kesalahan dengan segera. Setiap prosedur perlu diperiksa dibahagian ini bagi mengelakkan kesilapan dari berlaku. Sebagai contoh, *Inspection Test Plan (ITP), Welding Procedure Specification (WPS)* dan sebagainya. Peringkat seterusnya adalah kawalan material iaitu memastikan material yang sampai daripada pembekal hendaklah selaras dengan tempahan pembelian dan pensijilan bahan. Material yang sampai hendaklah mematuhi spesifikasi kod yang ditetapkan. Pembuatan adalah bahagian yang perlu diberi penekanan kerana bahagian ini memulakan proses penghasilan pengandung takanan. Setiap proses perlu diperiksa dengan teliti bagi mengelakkan kegagalan dan kecacatan kimpalan. Peringkat pemeriksaan dan ujian menerangkan bahawa setiap pengandung tekanan yang telah siap akan diuji dengan *Non-Destructive Examination (NDE)* dan *Hydrostatic Test.*

ABSTRACT

This project was discussed about the critical Quality Assurance (QA) and Quality Control (QC) in process and procedure to ensure that the manufacture of pressure vessel that been produces were in high quality. Quality control (QC) is very important in order to produces the pressure vessel, without the details test will lead the failure to the pressure vessel. This project was collaboration with Akra Engineering Sdn.Bhd which is part of oil and Gas Company in Malaysia. This project also used the AMERICAN SOCIETY MECHANICAL ENGINEERING (ASME) code as reference which is ASME BOILER and PRESSURE VESSEL CODE VIII. Quality assurance (QA) and quality control (QC) process were divided into 6 parts. The first part is documentation review, material control, fabrication process, inspection and testing. The inspections were start with the documentary check followed by repairing the defect instantly. Each procedure should be test to prevent the defect from occur. The procedure that should be held was Inspection Test Plan (ITP) and Welding Procedure Specification (WPS). The material receiving inspection was to ensure that the materials that deliver were same as the purchase order and material certificate. All the material should obeyed the specification code that already fixed. Fabrication part was the critical part that should be highlight because this part was the beginning of pressure vessel construction. As were mention above, all parts should been details check in order to prevent the defect and failure especially to the welding. The inspection and test part explains that when the pressure vessel is already done, it then was tested by Non-Destructive Examination (NDE) and Hydrostatic Test.

DEDICATION

Special gratitude dedication to……

My dearest parents,

Mr. Humaidi Asnawi and Mrs. Mahaya Abu

For your love, care and support.

My brothers and sisters,

Raden Adisidaharta, Raden Zuhair, Raden Humairah

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For helping me whenever I am in difficulties.

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CHAPTER 1

INTRODUCTION

1.1 Project Background

This project was to implement the Quality Assurance (QA) and Quality Control (QC) process and procedures that associated with Pressure Vessel. A pressure vessel was a closed, rigid container designed to hold gases or liquids at a pressure different from the ambient pressure. The main intention of Quality Assurance (QA) and Quality Control (QC) is to perform the systematic way of specifying procedures involving each level of design, material, fabrication, testing and inspection. Quality Assurance (QA) was define as a systematic set of activities necessary to provide adequate confidence that requirements are properly established and products or services conform to specified requirement. Quality Control (QC) was defined as a process by which product quality was compared with applicable standards, and the action taken when nonconformance is detected.

This collaboration project was held with the company that produces pressure vessel commercially used. Akra Engineering Sdn. Bhd. was a very well known company especially in services such as plant operation & maintenance services, fabrication of storage tanks, industrial steel structures & minor offshore steel structures, enhanced oil recovery system, including other related engineering services.

1.2 Problem Statement

Pressure vessels used in refineries, chemical processing plants, and water treatment systems of boilers operate over a broad range of pressures, temperatures and experience a variety of operating environments. Shell, head and attachments are some of the components that commonly fail. These situations occur during the improper quality assurance (QA) and quality control (QC) implementation regarding of:

i. Pre-fabrication documentation: Design error and lack of welding specification.
ii. Material: Lack of material identification and verification.
iii. Improper fabrication practice: Marking and cutting, fit-up and weld-up process.
iv. Inspection and testing: lack of inspection and faulty inspection.

