UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Study Performance of Cylindrical Grinding On Straightness

Thesis submitted in accordance with the partial requirement of the Universiti Teknikal Malaysia Melaka for the Degree of Bachelor of Manufacturing Engineering (Manufacturing Process) with Honours

BY

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May 2008

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PSM

JUDUL:

STUDY PERFORMANCE OF CYLINDRICAL GRINDING ON STRAIGHTNESS

SESI PENGAJIAN:
SEMESTER 1 & 2 2007/2008

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (*Manufacturing Process*) with Honours. The members of the supervisory committee are as follow:

MOHD AMRI BIN SULAIMAN

Main Supervisor

(Official Stamp & Date)

ABSTRACT

Main goal through this project is to have the deeply knowledge to the performance of cylindrical grinding on straightness of the specimen, an experimental investigations were planned with machining difference type of specimen materials. Detail studies were been done for the speed of grinding cutting, feed rate, type of specimen material that were use, and table speed. Attempts were made to mild steel and stainless steel with difference of strength to get the result. The objective of the project is to expose the students about the knowledge to identify machine part and performance of cylindrical grinding conventional machine. These projects are also including machine operating training session in order to make student easily understand the machine principle to produce full report writing, slide presentation and report during this project. The studies also concern the student capability through process and maintenance. All data will be evaluated done from the project lab result. The performance of the cylindrical grinding machine were related with all parameter, material structure, coolant type, machine alignment and procedure used. Lastly, after getting the result, conclusion will be able to make for complete the report. The conclusion explains about the problems occurs and problem solving.

ABSTRAK

Matlamat utama projek ini adalah untuk mendapatkan pengetahuan yang lebih mendalam mengenai perlaksanaan mesin pengisar membulat terhadap kelurusan bahan kajian melalui penggunaan jenis bahan kerja yang berbeza. Kajian terperinci dijalankan terhadap kelajuan mengisar, kedalaman suapan, jenis bahan kerja yang digunakan serta kelajuan pergerakan meja mesin. Percubaan dijalankan ke atas keluli lembut dan keluli tahan karat yang mempunyi perbezaan kekuatan untuk mendapatkan keputusan kajian. Tujuan projek ini adalah untuk memberikan pendedahan pengetahuan kepada pelajar untuk mengenal pasti bahagian-bahagian mesin dan perlaksanaan oleh mesin pengisar membulat biasa. Sesi latihan mengoperasikan mesin juga turut disertakan bagi memudahkan pelajar lebih memahami prinsip pengoperasian mesin serta menyediakan laporan dan membuat perbentangan untuk projek ini. Kajian juga berkenaan kebolehupayaan pelajar melalui kerja penjagaan mesin. Setiap keputusan akan dinilai melalui data dari kajian yang dijalankan. Persembahan mesin pengisar adalah berhubung kait dengan parameter, struktur bahan kajian, jenis cecair penyejuk, penjajaran mesin, dan kaedah yang digunakan. Akhir sekali, setelah mendapat keputusan, kesimpulan dapat dibuat untuk melengkapkan laporan. Kesimpulan menerangkan permasalahan yang timbul dan penyelesaian masalah.

DEDICATION

Special thanks I dedicate to my beloved family especially for my father (Samdin bin Ali) and my mother (Pauziyah binti Abd. Ghani). Thanks for all your love and support. I also would like to say thanks to all my friends and class mate for contributing to the success of my project. The successful of this project cannot be achieved without all of you. Once again, thank you to all for ever thing.

ACKNOWLEDGEMENTS

ALHAMDULILLAH, thanks to Allah the Almighty God for giving me strength and patience to work on my final year thesis project. I would like to take this opportunity to express my sincere and deepest gratitude to my PSM supervisor Mr Mohd Amri Sulaiman, for his guidance and opinion in the cause of completing this report. My greatest thanks to my beloved family for their prayers, support and encouragement throughout this entire period of this project.

