

# Extensometer Verification Range

Understanding Extensometer Test Certificates, Verification Range, and Class

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## Extensometer System Class: Verification Over a Range

Extensometer test certificates are generally presented with comparison to limits set in standards such as ASTM E83 or ISO 9513. Specific tests require an extensometer to be verified to meet a given classification over the measuring range of interest. For example, with regard to determination of yield strength:

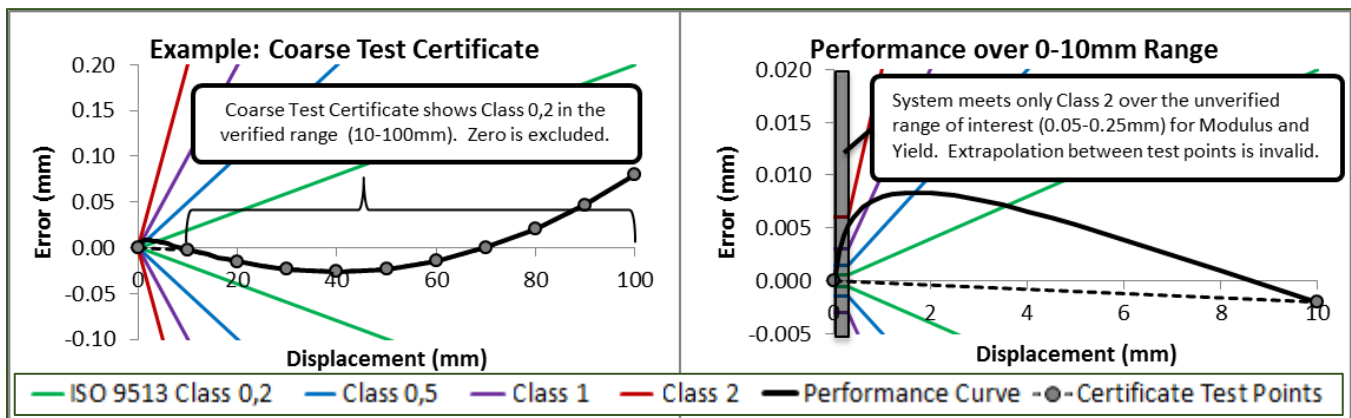
*“...use only [extensometers] that are verified over a strain range in which the yield strength will be determined (see 5.4).” ASTM E08 Section 7.7, emphasis added.*

The requirements of both standards are more stringent for small measurements, and extensometer readings are often nonlinear. Thus, in general an extensometer might meet a better classification for one measurement range than another, or be optimized for the best performance over a specific measuring range. See [Epsilon TechNote – Shunt Calibration and Gain Optimization](#).



## Extensometer Verification Range: Extrapolation

It is inappropriate to extrapolate the performance class stated on an extensometer’s verification test certificate outside the measuring range that was verified. In the example below, the verification range (first non-zero displacement) is 10-100mm. *This extensometer has been verified to meet Class 0,2 from 10-100mm.*



In this case, the measurement of interest is yield strength, which will be measured from 0.05-0.25mm range. A closer look at the true performance curve reveals that the extensometer meets *only class 2 over the range of interest*. The extensometer does not meet the required class for this measurement, despite a “Class 0,2” test certificate. The test certificate from 10-100mm cannot be extrapolated to the 0-10mm range.

*The Verified accuracy class of an extensometer covers only the verified range, and never includes 0. Be cautious extrapolating test certificates with few data points.*



### *The Verified Range never includes zero*

Note that the verified range in either direction begins at the first non-zero displacement – even if the test certificate includes a data point at zero (which is common). *The verified range never includes zero.*

### *High elongation and variable gauge length systems*

Even the worst performing extensometers will meet Class A or 0,2 for sufficiently large measuring range and/or gauge length. *Accuracy classes are valid only for the measuring range and gauge length that was verified and may be worse over smaller gauge length or measuring range.*

*This is particularly important when evaluating high elongation, variable range, or variable gauge length systems such as laser, video, and tower extensometers, especially at a smaller gauge length or measuring range.*



### *Epsilon Standard Practice*

A manufacturer's extensometer test certificate is not a suitable replacement for on-site system verification to ASTM E83 or ISO 9513. It is incumbent upon the user to ensure that their system has been verified at the gauge length of interest, over the measuring range of interest, as installed in their test system.

Epsilon Technology's standard practice for extensometer verification is more stringent than this general case. Our development process includes more extensive evaluation than is represented on a test certificate; our specified system class may be more conservative than the performance indicated on our test certificate.

It is Epsilon's expectation and policy that the specified performance for our extensometers will be met over the full measuring range of the instrument – even very small displacements below the range explicitly covered in the test certificate. This is more conservative than industry standard practice for some high-elongation and variable gauge length systems.

### *Multiple Verification Ranges*

In some cases it might be beneficial to classify an extensometer over several ranges, for different applications. For example, a COD gage performance class might be stated as:

*meets ASTM E399 requirements from 0-2mm, and ASTM E1820 requirements from 0-20mm*

, which might be useful when the requirements for E399 is more stringent than E1820, but the measuring range used under E399 is smaller.

### *Summary Notes on Extensometer Verification Range:*

- Extensometer performance class may vary by measurement range and gauge length
- Extensometer verifications are applicable only over the range and gauge length verified
- Epsilon system specifications generally allow for arbitrarily small measuring range
- Multiple verification ranges can be used to expand the utility of an extensometer's applications.



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