This report consists of the pressure vessel fabrication which as result through documentation, fabrication and inspection related with quality assurance (QA) and quality control (QC) operation. This investigation was carried out by using American Society of Mechanical Engineers VIII (ASME VIII) code.

1.3 Objective

The main objectives of this report to be achieved are:

i. Preparation of pre-fabrication documentation of pressure vessel.
ii. Fabrication of pressure vessel according to American Society of Mechanical Engineers VIII (ASME VIII) code.
iii. Inspection and testing of developed pressure vessel.

1.4 Scope

These project scopes are limited to:

i. Utilize the current quality system at AKRA Engineering Sdn.Bhd
ii. Fabricate a pressure vessel through several process such as material receiving inspection, marking and cutting, fit-up and weld-up process; that complies with ASME specification.
iii. Inspection and testing using Dye penetrate inspection and hydrostatic test.

1.5 Project summary

The expected output in this project is to have the information on process that has been made. This information is to verify any problem that occurred on quality assurance (QA) and quality control (QC) process related to pressure vessel fabrication, so the precaution to avoid the crisis will be implementing. Quality assurance (QA) will establish and evaluates the processes to produce the products while quality control (QC) will verify if the product meets pre-defined standards.

This project investigation will exactly implement the quality processes in fabrication of pressure vessel at Akra Engineering Sdn. Bhd. Throughout this project, a lot of knowledge and experiences will be gained regarding of quality process and procedure including documentation, fabrication also inspection and testing.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, the literature of material, code, failed, test, safety, inspection and also welding of pressure vessel are included.

2.2 Project Selection

This project was in collaboration with AKRA Engineering Sdn. Bhd. This company is located at Senawang, Negeri Sembilan. AKRA Engineering has been involved in Engineering Project construction and commissioning such tanks, pressure vessels, steel structures detail design, fabrication also supplied in related with fabrication field.

Figure 2. 1 : AKRA Engineering Sdn. Bhd

Title of this project was “Critical Quality (QA) and Quality control (QC) Process Procedure in Pressure Vessel Fabrication”, where this project are made in term of to implement quality assurance (QA) and quality control (QC) process in manufacturing pressure vessel and also to fabricate an air receiver of pressure vessel comply with American Society of Mechanical Engineers VIII (ASME) Boiler and Pressure Vessel Code (Division 1).

.

2.3 Pressure Vessel

Pressure vessel was a rigid container designed to hold gases or liquids at a pressure different from the ambient pressure. Type of pressure vessel are gas cylinder, unified pressure vessels, boilers, valves, pipe work and some miscellaneous.

Figure 2. 2 : Pressure vessel

Pressure vessels are used in a variety of applications. These include the industry and the private sector. They appear in these sectors respectively as industrial compressed air receivers and domestic hot water storage tanks. Other examples of pressure vessels are diving cylinder, recompression chamber, distillation towers, autoclaves, oil refineries, petrochemical plants, nuclear reactor vessel, habitat of a space ship, habitat of a submarine, pneumatic reservoir, hydraulic reservoir under pressure, rail vehicle airbrake reservoir, road vehicle airbrake reservoir and storage vessels for liquefied gases such as ammonia, chlorine, propane, butane and LPG.

