

# CRAFTSMAN'S CRIBSHEET

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**72**

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## Variables Data: Four Aspects of Every Measurement

What's in a number? What's in the numbers we use? A lot more than you might think. Numbers carry far more information than only their value or size. In my experience, there are four aspects or properties of each and every measurement that we make:

- The number
- Accuracy of the number
- The units of the number
- Direction of the difference (from the average or last reading)

### The Number

Numbers are important in measurement because they represent a distinct, confirmable quantity. That quantity can be evaluated against other numbers because of the order and sequence established by the number's location on the continuous number line. This means when something is expressed as a number, it has a distinct and confirmable value upon which we can make decisions, either alone or by comparing with other numeric measures. Variables data is data acquired through numeric measurements. The magnitude or absolute (numeric) value of the measurement is what most people understand by a given measurement.

### Accuracy of the Number

Because numbers are found on a continuous number line, the accuracy of the number is determined by the gaging system and the units of measure. The length of cold drawn steel bars sold through distribution in the U.S. is typically 12 feet or 20 feet, depending on its grade. Shear cut bars are produced to a length tolerance of 0.000 inch minus, 2.000 inch plus. The accuracy of the length is given in units of inches, and while the specification calls out 12-foot bars, in reality the accuracy is 12 feet 0 inch to 12 feet 2 inches. Accuracy issues are systemic and subject to technological advancement. Tolerances that were typical in years past have been replaced by much more stringent requirements as our technology and gaging improves.

### Units

Units are both descriptors of the variable being measured on a product and a clue as to what is its



accuracy. In our length example, the bars may be ordered to a length in feet. They will be produced to an accuracy of minus nothing, plus 2 inches. And, yet, the parts your shop produces may be held to only a few thousandths of an inch. In metric, a length could be measured to the nearest meter, centimeter, millimeter or micron.

### Direction of the Difference

One property of measurements is they are produced as part of an ongoing series of measurements, and so, with the exception of the very first measurement on a job, we always have prior measurements with which to compare our latest measurement. The direction the current measurement takes from the prior reading, or in best practice shops, from the average of the prior readings, can be an important call to action. The change in a length measurement off the shear in that cold drawn steel line may only be ½ inch, but if it is ½ inch under that 12-foot minimum, action must be taken immediately to get the process back within tolerance. Normally, a ½ inch change in length, between 12 feet and 12 feet 2 inches would be unremarkable. It is the direction of the difference between the last reading or average, say 12 foot ¼ inch, which is compliant with the spec, and the immediate value 11 feet ¾ inch, that elevates this measurement to, "take action now" status.

What is in a number? The quantitative value is certainly the most easily recognized property of any variables measurement that you take. However, it is much more than only the quantity it expresses. A measurement's accuracy, the units in which it was determined and the direction of its difference from prior readings or averages are what give it such power for defining the acceptability of the variables that we measure.

All Craftsman's Crib sheets are available for viewing and download at [mpa.org/knowledge-tools/craftsmans-cribsheets](http://mpa.org/knowledge-tools/craftsmans-cribsheets).