

CARBON DIOXIDE (CO<sub>2</sub>) LASER CUT QUALITY  
USING DIFFERENT FEED  
RATE AND CONSTANT POWER LEVEL

MOHD YUSRIZAL BIN MOHD ALI

Report submitted in partial fulfillment of the requirement  
for the award of the degree of  
Bachelor of Mechanical Engineering

Faculty of Mechanical Engineering  
Universiti Malaysia Pahang

NOVEMBER 2008

## SUPERVISOR DECLARATION

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scopes and quality for the award of the degree of Bachelors of Mechanical Engineering.

**Signature** : .....

**Supervisor** : **Mdm. Nurul Shahida Binti Mohd Shalahim**

**Position** : .....

**Date** : .....

**Signature** : .....

**Panel** : **Mr. Zamri Bin Mohamed**

**Position** : .....

**Date** : .....

**STUDENT DECLARATION**

I declare that this dissertation entitled "*Carbon Dioxide (CO<sub>2</sub>) Laser Cut Quality Using Different Feed Rate and Constant Power Level*" is the result of my own research except as cited in the references. The dissertation has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

**Signature** : .....

**Name** : **MOHD YUSRIZAL BIN MOHD ALI**

**ID Number** : **MA 05074**

**Date** : .....

To my beloved Mother and Father

Mr. Mohd Ali Bin Shaari

Mdm. Siti Ain Sarah Binti Abas

## ACKNOWLEDGEMENT

Praise to Allah S.W.T., the Most Merciful and the Most Compassionate. Peace upon Him, Muhammad S.A.W., the messenger of Allah.

First and foremost, I would like to express my gratitude to my supervisor and co-supervisor, Madam Nurul Shahida binti Mohd Shalahim and Mr. Mahendran Samykano for their invaluable guidance, suggestions and helpful advices are highly appreciated. This acknowledgement also goes to all lecturers and associates in Faculty of Mechanical Engineering, University Malaysia Pahang especially Mr. Khairul Fikri Bin Muhamad. Their contribution and cooperation during my research was really helpful and I really appreciate it.

My thanks also extended to all my beloved friends, BMM Class of 2005 -2009 for sharing their input, information and ideas on this thesis especially for their critical eyes and minds which gave me a lot of confidence to finish this project.

Finally, I wish to convey my heartfelt thanks to my beloved parents, Mohd Ali Bin Shaari and Siti Ain Sarah Binti Abas who gave me constant support and encouragement throughout the dissertation.

## ABSTRACT

In manufacturing industries, laser is uniquely versatile tool for processing a remarkable range of metals, alloys, ceramics, glasses, polymers and composites. Light can be produced in pulsed or continuous form with different wavelength and power level. Laser processing has greater advantages compared to the traditional methods of industrial fabrication. It can be a profitable replacement for an existing technique. This differs to the traditional machine tools that are normally designed for a particular purpose. There are a large number of parameters that control the laser cutting process. Each parameter has its own function which can affect the processing operation. The most important parameters to be considered is the laser power level range because there is significant relationship between power level and feed rate. The different laser cut power level range will produce different type of results depends on the feed rate. So, in this project sample of acrylic were cut on a CO<sub>2</sub> laser cutting system with the variation in feed rate value and constant power level. The effect of both factors on width of heat-affected zone (HAZ), and striation frequencies have been studied. Manual calculation was used to develop graph that describes the effect on both factors on laser cut quality. As a result, the increased in feed rate were led to the decrease of the width of the heat-affected zone. The striation frequencies were increased with the increased of feed rate. Its means that, feed rate has important has a major effect on both the width of HAZ and striation frequency. To obtain better result, environmental effects such as room temperature, air ventilation, air humidity and lightning condition should be considered.

## ABSTRAK

Di dalam industri pembuatan, laser digunakan secara meluas untuk memproses pelbagai jenis logam, aloi, seramik, kaca, polimer dan komposit. Sinaran dalam bentuk denyutan ataupun berterusan terhasil dalam pelbagai julat panjang gelombang dan kuasa. Laser mempunyai kelebihan jika dibandingkan dengan kaedah-kaedah tradisional yg digunakan dalam industri. Ia boleh digunapakai sebagai pengganti kepada kaedah-kaedah yang sedia ada. Terdapat banyak pembolehubah yang mengawal pemprosesan menggunakan laser. Setiap pembolehubah mempunyai fungsi tersendiri dimana setiap pembolehubah ini mampu memberi kesan kepada operasi proses yang dijalankan. Kuasa dan halaju potongan merupakan pembolehubah yang paling penting dalam proses yang melibatkan laser. Penggunaan kuasa laser yang berbeza akan menghasilkan hasil potongan yang berbeza bergantung kepada halaju potongan yang digunakan. Oleh sebab itu, di dalam projek ini, akrilik akan dipotong menggunakan sistem laser karbon dioksida (CO<sub>2</sub>) dengan menggunakan halaju potongan yang berbeza dibawah satu nilai kuasa yang tetap. Kesan terhadap zon kesan haba (HAZ) dan frekuensi pengoresan akan dianalisis. Pengiraan secara manual akan digunakan untuk menghasilkan graf yang menunjukkan hubungan antara kedua-dua pembolehubah terhadap kualiti potongan. Peningkatan dalam halaju potongan akan menyebabkan pengurangan dalam zon kesan haba (HAZ) dan peningkatan dalam frekuensi pengoresan. Ini bermakna, halaju potongan memainkan peranan penting dalam pembentukan HAZ dan frekuensi pengoresan. Hasil eksperimen yang lebih baik boleh diambil sekiranya faktor-faktor persekitaran seperti suhu bilik, pengudaraan, kelembapan udaram dan keadaan pencahayaan dapat dikawal.