

**Comments on Transfer Standards Issues
S&T Items 3302-1(LPG), 3307-2 (MFM), 3504-2 (Taximeters)
and 3600-6 (Transportation Network Measuring Systems)**

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Positions:

Items 3302-1 and 3307-2: I am opposed to the adoption of these items. **These two items should be changed to “Developing.”** It is premature to put these items for a vote, because the “transfer standards” are actually proposed as field standards. No data have been provided to demonstrate that the “transfer standards” meet the one-third requirement as field standards.

Item 3504-2: The addition of **paragraph T.2. should be deleted** from the proposed changes until the issue of the use of a transfer standard is examined more completely. Numerous issues must be resolved regarding the use of transfer standards. Among these issues, the criteria and procedures are needed to specify how the standard deviation of the transfer standard is to be determined.

Item 3600-6: The proposed definition of “transfer standard” is incorrect and conflicts with the Fundamental Considerations of Handbook 44. **The proposed definition of “transfer standard” should be deleted from the proposal.** At the end of these paper, an alternate definition is proposed for consideration.

Discussion:

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 have been provided to ensure weights and measures officials that the master meters comply with the “one-third” requirement. Until this is done, the master meters should not be used as field standards.

Item 3504-2 for the Taximeter Code addresses transfer standards in the Notes paragraphs N.1.1. and N.1.1.2. Furthermore, there is a proposed Tolerance paragraph T.2. that states:

T.2. Tests Using Transfer Standards. – To the basic tolerance values that would otherwise be applied, there shall be added an amount equal to two times the standard deviation of the applicable transfer standard when compared to a basic reference standard.

Although this proposal specifies larger tolerances when transfer standards are used, procedures are needed to specify how to determine the standard deviation to be used to increase the

tolerance. These guidelines should include the number of tests needed to determine the standard deviation, the range of environmental conditions over which the standard deviation is to be determined, the range of operating conditions (e.g., meter flow rates, operating pressures, vehicle speeds, and the frequency with which to verify the standard deviation) or other variables that could affect the performance of the transfer standard. **Furthermore, what is the limit of acceptability of the standard deviation relative to the tolerance of the device under test?** If the standard deviation is “large” relative to the tolerance of the device under test, then the use of a transfer standard is detrimental to measurement accuracy in the commercial measurement system. The lack of instructions regarding how to determine the variability (i.e., the standard deviation of the transfer standard) exists in all Handbook 44 codes that reference transfer standards. However, since there are several proposals to recognize the use of transfer standards, this deficiency must be corrected before more transfer standards are recognized in Handbook 44.

In **item 3600-6**, the proposed definition of “transfer standard” conflicts with the Fundamental Consideration in section 3.2. The proposed definition includes “standard” as a transfer standard. It must be presumed that “standard” means “field standard.” However, the proposed tentative code paragraph T.2. states “To the basic tolerance values that would otherwise be applied, there shall be added an amount equal to two times the standard deviation of the applicable transfer standard when compared to a basic reference standard.” Since the proposed definition includes standards as transfer standards, this means that the tolerance applied to the measuring instrument is to be increased by two times that standard deviation of the (field) standard. However, section 3.2. of the Fundamental Considerations states that the correction and uncertainty associated with a (field) standard must not exceed one-third of the tolerance applied to the measuring instrument under test and that the uncertainty associated with the (field) standard is incorporated into the tolerance that is stated for the measuring instrument.

The definition for “transfer standard” in item 3600-6 should be deleted until an appropriate definition is developed and that does not conflict with the Fundamental Consideration in section 3.2.

Proposed Definitions

It is important that agreement is achieved on the definitions of what constitutes a field standard and what qualifies as a transfer standard. A field standard meets the “one-third” requirement based upon data and technical assessment, is stable over an extended period of time, and is recognized in a NIST 105-series handbook for field standards. Presumably, (1) a transfer standard does not meet the “one-third” requirement, (2) may only be accurate and repeatable over a narrow range of environmental conditions, and (3) may not maintain its accuracy and repeatability over an extended period of time. If it did, it would be a field standard. Consequently, some codes in Handbook 44 have a tolerance paragraph that recognizes the variability of the transfer standard by applying a larger tolerance to the commercial device under test. However, the user of each transfer standard must have data that documents the accuracy and standard deviation for the transfer standard over the range of operating and environmental conditions over which the transfer standard is used.

The following definitions are proposed for consideration. In reality, the last paragraph in each proposed definition should probably not be included in the definitions for Handbook 44, but the paragraphs are included in these proposals to promote an understanding of the data needed to properly document the performance of a field standard and transfer standard.

Field standard - A standard (a physical artifact, static or dynamic measurement device or a reference material) that:

- (1) Has proven through laboratory and field tests that it satisfies the NIST Handbook 44 Fundamental Consideration that its correction and uncertainty are less than one-third of the smallest tolerance applied to the commercial measuring instrument under test;
- (2) Has proven that it will maintain its accuracy and repeatability for a period of normal use as a field standard for a time period of at least the minimum time period suggested in **NIST-suggested Field Standards & Calibration Intervals** dated August 2005 (See: <http://www.nist.gov/pml/wmd/labmetrology/upload/h-009.pdf>); and
- (3) For which a NIST 105 series handbook for field standards exists.

The variables for which the field standard must be evaluated include the range of field conditions in which the commercial measuring instruments are used, such as, the products measured, environmental conditions, such as the range of temperatures and temperature differentials in which the commercial measuring instruments are used, the range of flow rates, the operating pressures and any other variables that may affect its performance.

Transfer standard – A physical artifact, static or dynamic measurement device or a reference material that may be used as a temporary measurement reference to check the accuracy of a commercial measuring instrument, but does not satisfy the NIST Handbook 44 Fundamental Consideration that its correction and uncertainty are less than one-third of the smallest tolerance applied to the commercial measuring instrument under test. To recognize a transfer standard:

- (1) Its accuracy and repeatability must be established through laboratory and field tests over the range of variables for which it is used;
- (2) An additional tolerance is recognized in the appropriate Code of NIST Handbook 44 for the commercial measuring instrument; and
- (3) The transfer standard must maintain its accuracy and repeatability during the period of use between calibrations.

The variables for which the transfer standard must be evaluated include the range of field conditions in which the transfer standards are used, such as, the products measured, environmental conditions, such as the range of temperatures and temperature differentials over which the transfer standard is used, the range of flow rates, the operating pressures and any other variables that may affect its performance.