Appendix C

National Type Evaluation Technical Committee
Measuring Sector

October 20 - 21, 2005, Annapolis, Maryland
Meeting Summary

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Details of All Items
(In Order by Reference Key Number)

1. Recommendations to Update to NCWM Publication 14 to Reflect Changes to NIST Handbook 44

Source: NIST/WMD

Background: The 90th National Conference on Weights and Measures (NCWM) adopted the following items that will be reflected in the 2006 edition of NIST Handbook 44 and NCWM Publication 14. These items are part of the agenda to inform the Measuring Sector of the NCWM actions and recommend changes to NCWM Publication 14.

Recommendation: The Sector will review and, if acceptable, recommend to the NTEP Committee adoption of the following changes to Publication 14 based on changes to NIST Handbook 44:

A. Checklist and Test Procedures (LMD – 11)

Code Reference G-S.1. (*e* ~~g~~). Effective January 1, 2003 (LMD – 13)

1.1.5. The NTEP Certificate of Conformance (CC) Number or a corresponding CC addendum number for devices that have a CC. The number shall be prefaced by the terms "NTEP CC", "CC", or "Approval". These terms may be followed by the word "Number" or an abbreviation for the Word "Number". The abbreviation shall as a minimum begin with the letter "N" (e.g., No or No.). **Yes ☐ No ☐ N/A ☐**

The device must have an area, either on the identification plate or on the device itself, suitable for the application of the CC Number. If the area for the CC Number is not part of an identification plate, note its intended location and how it will be applied.

Location of CC Number if not located with the identification: _____

_____

Code Reference: G-S.1.1. Location of Marking Information for Not-Built-for-Purpose Devices, Software-Based (LMD – 13)

1.2. For not built-for-purpose, software-based devices the following shall apply:

1.2.1. ***The required information in G-S.1 Identification. (a), (b), (d), and (e) shall be permanently marked or continuously displayed on the device; or*** **Yes ☐ No ☐ N/A ☐**
~~the manufacturer or distributor and the model designation shall be continuously displayed or marked on the device (see note below),~~
~~or~~

1.2.2. ***The Certificate of Conformance (CC) Number shall be:*** **Yes ☐ No ☐ N/A ☐**

1. ***permanently marked on the device;***
2. ***continuously displayed; or***
3. ***accessible through an easily recognized menu and, if necessary, a submenu. Examples of menu and submenu identification include, but are not limited to "Help," "System Identification," "G-S.1. Identification," or "Weights and Measures Identification."***

~~the Certificate of Conformance (CC) Number shall be continuously displayed or marked on the device (see note below), or~~

~~1.2.3. all required information in G-S.1. Identification. (a), (b), (c), (e), and (h) shall be continuously displayed. Alternatively, a clearly identified view only System Identification, G-S.1. Identification, or Weights and Measures Identification shall be accessible through the "Help" menu. Required information includes that information necessary to identify that the software in the device is the same type that was evaluated.~~ **Yes ☐ No ☐ N/A ☐**

Note: For (b), clear instructions for accessing the information required in G-S.1. (a), (b), and (d) shall be listed on the CC, including information necessary to identify that the software in the device is the same type that was evaluated. ~~Clear instructions for accessing the remaining required G-S.1. information shall be listed on the CC. Required information includes that information necessary to identify that the software in the device is the same type that was evaluated.~~

1.3. The identification badge must be visible after installation. **Yes ☐ No ☐ N/A ☐**

1.4. The identification badge must be permanent. **Yes ☐ No ☐ N/A ☐**

B. Philosophy for Sealing (LMD – 17- 20)

Category 1 Devices (Devices with No Remote Configuration Capability):

- The device is sealed with a physical seal or it has an audit trail with two event counters (one for calibration, the second for configuration). **Yes ☐ No ☐ N/A ☐**
- A physical seal must be applied without exposing electronics. **Yes ☐ No ☐ N/A ☐**
- Event counters are non-resettable and have a capacity of at least 000 to 999. **Yes ☐ No ☐ N/A ☐**
- Event counters increment appropriately. **Yes ☐ No ☐ N/A ☐**
- The audit trail information must be capable of being retained in memory for at least 30 days while the device is without power, or must be retained in nonvolatile memory. **Yes ☐ No ☐ N/A ☐**
- Accessing the audit trail information for review shall be separate from the calibration mode. **Yes ☐ No ☐ N/A ☐**
- Accessing the audit trail information must not affect the normal operation of the device. **Yes ☐ No ☐ N/A ☐**
- Accessing the audit trail information shall not require removal of any additional parts other than normal requirements to inspect the integrity of a physical security seal. (e.g., a key to open a locked panel may be required). **Yes ☐ No ☐ N/A ☐**

Category 2 Devices (Devices with Remote Configuration Capability but Controlled by Hardware):

- ~~**Category 2 applies only to devices manufactured prior to January 1, 2005. Devices with remote configuration capability manufactured after that date must meet the sealing requirements outlined in Category 3. Devices without remote configuration capability manufactured after that date will be required to meet the minimum criteria outlined in Category 1.**~~ **Yes ☐ No ☐ N/A ☐**
- **The physical hardware enabling access for remote communication must be on-site.** **Yes ☐ No ☐ N/A ☐**
- **The physical hardware must be sealable with a security seal *or*** **Yes ☐ No ☐ N/A ☐**
- **The device must be equipped with at least two event counters: one for calibration, the second for configuration parameters** **Yes ☐ No ☐ N/A ☐**
  - **- calibration parameters event counter**
  - **- configuration parameters event counter**
- **Adequate provision must be made to apply a physical seal without exposing electronics.** **Yes ☐ No ☐ N/A ☐**
- **Event counters are non-resettable and have a capacity of at least 000 to 999.** **Yes ☐ No ☐ N/A ☐**
- **Event counters increment appropriately.** **Yes ☐ No ☐ N/A ☐**
- **Event counters may be located either:** **Yes ☐ No ☐ N/A ☐**
  - **- at the individual measuring device or**
  - **- at the system controller**
- **If the counters are located at the system controller rather than at the individual device, means must be provided to generate a hard copy of the information through an on-site device.** **Yes ☐ No ☐ N/A ☐**
- **An adequate number (see table below) of event counters must be available to monitor the calibration and configuration parameters of each individual device.** **Yes ☐ No ☐ N/A ☐**
- **The device must either:** **Yes ☐ No ☐ N/A ☐**
  - **- clearly indicate when it is in the remote configuration mode or**
  - **- the device shall not operate while in the remote configuration mode.**
- **If capable of printing in the calibration mode, it must print a message that it is in the calibration mode.** **Yes ☐ No ☐ N/A ☐**
- **The audit trail information must be capable of being retained in memory for at least 30 days while the device is without power.** **Yes ☐ No ☐ N/A ☐**
- **The audit trail information must be readily accessible and easily read.** **Yes ☐ No ☐ N/A ☐**

Minimum Number of Counters Required		
	Minimum Counters Required for Devices Equipped with Event Counters	**Minimum Event Counter(s) at System Controller**
Only one type of parameter accessible (calibration or configuration)	One (1) event counter	One (1) event counter for each separately controlled device, or one (1) event counter, if changes are made simultaneously.
Both calibration and configuration parameters accessible	Two (2) event counters	Two (2) event counters for each separately controlled device, or two (2) or more event counters if changes are made to all controlled devices simultaneously.

Category 3 Devices (Devices with Unlimited Remote Configuration Capability):

Category 3 devices have virtually unlimited access to sealable parameters or access is controlled though a password.

- For devices manufactured after January 1, 2001, the device must either: **Yes ☐ No ☐ N/A ☐**
  - clearly indicate when it is in the remote configuration mode, or
  - the device shall not operate while in the remote configuration mode
- The device is equipped with an event logger **Yes ☐ No ☐ N/A ☐**
- The event logger automatically retains the identification of the parameter changed, the date and time of the change, and the new value of the parameter. **Yes ☐ No ☐ N/A ☐**
- Event counters are nonresettable and have a capacity of at least 000 to 999. **Yes ☐ No ☐ N/A ☐**
- The system is designed to attach a printer, which can print the contents of the audit trail. **Yes ☐ No ☐ N/A ☐**
- The audit trail information must be capable of being retained in memory for at least 30 days while the device is without power or must be retained in nonvolatile memory. **Yes ☐ No ☐ N/A ☐**
- The event logger must have a capacity to retain records equal to ten times the number of sealable parameters in the device, but not more than 1000 records are required. **Yes ☐ No ☐ N/A ☐**
- The event logger drops the oldest event when the memory capacity is full and a new entry is saved. **Yes ☐ No ☐ N/A ☐**
- Describe the method used to seal the device or access the audit trail information. _____
  _____
- ***~~Note: All devices with remote communication that are manufactured after January 1, 2005 must meet the requirements outlined for Category 3.~~***

C. Checklist and Test Procedures for Retail Motor-Fuel Dispensers

Code Reference S.1.2. Units (LMD – 26)

S.1.2. Units. – A liquid-measuring device shall indicate, and record if the device is equipped to record, its deliveries in liters, gallons, quarts, pints, **fluid ounces,** or binary-submultiples or decimal subdivisions of the liter or gallon.

