DEVELOPMENT OF A NEW JOINTING SYSTEM FOR OPEN PLAN OFFICE SYSTEM

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MASTER OF SCIENCE
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DEVELOPMENT OF A NEW JOINTING SYSTEM FOR OPEN PLAN OFFICE SYSTEM

By

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Thesis Submitted to School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirement for Degree of Master of Science

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DEDICATION

This thesis is dedicated to my parents

and my family,

my wife Hanim and my daughters Sarah, Illyah and Aein

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for degree of Master of Science

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Chairman : Associate Professor Rosnah bt Mohd Yusuff, PhD

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Most modern offices use open plan office system due to the flexibility of the product. The open plan office system (OPS) can be customized from low screen to high screen and can be installed and dismantled according to the office needs. According to MIDA (Malaysian Industrial Development Authority) the total sales for Malaysian office furniture industries was RM 1.6 billion in 2003 of which 7.2% (115 million) comes from sales generated from the open plan office system. The sales report showed the importance of the open plan office system in creating the office environment. Since the demand of OPS is increasing, effective ways of assembling the system is required. Most OPS manufacturer uses bolts and nuts as a jointing system. However, this jointing system requires many parts and the assembly process is time consuming. Based on a survey carried out on 26 OPS manufacturers, the main criteria of the jointing system design identified were those that can increase efficiency and facilitate assembly. One of the important functions of the

jointing systems is to ensure that the system is flexible during the assembly process. Based on these findings, the study looked into various jointing system design concepts and the different materials that can satisfy all the requirements. Two designs of the jointing system have been proposed in this study. The designs were based on the snap fit concept and referred to 'Design for Assembly' (D*f*A) guidelines. Design proposal 1 is based on cylindrical or annular snap fit joint concept and design proposal 2 is based on a cantilever lug snap fit joint concept. The assembly and strength of the joints of the proposed designs were simulated using 'COSMOSXpress 2003' software with reference to the tile system model. The simulation showed that the new jointing system complied with all the requirements of the design factor specified by the manufacturers and D*f*A guidelines. It showed that the new jointing system is better than bolt and nut joint not only in terms of ease of assembly but also efficiency. The simulation results showed that although both design proposal 1 (cylindrical) and 2 (cantilever) were similar in many aspects which are easy to assembly, reduce time, light weight and reduce part, but design proposal 1 failed the strength test. The advantage in strength makes design proposal 2 is a better choice.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

PERKEMBANGAN SISTEM PENYAMBUNGAN BARU UNTUK SISTEM PEJABAT TERBUKA

Oleh

MOHD SHAHRIZAL B. Hj. DOLAH

Julai 2006

Pengerusi : Professor Madya Rosnah bt Mohd Yusuff, PhD

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Hampir semua pejabat moden menggunakan 'sistem pejabat terbuka' memandangkan produk tersebut mudah dipasang. Sistem pejabat terbuka boleh diubah suai dari skrin yang rendah hingga skrin tinggi mengikut kehendak pengguna. Mengikut perangkaan yang telah dikeluarkan oleh Malaysian Industrial Development Authority (MIDA) pada tahun 2003, indusrti perabot pejabat telah menyumbangkan sejumlah RM1.6 bilion kepada pendapatan negara dimana 7.2% (RM 115 juta) daripadanya adalah hasil daripada penjualan 'sistem pejabat terbuka'. Daripada perangkaan tersebut menunjukkan kepentingan 'sistem pejabat terbuka' di dalam membentuk ruang pejabat masa kini. Memandangkan pemintaannya yang semakin meningkat, satu sistem pemasangan yang efektif diperlukan. Kebanyakkan pengilang menggunakan '*bolt*' dan '*nut*' sebagai sistem pemasangan. Namun demikian sistem ini melibatkan banyak komponen dan

