# Verification: Fixed and Relative Errors

*Understanding the Bias Error requirements of standards ASTM E83 and ISO 9513*

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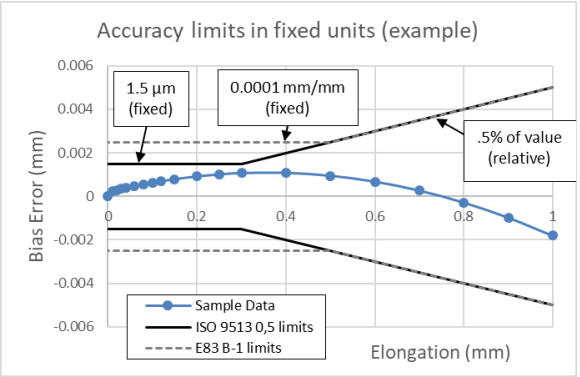
## Common extensometer verification standards

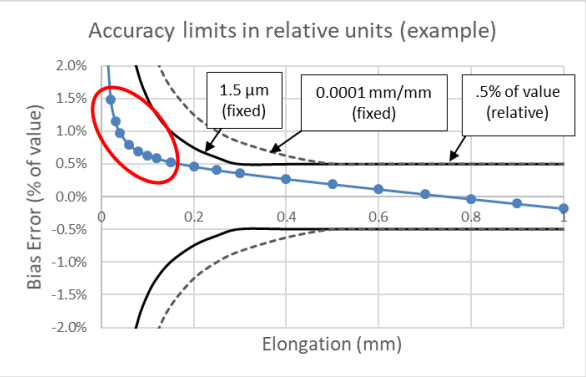
Many standard test methods require accuracy classifications for the extensometer or other transducer according to standards ASTM E83, ISO 9513, and other similar standards. These standards require bias error requirements which are a common source of confusion.

*Example: 25mm gauge length extensometer, to ASTM E83 class B-1 and ISO 9513 class 0,5:*

Under ASTM E83 (Table 1): *Error of strain not to exceed the greater of ±0.0001 mm/mm or ±0.5% of value.*
Under ISO 9513 (Table 2): *Bias error not to exceed the greater of ±1.5 µm or ±0.5% of value.*

The requirements of both standards are more stringent for smaller measurements, based on the *relative* error limits; for small values, the *fixed* error limits are applicable. For small displacements in the fixed error range, errors exceeding the relative limit *can still meet the requirement* (red).




## Ill-posed accuracy requirements

Some standard test methods include ill-posed requirements which are indeterminate or in principle impossible to meet. For example, consider the following test requirement:

*"The measurement device shall have a precision of at least ±1%."*

Users might interpret this as requiring accuracy of 1% of the *reading*, 1% of the *total displacement*, 1% of the *transducer full scale*, etc. If the requirement is understood as 1% *of reading*, then it becomes ill-posed for small displacements as errors become mathematically unbounded (*i.e., division by zero)*:

$$\lim_{dx \to 0} \left( \frac{\varepsilon}{dx} \right) = \infty$$

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