Code Reference: S.1.2. Units

7.23. A liquid-measuring device shall indicate, and record if the device is equipped to record, its deliveries in liters, gallons, quarts, pints, fluid ounces, or binary-submultiples or decimal subdivisions of the liter or gallon. **Yes □ No □ N/A □**

D. Checklist and Test Procedures for Specific Criteria for Vehicle Tank Meters

Code Reference: S.1.1.3. Value of Smallest Unit

If the meter is equipped to record, the value of the smallest unit of indicated delivery and recorded delivery shall not exceed the equivalent of:

24.4. 0.5 L (0.1 gal) or 0.5 kg (1 lb) on milk-metering systems and on meters with a rated maximum flow rate of ~~500~~ **700** L/min (~~100~~ **200** gal/min) or less used for ~~retail~~ deliveries ~~of liquid fuel~~, **or** **Yes □ No □ N/A □**

24.5. **5 L (1 gal) on meters with a rated maximum flow of 575 L/min (150 gal/min) or more used for jet fuel aviation refueling systems, or (Added 2006)** **Yes □ No □ N/A □**

24.6 5 L (1 gal) on other meters **Yes □ No □ N/A □**

(Renumber succeeding paragraphs)

Code Reference S.1.4.1. Display of Unit Price (LMD – 43)

Code Reference: S.1.4.1. Display of Unit Price

25.1. Means must be provided to display the unit price at which the device is set to compute in proximity to the total computed price display. **(In a device of the computing type, means shall be provided for displaying, in a manner clear to the operator and an observer, the unit price at which the device is set to compute. The unit price is not required to be displayed continuously.)** **Yes □ No □ N/A □**

25.2. The unit price shall be expressed in dollars and decimals of dollars using a dollar sign. A common fraction shall not appear in the unit price (e.g., $1.299 not $1.29 9/10). **Yes □ No □ N/A □**

Code Reference Measuring Element (LMD – 44)

Code Reference: S.2.2. Provision for Sealing

Measuring elements shall be designed with a provision for sealing such that an adjustment to the measuring element or the flow rate control (if the flow rate affects the accuracy of deliveries) cannot be made without breaking the security seal. **These provisions can be an approved means of security (e.g., data change audit trail) or physically applying a security seal which must be broken before adjustments can be made.** ~~Milk meters are exempt from this requirement.~~ **When applicable, t**~~T~~he adjusting mechanism shall be readily accessible for the purposes of affixing a security seal.

26.1. A measuring element shall have provision for sealing its adjustable components. **Yes □ No □ N/A □**

26.2. Any adjustable element controlling the delivery rate shall provide for sealing if the flow rate affects the accuracy of deliveries. **Yes □ No □ N/A □**

26.3. The adjusting mechanism shall be readily accessible to affix a security seal. **Yes □ No □ N/A □**

E. Checklist for LPG Liquid Measuring Devices

31. Measuring Element (LMD – 49)

Code Reference: S.2.2. Provision for Sealing

Measuring elements shall be designed with a provision for sealing such that an adjustment to the measuring element or the flow rate control (if the flow rate affects the accuracy of deliveries) cannot be made without breaking the security seal. **These provisions can be an approved means of security (e.g., data change audit trail) or physically applying a security seal which must be broken before adjustments can be made. When applicable, t**~~T~~he adjusting mechanism shall be readily accessible for the purposes of affixing a security seal.

31.1. A measuring element shall provide for sealing its adjustable components. **Yes □ No □ N/A □**

31.2. Any adjustable element controlling the delivery rate shall provide for sealing if the flow rate affects the accuracy of deliveries. **Yes □ No □ N/A □**

31.3. The adjusting mechanism shall be readily accessible to affix a security seal. **Yes □ No □ N/A □**

33. Marking

Code Reference: S.4. Marking Requirements

Code Reference: S.4.3. Location of Marking Information; Retail Motor-Fuel Dispenser

33.4. ***The marking information required in the General Code, paragraph G-S.1. Identification shall appear as follows:*** **Yes □ No □ N/A □**

(a) within 60 cm (24 in) to 150 cm (60 in) from the base of the dispenser;

(b) either internally and/or externally provided the information is permanent and easily read; and

(c) on a portion of the device that cannot be readily removed or interchanged (i.e.,not on a service access panel).

Note: ***The use of a dispenser key or tool to access internal marking information is permitted for retail liquid-measuring devices.***
[Nonretroactive as of January 1, 2003]
(Added 2006)

Code Reference: S.4.3. Temperature Compensation

33.~~4~~5. If a device is equipped with an automatic temperature compensator, the primary indicating elements, recording elements, and recorded representations shall be clearly and conspicuously marked to show that the volume delivered has been adjusted to the volume at 15 °C (60 °F). **Yes □ No □ N/A □**

F. Checklist for Mass Flow Meters

38. Marking (LMD – 57)

Code Reference: S.5. Marking Requirements

38.1. The dispenser shall have the following information on the identification plate:

a. pattern approval mark (i.e., type approval number); **Yes ☐ No ☐ N/A ☐**

b. name and address of the manufacturer or his trademark and, required by the weights and measures authority, the manufacturer's identification mark in addition to the trademark; **Yes ☐ No ☐ N/A ☐**

c. model designation or product name selected by the manufacturer; **Yes ☐ No ☐ N/A ☐**

d. non-repetitive serial number; **Yes ☐ No ☐ N/A ☐**

e. accuracy class of the meter as specified by the manufacturer consistent with Table T.2; **Yes ☐ No ☐ N/A ☐**

f. maximum and minimum flow rates in pounds per unit of time; **Yes ☐ No ☐ N/A ☐**

g. maximum working pressure; **Yes ☐ No ☐ N/A ☐**

h. applicable temperature range if other than –10 °C to +50 °C; **Yes ☐ No ☐ N/A ☐**

i. minimum measured quantity (MMQ); **Yes ☐ No ☐ N/A ☐**

j. product limitations if applicable. **Yes ☐ No ☐ N/A ☐**

Code Reference: S.5.1. Location of Marking Information; Retail Motor-Fuel Dispensers.

38.2. **The marking information required in General Code, paragraph G-S.1. Identification shall appear as follows:** **Yes ☐ No ☐ N/A ☐**

(a) within 60 cm (24 in) to 150 cm (60 in) from the base of the dispenser;

(b) either internally and/or externally provided the information is permanent and easily read; and

(c) on a portion of the device that cannot be readily removed or interchanged (i.e., not on a service access panel).

Note: The use of a dispenser key or tool to access internal marking information is permitted for retail liquid-measuring devices.
[Nonretroactive as of January 1, 2003]
(Added 2006)

Code Reference: S.5.~~1~~2. Marking of Gasoline Volume Equivalent Conversion Factor

A device dispensing compressed natural gas shall have either the statement "1 Gasoline Liter Equivalent (GLE) is Equal to 0.678 kg of Natural Gas" or "1 Gasoline Gallon Equivalent (GGE) is Equal to 5.660 lb of Natural Gas" permanently and conspicuously marked on the face of the dispenser according to the method of sale used.

Conclusion: The Sector reviewed and agreed to recommend to the NTEP Committee adoption of the changes to Publication 14 shown above based on changes to the 2007 edition of NIST Handbook 44.

Carry-over Items:

2. Reorganize Publication 14 to Clarify Tests of ECRs for RMFDs

Source: NTEP Laboratories

Background: At the 2005 NTEP laboratory meeting, one of the measuring labs stated that the LMD section of Publication 14 was not well organized. During an NTEP evaluation, the evaluator must continuously flip from one section of the publication to another to find all the requirements applicable to the device under test. The lab also stated that the evaluation of an ECR interfaced with a RMFD required the use of both the ECR Checklist and the LMD Checklist in order to find all the applicable requirements. The California laboratory volunteered to provide a draft reorganization of the LMD Checklist and a draft of a revised ECR Checklist with the applicable requirements added from the LMD Checklist. The drafts of the reorganized LMD Checklist and the revised ECR Checklist are in Appendices A and B, respectively. At the 2005 Sector Meeting, the Sector supported the concept, provided all NTEP laboratories and other interested parties conducted a thorough review of the proposed changes before they are incorporated into NCWM Publication 14.

Recommendation: The Sector reviewed the drafts submitted and received input from the NTEP laboratories for possible forwarding to the NTEP Committee for approval as revisions to the 2007 version of Publication 14.

Conclusion: The Sector discussed the reorganized checklists which were reorganized with the intent to make them more user friendly. Although the draft reorganized checklists have not been used extensively, the NTEP laboratories had no problems to report. The Sector agreed to forward the drafts to the NTEP Committee for inclusion in the next edition of Publication 14.

