

PRECISION

MEASUREMENT

UNIT

PRECISION MEASUREMENT

MATH CONVERSIONS AND THE MICROMETER

Math Conversions:

Conversions of fractions to decimals and decimal to fractions must be done because:

- materials are manufactured and delivered to our facility in fractional sizes
- some drawings use fractional dimensioning
- precision measuring equipment uses decimal system

TO CONVERT a fraction to a decimal, divide the numerator by the denominator. For example:

$$\begin{array}{r} 1/4'' \qquad \qquad .250 \\ \underline{4 \overline{) 1.000}} \\ 8 \\ 200 \\ 200 \\ 0 \end{array}$$

ANSWER: .250 - always provide a minimum of three places to the right of the decimal for use on precision measuring equipment.

TO CONVERT a decimal to a fraction, place the decimal over an equal number of zeroes and add a "1" to the left of the zeroes. For example:

$$.375 = \frac{375}{1000}$$

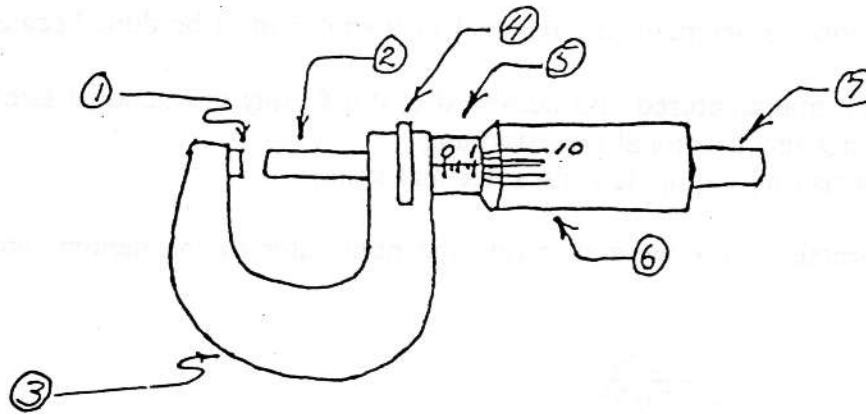
Begin reducing this fraction, using the top right number as the divisor. For example, in this case the "5" would be used.

$$\frac{375}{1000} = \frac{75}{200}$$

Continue the same process until this fraction has been reduced as far as possible to acquire the answer.

$$\frac{75}{200} = \frac{15}{40} = \frac{3''}{8}$$

Parts of a Micrometer



There are seven important parts of the micrometer.

_____ stationary measuring tip that contacts workpiece

_____ moveable measuring tip that contacts workpiece

_____ holds anvil and spindle in alignment.

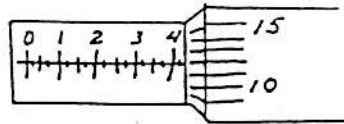
_____ prevents motion among the moveable parts on the micrometer.

_____ has graduations on it in hundreds of thousandths and additional graduations for each twenty-five thousandths.

_____ has twenty five equal graduations upon this revolving cylinder.

_____ allows for all people using the micrometer to acquire the same pressure and therefore the same reading on a micrometer.

Reading a Micrometer



Hub w/ graduations

Thimble

How many numbers show on hub?
(each number is one hundred thousandths)

Answer: 3 or = .300

How many graduations show past "3"?
(How many .025's)

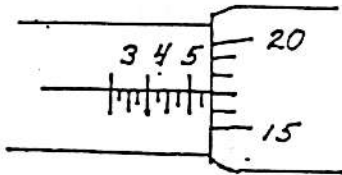
Answer: 2 or
2 x .025 each = .050

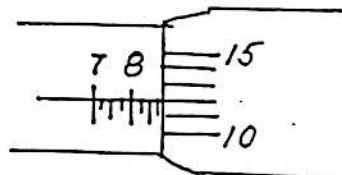
What graduation on the thimble lines up
with the indicator line on the hub?

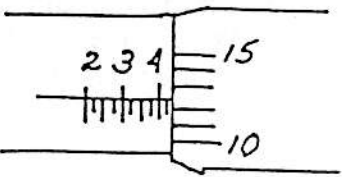
Answer: #13 or = .013

Reading of this setting is: .363

PRACTICE: Give answers for these settings -







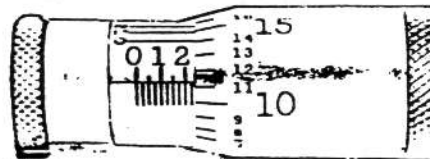
VERNIER & DIAL INDICATED TOOLS

Reading a Vernier Scale:

Vernier scales appear on different precision measuring instruments such as micrometers, calipers, height gauges, protractors, etc.

On a micrometer, the vernier scale gives the user an opportunity to measure to the nearest one ten thousandth (or tenths .0001) of an inch. The vernier scale is etched into the back side of a micrometer hub as ten equally spaced lines. Each line on the vernier scale is 1/10 closer together than the lines etched into the thimble.

