UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF CHASSIS FOR SHELL ECO MARATHON.

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Automotive) with Honours.

by

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This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as partial fulfillment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Kajian ini berkaitan dengan operasi pengelasan arka plat tipis yang ketebalannya 1mm dengan menggunakan ASTM D1002. Kajian ini bertujuan untuk menentukan proses kimpalan yang sesuai untuk digunakan dalam industri automotif dengan membandingkan kesan parameter kimpalan pada sifat tegangan dan makrostruktur spesimen dikimpal dari Gas Metal Arc Welding (GMAW). Kekuatan struktur kenderaan casis kebanyakannya bergantung kepada struktur kimpal. Oleh itu, projek ini bertujuan untuk mengkaji kesan parameter kimpalan yang berbeza pada sifat mekanik kimpalan MIG. Parameter rintangan MIG rintangan seperti kimpalan semasa, daya kimpalan, dan masa kimpalan telah ditukar diikuti dengan parameter yang ditetapkan. Dalam projek ini, ujian tegangan dan kekerasan tegangan sambungan lap di tempat kimpalan untuk ketebalan 2.00 mm lembaran yang dikimpal dua lapisan telah diselidiki. Proses ujian yang telah dilakukan adalah uji ricih tegangan dengan menggunakan Mesin Ujian Universal. Dengan hasil yang diperolehi dalam projek ini, parameter empat nampaknya menjadi parameter yang paling baik berbanding yang lain. Yang paling kurang kecemerlangan ialah parameter yang mempunyai nilai tegangan dan kekerasan yang paling rendah. Keputusan kajian ini didapati, parameter empat sesuai untuk proses kimpalan MIG kerana ia mempunyai kualiti yang tinggi dari segi kekuatan

ABSTRACT

This study deals with the arc welding operation of the thin plate which thickness is 1mm with using ASTM D1002 standard. This study aims to determine the suitable welding process to be applied in the automotive industry by comparing the effect of welding parameters on the tensile properties and macrostructure of welded specimens of Metal Inert Gas (MIG) welding. The strength of the chassis vehicle structure mostly depends on the weld structure. Thus, this project purposed to study the effect of different welding parameters on the mechanical properties of MIG welding. The parameter of resistance MIG welding such as welding current, welding force, and welding time was changed followed by the parameters designated. In this project, the tensile strength and hardness test of lap joint in spot welding for 2.00 mm total thickness of the two-layer welded sheet were investigated. The testing process that had been done is the tensile shear-test by using Universal Testing Machine. By the results obtained in this project, best welding parameter with significant strength is determined. The less performing parameter is the one that has lowest shear strength value. The study found that, varying the welding parameters for MIG welding process will have effect in terms of strength and rigidity. Correct welding parameter should be determined before developing a lightweight chassis with thin wall thickness.

DEDICATION

Most Elevated Exceptional Grateful To Both My Beloved Father and Mother

Suhaimi bin Abdul Rahman

&

Nafisah Binti Deris

Also

Beloved Brothers and Sisters

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ϵ	=	True Strain
σ	=	TrueStress,Pa
S	=	Engineering Stress, Pa
e	=	Engineering Strain
P	=	Load, N
A	=	Area, m^2
L	=	Length, m
E	=	Modulus Elasticity
σ_{UTS}	=	Ultimate Tensile Strength

LIST OF ABBREVIATIONS

UTM	Universal Testing Machine
UTS	Ultimate Tensile Strength
MIG	Metal inert gas
ASTM	American Society for Testing and Materials
HAZ	Heat affected zone
SMAW	Shielded-metal arc welding
MAG	Metal active gas
RSW	Resistance spot welding
SAW	submerged arc welding
CCN	Cocuring without adhesive
CCA	Cocuring with adhesive
SEB	Secondary bonding
COB	Co-bonding

CHAPTER 1

INTRODUCTION

1.1 Introduction

In this chapter, it consists of a literature review by the previous researched based on articles, books, journal, and other sources. The explanation of this chapter includes Metal Inert Gas (MIG) welding, welding parameter, and material of mild steel and design of the experiment. It covers all the information that has been used in this research and project.