3. Add Magnetic Flowmeters to Product Family Table.

Source: Magnetic Meters Work Group (WG)

Background: At the 2002 Sector Meeting, a Work Group (WG) was formed to address the issue of product family criteria. Prior to the 2003 Sector Meeting the technical advisor was informed that this WG was not ready to present a recommendation; however the WG requested that the item remain on the agenda for further development.

At the 2003 Sector Meeting, the Sector agreed that a new WG should be formed to develop family product tables for Mag Meters for consideration by the Sector at its next meeting. The members of the new WG are: Charlene Numrych (Liquid Controls), Chair, Richard Miller (FMC); Joe Buxton (Daniel Measurement & Control); Randy Byrtus (Measurement Canada). Charlene volunteered to contact other manufacturers to invite them to participate in the WG.

The WG formed at the 2003 Sector Meeting identified four Turbine Meter manufacturers that could provide data on a variety of products measured using this type of meter. For the 2004 Measuring Sector Meeting, only one Mag Meter manufacturer of three manufacturers was identified as having a certificate for products other than milk. No information had been gathered regarding manufacturers of Ultrasonic Meters. The WG did not have a proposal to present at that time, but planned to continue its work. A new chairman was needed for the WG because Charlene Numrych (Liquid Controls) was no longer available to perform that function. The WG had nothing to provide for the 2005 Measuring Sector Meeting.

The WG is submitting a proposal to add Magnetic Meters to the Family Products table with additional background information, for discussion at the 2006 Sector Meeting.

The proposed Product Family table adding magnetic flowmeters has been reviewed by manufacturer representatives holding magnetic flowmeter NTEP Certificates of Conformance (CC). Those comments were included in the organization of this proposal.

Operation: Magnetic flowmeters determine the velocity of an electrically conductive liquid in a known diameter tube section of the piping. The gross volumetric flow rate of the liquid is calculated in the electronic transmitter. The delivered volumetric quantity is displayed on the transmitter and/or scaled pulses are transmitted to a compatible register.

Influence factors: The magnetic flowmeter determines the gross volume. The magnetic flowmeter is not influenced by the density of the liquid.

The magnetic flowmeter has no moving mechanical components that would rely on close tolerances and capillary fluid action. The magnetic flowmeter is not influenced by the viscosity of the liquid.

Magnetic flowmeters determine the velocity of electrically conductive liquids. The conductivity of the liquid must be above a minimum threshold value determined in the engineered design of the flowmeter and specified by the manufacturer. The value of the conductivity is not significant to the determination of the volumetric flow rate.

The Product Family Table: The table has been edited to add a column for magnetic flowmeters.

The Water Mixes of Alcohol and Glycols and Water categories have been combined for magnetic flowmeters. Juices and Beverages have been added to this category.

The Agricultural Chemical Liquids and Chemicals categories have been combined for magnetic flowmeters.

Test D is required for Agricultural Chemical Liquids, Chemicals, Water, Beverages and Juices. The conductivity of the liquids in these categories is not significant to the performance of the magnetic flowmeter.

A new Test F has been added that is specific to magnetic flowmeters. Test F is required for liquids in product categories where the liquids commonly have low conductivity. The manufacturer submits the flowmeter to be tested at a specified conductivity. The specified conductivity is listed on the certificate. All liquids in the same category with conductivity above the conductivity of the liquid tested will be included.

The following copyrighted documents can be referenced for as supporting documentation:

ASME Draft MFC-16M: Measurement of Fluid Flow in Closed Conduits, with Electromagnetic Flowmeters.

AWWA Draft Committee Report: Magnetic Inductive Flowmeters

Recommendation: The Sector will review the following proposal for possible forwarding to the NTEP Committee for approval and addition to the 2007 edition of Publication 14.

Add magnetic flowmeters to the Product Family Table as follows:

Tests to be Conducted

Test A - Products must be individually tested and noted on the CC.

Test B - To obtain coverage for a range of products within a family: Test with one product having a low specific gravity; test with a second product having a high specific gravity. The CC will cover all products in the family within the specific gravity range tested.

Test C - To obtain coverage for a range of products within a family: Test with one product having a low viscosity; test with a second product having a high viscosity. The CC will cover all products in the family within the viscosity range tested.

Test D - To obtain coverage for a product family: Test with one product in the product family.

Test E - To obtain coverage for a range of products within a family: Test with one product having a low kinematic viscosity; test with a second product having a high kinematic viscosity. The CC will note coverage for all products in the family within the kinematic viscosity range tested.

Test F - To obtain coverage for a range of products within a family: Test with one product having a specified conductivity. The CC will note coverage for all products in the family with conductivity equal to or above the conductivity of the tested liquid.

Mass Meter Product Family & Test Requirements (Test B unless otherwise noted)	Magnetic Flow Meter Product Family & Test Requirements (Test D unless otherwise noted)	PD Product Family & Test Requirements (Test C unless otherwise noted)	Turbine Product Family & Test Requirements (Test A unless otherwise noted)	Typical Products[1]	Viscosity[5] (Centipoise) (Centistokes)	Specific Gravity[2]
Normal Liquids	Test F	Fuels, Lubricants, Industrial and Food Grade Liquid Oils	Fuels, Lubricants, Industrial and Food Grade Liquid Oils (Test E permitted)	Diesel Fuel[3], Distillate, Gasoline[4], Fuel Oil, Kerosene, Light Oil, Spindle Oil, Lubricating Oils, SAE Grades, Bunker Oil, 6 Oil, Crude Oil, Asphalt, Vegetable Oil, Biodiesel above B20, Avgas, Jet A, Jet A-1, Jet B, JP4, JP5, JP7, JP8, Cooking Oils, Sunflower Oil, Soy Oil, Peanut Oil, Olive Oil, etc.	0.3 to 2500 0.44 to 2270	0.68 to 1.1
	Test F	Solvents General	Solvents General (Test E permitted)	Acetates, Acetone, Esters, Ethylacetate, Hexane, MEK, Naphtha, Toluene, Xylene, etc.	0.3 to 7 0.5 to 4.38	0.6 to 1.6
	Test F	Solvents Chlorinated	Solvents Chlorinated	Carbon Tetra-Chloride, Methylene-Chloride, Perchloro-Ethylene, Trichloro-Ethylene, etc.	0.3 to 7 0.5 to 4.38	0.6 to 1.6
	Pure Alcohols & Glycols, Water (Demineralized & Deionized) Test F	Alcohols, Glycols, & Water Mixes Thereof	Alcohols, Glycols, & Water Mixes Thereof (Test E permitted)	Ethanol, Methanol, Butanol, Isopropyl, Isobutyl, Ethylene glycol, Propylene glycol, etc.	0.3 to 7 0.5 to 4.38	0.6 to 1.6
	Water (Tap, Potable & Nonpotable), Water (Mixes of Alcohols & Glycols), Juices, Beverages, (Test D)	Water (Test D permitted)	Water (Test D permitted)	Tap Water, Deionized, Demineralized, Potable, Nonpotable	1.0	1.0

Mass Meter Product Family & Test Requirements (Test B unless otherwise noted)	Magnetic Flow Meter Product Family & Test Requirements (Test D unless otherwise noted)	PD Product Family & Test Requirements (Test C unless otherwise noted)	Turbine Product Family & Test Requirements (Test A unless otherwise noted)	Typical Products[1]	Viscosity[5] (Centipoise) (Centistokes)	Specific Gravity[2]
	Clear Liquid Fertilizers, Crop Chemicals, Suspensions Fertilizers, Liquid Feeds, Chemicals Test D	Clear Liquid Fertilizers	Clear Liquid Fertilizers	Nitrogen Solution; 28 %, 30 % or 32 %; 20 % Aqua-Ammonia; Urea; Ammonia Nitrate; N-P-K solutions; 10-34-0; 4-10-10; 9-18-9; etc.	10 to 400 10 to 275	1.0 to 1.45
		Crop Chemicals	Crop Chemicals	Herbicides: Round-up, Touchdown, Banvel, Treflan, Paraquat, Prowl, etc	4 to 400 5.7 to 333	0.7 to 1.2
		Crop Chemicals	Crop Chemicals	Fungicides, Insecticides, Adjuvants, Fumigants	0.7 to 100 1 to 83	0.7 to 1.2
		Flowables	Flowables	Dual, Bicep, Marksman, Broadstrike, Doubleplay, Topnotch, Guardsman, Harness, etc.	20 to 900 20 to 750	1 to 1.2
		Crop Chemicals	Crop Chemicals	Fungicides		
		Crop Chemicals	Crop Chemicals	Micronutrients		
		Suspensions Fertilizers	Suspensions Fertilizers	3-10-30; 4-4-27, etc.	20 to 900 20 to 560	1.0 to 1.6
		Liquid Feeds	Liquid Feeds	Liquid Molasses; Molasses plus Phos Acid and/or Urea; etc.	10 to 50 000 8 to 33 000	1.2 to 1.5
		Chemicals	Chemicals	Sulfuric Acid, Hydrochloric Acid, Phosphoric Acid, etc	1.0 to 296 0.9 to 160	1.1 to 1.85
Heated Products (above 50 °C)	Test F	Heated Products (above 50 °C)	Heated Products (above 50 °C)	Bunker C, Asphalt, etc.		0.8 to 1.2

