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Comments on S&T Items 3302-1 and 3307-2 Regarding Transfer Standards

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Position: Items 3302-1 and 3307-2 should be changed to "Developing."

Discussion: These proposals are to recognize positive displacement (PD) meters and mass flow meters (MFMs) as field standards, although they are called "transfer standards." Meters must prove that they are accurate over the range of operating conditions over which the meters are to be used as volume standards. The accuracy of meters varies with the range of flow rates for which the meters are designed for use. Hence, meters must prove that they have the accuracy and repeatability to serve as field standards over the range of flow rates for which the meter is to be used as a standard. The viscosity of the products that are measured affects the accuracy of PD meters. For example, PD meters are calibrated with either gasoline or with diesel fuel to ensure that they are calibrated correctly for the product that they measure when in commercial use. The accuracy and sensitivity of MFMs depend upon density and pressure of the fluid being measured, e.g., liquid or gas. Furthermore, the accuracies of meters vary with temperature, so the meters must prove that they are accurate as field standards over the range of temperatures for which the meters are used when testing commercial meters.

In addition to the parameters that directly affect the measurement capability of meters, there are field variables that affect the accuracy of test results when proposed standards are used over the range of field conditions to test commercial meters. For example, unstable temperatures and the temperature differences between the air and the fuel under field test conditions may affect field test results. Field standards must be designed such that they will produce accurate results over the range of field conditions in which the standards will be used.

A field standard is any artifact or measuring system (e.g., scale or meter) that:

1. Has corrections and uncertainties less than one-third of the smallest tolerance that is to be applied to the measuring device that is to be tested using the standard;
2. Is stable over an extended period of use; and
3. Has design and performance specifications documented in a NIST 105-series handbook to recognize field standards.

Transfer standards do not satisfy the one-third requirement for a field standard, so some codes in Handbook 44 allow larger tolerances to be applied when transfer standards are used. There isn't a common understanding of the distinction between a transfer standard and a field standard.

Any standard that meets the one-third requirement is acceptable as a field standard. However, when there is a difference in results from two different standards and test methods, how much difference is acceptable? What is the cause of the difference? Is one standard right and the other one wrong? How does an offset from two test methods affect the application of the predominance of error requirement?

Items 3302-1 and 3307-2 use the term "transfer standard" in the effort to recognize master meters as "transfer standards," but the proposals do not include any expansion of the tolerances to recognize the variability (e.g., standard deviation) in the performance of the master meters. Consequently, the master meters are being proposed as field standards with the claim that they meet the "one-third" requirement of section 3.2. of the Fundamental Considerations. However, no data over the range of meter operating conditions and field environmental conditions has been provided to ensure weights and measures officials that the master meters comply with the "one-third" requirement. Until this is done, a master meter should not be used as a field standard.

The Office of Weights and Measures established a National Work Group on Alternative Test Methods. One objective of the Work Group is to identify the variables and parameters over which a proposed alternate standard must be tested and evaluated "to ensure that the methodologies and standards facilitate measurements that have metrological traceability." The Work Group will review a draft Handbook 105 for master meters to determine the tests and data needed to ensure that master meters demonstrate that they may be used as field standards.

Weights and measures officials must be confident that their test results are accurate, repeatable and truly reflect the accuracy of the meters that they test.

- Weights and measures officials must be able to prove that the results they obtain when testing commercial measuring devices are valid and legally defendable.

- Any field standard, for which the corrections and uncertainty meet the one-third requirement, may be used to test meters used in commercial measurement. However, data must be provided that prove that the proposed field standard (also called a transfer standard) meets the one-third requirement.

- Before a transfer standard may be used as a field standard, the manufacturer must prove that the transfer standard is accurate and repeatable over the range of products, flow rates, pressures, temperatures, other environmental conditions, and operating conditions over which meters are used. Transfer standards must also prove that they perform within the one-third requirement during the time between laboratory calibrations. No data or explanations have been provided to demonstrate that the proposed transfer standards meet the one-third accuracy requirement.

- The types of meters to be used as transfer standards are not defined or identified. **How do you know which ones are acceptable?**

- No laboratory calibration procedures are specified for the transfer standards. The laboratory calibration procedures must reflect the accuracy of the transfer standard over the range of flow rates when the transfer standard is used to test meters.