2.4 Project Execution Flow for Fabricator

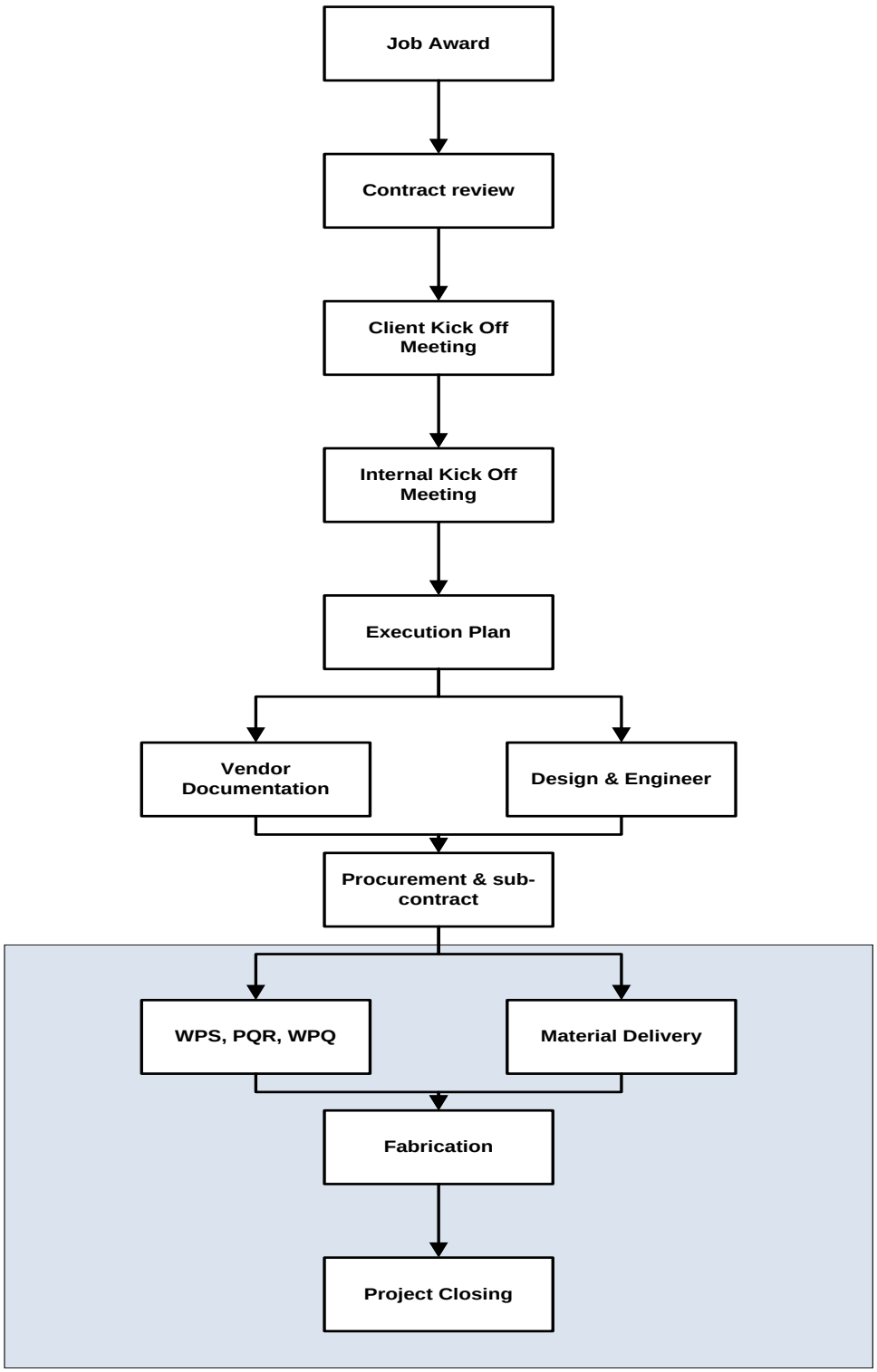
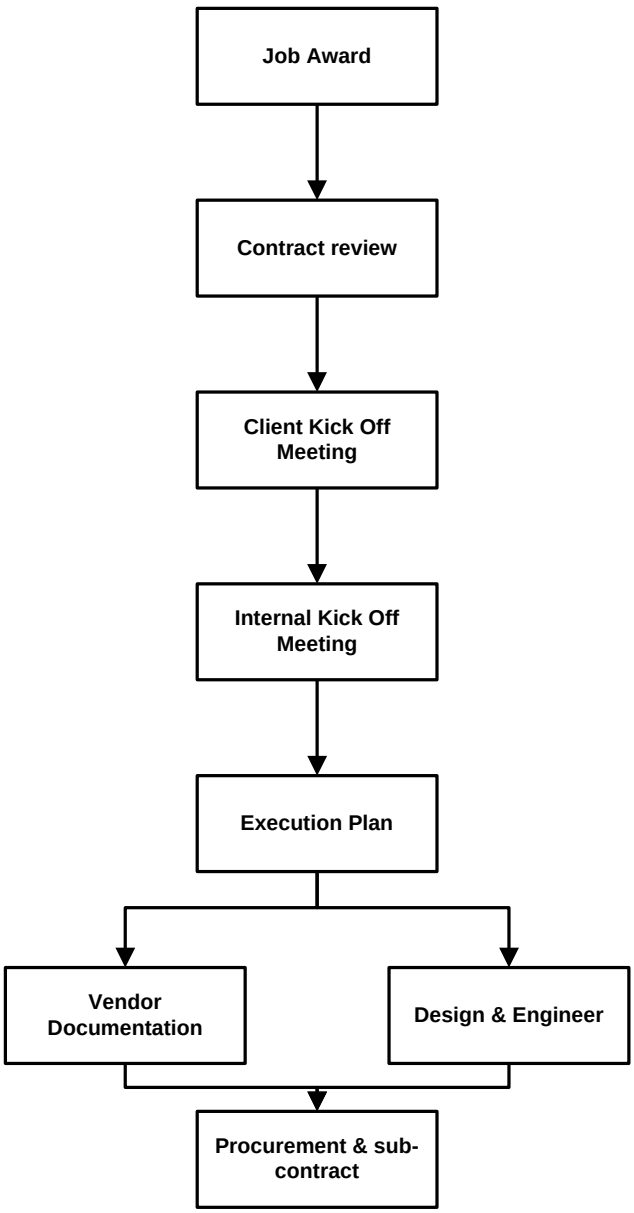