Mass Meter Product Family & Test Requirements (Test B unless otherwise noted)	Magnetic Flow Meter Product Family & Test Requirements (Test D unless otherwise noted)	PD Product Family & Test Requirements (Test C unless otherwise noted)	Turbine Product Family & Test Requirements (Test A unless otherwise noted)	Typical Products[1]	Viscosity[5] (Centipoise) (Centistokes)	Specific Gravity[2]
Compressed Liquids - (Test D)	Not Applicable (conductivity too low)	Fuels and Refrigerants	Fuels and Refrigerants (Test E)	LPG, Propane, Butane, Ethane, Freon 11, Freon 12, Freon 22, etc.	0.1 to 0.5 0.3 to 0.77	0.3 to 0.65
		NH[3]	NH[3]	Anhydrous Ammonia Note: If a meter is certified for anhydrous ammonia, the same meter type may also be certified for LPG without further testing.	0.1 0.2	0.56 to 0.68
Compressed Gases - (Test D)	Note: CNG is only included in Section 3.37 Mass Flow Meters of Handbook 44		CNG		0.6 to 0.8	
Cryogenic Liquids and Liquefied Natural Gas - (Test D)	Not Applicable (conductivity too low)	Cryogenic Liquids and Liquefied Natural Gas – (Test A)	Cryogenic Liquids and Liquefied Natural Gas – (Test D)	Liquefied Oxygen, Nitrogen, etc.	0.07 to 1.4	

[1] ***NOTE: The Typical Products listed in this table are not limiting or all-inclusive; there may be other products and product trade names, which fall into a product family. Water and a product such as stoddard solvent or mineral spirits may be used as test products in the fuels, lubricants, industrial, and food- grade liquid oils product family.***

[2] **The specific gravity of a liquid is the ratio of its density to that of water at standard conditions, usually 4 °C (or 40 °F) and 1 atm. The density of water at standard conditions is approximately 1000 kg/m^3 (or 998 kg/m^3).**

[3] **Diesel fuel blends (biodiesel) with up to 20 % vegetable or animal fat/oil.**

[4] **Gasoline includes oxygenated fuel blends with up to 15 % oxygenate.**

[5] **Kinematic viscosity is measured in centistokes.** $$Centistokes = \frac{Centipoise}{Specific\ Gravity}$$

Source for some of the viscosity value information is in the Industry Canada - Measurement Canada "Liquid Products Group, Bulletin V-16-E (rev. 1), August 3, 1999."

Conclusion: There was considerable discussion of the proposal to add magnetic flowmeters to the Product Families table. Most of the discussion centered on a determination of what product characteristics were most important when evaluating a magnetic flow meter. The members of the WG present at the meeting agreed that the most important product characteristic is conductivity. During the discussion, a member stated that the column for magnetic flowmeters could be simplified similar to the column for mass meters. The Sector agreed and modified the Product Families table to add Magnetic Flow Meters as follows:

Tests to be Conducted

Test A - Products must be individually tested and noted on the CC.

Test B - To obtain coverage for a range of products within a family: Test with one product having a low specific gravity; test with a second product having a high specific gravity. The CC will cover all products in the family within the specific gravity range tested.

Test C - To obtain coverage for a range of products within a family: Test with one product having a low viscosity; test with a second product having a high viscosity. The CC will cover all products in the family within the viscosity range tested.

Test D - To obtain coverage for a product family: Test with one product in the product family. The CC will cover all products in the family.

Test E - To obtain coverage for a range of products within a family: Test with one product having a low kinematic viscosity; test with a second product having a high kinematic viscosity. The CC will note coverage for all products in the family within the kinematic viscosity range tested.

Test F - To obtain coverage for a range of products within a family: Test with one product having a specified conductivity. The CC will note coverage for all products in both of the families with conductivity equal to or above the conductivity of the tested liquid.

Mass Meter Product Family & Test Requirements (Test B unless otherwise noted)	Magnetic Flow Meter Product Family & Test Requirements (Test D unless otherwise noted)	PD Product Family & Test Requirements (Test C unless otherwise noted)	Turbine Product Family & Test Requirements (Test A unless otherwise noted)	Typical Products[1]	Viscosity[5] (Centipoise) (Centistokes)	Specific Gravity[2]
Normal Liquids	(Test F permitted) Fuels, Lubricants, Industrial and Food Grade Liquid Oils, Solvents General, Solvents Chlorinated, Pure Alcohols & Glycols, Water (De-mineralized & deionized), Heated Products (above 50 °C)	Fuels, Lubricants, Industrial and Food Grade Liquid Oils	Fuels, Lubricants, Industrial and Food Grade Liquid Oils (Test E permitted)	Diesel Fuel[3], Distillate, Gasoline[4], Fuel Oil, Kerosene, Light Oil, Spindle Oil, Lubricating Oils, SAE Grades, Bunker Oil, 6 Oil, Crude Oil, Asphalt, Vegetable Oil, Biodiesel above B20, Avgas, Jet A, Jet A-1, Jet B, JP4, JP5, JP7, JP8, Cooking Oils, Sunflower Oil, Soy Oil, Peanut Oil, Olive Oil, etc.	0.3 to 2500 0.44 to 2270	0.68 to 1.1
		Solvents General	Solvents General (Test E permitted)	Acetates, Acetone, Esters, Ethylacetate, Hexane, MEK, Naphtha, Toluene, Xylene, etc.	0.3 to 7 0.5 to 4.38	0.6 to 1.6
		Solvents Chlorinated	Solvents Chlorinated	Carbon Tetra-Chloride, Methylene-Chloride, Perchloro-Ethylene, Trichloro-Ethylene, etc.	0.3 to 7 0.5 to 4.38	0.6 to 1.6

Mass Meter Product Family & Test Requirements (Test B unless otherwise noted)	Magnetic Flow Meter Product Family & Test Requirements (Test D unless otherwise noted)	PD Product Family & Test Requirements (Test C unless otherwise noted)	Turbine Product Family & Test Requirements (Test A unless otherwise noted)	Typical Products[1]	Viscosity[5] (Centipoise) (Centistokes)	Specific Gravity[2]
		Alcohols, Glycols, & Water Mixes Thereof	Alcohols, Glycols, & Water Mixes Thereof (Test E permitted)	Ethanol, Methanol, Butanol, Isopropyl, Isobutyl, Ethylene glycol, Propylene glycol, etc.	0.3 to 7 0.5 to 4.38	0.6 to 1.6
	Test D Water (Tap, Potable & Nonpotable), Water (Mixes of Alcohols & Glycols), Juices, Beverages, Clear Liquid Fertilizers, Crop Chemicals, Suspensions Fertilizers, Liquid Feeds, Chemicals	Water (Test D permitted)	Water (Test D permitted)	Tap Water, Deionized, Demineralized, Potable, Nonpotable	1.0	1.0
		Clear Liquid Fertilizers	Clear Liquid Fertilizers	Nitrogen Solution; 28 %, 30 % or 32 %; 20 % Aqua-Ammonia; Urea; Ammonia Nitrate; N-P-K solutions; 10-34-0; 4-10-10; 9-18-9; etc.	10 to 400 10 to 275	1.0 to 1.45
		Crop Chemicals	Crop Chemicals	Herbicides: Round-up, Touchdown, Banvel, Treflan, Paraquat, Prowl, etc	4 to 400 5.7 to 333	0.7 to 1.2
		Crop Chemicals	Crop Chemicals	Fungicides, Insecticides, Adjuvants, Fumigants	0.7 to 100 1 to 83	0.7 to 1.2
		Flowables	Flowables	Dual, Bicep, Marksman, Broadstrike, Doubleplay, Topnotch, Guardsman, Harness, etc.	20 to 900 20 to 750	1 to 1.2
		Crop Chemicals	Crop Chemicals	Fungicides		
		Crop Chemicals	Crop Chemicals	Micronutrients		
		Suspensions Fertilizers	Suspensions Fertilizers	3-10-30; 4-4-27, etc.	20 to 900 20 to 560	1.0 to 1.6
		Liquid Feeds	Liquid Feeds	Liquid Molasses; Molasses plus Phos Acid and/or Urea; etc.	10 to 50 000 8 to 33 000	1.2 to 1.5
		Chemicals	Chemicals	Sulfuric Acid, Hydrochloric Acid, Phosphoric Acid, etc	1.0 to 296 0.9 to 160	1.1 to 1.85
Heated Products (above 50 °C)		Heated Products (above 50 °C)	Heated Products (above 50 °C)	Bunker C, Asphalt, etc.		0.8 to 1.2

