

# Unit 10: Mechanical Workshop Practices

<b>Unit code</b>	<b>L/615/1484</b>
<b>Unit level</b>	<b>4</b>
<b>Credit value</b>	<b>15</b>

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## Introduction

The complex and sophisticated engineering manufacturing processes used to mass produce the products we see and use daily has its roots in the hand-operated lathes and milling machines still used in small engineering companies. To appreciate the fundamentals underpinning complex manufacturing processes, it is essential that engineers are able to read engineering drawings and produce simple components accurately and efficiently.

This unit introduces students to the effective use of textual, numeric and graphical information, how best to extract and interpret information from engineering drawings, and the practices of workshop-based turning and milling machining.

On successful completion of this unit students will be able to identify the mechanical measurement and quality control processes to analyse the dimensional accuracy of a machined component; operate machining equipment to produce a range of components to specification; explain the importance of material selection when choosing the most appropriate machining process; and apply safe working practices throughout.

## Learning Outcomes

By the end of this unit students will be able to:

1. Identify the potential hazards that exist when operating machine tools and bench fitting equipment, with reference to the appropriate health and safety regulations and risk assessment criteria.
2. Operate a manual lathe and milling machine to produce dimensionally accurate engineering components.
3. Interpret information from engineering drawings and operate measuring tools and work-holding equipment to check dimensional accuracy of machined components.
4. Explain mechanical measurement and quality control processes.

## Essential Content

### LO1 **Identify the potential hazards that exist when operating machine tools and bench fitting equipment, with reference to the appropriate health and safety regulations and risk assessment criteria**

#### *Safety compliance:*

Importance of, and responsibility for, safe working practice

Safe working practices when operating machining equipment in the mechanical machine workshop

Workshop safety legislation and regulations, and how they are met in practice

Risk assessment of bench fitting and machining activities

### LO2 **Operate a manual lathe and milling machine to produce dimensionally accurate engineering components**

#### *Operation:*

Factors influencing machining operations

Set-up and use of a manual lathe and milling machine following all safety procedures

Most appropriate cutting tools, work and tool holding methods for multiple applications

Speeds and feeds to suit material properties and application

Use of work-holding jigs and fixtures

Removing material within dimensional tolerances

**LO3 Interpret information from engineering drawings and operate measuring tools and work-holding equipment to check dimensional accuracy of machined components**

*Drawings function:*

Types of engineering drawing and their use

Developing proficiency in reading and extracting information from mechanical engineering drawings

Types of measuring tools

Characteristics of measurement tools for inspecting parts

Preparing quality control and inspection reports

**LO4 Explain the types and use of mechanical measurement and quality control processes**

*Control processes:*

Types of production quality control processes, metrology techniques

Importance of quality checks on machined components

Function of quality control metrology equipment, including CNC controlled coordinate measuring machines, mobile measuring arms and touch probes, contact scanning probes and non-contact sensors (optical)

Importance of the process for data collection, analysis and product improvement

## Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
<p><b>L01</b> Identify the potential hazards that exist when operating machine tools and bench fitting equipment with reference to the appropriate health and safety regulations and risk assessment criteria</p>		<p><b>D1</b> Interpret the key features of relevant health and safety regulations as applied to a machining workshop</p>
<p><b>P1</b> Identify the potential hazards that exist when operating machine tools and bench fitting equipment</p> <p><b>P2</b> Describe the safe working practices and procedures to be followed when preparing and using a manual lathe and milling machine</p>	<p><b>M1</b> Produce a risk assessment, identifying suitable control measures, prior to undertaking a machining activity</p>	
<p><b>L02</b> Operate a manual lathe and milling machine to produce dimensionally accurate engineering components</p>		<p><b>D2</b> Illustrate the operating parameters of the milling machine and lathe and describe the function and features of cutting tools, work and tool-holding devices</p>
<p><b>P3</b> Produce a dimensionally accurate component using a lathe and milling machine</p>	<p><b>M2</b> Calculate appropriate cutting speeds and feeds to suit material properties and application for a given component</p>	

Pass	Merit	Distinction
<p><b>L03</b> Interpret information from engineering drawings and operate measuring tools and work-holding equipment to check dimensional accuracy of machined components</p>		<p><b>D3</b> Examine, with reference to material properties and geometry, the criteria for selection of the appropriate tooling for machining components from engineering materials including aluminium alloy, stainless steel and titanium alloy</p>
<p><b>P4</b> Identify the information that is required from a drawing to plan, machine and check the accuracy of a complex engineering component</p> <p><b>P5</b> Describe the function of precision measuring equipment used to check the dimensional accuracy of machined components</p>	<p><b>M3</b> Explain the process of using a dial gauge indicator to set-up work-holding devices on a milling machine</p>	
<p><b>L04</b> Explain the types and use of mechanical measurement and quality control processes</p>		<p><b>D4</b> Illustrate why the process of machining data collection and analysis is of critical importance to a production engineering company</p>
<p><b>P6</b> Explain the purpose of an engineering metrology laboratory and list the equipment found in a typical such lab</p>	<p><b>M4</b> Determine the function of the metrology equipment, surface testing, profile projectors, video measuring, interferometer, SIP measuring equipment, coordinate measuring machines (CMM) and 3D scanners</p>	

## Recommended Resources

### Textbooks

- BADADHE, A.M. (2006) *Metrology and Quality Control*. Tathawade: Technical Publications.
- BLACK, B.J. (2015) *Workshop Processes, Practices and Materials*. Routledge.
- JOHN, K.C. (2010) *Mechanical Workshop Practice*. 2nd Ed. Prentice-Hall.
- NUBUO, S. (2007) *Metrology Handbook: The Science of Measurement*. 5th Ed. Mitutoyo (UK) Ltd.
- RAGHAVENDRA, N.V. and KRISHNAMURTHY, L. (2013) *Engineering Metrology and Measurements*. Oxford University Press.

### Journals

- International Journal of Metrology and Quality Engineering*.
- Metrology Journal*.

### Links

This unit links to the following related units:

*Unit 9: Materials, Properties and Testing*

*Unit 14: Production Engineering for Manufacture*