

A STUDY OF WARPAGE AND WELD LINE  
DEFECTS ON A PLASTIC COMPOSITE'S MANHOLE  
COVER

HAZWANI BINTI KAMARULZZAMAN

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SCHOOL OF MANUFACTURING ENGINEERING  
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# A STUDY OF WARPAGE AND WELD LINE DEFECTS ON A PLASTIC COMPOSITE'S MANHOLE COVER

by

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Report submitted in partial fulfillment  
of the requirements for the degree  
of Bachelor of Engineering



**UniMAP**

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## **APPROVAL AND DECLARATION SHEET**

**This project report titled A study of warpage and weld line defects on a plastic composite's manhole cover was prepared and submitted by Hazwani Binti Kamarulzaman, (Matrix No: 061120186) and has been found satisfactory in terms of scope, quality and presentation as partial fulfillment of the requirement for the Bachelor of Engineering (Manufacturing Engineering) in Universiti Malaysia Perlis (UniMAP).**

**Checked and Approved by**

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**Project Supervisor**

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**April 2010**

# **MENGAJI KEUPAYAAN UNTUK MENGGANTIKAN BESI BERACUAN DALAM PEMBUATAN PENUTUP LUBANG DENGAN THERMOPLASTIC OLEFINS (TPO)**

## **ABSTRAK**

Penutup lubang biasanya diperbuat daripada besi beracuan bagi menampung beban yang tinggi. Kajian ini mengkaji tentang bagaimana hendak memilih dan mengenalpasti material plastik komposit yang paling sesuai bagi menggantikan material asal penutup lubang. Material plastik komposit tersebut mestilah tahan lasak dan mempunyai kos yang rendah. Di samping itu, kajian tentang kesan terhadap parameter yang menyebabkan keledingan dan garis kimpal juga perlu dilakukan bagi mencari material plastik yang paling sesuai. Oleh sebab itu, projek ini bertujuan untuk mendapatkan gabungan parameter yang boleh mengoptimumkan penyebab berlakunya keledingan dan garis kimpal pada material plastik komposit. Projek ini bermula dengan pembikinan awalan rekabentuk penutup lubang bersesuaian dengan material barunya iaitu plastik komposit dan mengenalpasti faktor-faktor yang berkemungkinan akan memberi kesan ke atas tindak balas keledingan dan garis kimpal. Kemudian, eksperimen dijalankan dengan menggunakan perisian Moldflow Plastics Insight (MPI). Lapan parameter telah dipilih termasuklah masa pengisian, suhu acuan, suhu melebur, masa menyejuk, masa pek, tekanan pek, masa suntikan material, dan tekanan suntikan material. Projek bermula dengan mengaplikasikan Rekabentuk Eksperimen (DOE) dengan menggunakan Kaedah Taguchi. Keputusan daripada 18 eksperimen percubaan ini dianalisis untuk mendapatkan keadaan optimum dan nilai anggaran keledingan dan garis kimpal. Langkah terakhir ialah ujian kepastian untuk melihat peratusan kesalahan dibandingkan dengan nilai sebenar. Semua keputusan telah dibincangkan di dalam bahagian 4.

## **A STUDY OF WARPAGE AND WELD LINE DEFECTS ON A PLASTIC COMPOSITE'S MANHOLE COVER**

### **ABSTRACT**

Manhole covers are generally made out of cast iron in order to bear the large loads [1]. This study is about choosing and identifying the most suitable plastic composite material which can best replace cast iron. The plastic composite must be high durability and low cost. Besides that, the effects of parameter which causes warpage and weld line also must be done to identify the most suitable plastic composite material. Therefore, the goal of this project is to achieve the parameter's combinations which are able to minimize causes of warpage and weld line on plastic part. This project is begun with the design concept of the manhole cover which is suitable with the new material of plastic composite material condition and identifying all factors which may affect warpage and weld line defects responses. Then, the experiment is held by using Moldflow Plastics Insight (MPI) software. Eight parameters have been chosen including the filling time, mold surface temperature, melt temperature, cooling time, packing time, packing pressure, injection time, and injection pressure. This project begins with the Design of Experiments (DOE) by applying Taguchi Method with Orthogonal Array  $L_{18}2^{13}7$ . The results from eighteen trial experiments are analyzed to get the optimum condition and estimate values of warpage and weld line values. The last steps in this project is the confirmation test to see the difference or how far the actual value error percentage from the predicted value. All the results have been discussed in Chapter 4.

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