Mass Meter Product Family & Test Requirements (Test B unless otherwise noted)	Magnetic Flow Meter Product Family & Test Requirements (Test D unless otherwise noted)	PD Product Family & Test Requirements (Test C unless otherwise noted)	Turbine Product Family & Test Requirements (Test A unless otherwise noted)	Typical Products[1]	Viscosity[5] (Centipoise) (Centistokes)	Specific Gravity[2]
Compressed Liquids – (Test D)	Not Applicable (conductivity too low)	Fuels and Refrigerants	Fuels and Refrigerants (Test E)	LPG, Propane, Butane, Ethane, Freon 11, Freon 12, Freon 22, etc.	0.1 to 0.5 0.3 to 0.77	0.3 to 0.65
		NH^3	NH^3	Anhydrous Ammonia Note: If a meter is certified for anhydrous ammonia the same meter type may also be certified for LPG without further testing.	0.1 0.2	0.56 to 0.68
Compressed Gases – (Test D)	Note: CNG is only included in Section 3.37 Mass Flow Meters of Handbook 44		CNG		0.6 to 0.8	
Cryogenic Liquids and Liquefied Natural Gas – (Test D)	Not Applicable (conductivity too low)	Cryogenic Liquids and Liquefied Natural Gas – (Test A)	Cryogenic Liquids and Liquefied Natural Gas – (Test D)	Liquefied Oxygen, Nitrogen, etc.	0.07 to 1.4	

[1] *NOTE: The Typical Products listed in this table are not limiting or all-inclusive; there may be other products and product trade names, which fall into a product family. Water and a product such as stoddard solvent or mineral spirits may be used as test products in the fuels, lubricants, industrial, and food- grade liquid oils product family.*

[2] The specific gravity of a liquid is the ratio of its density to that of water at standard conditions, usually 4 °C (or 40 °F) and 1 atm. The density of water at standard conditions is approximately 1000 kg/m^3 (or 998 kg/m^3).

[3] Diesel fuel blends (biodiesel) with up to 20 % vegetable or animal fat/oil.

[4] Gasoline includes oxygenated fuel blends with up to 15 % oxygenate.

[5] Kinematic viscosity is measured in centistokes. $$Centistokes = \frac{Centipoise}{Specific\ Gravity}$$

Source for some of the viscosity value information is in the Industry Canada - Measurement Canada "Liquid Products Group, Bulletin V-16-E (rev. 1), August 3, 1999."

4. Value of the Smallest Unit for LMD Code

Source: NCWM S&T Committee

Background/Discussion: In 2004 the definition of a "retail device" in NIST Handbook 44 was modified to include all devices used to measure product for the purpose of sale to the end user. At that time the Committee believed all affected parties were aware of the proposal and there was no opposition to the change. The Committee had not considered applications where very large deliveries are made to the end user, typically at high flow rates. After the 2005 edition of the Handbook was published and distributed, WMD received a comment from a weights and measures jurisdiction that routinely tests large meters used to deliver fuel to fishing fleets and other large ocean-going boats. The jurisdiction stated that the average delivery is approximately 300 000 gal and may be as much as 1 000 000 gal. Prior to the revision of the definition of "retail," the value of the smallest unit of the indicated delivery for these devices was permitted to be 1 gal. Most of these devices have mechanical registers which make it impractical to have a smallest unit of 0.1 gal at the high flow rates used for such large deliveries. Because the fuel is being delivered to the end user, the jurisdiction believes this is a retail delivery. However, with the revisions to the definition of retail device, NIST Handbook 44 now requires a smallest unit of delivery of not more than 0.5 L (1 pt or 0.125 gal) for these devices.

At its October 2005 meeting, the NTETC Measuring Sector developed a proposal and agreed to forward it to the Committee for consideration. The Measuring Sector believed that, because the maximum flow rate for many applications has increased, 200 gal/min is an appropriate "break point" for determining what the smallest unit of measurement should be. At its October 2005 meeting, the SWMA agreed with the Measuring Sector's proposal and recommended that the item move forward to the Committee.

At the 2006 NCWM Interim Meeting, it was suggested that the Committee should revisit the discussion on suitability of liquid-measuring devices that was discussed by the NCWM in 1991 through 1993. In these earlier discussions, the NCWM was unable to reach a consensus on any changes to NIST Handbook 44, and the item was withdrawn from the Committee agenda. The Committee was informed that there was interest expressed at the 2005 NTETC Measuring Sector meeting in developing new criteria addressing suitability as it relates to flow rate, minimum measured quantity (MMQ), and the smallest unit of measure for applications using liquid-measuring devices. The Committee encourages the NTETC Measuring Sector to pursue development of suitability requirements for submission to the Committee for consideration. In the meantime, the Committee heard no opposition to Item 330-2 and agreed to present the item for a vote at the 2006 NCWM Annual Meeting.

At the 2006 NCWM Annual Meeting, the Committee received input from several manufacturers of aircraft refueling equipment that there is a safety concern with stationary refueling systems that are capable of delivering jet fuel through two different sized hoses at different flow rates using two different meters. In this scenario, the operators of the refueling facility want both meters to have the same unit of indication; that is, 5 L or 1 gal. The Committee understood the concern, but was reluctant to modify the recommendation based on the limited information available at the meeting. The Committee believed that the aircraft refueling industry should propose a change during the next Conference cycle through the NTETC Measuring Sector and the regional associations. However, the Committee recognized that a legitimate problem may exist with existing jet aircraft refueling equipment and encouraged weights and measures jurisdictions to consider safety implications before taking official action on existing jet aircraft refueling devices that may not meet the requirements of paragraph S.1.2.3. During the voting session, there appeared to be concern that if this item was adopted, weights and measures officials could be perceived as ignoring safety issues for aircraft refueling. There was an evident lack of support for the item without an exemption for jet aircraft refueling; therefore, the Committee changed the status of Item 330-2 to an information item to provide sufficient time for development of appropriate language to address the safety concerns with jet aircraft refueling equipment. The Committee requested that the Measuring Sector provide comments or changes to the proposal as appropriate.

Recommendation: The Sector reviewed the following proposal and provided comments to the S&T Committee for consideration at the 2007 NCWM Interim Meeting.

Proposal: Modify Handbook 44, Section 3.30., S.1.2.3. Value of the smallest unit as follows:

S.1.2.3. Value of Smallest Unit. – The value of the smallest unit of indicated delivery, and recorded delivery if the device is equipped to record, shall not exceed the equivalent of:

(a) 0.5 L **(~~1 pt~~0.1 gal)** on ~~**retail**~~ devices **with a maximum rated flow rate of 750 L/min (200 gal/min) or less.**

(b) 5 L (1 gal) on ~~**wholesale**~~ devices **with a maximum rated flow of more than 750 L/min (200 gal/min).**

This requirement does not apply to manually operated devices equipped with stops or stroke-limiting means.
(Amended 1983**,** ~~**and**~~ 1986**, and 200X**)

See agenda Item 12.

Conclusion: The Sector continued to support its recommended changes to S.1.2.3. as shown above but agreed to consider the addition of a paragraph (c) to allow a larger minimum unit for aircraft jet refueling, during the discussion of agenda Item 12.

New Items:

5. Product Families for Meters

Source: NTEP Director

Background/Discussion: During several NTEP evaluations conducted since the last Sector meeting, there have been concerns that the Product Families tables for meters needs to be revised and updated to reflect changes in metering designs being submitted for evaluation and products currently found in the market place. One meter manufacturer wanted to know what testing was required to include "biodiesel" on a CC: Must the evaluation be conducted using biodiesel fuel with the highest specific gravity available or can testing be conducted using a product, with very similar characteristics, that is available in the manufacturer's lab?

Recommendation: The Sector reviewed and discussed possible changes to clarify the Product Families table for Positive Displacement Meters in the LMD Technical Policy of Publication 14 to be forwarded to the NTEP Committee for approval and addition to the 2007 edition of Publication 14.

The NTEP Director, Steve Patoray, offered the following list of concerns with the current Product Families table:

1. The table as it currently exists is still very confusing.
2. It is not clear which tests are actually required.
3. Instead of the "Tests" being listed in the header of the table, they should be listed with each product group.
4. Typical products should be listed in ascending order (if possible) based on one of the key characteristics or have a method to ID key characteristics.

Conclusion: The Sector agreed that it would be appropriate to consider reorganizing the Product Families table by meter technology considering the most important product characteristics for each. The Sector formed a WG to develop a proposal for consideration at the next meeting. The WG will work primarily through e-mail and conference calls. The chairman appointed the following individuals as members of the WG:

Alex Gutierrez	MEGGITT Fueling Products, Whittaker Controls
Maurice Forkert	Tuthill Transfer Systems
Mark Buttler	Emerson Process Management – Micro Motion
Rodney Cooper	Actaris Neptune
Charlene Numrych	Liquid Controls LLC

Paul Glowacki	Murray Equipment Inc.
Wade Mattar	Invensys/Foxboro
Richard Suiter	NIST/WMD
Ross Andersen	New York Bureau of Weights and Measures
Richard Miller	FMC Measurement Solutions
Mike Keilty	Endress & Hauser Flowtec AG
Richard Wotthlie	Maryland Weights and Measures
Joe Buxton	Daniel Measurement & Control

6. Table of Key Characteristics of Products in Product Families Table for Meters

Source: NTEP Director

Background/Discussion: Prior to the Sector Meeting the NTEP Director, Steve Patoray submitted the following comments for Sector consideration.