I also would like to convey my biggest thanks to all UTeM staff especially to all staff at manufacturing department for supporting me throughout my PSM Project. The knowledge and experience I gained from you all will not be forgotten. I'm also obliged to everyone who had directly and indirectly involve through contributions of ideas, as well as materials and professional opinions.

Last but not least, thank you very much especially to UTeM for giving me this kind of chances. Many of my projects would not be completed successfully without their help.
Thank You.

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

CNC	-	Computer Numerical Control
DOE	-	Design of Experiment
FKP	-	Fakulti Kejuruteraan Pembuatan
PSM	-	Projek Sarjana Muda
UTeM	-	Universiti Teknikal Malaysia Melaka
In/min	-	Inch per Minute
rpm	-	Revolution per Minute
µm	-	Micron Meter
mm	-	Millimeter
L_s	-	Length of ground dimension on workpiece, in.
T_s	-	Total rough or finish stock depth removed from diameter, in.
D	-	Original workpiece diameter, in.
W	-	Wheel width, in.
P	-	Traverse for each work revolution in fraction of wheel width
fi	-	Infeed of wheel per pass, in./pass
v	-	Workpiece peripheral velocity, in. /min
PS	-	Manufacturer's symbol indicating exact kind of abrasive
A	-	Aluminum Oxide
80	-	Abrasive Grain size; 80 in fine grain size
K	-	Grade; K is in medium grade.
8	-	The wheel structure
V	-	Bond type; V for vitrified
6N	-	Manufacturer's private marking to identify wheel

LIST OF APPENDICES

CHAPTER 1
INTRODUCTION

1.1 Background of Project

As one of the many tools available to manufacturing, grinding is a distinctive technology that uses abrasives or synthetic minerals in loose or bonded form. Grinding is one of most important technologies used by manufacturing today. Used to machine and finish materials, grinding is in many cases the only method available to engineers, particularly when ceramic or new composite materials are involved. In other cases, grinding competes with other technologies and offers the most economical way to produce precision component. As compared with other machining processes, grinding is a costly operation that should be utilized under optimal conditions.

Grinding is a finishing process used to improve surface finish, abrade hard materials, and tighten the tolerance on flat and cylindrical surfaces by removing a small amount of material. In grinding, an abrasive material rubs against the metal part and removes tiny pieces of material. The abrasive material is typically on the surface of a wheel or belt and abrades material in a way similar to sanding. On a microscopic scale, the chip formation in grinding is the same as that found in other machining processes. The abrasive action of grinding generates excessive heat so that flooding of the cutting area with fluid is necessary.

In Faculty of Manufacturing Laboratory in Universiti Teknikal Malaysia Melaka there were new types of machine called Cylindrical grinding machine. Hence, this report is mainly purpose to cover the study of performance of the cylindrical grinding. This study also to determine the machine capability in term of producing high accuracy and precision, the highly product finishing that can influence by straightness to the product.

1.2 Problem Statement

i. Cylindrical grinding machine is a new machine in FKP laboratory. Thereby, student does not have any experience of handling the machine.
ii. Student does not know the machine performance because there is no machining has done before.
iii. This study will develop the appropriate parameter for cylindrical grinding machining that can practice for the student.

1.3 Objectives

i. To study the performance of Cylindrical Grinding machine in FKP Laboratory
ii. To analyzed the straightness factor of the finish product using Mahr Formtester MMQ44 at the university Metrology Lab.
iii. To determine relationship between parameters and term of straightness factor.
iv. To expose student how to research environment such as Design Of Experiment (DOE) and others.

