

# Mechanical Measurement and Quality Control (Metric)

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|------------------|-----------------|
| Catalogue Number | 8014-0002       |
| Category         | Quality Control |
| Duration         | 15 Hours        |

## Activity 1: Getting Started

- Quality Control
- Standards
- Units
- Handling and Care of Measurement Tools
- Hardware Tasks

## Activity 2: Accuracy, Precision, and Measurement Tools

- Inspection and Measurement/ Quality Control Toolkit
- Review of Measuring Tools
- Measurement Accessories
- Accuracy and Precision
- Reliability

## Activity 3: Units of Measurement and Conversion

- Imperial System vs. Metric System
- The Metric System
- The English / Imperial System
- Conversion Table
- Task: Measuring a Piece of Paper
- Task: Calculating the Area and Volume of a Piece of Paper

**Activity 4: Fractions, Decimals, and Rounding**

Fractions vs. Decimals

Task: Converting Measurements

Significant Figures

Task: Conversion

Rounding

**Activity 5: Scaled Measurement Tools**

Scaled Measurement Tools

Common Measurement Errors

Task: Demonstrating Parallax

Common Measurement Errors: Origin Error

Scaled Measurement Tools: Tape Measure

Task: Measuring Outside Dimensions

Steel Rules

Task: Measuring Using the Different Zero

Steel Protractor

**Activity 6A: Vernier, Dial, and Digital Calipers**

Slide Calipers

Vernier Calipers

Dial Calipers

Electronic Digital Calipers

Cleaning the Outside Jaws of a Caliper

Task: Setting Zero on Dial Calipers

Task: Setting Zero on Digital Calipers (For Use with Hardware)

Relative Measurements

Task: Measuring the Dimension of a Plug Gauge

Task: Comparing Outside Diameter Measurements

Measuring Inside Dimension

Task: Comparing Inside Diameter Measurements

Task: Comparing Thickness Measurements

Measuring Depth

Task: Comparing Depth Measurements

Measuring a Step Dimension

Task: Comparing Step Measurements

**Activity 6B: Caliper Hardware Tasks**

Task: Zeroing Dial Calipers (For Use with Hardware)

Task: Measuring the Diameter of a Plug Gauge (For Use with Hardware)

Task: Measuring the Inside Dimension (For Use with Hardware)

Task: Measuring the Inside Dimension (For Use with Hardware)

Task: Measuring Inside Diameter and Outside Diameter (For Use with Hardware)

Task: Measuring a Depth Dimension (For Use with Hardware)

Task: Measuring a Step Dimension (For Use with Hardware)

**Activity 7: Micrometers**

Micrometers

Working with Micrometers

Taking Measurements with a Micrometer

Reading a Micrometer

Cleaning the Outside Jaws of a Micrometer

Task: Measuring an Outside Dimension with a Micrometer

Task: Measuring an Outside Dimension with a Micrometer (For Use with Hardware)

Task: Measuring a Small Curved Object with a Micrometer

Task: Comparing Precision

Hardware Tasks

Task: Measuring a Small Curved Object (For Use with Hardware)

Task: Comparing Accuracy of the Tools (For Use with Hardware)

**Activity 8: Height Gauges and Dial Indicators**

Height Gauges

Surface Plates

Task: Measuring Depth and Height

Task: Measuring a Notch on a Bracket

Dial Indicators

Dial Height Indicators

Task: Measuring a Close Tolerance Dimension

Hardware Tasks

Task: Measuring Depth and Height (For Use with Hardware)

Task: Measuring a Notched Section (For Use with Hardware)

Task: Close Tolerance Dimension (For Use with Hardware)

**Activity 9: Fixed Gauges**

Fixed Gauges

Plug Gauges

Using Plug Gauges to Fixture Parts

Finding the Center of a Hole with a Plug Gauge

Task: Measuring the Holes

Gauge Blocks

Task: Using a Gauge Block

Gauge Block vs. Height Gauge

**Activity 10: Transfer Measurement Tools**

Transfer Measurement Tools

Outside Calipers

Use of Outside Calipers

Task: Using an Outside Caliper

Inside Calipers

Use of Inside Calipers

Task: Using an Inside Caliper

Sources for Error in Caliper Measurements

Dividers

Small Hole Gauges

Telescoping Hole Gauges

Hardware Tasks

Task: Using an Outside Caliper (For Use with Hardware)

Task: Using an Inside Caliper (For Use with Hardware)

**Activity 11: Statistical Analysis**

Statistics

Mean

Median

Standard Deviation

Application of Standard Deviation to a Population

Sample Size

Application of Statistics in Manufacturing

Calculating the Mean for the Manufacturing Example

Calculating the Extreme Spread

Preliminary Conclusion

**Activity 12: Statistical Process Control and Control Charts**

Statistical Process Control

Why is SPC Used?

Where Does the Sampling Occur?

Using Software for Statistical Analysis

Normal Distribution

Hardware Tasks

Task: Collecting Statistical Analysis Data (For Use with Hardware)

Task: Downloading and Installing Software (For Use with Hardware)

Task: Setting Up the Digital Caliper (For Use with Hardware)

Task: Collecting Statistical Analysis Data (For Use with Hardware)

Task: Analyzing the Data (For Use with Hardware)

Example Population Curve

**Activity 13: Nominal Dimensions and Tolerance**

An Engineering Drawing  
Task: Identifying Components of an Engineering Drawing  
Nominal Dimensions  
Tolerances  
Analyzing an Engineering Drawing  
Under Lower Limit and Over Upper Limit  
Tolerances and Fits  
Filling Out an Inspection Sheet - Walkthrough

**Activity 14: Parts Inspection and Inspection Reports**

Inspection  
Completing an Inspection  
Inspection Reports  
How an Inspection Report is Completed  
Non-Conforming Material  
Dim Numbers  
Task: Inspection of Dimension (Dim) 19  
Hardware Tasks  
Task: Inspection of Dimension (Dim) 19 (For Use with Hardware)

**Activity 15: Conclusion**

Quality Control in Industry  
Additional Fixturing and Measurement Tools  
Sine Bars and Sine Plates  
1-2-3 Blocks  
V-Blocks  
In-Process Inspection and Custom Fixtures and Gauges  
Optical Comparator and Shadowgraph  
Coordinate Measuring Machine (CMM)  
Electronic Optical Inspection  
3D Scanning  
Laser Scanning