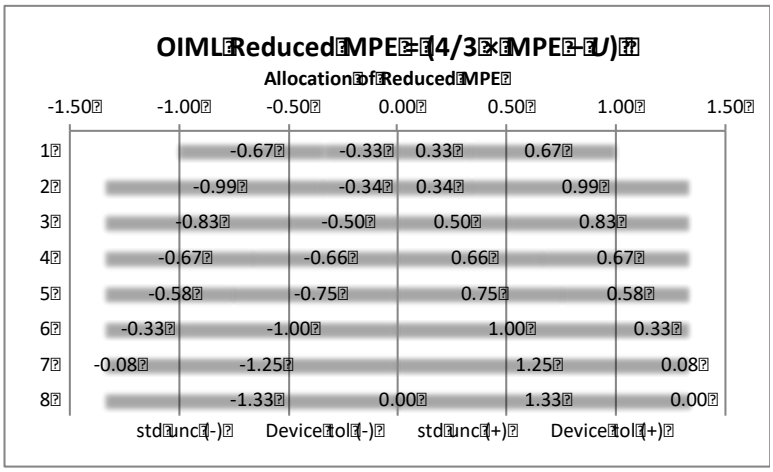
April 3, 2020

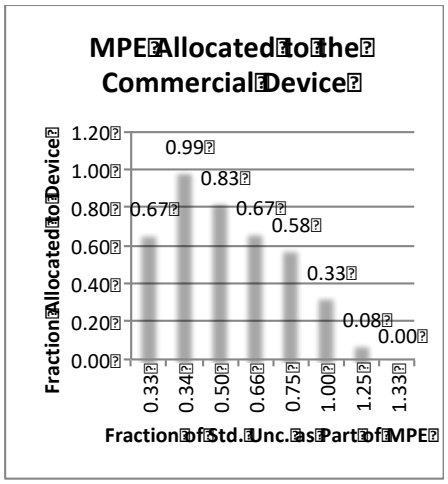
OIML Reduced MPE (Tolerance) Formula Application

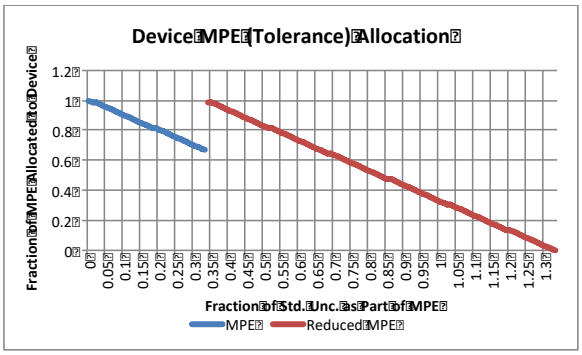
When the uncertainty for the standard does not exceed 1/3 of the MPE, then the tolerance allowed for the device under test is the MPE (maximum permissible error). There are several components in the calculation of the expanded uncertainty, but for simplicity, assume that the uncertainty is entirely from the standard. When the uncertainty for the standard exceeds 1/3 of the MPE, then the following formula is used for field verification:

$$\text{Reduced MPE} = (4/3 \times \text{MPE} - U)$$

The formula increases by 1/3 the overall tolerance applied to the device under test (to 4/3 MPE) when the uncertainty for the standard exceeds 1/3 of the tolerance. Hence, the portion of the MPE allocated the device under test (i.e., the commercial device) is actually larger than when the uncertainty of the standard is 1/3 of the MPE, until the uncertainty in the standard increases to about 0.66 MPE. The chart below and to the left shows the relationship for the tolerance allowed to the device under test when compared to the uncertainty of the standard as a fraction of the 4/3 MPE (i.e., the tolerance). The first bar in the chart is for when the uncertainty of the standard is 1/3 of the MPE. The charts below and to the right show the fractions of the MPE (i.e., 1 x MPE) allocated to the commercial device (for the reduced MPE) relative to the uncertainty of the standard as a fraction of the MPE.







This approach essentially establishes a "device-to-device" tolerance for the device under the test compared to the reference scale or meter (or other reference standard) when the uncertainty for the standard becomes a large fraction of the MPE. If the same commercial device is tested using different standards with large uncertainties, then the potential for conflicting results *for acceptance or rejection* of the same commercial device would differ greatly from one standard to another since the "true values" for different standards could be anywhere within the uncertainty statements for the standards. There is also the potential for large differences in the directions and magnitudes of the errors determined for the commercial device when different standards are used, but that is true whenever the uncertainties for standards are a large percentage of the tolerance for the commercial device.