1.4 Scope Project

The scope of this project is to handling an appropriate machining operation by using the cylindrical grinding machine to study the machine performance in term of straightness factor. The Universal Cylindrical Grinder Model OD618S will be used in the study is. The material used for machining is mild steel SS400 and stainless steel SUS 304. The parameters that involve in this analysis are work head speed, depth of cut, and traverse speed are set followed to the design of experiment (DOE). Parameters such as coolant which is Pretech Cool Syn 3000 Green with a 1-3% of viscosity and abrasive wheel speed are constant. The straightness test for the specimen will be test or conduct by using the Mahr Formtester MMQ44 at the Metrology Lab and method that is will be applied to determine the straightness.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction to Cylindrical Grinding Machines

Grinding machines finish parts having cylindrical, flat, or internal surfaces. The surface of the parts largely selects the grinding machines. A machine grinding cylindrical surfaces is called a cylindrical grinder. Machines designed for special functions, such as tool grinding or cutting off, are designated according to their operation. [13]

Cylindrical grinding machines were used extensively in engineering workshops and industries for finish pre-machined and heat-treated components. Grinders can rough out and finish the work to fine tolerances. The surface and great accuracy can be obtained more economically on grinders than other machines.

In Manufacturing Laboratory, the machine that were use for this studies is conventional Universal Cylindrical Grinder Model OD 618H/S, with variable speed table and manual wheel head in feed manufactured by SHARP Precision Machine Tools. The machine has the capability to machine both of internal and external cylindrical grinding.

In the cylindrical grinding machine, the work piece is supported and rotated between centres. The head stock provides the low-speed rotational drive to the work piece and is mounted, together with the tail stock on a work table that reciprocated horizontally using the hydraulic drive. The grinding-wheel spindle is horizontal and parallel to the axis of work piece rotation, and horizontal, hydraulic feed can be applied to the wheel head in a direction normal to the axis of work piece rotation; this motion known as in feed.

A cylindrical surface being generated using the traverse motion; an operation that can be linked to cylindrical to cylindrical turning where the single point cutting tool is replace by a grinding wheel. [13]

The cylindrical grinder traverses the work, to and fro, in repeated passes along the length of the diameter, and the time to traverse is found using [18]:

$$time\ /pass = \frac{L_s \text{ x } T_s \text{ x } D}{(WP)\ 2fi\pi v}$$

Where;

L_s = Length of ground dimension on workpiece, in.
T_s = Total rough or finish stock depth removed from diameter, in.
D = Original workpiece diameter, in.
W = Wheel width, in.
P = Traverse for each work revolution in fraction of wheel width
fi = Infeed of wheel per pass, in./pass
v = Workpiece peripheral velocity, in. /min

2.2 Types of Machine

Cylindrical grinding machines are used extensively in .engineering workshops to finish pre-machined and heat-treated components. Grinders can rough out and finish the work to fine tolerances. The surface finishes and great accuracy can be obtained more economically grinders than on other machines.

(a) The four types of cylindrical grinders are:

i. Plain cylindrical grinding machine
ii. Universal cylindrical grinding machine
iii. Internal grinding machine
iv. Centreless grinding machine

2.2.1 Plain Cylindrical Grinding Machine

This machine is used for grinding parallel, tapered, stepped or formed external cylindrical surfaces. They were originally designed for finishing hardened work, but their operation efficient that they are now used for finishing most types of metals and materials.

