THE MICROMETER INSTRUMENTS (contd.)

PURPOSE

(D4) To learn the techniques of measuring round objects with micrometers.

(D5) To show the sensitivity of the rocking-over-center technique to surface finish and materials.

(D11) To gain experience in the use of a micrometer and develop SPC data for control charts.

EQUIPMENT

(1) 0-1" and 1-2" vernier micrometers

(2) 0-25mm and 25-50mm vernier micrometers

MATERIAL

(1) A set of plug gages, A through I, with varying diameters (for D4)

(2) Various sizes of drill bits, A through F (for D4)

(3) Plug gages (#16, 20, 8 colored and "J" for D5, 1 set only)

(4) Sets of similar diameter parts with varying finishes, 5/8", 3/4" and 1 1/16" (for D5)

(5) A set of 100 cylindrical parts (for D11)

EXPERIMENT D4 To learn the techniques of measuring round objects with micrometers.

Accurate outside measurement of round objects requires that the line of measurement be a diameter. When the diameter of a part is no larger than the diameter of the anvil and spindle, the alignment problem is simple. If the micrometer is closed and the diameter overhangs the anvil and spindle, the part pops out. The reading may or may not be the correct reading depending upon the shape of the part as illustrated in Figures 6.1 and 6.2. In other words, it is possible to have severe misalignment as shown in Figure 6.2 and still produce the same desired feel.

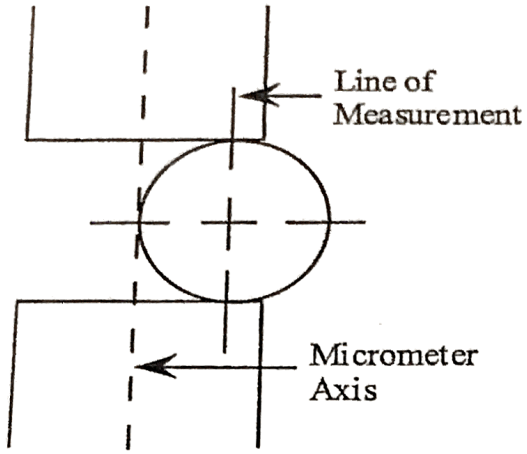

Figure 6.1 Gaging Pressure Limits the Micrometer Opening to Part Diameter.

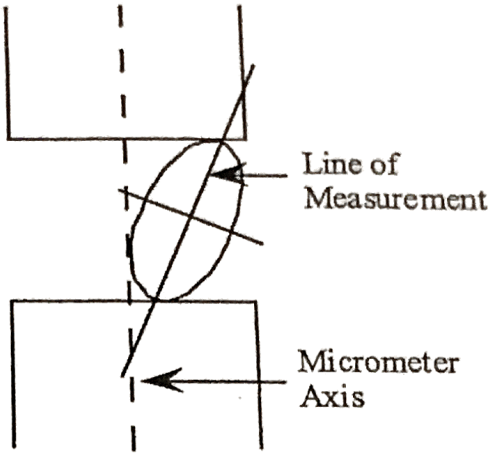

Figure 6.2 The Measurement is in Error Unless the Line of Measurement is Parallel to the Micrometer Axis.

It is important to keep the line of measurement (diameter for round objects) parallel and close to the axis of the micrometer. The problems in cylindrical measurement become greater as the diameter increases. Therefore, in such situations, rock-over-center technique is used to ensure that the diameter being measured is parallel to the micrometer axis.

In this experiment, a series of cylindrical parts with varying diameters and different sizes of drill bits will be used for measurement. The measurement of drill diameter should be taken just behind the cutting edge (across the margin).

Procedure

1. Hold a small-diameter part in one hand and measure with vernier micrometer in other.

2. Measure all parts to tenth-mil. For large diameter parts or odd-shaped parts, take precautions to align the diameter being measured parallel to the axis of the micrometer by using rock-over-center technique given in the next step.

3. Rock across cylinder to find the maximum opening that provides the desired feel. Rock along the part axis very slightly to find minimum feel. This process will establish micrometer axis parallel to the diameter. If feel across cylinder is lost, close micrometer slightly and repeat this step.