Figure 2. 3: Project Execution Flow Process

2.5 General Overview of Project Execution Process:

From the flow chart, we can see the overall process of making the pressure vessel. As we go through the flow chart:

PROCESS	DESCRIPTION
	Contract award by client Review the contact and if agreed, contract agreement signed and returned. Client Kick of Meeting if required Contract/project brief, document handover, execution plan Design Engineering plan, vendor documentation plan, sub contract, procurement plan, quality plan etc. Execute design & engineering activities, design calculation and drawings, engineering and project management document. Execute sub-contact & procurement activities and material procurement.

2.6 Quality Assurance (QA) and Quality Control (QC) parts

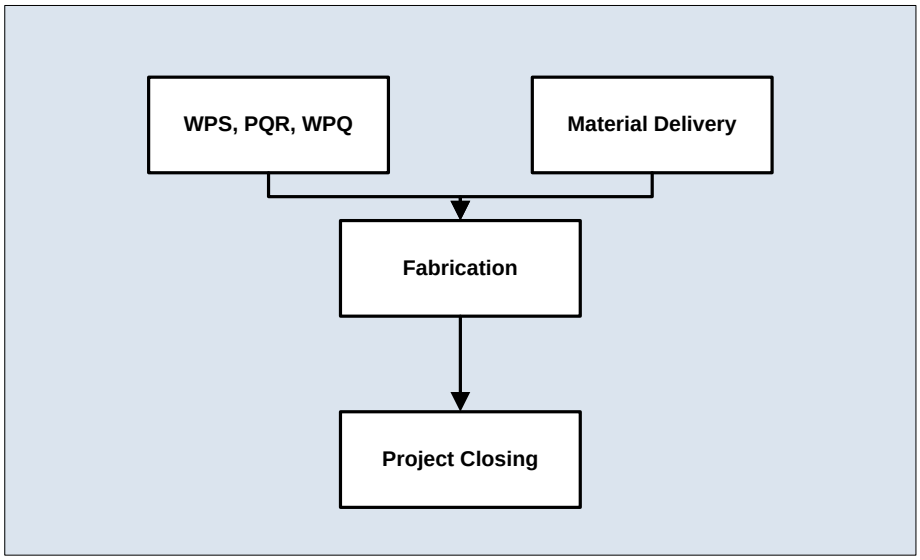


Figure 2. 4: Parts of Quality Assurance (QA) and Quality Control (QC)

The task of Quality Assurance (QA) and Quality Control (QC) process starts from the part that has been highlight as above. Initially, all the documentation for the project should be prepare such as Welding Procedure Specification (WPS), Procedure Qualification Record (PQR) and Welder Performance Qualification (WPQ), and also all the checklist and report for the project. This is the part of quality assurance (QA).

When it goes down to fabrication part, Quality Control (QC) Inspector was responsible to construct all the inspection and testing for example dimensional check, fit-up, visual inspection and other. As the close out of the project, Manufacturer's Data Report (MDR) should be arranging. It is a compilation of all the documentation for the project for instance drawing, welding procedure specification (WPS) and design calculation.