mengambil masa yag lama. Daripada soal selidik yang telah dijalankan keatas 26 pengeluar sistem pejabat terbuka, satu sistem penyambungan yang dapat meningkatkan keberkesanan dan memudahkan proses pemasangan adalah merupakan kriteria yang diutamakan. Salah satu fungsi penting sistem penyambungan ialah untuk memastikan keanjalan dalam proses pemasangan. Berdasarkan dapatan, kajian melihat pelbagai jenis sistem penyambungan, konsep reka bentuk dan bahan yang dapat memenuhi segala criteria yang telah ditetapkan telah dikaji. Berdasarkan kajian ini, dua konsep reka bentuk telah dicadangkan. Kedua-dua reka bentuk yang dicadangkan menggunakan konsep *'snap fit'* dan merujuk kepada garis panduan *'Design for Assembly' (DfA).* Reka bentuk cadangan 1 adalah berdasarkan konsep *snap fit cylindrical* atau *annular* manakala reka bentuk cadangan 2 adalah berdasarkan konsep *snap fit cantilever*. Ujian simulasi pemasangan dan kekuatan reka bentuk cadangan dilakukan menggunakan perisian '*COSMOSXpress 2003*' dengan merujuk kepada model '*tiles system'*. Hasil simulasi menunjukkan sistem penyambungan yang dicadangkan memenuhi semua kriteria yang telah dikenalpasti dan juga memenuhi garispanduan *DfA*. Sistem penyambungan yang dicadangkan bukan sahaja memudahkan pemasangan tetapi juga lebih effisien. Hasil simulasi juga menunjukkan walaupun reka bentuk cadangan 1(cylindrical) dan 2 (cantilever) adalah mempunyai persamaan dari banyak aspek dari segi memudahkan pemasangan, masa pemasangan, ringan dan mengurangkan komponen, tetapi reka bentuk cadangan 1 gagal dalam ujian kekuatan. Kelebihan dari segi kekuatan membuatkan reka bentuk cadangan 2 adalah pilihan yang terbaik.

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Finally, I also wish to express special thank to my family and other individuals for their support and encouragement for making this study possible.

"Advancing the world with logic design"
+ Leonardo da Vinci+

I certify that an Examination Committee has met on 13 July 2006 to conduct the final examination of Mohd Shahrizal B. Hj. Dolah on his Master of Science thesis entitled "Development of a New Jointing System for Open Plan Office System" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Member of the Examination Committee are as follow:

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This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as partial fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee are as follow:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotation and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

_____

MOHD SHAHRIZAL B. Hj. DOLAH

Date :

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

GLOSSARY OF TERM

ABS	**Acrylonitrile-butadiene-styrene**
CAD	**Computer-Aided Design**
CAE	**Computer Aided Engineering**
D*f*A	**Design for Assembly**
D*f*M	**Design for Manufacturing**
DIY	**Do It Yourself**
FEA	**Finite Element Analysis**
FOS	**Factor of Safety**
FRIM	**Forest Research Institute of Malaysia**
MATRADE	**Malaysian External Trade Development Cooperation**
MDF	**Medium Density Fiberboard**
MFIC	**Malaysian Furniture Industries Council**
MFPC	**Malaysian Furniture Promotion Council**
MIDA	**Malaysian Industrial Development Authority**
MS Words XP	**Microsoft Words Explorer**
MTIB	**Malaysian Timber Industrial Board**
NM	**Minimum number of part**
OPS	**Open Plan Office System**
PA	**Polyamide**
PANCON	**Panel Connection**
PC	**Polycarbonate**
PDS	**Product Design Specification**

PE	**Polyethylene**
PMMA	**Polymethylmethacrylate**
POM	**Polyoxymethylene**
PP	**Polypropylene**
PS	**Polystyrene**
PU	**Polyurethane**
PVC	**Polyvinylchloride**
R&D	**Research and Development**
R1.2	**Release 1.2**
R2.4	**Release 2.4**
SIL	**Silicones**
TM	**Total assembly time**
UV	**Ultra Violet**
VP	**Vertical pole**