

Lab Framework

Text:CORD Classic

Unit number and title:13 Precision, Accuracy, and Tolerance

Developed by:Ray Smith

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Lab Title

Measuring the Thickness of Metals Using a Micrometer and a Metal Thickness Gauge

Contact Information: rsmith@centralia.wednet.edu

Short Description: Accurately measuring different pieces of metal using a micrometer and a metal gauge, then comparing the accuracy of measurements, and tolerances of the measurement tools and determining the metal thickness and gauge.

LAB PLAN

TEACHER: Teacher Prep/ Lesson Plan

- **Lab Objective**

Students will be able to accurately read micrometer within thousandths of an inch, measure thickness of metals within a thousandths of an inch, accurately read a metal gauge, and to identify whether the thickness is within given tolerances.

- **Statement of pre-requisite skills needed** (i.e., vocabulary, measurement techniques, formulas, etc.)

vocabulary, knowledge of measurement using decimal fractions, know how to use a metal gauge and micrometer, ability to compare and contrast, addition and subtraction of decimal fractions with positive and negative integers.

- **New Vocabulary**

micrometer, spindle, anvil, sleeve, ratchet stop, thimble, tolerances upper and lower limit (positive and negative), tolerance interval, accuracy, precision, thickness.

- **Materials List**

three labeled different thicknesses of sheet metal, metal gauge, micrometer, paper and pencil per each group of three (adjustable).

- **GLEs addressed**

Math: GLE EALR 1 Understand and applies concepts and procedures of math, GLE 1.1 Understand and apply concepts and procedures from number sense. GLE 1.17 Applies strategies and uses tools to complete tasks involving computation of real numbers.

Reading: GLE 2.1 Demonstrate evidence of reading comprehension. 2.2 Understand and apply knowledge of text components to comprehend text. 3.1 Read to learn new information. 3.2 Read too perform task.(Reading)

Writing: GLE 2.21 Demonstrate understanding of different purposes for writing. GLE 2.4 Writes for career application.

- **Leadership Skills**

Active Skills USA Metals Club

- **SCAN Skills**

Basic Skills: C. Identifies relevant details, facts, and specifications. Writing: B. Records information completely and accurately. Arithmetic: A. Perform basic computation, D. Uses graphs and charts to convey quantities. Math: B. Uses quantitative data to construct logical explanations for real world situations.

Listening: B. To comprehend, D. To critically evaluate, Thinking Skills: Problem solving. Personal qualities: Self management.

- **Set-up information**

Provide materials for each group of three students. Label each piece of metal A,B,C, and record each gauge size and make sure all burrs are removed from metal edges. Make sure each micrometer is zeroed in (use of students a great skill development tool.)

- **Lab organization**(-Grouping/leadership opportunities/cooperative learning expectations; **-Timeline required**)

Use of cooperative learning using a recorder and taking turns so that each student has a chance to 1. record data, 2. measure with a micrometer, and 3. measure with a metal gauge. This lesson could be used in association with the workbook after page 15 where they learn how to use a micrometer.

- **Teacher Assessment of student learning** (scoring guide, rubric)

Students will record data in chart form and take three measurements for each metal. The results need to be within tolerances: the exact metal gauge number and micrometer average reading within 0.001 inches. Students will self assess answers through verbal group sharing (around the room) or filling in the chart in front of the room (option) technique and if discrepancies will remeasure the objects. Teacher will collect data sheets and record accurately results.

- **Summary of learning** (to be finished after student completes lab)

- discuss real world application of learning from lab
- opportunity for students to share/present learning

Students will have learned to properly measure metal thickness using a micrometer and a metal gauge. They will share their information gathered on their data sheets and with the class on the board and orally. Additionally they will have a written evaluation of their results as to whether they met their accuracy and tolerance criteria.

- **Optional activities**

Measure bolts using a bolt gauge and micrometer. Measure wire size with gauge and micrometer.

- **Career Applications**

Welders with choice of materials, metal distributors knowing what size for pricing, Machinists for accurate tool and parts measurements.

LAB TITLE: Measurement of Metals: Thickness

STUDENT INSTRUCTIONS:

- **Statement of problem addressed by lab**

Given a micrometer and a metal thickness gauge, create a data chart that shows accurate measurement of the thicknesses of three pieces of metal identifying the gauge measurement and the decimal measurement in inches to the nearest thousandth; then analyze the data and determine whether the data fits within the tolerance allowed.
- **Grouping instructions and roles**

Groups of three taking turns: 1. recording data, 2. using the micrometer, and 3. using the metal thickness gauge.
- **Procedures – steps to follow/instructions**

Each person in each group will measure one piece of metal with a micrometer to the nearest thousandth and measure one piece of metal with the metal thickness gauge, and record the data from a third piece of metal on the data chart.
- **Outcome instructions**

Once the data sheets are completed share the information with your group and discuss if the results appear accurate.

When the group has agreed that the data is as accurate as the tools allow record your data on the chart on the board in front of the room. If any data seems inaccurate remeasure using the appropriate tool.

Next analyze your group data in a written statement verifying your assessment as to whether your group results have met the tolerance criteria and explain the accuracy and precision of your group results.
- **Assessment instructions (peer-teacher)**

Teacher observation of proper use of measurement tools.

Completed data sheets (everyone needs a sheet with all of the groups data)

Complete written analysis of group data using numbers in the explanation of data expectations.

Work area is clean.

Lab Data Collection

Student: _____ **Date:** _____

Unit: CLASSIC CORD UNIT 13 _____

Lab Title: Precision, Accuracy, and Tolerance

Criteria: Write the problem/objective in statement form

Data Collection: Record the collected/given data

Calculations: Complete the given calculations to solve for an answer(s)

Summary Statement:

Include an analysis of your group data in a written statement verifying your assessment as to whether your group results have met the tolerance criteria and explain the accuracy and precision of your group results.

Other Assessment(s)