> This is a developing item. Probably all of you reading this know more about this topic than I ever will. I have had discussions with several different people on this topic over the past several months. The Product table in NCWM Publication 14 has been improved over the past several years. Currently, Mass Flow Meters have a key characteristic of specific gravity. PD meters have a key characteristic of viscosity. We list in the table numbers; however, these numbers are without reference. These are normally tied to some temperature. None is listed; also, there is no cross reference for anyone to identify what products might fall within those ranges. I had a very difficult time finding specific information on even some very basic products that we normally use in evaluations. Several of the folks on the sector helped to locate various tables and charts to help identify these values. The information in these charts varies for the "same" product.
>
> As an example of the potential confusion, there are both dynamic (absolute) and kinematic viscosity. The values for these are not the same for the same product; the unit for these, respectively, is centipoises (cP) and centistokes (cSt).
>
> Quoting from the Engineering Tool Box: The viscosity of a fluid is highly temperature dependent and for either dynamic or kinematic viscosity to be meaningful, the reference temperature must be quoted.
>
> In the table on page LMD-3 there are numbers for both Viscosity and Specific Gravity (S.G.) but no temperatures. While S.G. may not be as temperature dependant, some reference should still be cited.
>
> To expand on this in the table in the publication on page LMD-3, we have Test C which just states viscosity, while Test E states specifically kinematic viscosity. This may be very important for the device that uses these tests, but I would suggest that it be clarified and consistent. The use of just the term "viscosity" could be misinterpreted.
>
> What I am proposing is that this group considers listing <u>specific values</u> for each of the typical products listed in this table. It may need to be a separate table. With this information, the NTEP evaluator would then be able to look to the chart and find the correct value for the critical characteristic. This could be listed on the CC and the range could clearly be identified. Additional products could be added as necessary when they are used for an evaluation. The main point is that the same values will be used.
>
> Also, there are four different product groups for crop chemicals. Without further information, this can lead to confusion.
>
> Trying to follow all of the special notes is very difficult.

> There still seems to be product families that are based on some other factor that is not specified, not just viscosity or specific gravity (first page of table); many of the different products' values overlap.
>
> This should be enough to get the discussion started. I hope that I have been clear in the fact that I would like to see this table continue to be revised and if possible condensed.

Recommendation: The Sector discussed the NTEP director's concern and explored the concept of having a table of product characteristics. The Sector considered appointing a WG to develop this item for presentation and discussion at the next meeting.

Conclusion: The Sector agreed that further development of key characteristics should be included in the tasks of the WG formed to develop a new product families table approach, as discussed in agenda Item 5.

7. NTEP Checklist for Water Meters in Sub-metering Application

Source: NTEP Director

Background/Discussion: The NTEP Committee has asked the Measuring Sector to consider and develop a checklist for residential water meters. These devices will most likely be used for sub-metering. Several states have recently contacted NTEP regarding these devices. California already has evaluation and certification of these devices in their state. It is recommended that the Sector review the procedures used by California and rework them into a format acceptable to NCWM Publication 14.

Comments from the California NTEP Laboratory: California has found an electronic version and copied the specific section. California uses this as an EPO for field enforcement, follows the same guidelines in approval, does three tests at three flow rates, and does check repeatability. It also has a basic form you can print and do water meter tests. This also follows Handbook 44 Sections 1.10 and 3.36.

In type evaluation, we have a procedure (not a checklist) but it is for the evaluator and starts with application review and other directives not pertaining to actual testing. We also have an electronic form, which is specific for our provers, and as previously stated, follow the testing criteria of the EPO. It probably would not take a whole lot of work (I'm guessing) to format it to the Publication 14 format.

The Sector members can review the California checklist for Domestic Cold Water Meters in the attached Appendix C.

Recommendation: The Sector discussed the NTEP director's concern and explored the concept of adding a checklist for evaluation of water meters in sub-metering applications to Publication 14. The Sector considered appointing a WG to develop this item for presentation and discussion at the next meeting.

Conclusion: The Sector agreed that the best approach for developing a Publication 14 checklist for water meters would be the utilization of a WG made up of technical experts and other interested parties. The members present at the meeting who volunteered to serve on the WG were Dan Reiswig, California NTEP Laboratory; Jim Welch, Measurement Canada; and Rodney Cooper, Actaris Neptune. The Sector chairman, Mike Keilty, will also invite participation by water meter manufacturers AMR, Badger Meter, and Neptune Water Meter Division.

8. NTEP Checklist for LPG Vapor Meters in Sub-metering Applications

Source: NTEP Director

Background/Discussion: The NTEP Committee has asked the Measuring Sector to consider and develop a checklist for LPG Vapor meters. These devices will most likely be used for sub-metering. Several states have

recently contacted NTEP regarding these devices. California already has evaluation and certification of these devices in their state. It is recommended that the Sector review the procedures used by California and rework them into a format acceptable to NCWM Publication 14.

The Sector members can review the California type evaluation checklist for LPG vapor meters in the attached Appendix D.

Recommendation: The Sector discussed the NTEP director's concern and explored the concept of adding a checklist for evaluation of LPG vapor meters in sub-metering applications to Publication 14. The Sector considered appointing a WG to develop this item for presentation and discussion at the next meeting.

Conclusion: The Sector agreed that the best approach for developing a Publication 14 checklist for LPG vapor meters would be the utilization of a WG made up of technical experts and other interested parties. Dan Reiswig, California NTEP Laboratory, will provide a list of vapor meter manufacturers to be contacted for participation on the WG.

9. Testing Electronic Indicators Using Simulated Inputs

Source: FMC

Background/Discussion: It was stated at the 2004 Measurement Sector meeting that the reason for allowing fixed indicators to use simulated inputs was the fact that durability testing was not required due to the limited vibration associated with their intended use, and vehicle-mounted indicators could not be tested with simulated inputs for the same reason. The intended use was a severe environment; therefore, testing in the field following the permanence requirements was needed to test the durability of the device. In other words to make sure the device would function in its intended environment without failures due to its usage.

The rational of allowing simulated inputs for revisions to an existing CC regardless of installation type is the fact that the device has already undergone the durability phase of the testing. Software revisions will not affect the durability of a device; software changes do however affect the functionality of a device. Therefore, testing with simulated inputs offers a sufficient test to verify software functionality.

Recommendation: The Sector reviewed the following proposal for possible forwarding to the NTEP Committee for consideration at the 2007 NCWM Interim Meeting.

Proposal: Modify Publication 14 Technical Policy Section U. as follows: (LMD – 9)

U. Testing Electronic Indicators ~~for Stationary Installations~~ Utilizing Simulated Inputs.

a. When evaluating electronic indicators for stationary installations, submitted separate from a measuring element, indicators may be evaluated using simulated inputs (i.e., meter pulse, temperature, pressure, density, communications, etc.).

b. When evaluating electronic indicators (regardless of installation type) for revisions to an existing CC for metrological significant software revisions, indicators may be evaluated using simulated inputs (i.e., meter pulse, temperature, pressure, density, communications, etc.),

Conclusion: The submitter explained the background for the original proposal as discussed above. A member asked if the current language in "a." would prevent being able to do some testing with simulated inputs and additional field testing using "live meter" input. During the meeting the Sector developed new language for Publication 14 Technical Policy Section U. as follows and agreed to forward it to the NTEP Committee for addition to the 2007 edition of Publication 14.

U. Evaluating electronic indicators submitted separate from a measuring element

When evaluating electronic indicators submitted separate from a measuring element, simulated inputs (i.e., meter pulse, temperature, pressure, density, communications, etc.) may be used as follows:

1) **For the initial testing of the indicator.**

2) **For the evaluation of stationary indicators.**

3) **For software changes to a device with an existing CC.**

10. Next Meeting

Recommendation: The Sector was asked to discuss the time and location for its next meeting.

Conclusion: The Sector discussed the time and location for its next meeting and agreed that the meeting would be scheduled immediately prior to the October 2007 SWMA Meeting, in Little Rock, Arkansas. The exact dates were yet to be determined. The Sector also agreed that any items to be included on the agenda for the 2007 Sector Meeting must be submitted not less than 30 days prior to the meeting in order for the agenda to be distributed to the membership at least 2 weeks prior to the meeting.