Results and Conclusions

Get the true values from the instructor and record them in the measurements table. Determine the deviation of each reading from its true value and record it in the table. Based on your results, answer the following question:

1. Why are drills hard to measure at the cutting edge?

Measurements and Deviation Table (for D4)

Part No.	Vernier Micrometer in	True Value in	Deviation in
Plug Gage A			
B			
C			
D			
E			
F			
G			
H			
I			
Drill A			
B			
C			
D			
E			
F			

EXPERIMENT D5 To show the sensitivity of the rocking-over-center technique to surface finish and materials.

This experiment will show the effect of surface finish on the feel required in micrometer measurements. Sets of similar diameter parts with varying finishes, both rough and smooth, will be used to demonstrate the reliability of such measurements. While taking measurements, concentrate on getting consistent feel. Use the rock-over-center technique described in Experiment D4 and in other previous labs for taking measurements.

Also, for greatest reliability the part and the standard should not only be made of the same material and have the same finish, but they should also be of the same shape. When they are not, an error is added.

Procedure

1. Select a part from the set of parts provided for this experiment at random. Arrive at a measurement of the diameter using an inch vernier micrometer. Take 2-3 readings of the diameter to tenth-mil (0.0001") and record the average reading.

2. Repeat step 1 until all parts have been measured.

Results and Conclusions

Record your results in the measurements table. Based on your results, answer the following question:

1. Why does a rough surface result in an unreliable measurement with a micrometer?

ug Gage or ylinder Description	Vernier Micrometer in	True or Nominal Value, in	Deviation
# 16			
# 20			
Red			
Brown			
Green			
Blue			
Purple			
Yellow			
Orange			
White			
J			
$1\frac{1}{16}$" dia, 15/16" length		$1\frac{1}{16}$"	
$1\frac{1}{16}$" dia, 3" length		$1\frac{1}{16}$"	
$\frac{5}{8}$" CD		$\frac{5}{8}$"	
$\frac{5}{8}$" AL		$\frac{5}{8}$"	
$\frac{5}{8}$" BR		$\frac{5}{8}$"	
$\frac{5}{8}$" SS		$\frac{5}{8}$"	
$\frac{3}{4}$" CD		$\frac{3}{4}$"	
$\frac{3}{4}$" AL		$\frac{3}{4}$"	
$\frac{3}{4}$" HR		$\frac{3}{4}$"	
$\frac{3}{4}$" SS		$\frac{3}{4}$"	

EXPERIMENT D11 To gain experience in the use of a micrometer and developing SPC data for control charts.

In previous labs (Lab No. 3, Experiment C1 and Lab No. 5, Experiment D11), the two diameters, d_1 and d_2, of some of the 100 cylindrical parts have been measured. This experiment will continue for the next three labs. Therefore, plan and coordinate your work of measurement such that you are fully aware of what needs to be measured and are able to take measurements on about 20 parts in each lab.

When all 100 are measured, SPC analysis is to be done to determine the condition of the process that produced and inspected them

Procedure

1. Obtain reasonable number of cylindrical parts from the set for taking measurements. Take consecutive numbered parts.

   Each student should measure both d_1 and d_2 of the cylinders in sets of 5, such as 1-5, or 6-10, or 11-15, ... or 96-100. There is a table on the next page to record this information.

2. Measure diameter d_1 using 0.0001" vernier micrometer and d_2 using 0.001mm vernier micrometer.

3. Repeat the above until all parts are done.

4. Loosen the lock nut, if tight, clean and lubricate the micrometers before returning them to their boxes. Store the micrometers with an air gap between their spindle and anvil.

Results and Conclusions

When all measurements are done, record them in the measurements table and obtain the true values from the instructor. Determine the deviation of each reading from its true value and record it in the table. Based on your readings, answer the following question:

1. How do your readings compare with the true values?

Measurements and Deviation Table (for D11)

Cylinder No.	Vernier Micrometer		True Value		Deviation	
	d1, in	d2, mm	d1, in	d2, mm	d1, in	d2, mm

The following data is to be used for SPC analysis in Lab 9

Cylinder Nos. (in sets of 5 - both d_1 and d_2)	Instrument Used	Measured By	Date Measured
	Vernier Micrometer		
	Vernier Micrometer		
	Vernier Micrometer		
	Vernier Micrometer		