Brief Explanation of the OIML Formula and the 2/3 Formula (GEN-19.1)
Seraphin Test Measure

The OIML formula calculates a meter-to-meter tolerance for the device under test, that is, the comparison of the indication of the commercial meter to the indication of the transfer standard. **When a Type 2 transfer standard is used (that is when the uncertainty of the transfer standard exceeds 1/3 of the device tolerance), the OIML formula increases the total tolerance for the commercial device plus the uncertainty of the transfer standard to 1.33 times the normal tolerance for the commercial device.** However, when the uncertainty of the transfer standard just exceeds the 1/3 limit of the tolerance, only 1.0 times the normal tolerance is allocated to the error of the commercial device indication, i.e., the meter-to-meter tolerance. As the uncertainty of the transfer standard increases above the 1/3 limit, the tolerance allocated to the commercial device decreases. As the uncertainty of the transfer standard increases to be a large percentage of the tolerance, the meter-to-meter tolerance for the commercial device becomes so small that using the transfer standard is no longer reasonable.

When a Type 2 transfer standard is used, the 2/3 formula calculates the total tolerance for the commercial device starting with 2/3 of the normal tolerance and then increases by the uncertainty associated with the transfer standard. This formula **gradually increases** the total tolerance (applied to the test result) as the uncertainty of the transfer standard increases, until the maximum-allowed limit for the uncertainty for the transfer standard (2/3 of the normal device tolerance) is reached. The maximum combined device tolerance plus the uncertainty associated with the Type 2 transfer standard is limited to 1.33 times the normal uncertainty for the commercial device. This maximum limit for the tolerance allocated to the meter under test plus the uncertainty of the transfer standard is the same as established by the OIML formula.

OIML Formula [Only calculates the meter-to meter tolerance and, as the uncertainty associated with the transfer standard increases, gradually decreases the tolerance allocated to the commercial meter.]
1. The calculated tolerance is a meter-to-meter tolerance (i.e., excludes the uncertainty of the transfer standard).
2. Total tolerance is 1.33 times the normal tolerance for the meter under test.
3. When the uncertainty for the transfer standard just exceeds 1/3 of the normal meter tolerance, the meter-to-meter tolerance jumps up to 1.0 times the normal tolerance.
4. As the uncertainty of the transfer standard gradually increases above the 1/3 limit, the meter-to-meter tolerance applied to the meter under test decreases.
5. There is no upper limit on the uncertainty that the transfer standard may have, except that the uncertainty causes the meter-to-meter tolerance to drop to zero and be impractical.

2/3 Formula [The calculation includes all of the uncertainty associated with the transfer standard. The tolerance allocated to the commercial meter never drops below 2/3 of the normal tolerance.]
1. Calculates the total tolerance applied to the meter under test, which includes the uncertainty associated with the transfer standard.
2. The tolerance for the meter under test is never less than 2/3 of the normal tolerance.
3. The total tolerance applied to the meter under test gradually increases as the uncertainty associated with the transfer standard increases above the 1/3 limit for field standards.
4. The total tolerance when using a Type 2 transfer standard has an upper limit of 1.33 times the normal tolerance for the meter under test.