1.2 Background.

The chassis is the vehicle's middle frame which must carry all components and carry all loads. This load includes the weight of each component and the force experienced during acceleration, braking, and cornering. Components that are usually attached to the chassis are the engine, the control arm, the steering system, the braking system, and the seat, so the chassis is considered the most important element of the vehicle because it unites all the parts and components. A well-designed chassis is important to ensure safety, performance and road safety. In the event of a collision, the chassis must be able to protect passengers from injury. The frontal impact is absorbed by a collision on the front of the case. In the event of a rollover accident, occupants are protected by the main and front trunks, which form the main part of the chassis. Side impact protection protects occupants if side effects occur. In addition to the safety aspect, the chassis must also be designed for fuel-efficiency. Therefore, the material should be reduced in order to

develop a lightweight chassis that meet safety and fuel efficiency requirements. An appropriate parameter for joining each chassis component should be determined in order to improve strength while minimizing fatigue. In this project, the metal inert gas welding process had been chosen to join the chassis structure.

1.3 Problem Statement

The parameter is one of the key factors in the welding process that affect the welding strength. The parameter is such a current, voltage, welding speed, and welding pattern. The optimization parameter for welding mild steel plate ASTM D1002 hollow square using MIG welding. Using thin material as thin as 1.0mm hollow square sheet metal is difficult to make joining via MIG welding. In order to get a good welding quality with optimum strength, the exact parameter and welding setup is required. By varying the welding parameters, the welded parts will be tested using the universal testing machine (UTM). The shear strength result will be analyzed and the best parameters will be presented.

1.4 Project Objective

This project's objective includes the research's main point and the outcome we can get from the research. These are the objectives of this research:

i. Use the different welding parameters to examine the strength of the welding area for the same specimen.

ii. To examine the factor that contributes more to the welding strength

iii. To determine the optimal welding parameter for joining ASTM D1002 hollow square

1.5 Project Scope

The welding parameter is an evaluation of the welding specimen according to the ASTM standard. First, cut the raw material to the required dimensions by workpiece size is 100 mm (length) x 19 mm (width) x 1 mm (thickness). On every pair of plates, there will be a groove (30). The welding parameter will be set on the machine, using nine samples with different parameters. After the welding process, each sample will be sent to the tensile test. The results are examined with different parameters for each plate.

The development of lightweight chassis only focuses on the welding process. Other methods of joining such as adhesive, rivet are not in the scope of work. Only CO2 welding is covered in this study. All welding parameters are tested on the same specimen size and materials.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In order to find related information, this chapter discusses previous research and collected sources on this project. The sources are newspapers, articles, reports, websites, books, and websites. The main purpose of this chapter is to convey the knowledge and ideas of other researchers as a guideline for completing this project. The information obtained is chosen based on the objectives of the project. For example, information on the chassis frame, materials, rigidity, and the safety factor is needed to achieve the objectives.

2.2 Chassis

A vehicle without a body is called a chassis. Initially, chassis was used to indicate the frame parts or basic structure of a vehicle. It is the structural backbone of any vehicle. The main function of the chassis frame is to resist the body, parts, and components as well as the payload placed on it. The chassis must retain the stresses, deformation, shock, twist vibration and other stresses developed (Francis et al 2014). Chassis is also a skeletal frame where mechanical parts like engine, tires, axle, assemblies, brake, and steering have been joined together. It is the most important element that, under different conditions, gives the vehicle strength and stability to keep the vehicle rigid, rigid and unbending. It's usually made from a steel frame. Four major types of chassis frames are available which is chassis ladder, backbone chassis, chassis space frame and chassis monocoque

(*Structural Analysis of Heavy Vehicle*, 2015). In the following section, each type is explained.

2.3 Spaceframe

There are different possibilities with regard to the frame geometry in the design space defined by the position of the conventional driver forward and backward. At this time, as it facilitates the driver and optimizes driver comfort, the driver's seat is the most commonly used design today for a good reason. In addition, there is no confirmation of the seating position for which it will or will not relate to maximum power output (Lei et al., 1993). Aerodynamics of frontal area, ergonomics and driver comfort, stability, frame type experience, and frame geometry innovation are some of the criteria used for comparisons (Darvirris et al., 2009). Fit and ergonomics also have enormous impacts on the driver's power and confidence, particularly on a new driver’s. It is therefore crucial that each of the drivers can pedal effectively and achieve their full skills without any obstacle. Body measurement parameters are becoming important criteria when designing an HPV as shown in Figure 2. 1.