Additional Items for Discussion if Time Permits

11. Display of Quantity and Unit Price for Self-serve Aviation Dispensers

Source: Veeder-Root

Background/Discussion: The normal self-serve installation for aviation fuels does not use an analog or digital "gasoline dispenser" that simultaneously displays money and volume. In most cases the self-serve user interface is a credit card console/controller that handles the transaction. These devices are not set up for the simultaneous display.

Aviation self-serve dispensing systems use a base meter-register that is a PD meter with a mechanical register and pulser or an electronic register with pulse output, or an industrial dispenser with volume only and a pulse output. The meter-register part sends pulses to the credit card console/controller. All three components including the consol/controller have NTEP certificates.

In June, the State of Alabama Weights and Measures reviewed a couple of planned installations and informed the installing company that the equipment was "Retail Motor Fuel," and "simultaneous display of Quantity and Sale was required." This started a series of exchanges of information between several parties including two consol/controller manufacturers, several equipment suppliers, and the State of Alabama.

The typical "retail gasoline dispenser" that has the display capability is not designed in terms of materials of construction for aviation gasoline or jet fuel, nor does it have the flow rate capacity. Higher capacity diesel dispensers have the materials of construction problem. Moreover, in jet fuel applications, the dispensers do not have the flow rate capacity required.

There is one small company that assembles dispensers that could today put together a unit to meet the materials of construction and minimum flow requirements. Their NTEP certificate currently is for diesel and gasoline on their simultaneous display dispenser. They could use the appropriate aviation-approved materials of construction components for applications up to 50 gpm and simultaneously display price and currency. These units, however, are not now commonly used in the aviation industry, which means the experience is not there for wide acceptance, and would not be adequate for jet fuel flow rates.

Recommendation: The Sector reviewed the following proposal for possible forwarding to the NCWM S&T Committee for consideration.

Proposal: Modify Handbook 44, Section 3.30., paragraph S.1.6.5.5. as follows:

S.1.6.5.5. Display of Quantity and Total Price.

(a) *When a delivery is completed, the total price and quantity for that transaction shall be displayed on the face of the dispenser for at least 5 minutes or until the next transaction is initiated by using controls on the device or other customer-activated controls.*
[Nonretroactive as of January 1, 1994]
(Added 1992)(Amended 1996)

(b) For aviation fuel dispensing, the quantity and total price need not be displayed simultaneously as long as the total price and quantity delivered can be viewed by interacting with the display or controller, or the total price and quantity is available on a printed receipt as specified in S.1.6.7.

Conclusion: The Sector reviewed the proposal to allow devices used in aircraft refueling to either display or print the total price and quantity delivered at the end of the transaction. The Sector took no position on the proposal because most members did not feel qualified to make an informed recommendation concerning aircraft refueling.

12. S.1.2.3. Value of the Smallest Unit for Aviation Turbine Fuel

Source: Veeder-Root

Background/Discussion: At the NCWM Annual Meeting in July, the VTM code Section 331-1, S.1.1.3. Value of Smallest Increment was changed to make the smallest increment 1 gal for aviation jet fuel metering. This item is a follow-on to that item for recognizing the normal installations and operations of the aviation industry for jet fuel. The aviation industry meters and registers jet fuel in whole gallons in fixed applications as it does on aviation refueling vehicles (VTM code). Jet fuel consumers normally expect whole gallon increments.

In most applications, 2 in or larger (150 gal/min or greater) PD meters are used. Retail sale of jet fuel from a fixed fueling system is done in the industry, and there are self-serve jet aviation installations. The minimum flow rate of 150 gal/min relates to a 2 in meter that is not mounted in a dispenser housing. If "self-contained" dispensers were available and used for jet fuel, it would use a smaller meter with less flow rate and the expected minimum increment would be 0.1 gal.

The "exemption" requested for jet fuel is not for "dispensers," but for 2 in and above meters.

See agenda Item 4.

Recommendation: The Sector reviewed the following proposal for possible forwarding to the NCWM S&T Committee for consideration.

Proposal: Modify Handbook 44, Section 3.30., paragraph S.1.2.3. Value of the smallest unit as follows:

S.1.2.3. Value of Smallest Unit. - The value of the smallest unit of indicated delivery, and recorded delivery if the device is equipped to record, shall not exceed the equivalent of:

(a) 0.5 L (1 pt) on retail devices;

(b) 5 L (1 gal) on wholesale devices.

(c) 5 L (1 gal) on meters with a rated maximum flow rate of 575 L (150 gal/min) or more used for aviation turbine fuels.

This requirement does not apply to manually operated devices equipped with stops or stroke-limiting means.
(Amended 1983, 1986, and 200X)

Conclusion: The Sector discussed the Veeder-Root proposal to add an exemption for jet aircraft refueling to S.1.2.3. to allow the smallest unit required to be 1 gal on meters with flow rates of 575 L (150 gal/min) or more. One member noted that the similar exemption to the requirements in the VTM Code lists the flow rate as 375 L (100 gal/min) and suggested that the flow rate be the same in both codes. The Sector agreed and modified the proposal as follows:

S.1.2.3. Value of Smallest Unit. - The value of the smallest unit of indicated delivery, and recorded delivery if the device is equipped to record, shall not exceed the equivalent of:

(a) 0.5 L **(~~1 pt~~ 0.1 gal)** on ~~**retail**~~ devices **with a maximum rated flow rate of 750 L/min (200 gal/min) or less.**

(b) 5 L (1 gal) on ~~**wholesale**~~ devices **with a maximum rated flow of more than 750 L/min (200 gal/min).**

(c) 5 L (1 gal) on meters with a rated maximum flow rate of 375 L (100 gal/min) or more used for jet fuel aviation refueling systems.

The Sector agreed to forward the modified proposal to the SWMA and NCWM S&T Committees for consideration.

13. Testing Meters Made of Different Metals

Source: California NTEP Laboratory

Discussion/Background: The California NTEP Laboratory is conducting an NTEP evaluation of a family of meters using multiple products in different product families. The meter family includes meters made of aluminum and stainless steel. Because Publication 14 does not specifically address this scenario, the laboratory is asking for input from the Sector before testing starts.

Recommendation: The Sector discussed the scenario described above. The following proposal was offered as a possible solution. The Sector reviewed the proposal for possible forwarding to the NTEP Committee for inclusion in Publication 14.

Proposal: Add a new Section F. to the Publication 14 Technical Policy as follows and renumber subsequent sections:

U. Meters Within the Same Family Made of Different Materials

When multiple meters within a meter family, made of different materials, are submitted for evaluation, all meters will be tested with at least one product from each product family to be included on the CC and at least one meter will be tested with the range of products required in the product family table for the meter type (e.g., positive displacement, turbine, mass meter, etc.) submitted for evaluation.

The MMA provided the following white paper for Sector consideration during the discussion:

Meter Manufacturers Association

Speaking as experienced manufacturers of PD Meters, Turbine Meters, and Mass Meters; it is our experience that the materials of construction do not affect the quality of measurement over the

specified operating range of a particular metering technology, as these have been considered and accounted for during the design phase of the meter.

It is the manufacturers responsibility to ensure that the meter meets type, additionally material selection is the manufacturer's responsibility and is typically driven by the requirements of chemical compatibility with the liquid products that are being measured or by industry regulations. (i.e., non ferrous meters for aircraft refueling).

Materials are not selected or modified for reasons of accuracy. The market does identify and eliminate the inferior products through the normal surveillance process as well as the manufacturers' warranty process.

It is normal industry practice to include material varieties such as Stainless Steel, Aluminum, cast Iron, Plastic, etc. into one meter, for example some of our PD meters have cast steel outer housings, stainless steel bearings, cast iron rotors, anodized aluminum blades or cast Iron blades or Plastic blades. Non-ferrous aircraft meters will utilize aluminum cast components and Stainless Steel bearings. We manufacturer turbine meters with stainless steel housings and aluminum rotors, the point being the measurement accuracy is a function of the manufacturing process, not the materials used.

<u>It is not the intent of Handbook 44 to differentiate between measurement technologies</u>, only the intended application.

Doesn't material selection fall under measurement technology?

Where do you draw the line on NTEP lab decisions on the materials of construction?

The manufacturers believe that the answer to the question is in the **<u>LONG</u>** history of meters themselves. There are hundreds of thousands of meters in service in the United States used for direct sales (i.e., home heating oil delivery, loading rack wholesale deliveries, aircraft refueling, agriculture chemical deliveries, etc.). These meters are verified routinely by the local Weights and Measures agencies, if problems are detected (accuracy out of range) then they are taken out of service.

Summary:

The meter manufacturers make determination of materials of construction.

Meter manufacturers make the determination of what particular attributes of a meter enable it to be considered as "part of a family."

<u>Questions that need to be answered in order to make an informed decision:</u>

1. Is there a real world problem that requires a solution by the inclusion of a new section specifically aimed at materials in Publication 14?