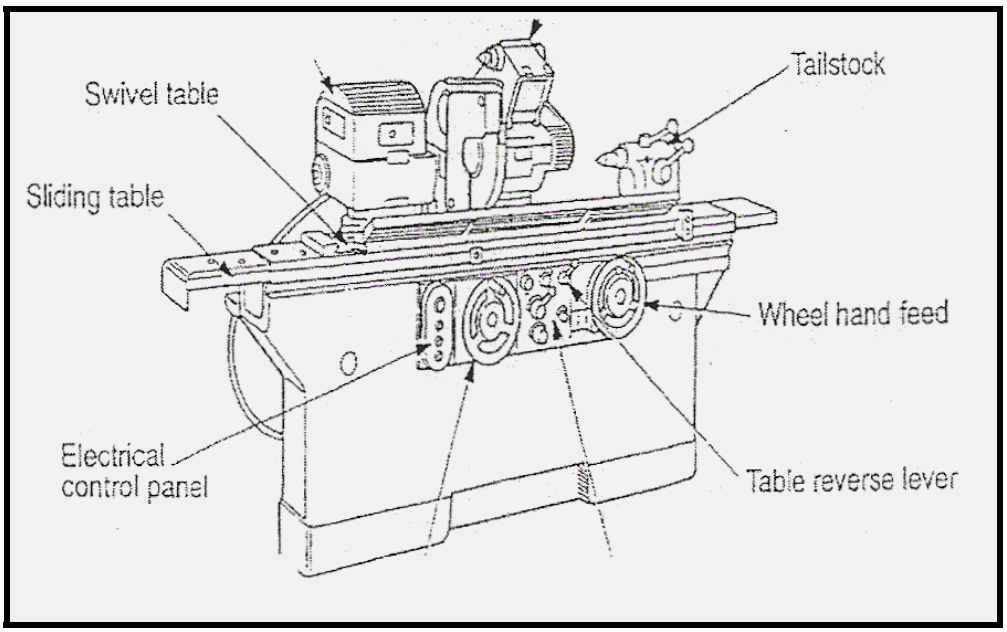

Figure 2.1: Plain Cylindrical Grinding Machine

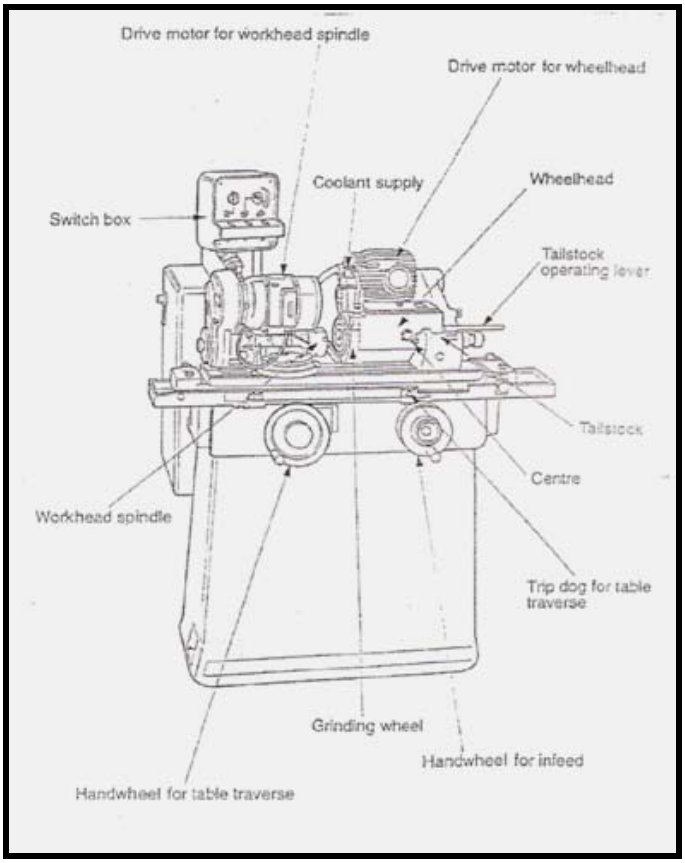

Figure 2.2: Universal Grinding Machine Showing Operating Controls and Principal Parts

2.2.2 Universal Cylindrical Grinding Machine

The universal grinding machine is very similar in construction to a plain grinding machine, except for the work head and the wheel head, both of which swivel. The work head swivels on a graduated base to 100 either side of zero. The wheel head platen not only swivels through 180° either side of zero, but is also mounted on a slide that swivels independently through 800 to 90° either side of zero. Thus, the slide can be set to the grinding angle required, and the platen swivelled through 90° presenting the wheel/face parallel to the face to be ground. A semi-universal machine in common use is very similar, except that the wheel platen and slide do not swivel independently of each other.