The first two steps in a vernier micrometer reading are the same as always (read hub, then thimble), then see which line on the vernier scale lines up with a line on the thimble - read the number at the end of the vernier scale line - this is the "tenths" that should be added to the micrometer reading. For example:

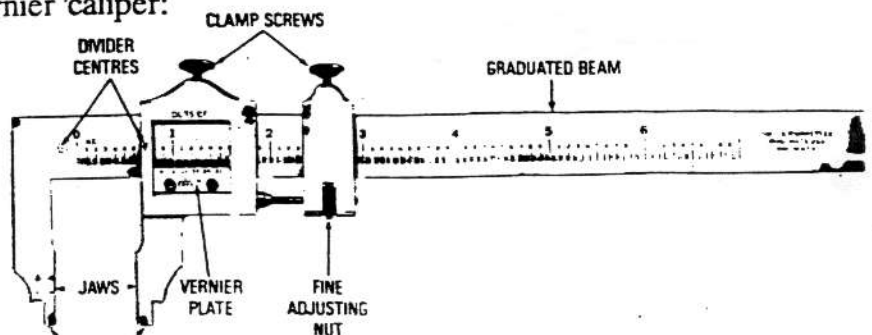


32 NOS. . . .
.0312

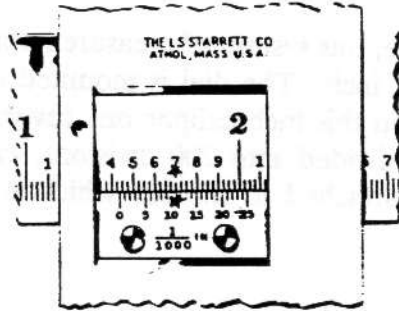
This reading would be:

2 x .100	=	.200
1 x .025	=	.025
11 x .001	=	.011
3 x .0001	=	.0003
		.2363

A vernier caliper might have a 25 - division vernier scale on the moveable bar which must be read. First, find point the zero (0) on the moveable bar lines up with the graduations on the main frame - how many inches, then how many hundred thousandths, then how many 25 - division marks, then finally use the vernier? Which line on the moveable jaw scale lines up with a graduation on the frame scale? Add that amount to the total. For example, here is a vernier caliper:



Here is a close-up of the frame graduations and the vernier scale attached to the moveable jaw.



Now lets read this setting:

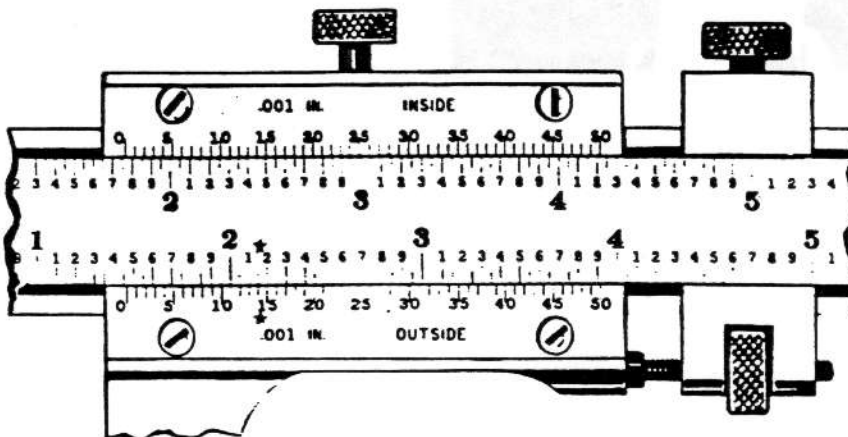
Last large number to the left is #1 = 1.000
 "0" on the vernier is past the #4
 $4 \times .100 = .400$
 "0" is also one line past the #4
 $1 \times .025 = .025$
 now, which line on the vernier scale
 lines up with the frame graduations?
 ANSWER: #11 x .001 = .011

1.436

Height gauges also use a vernier scale, but usually with a 50 or 100 division vernier scale. The reading process is the same. What is are the answers for these settings?

the "Outside Reading"

the "Inside Reading?"



Dial Indicated Calipers

After the vernier scale, this system of measurement is quite simple. This instrument is capable of reading to .001 inch. The dial is mounted on the moveable jaw with a hand attached to a pinion gear. On this inch caliper one revolution of the hand represents .200 inch of travel. The dial is divided into 200 divisions, each representing .001 inch. The pinion meshes with a rack attached to the bar which is graduated in inches (1.000) and tenths of an inch (.100).

So you can read:

Last large number to the left		
first - represents inches		
Example #1	=	1.000
Then the small number at left		
edge of moveable jaw second		
Example #4	=	.400
Then the remainder on the dial		
Example #53	=	.053
		<hr/>
		1.453