2. Is there an inequity in the market, facilitation of fraud?

One of the NTEP laboratories stated that during an evaluation of a mass flow meter, the performance was different for two meters with different "tube" materials. Two mass flow meter manufacturers stated that if both meters were calibrated for the product being measured, there should be no difference in performance due to "tube" material. Another laboratory stated that the permanence test of a meter conducted after 30 days is not a true indicator of long-term permanence. Another member stated that NTEP should be interested in testing key characteristics and metrologically significant components.

Conclusion: The Sector agreed that the best approach for resolving the issue of what components are "metrologically significant" and require additional evaluation, was to include the discussion and development of a proposal for Sector consideration in the tasks of the WG formed to develop a new Product Families table approach, as discussed in agenda Item 5.

Additional Items Added at the Meeting

14. Number of Tests Required for Permanence Test

Source: Endress & Hauser Flowtec AG

Background/Discussion: An application was submitted for evaluation of mass flow meter. During the initial test, not only was the meter tested and met all requirements for the 10 to 1 turndown ratio, but it also passed at 12 to 1 turndown ratio. Following the required time and throughput, the permanence testing was conducted. The meter passed testing for the 10 to 1 turndown ratio but failed at the 12 to 1 ratio. The question was: Should a CC be issued for the meter limited to only a 10 to 1 turndown ratio or should the device fail and testing begin over?

Conclusion: The Sector discussed the issue at length and agreed that the device should have a CC issued for the required 10 to 1 turndown ratio. During the meeting, the Sector proposed changes to Publication 14 as shown below to clarify how this situation should be addressed if it happened again in the future. The Sector agreed to forward its recommendations to the NTEP Committee for consideration at the 2007 NCWM Interim Meeting.

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Permanence Test Procedures for Meters

A. Field Evaluation and Permanence Test of New-Design Meters in Retail Motor-fuel Dispensers

All new-design meters are subject to a permanence test. If a meter is the same as one in a previously tested dispenser, a permanence test is not required. NTEP reserves the right to require a permanence test based on the result of the initial examination.

Initial Examination

1. All meters of the new type ----------
2. At least one meter ----------
3. All meters must ----------
4. Repeatability - When consecutive -------

Subsequent Examination

1. Following the period of use, the tests listed above are to be repeated. All results within the range of flow rates to be included on the CC must be within the ~~acceptance~~ applicable tolerances. Extended flow range testing performed at the manufacturer's discretion may be included on the CC provided the results are within the acceptable tolerances.
2. The examination ----------
3. Five tests ----------
4. Repeatability - When consecutive -------

C. Field Evaluation and Permanence Test for Vehicle-Tank; Except for LPG, Cryogenic and CO_2 Meters

The following tests are considered ----------

Only one meter is required ----------

Following the period of use, the tests listed above are to be repeated. All results within the range of flow rates to be included on the CC must be within the ~~acceptance~~ applicable tolerances. Extended flow range testing performed at the manufacturer's discretion may be included on the CC provided the results are within the acceptable tolerances.

D. Initial Evaluation and Permanence Tests for Wholesale Positive Displacement (PD) Meters

The following tests are considered to be appropriate for metering systems on Wholesale PD Meters:

1. Four test drafts at each of five flow rates.

2. Only one meter ----------

3. Following the period of use, the tests listed above are to be repeated. All results within the range of flow rates to be included on the CC must be within the ~~acceptance~~ applicable tolerances. Extended flow range testing performed at the manufacturer's discretion may be included on the CC provided the results are within the acceptable tolerances.

E. Field Evaluation and Permanence Test for LPG and Cryogenic Meters

The following tests are considered to be appropriate for metering systems on LPG and cryogenic meters:

1. Four test drafts at each of five flow rates.

Only one meter is required ----------

Following the period of use, the tests listed above are to be repeated. All results within the range of flow rates to be included on the CC must be within the ~~acceptance~~ applicable tolerances. Extended flow range testing performed at the manufacturer's discretion may be included on the CC provided the results are within the acceptable tolerances.

Repeatability on LPG & NH3 Meters (Code Reference T.3.)

When multiple tests ----------

Tests of Automatic Temperature Compensating Systems - LPG & NH_3 Meters

The difference between ----------

F. Field Evaluation and Permanence Test for LPG Vapor Meters

The following tests are to be run on an LPG vapor meter as part of the permanence test:

1. Three tests at the maximum discharge rate.

2. Three slow-flow tests.

3. One low-flame test.

Only one meter will be required ----------

Following the period of use, the tests listed above are to be repeated. All results within the range of flow rates to be included on the CC must be within the ~~acceptance~~ applicable tolerances. Extended flow range testing performed at the manufacturer's discretion may be included on the CC provided the results are within the acceptable tolerances.

G. Repeatability on Milk Meters (Code Reference N.4.1.1. and T.3.)

Technical Advisors Note: At the meeting, Section G. was identified for inclusion in the recommended changes; however, it speaks only to repeatability. Publication 14 does not have a section on Field Evaluation and Permanence Tests for Milk Meters other than vehicle-tank.

H. Field Evaluation and Permanence Test for Turbine Meters

The following tests are considered to be appropriate for turbine meters:

1. Meters tested in a laboratory ----------

2. At least one meter is required for each product type for the initial test.

3. If the meter is to be ----------

4. To indicate meter performance ----------

5. Following the initial test, ----------

6. Following the period of use, the tests listed above are to be repeated. All results within the range of flow rates to be included on the CC must be within the ~~acceptance~~ applicable tolerances. Extended flow range testing performed at the manufacturer's discretion may be included on the CC provided the results are within the acceptable tolerances. Following evaluation of test data and analysis of the data presented by the manufacturer for meter performance over temperature and viscosity ranges, the evaluating laboratory may require additional testing prior to issuing a CC for the meter.

I. Field Evaluation and Permanence Tests for Mass Flow Meters

The following tests are considered to be appropriate for mass flow meters:

Type evaluation. The gravimetric test method shall ----------

Test Data. Meters tested in a laboratory environment will ----------

Following the initial test, the meters will be placed into service for the permanence test. The minimum throughput criterion recommended for these meters are 60 days, or 2000 x maximum rated flow in units per minute. Following the period of use, the tests listed above are to be repeated. All results within the range of flow rates to be included on the CC must be within the ~~acceptance~~ applicable tolerances. Extended flow range testing performed at the manufacturer's discretion may be included on the CC provided the results are within the acceptable tolerances.

15. Permanence Tests for RMFD

Source: Gilbarco

Background/Discussion: During a recent evaluation the measuring element from a device with an existing CC was installed in a new frame. For the permanence test, the evaluator required a throughput of 20 000 gal and a minimum of 20 days use before conducting the follow-up tests. The manufacturer believes that the permanence criteria for RMFDs in Publication 14 should be separated into a 20-day requirement for electronics and a 20 000 gal throughput for metering elements. The Meter Manufacturers Association (MMA) developed a proposal to modify

Publication 14 to distinguish between electronics and measuring elements and between elements covered by an existing CC and new equipment being evaluated for the first time.

Conclusion: The Sector reviewed the MMA's proposed changes and agreed to forward them to the NTEP Committee with the recommendation that they be approved as revisions to the 2007 edition of Publication 14.

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A. Field Evaluation and Permanence Test of New-Design Meters in Retail Motor-fuel Dispensers

All new-design meters are subject to a permanence test. If a meter is the same as one in a previously tested dispenser, a permanence test is not required. NTEP reserves the right to require a permanence test based on the result of the initial examination.

Initial Examination

1. All meters of the new type ----------
2. At least one meter ----------
3. All meters must ----------
4. Repeatability - When consecutive ----------

Subsequent Examination

1. All meters of the new type installed at the type evaluation location must perform within acceptance tolerance throughout the time and volume period specified below.
2. ~~The examination will be conducted no sooner than 20 days after the initial examination and not before the previously chosen meters have measured at least 20 000 gallons for throughput testing.~~
   The examination will be conducted as applicable:
   - No sooner than 20 days for electronic changes of metrological significance.
   - 20 000 gal for throughput testing for mechanical changes of metrological significance.
3. Five tests ----------
4. Repeatability - When consecutive ----------

B. Field Evaluation Test of Previously Evaluated Components Retail Motor-Fuel Dispensers ~~Using Different Previously Evaluated Meters~~

Different Previously Evaluated Meter

Previously evaluated dispensers using a previously type evaluated meter and indicator (register) will be subject to an initial test. Based on the test results of the initial test, NTEP may require a permanence test.

Nonmetrological Changes

An administrative review shall be conducted to issue a new CC or revise an existing CC for previously evaluated devices because of non metrological changes. Based on the results of the administrative review, NTEP may require an initial test.

List of Appendices:

For copies of the following listed documents, contact Richard Suiter at NIST, (301) 975-4406 or by e-mail **richard.suiter@nist.gov**.

Appendix A – Reorganized Publication 14 – LMD Checklist

Appendix B – Reorganized Publication 14 – ECR Interfaced with RMFD Checklist

Appendix C – Domestic Cold Water Meters

Appendix D – Hydrocarbon Gas Vapor Meters

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