Virtual Lab Experiment Manual

Experiment: Measurement Using a Profile Projector

Experiment No: _____ **Date:** _____
Name: _____ **Section:** _____

---

1. Aim

To study the working principle of a profile projector and to accurately measure the critical dimensions of a given threaded specimen. The dimensions to be measured include Major Diameter, Minor Diameter, Pitch, and the included Flank Angle.

2. Apparatus Required

- Profile Projector (Optical Comparator) with Digital Readout (DRO)
- Threaded Specimen (e.g., M10 bolt)
- V-block or appropriate clamping fixture
- Cleaning cloth (lint-free)

3. Theory and Working Principle

A profile projector operates on the principle of optical projection. A high-intensity light source (diascopic for profiles, episcopic for surfaces) illuminates the specimen. The shadow or image is then passed through a series of lenses that magnify it and project it onto a built-in glass screen. The screen is equipped with a protractor for angle measurement and crosshairs for alignment.

The workstage, on which the specimen is mounted, can be moved with high precision along the X and Y axes. These movements are tracked by a Digital Readout (DRO) system, which displays the displacement, allowing for direct and accurate linear measurements. By combining linear stage movement with the rotational measurement of the screen, a wide variety of 2D geometric features can be inspected without any physical contact with the part. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris.

Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

4. Working Procedure

1. **Preparation:** Power on the profile projector and the DRO. Ensure the diascopic (profile) illumination is selected. Clean the workstage and specimen thoroughly.

2. **Mounting:** Securely mount the threaded specimen on the workstage using a V-block. Adjust the specimen so its primary axis is parallel to the stage's X-axis movement.

3. **Focusing:** Select a suitable magnification (e.g., 20x). Move the stage vertically using the focusing wheel until a crisp, sharp silhouette of the screw thread is projected onto the screen.

4. **Datum Setting:** Align the horizontal crosshair on the screen with the central axis of the screw's silhouette. This is a critical datum for all diameter measurements.

5. **Measurement of Major Diameter (D_{maj}):**

   (a) Align the horizontal crosshair with the crest of a thread at the top of the silhouette. Zero the Y-axis on the DRO.

   (b) Move the stage vertically downwards until the horizontal crosshair aligns with a corresponding crest at the bottom of the silhouette.

   (c) Record the Y-axis reading from the DRO. This is the Major Diameter. Repeat for 3 different thread locations and record in Table 1.

6. **Measurement of Minor Diameter (D_{min}):**

   (a) Align the horizontal crosshair with the root of a thread at the top of the silhouette. Zero the Y-axis on the DRO.

   (b) Move the stage vertically downwards to align with a corresponding root at the bottom.

   (c) Record the Y-axis reading. This is the Minor Diameter. Repeat for 3 different locations and record in Table 2.

7. **Measurement of Pitch (p):**

   (a) Align the vertical crosshair with the left flank of a specific thread. Zero the X-axis on the DRO.

(b) Move the stage horizontally until the vertical crosshair aligns with the left flank of the very next thread.

(c) The X-axis reading is the pitch. Repeat this measurement between several adjacent threads and record in Table 3.

8. **Measurement of Flank Angle (θ):**

(a) Align one of the screen's crosshairs to be perfectly parallel with one flank of a thread. Zero the angular reading on the DRO or note the angle on the protractor.

(b) Rotate the screen until the same crosshair is perfectly parallel with the opposite flank of the same thread.

(c) The total angle of rotation is the included flank angle. For standard metric threads, this should be close to 60°. Record readings in Table 4.

5. Observations and Results

Record all measurements in the tables below and calculate the mean value for each parameter.

Table 1: Table 1: Major Diameter Measurements

Trial No.	**Major Diameter, D_{maj} (mm)**
1	
2	
3	
Mean Value	

Table 2: Table 2: Minor Diameter Measurements

Trial No.	**Minor Diameter, D_{min} (mm)**
1	
2	
3	
Mean Value	

Table 3: Table 3: Pitch Measurements

Trial No.	**Pitch, p (mm)**
1	
2	
3	
Mean Value	

Table 4: Table 4: Flank Angle Measurements

Trial No.	**Flank Angle, θ (degrees)**
1	
2	
3	
Mean Value	

6. Discussion and Conclusion

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.