Appendix D

National Type Evaluation Technical Committee (NTETC)
Software Sector

Annual Meeting Summary
March 11 - 12, 2009, Reynoldsburg, Ohio

Carry-over Items:

1. Issuing Certificates of Conformance (CC) for Software

Source: National Conference on Weights and Measures (NCWM) Reports

Background: Excerpts of reports from the 1995 - 1998 Executive Committees were provided to National Type Evaluation Technical Committee (NTETC) Software Sector members at their April 2006 meeting. The chair asked the sector to review the following National Type Evaluation Program (NTEP) policy decision adopted by the NCWM in 1998 relative to the issuance of a separate Certificate of Conformance (CC) for software. During the 1998 NCWM Annual Meeting, the following recommendation was adopted as NTEP policy:

- "Software, regardless of its form, shall not be subject to evaluation for the purpose of receiving a separate, software CC Conformance from the NTEP."

- "Remove all of the software categories from the index of NCWM Publication 5, NTEP Index of Device Evaluations."

- "Reclassify all existing software CCs according to their applicable device categories."

Also relevant, from Section C of NCWM Publication 14: "In general, type evaluations will be conducted on all equipment that affect the measurement process or the validity of the transaction (e.g., electronic cash registers interfaced with scales and service station consoles interfaced with retail fuel dispensers); and all equipment to the point of the first indicated or recorded representation of the final quantity on which the transaction will be based."

Recommendation: The Sector recommended the following language to be submitted to the NTEP Committee as a policy change, and requested that the NTEP Committee place this issue on their agenda:

> **Software Requiring a Separate CC: Software, which is implemented as an add-on to other NTEP Certified main elements to create a weighing or measuring system and its metrological functions, are significant in determining the first indication of the final quantity. Such software is considered a main element of the system requiring traceability to an NTEP CC.**
>
> **NOTE: OEM software *may* be added to an existing CC or have a stand-alone CC with applicable applications (e.g., a manufacturer adding a software upgrade to their ECR or point-of-sale system, vehicle scale weigh-in/weigh-out software added as a feature to an indicating element, automatic bulk weighing, liquid-measuring device loading racks, etc.) and minimum system requirements for "type P" devices (see proposed software definition below). It may be possible for a manufacturer to submit a single application for both hardware and software contained in the same device. A single CC would be issued.**
>
> **In this instance, OEM refers to a 3rd party. The request to add software could be made by the original CC holder on behalf of the 3rd party. Alternatively, a new CC could be created that refers to the original CC and simply lists the new portions that were examined.**

The NTEP committee included this item in their agenda (*NTEP Committee 2009 Interim Agenda Item 8*). There was no discussion during the open hearing, and it was determined that this item be given voting status for the 2009 Annual Meeting Agenda.

Discussion: Dr. Ambler Thompson observed that in reality, this type of software represents only a small portion of type evaluations; the vast majority of them are not standalone software. Ms. Cassie Eigenmann indicated that this item as written might not clearly state the intention, which is to simply allow the labs to call standalone software packages that are type approved to be categorized as 'software.' It is an administrative change, not a regulatory change. The labs will not be doing anything differently at type approval time.

Mr. Dennis Beattie made the statement that if you follow the concept of 'first final,' then you have to address every step of the process, and if that is done with software, then the requirement to address software is obvious. Mr. David Vande Berg explained that it is not always black/white (i.e., external software for tare/net calculations is sometimes not judged subject to type approval.) It was suggested by Mr. Norm Ingram to define what is meant by 'software requiring a separate CC;' Ms. Cassie Eigenmann recommended using specific examples.

Mr. Steve Patoray listed some goals he felt were important the Sector accomplish:

- Answer the question, "What is this item that is up for vote going to change in practice?"
- Address Scale Manufacturers Association's (SMA) concerns on the S&T agenda Items 310-2 and 310-3.

Dr. Ambler Thompson agreed, further suggesting that the Sector needs to 'sell' the concepts we have realized, and it was mentioned that the Regional meetings might be an opportunity to approach the states.

Mr. Jim Truex, NTEP Administrator, felt that the upcoming vote will be a technical vote, requiring at least 27 states to vote in the affirmative to pass. He also indicated that this will not change the way the labs operate – it is merely the ability for the labs to label evaluated standalone software as such, and not be forced to categorize it as some type

of device, such as 'weigh-in-weigh-out-system'. Mr. Patoray also suggested that this is an important vote for the Sector; and asked that if the states continue to avoid dealing with software what is the future of the Sector?

Conclusions:

- **The Sector feels that this item is important and that there exists the possibility of misinterpretation of the scope/intent of this item by other interested parties, hence the Sector agreed to the following actions:**
  - Generate Problem Statement and specify benefits addressed by change (Done)
  - Feedback from labs/inspectors (Lucas, Frailer, Ingram?)
  - 'Sales flyer'/Newsletter article (Bliss et al.)
  - Request added as Agenda item at CWMA/NEWMA? (Pettinato/Ingram)
  - Attend CWMA/NEWMA regional meetings? (?)

NCWM was contacted and the staff indicated that if it is desired to include an article in the newsletter, a final draft must be submitted by April 15th. The Sector work group should have a draft circulating by April 3, 2009, so comments can be gathered by April 10, 2009, for consideration prior to the final draft.

Mr. Doug Bliss provided a draft 'slide show' format presentation as a starting point for clearly presenting the ideas put forth by the Sector, and started on a draft article for the newsletter. Further work has progressed since the meeting *(see Appendices B & C).*

2. Definitions for Software-Based Devices (2009 Interim Agenda Item 310-2)

Source: NTETC Software Sector

Background: Discussed was marking and G-S.1.1. It was initially suggested that "not built-for-purpose" be removed from the wording in NIST HB 44 G-S.1.1. However, after further discussion, this may not be the correct or final decision. There is no definition for a 'not built-for-purpose device' in HB 44. The current HB 44 definition for a built-for-purpose device reads:

> *Built-for-purpose device.* Any main device or element, which was manufactured with the intent that it be used as, or part of, a weighing or measuring device or system. [1.10] (Added 2003)

The Sector recommended the following definitions be submitted to the S&T Committee as an item and be considered for inclusion in Appendix D of NIST Handbook 44 to replace the current definition of 'build-for-purpose device':

> **Electronic devices, software-based. Weighing and measuring devices or systems that use metrological software to facilitate compliance with Handbook 44. This includes:**
>
> **(a) Embedded software devices (Type P), aka built-for-purpose. A device or element with software used in a fixed hardware and software environment that cannot be modified or uploaded via any interface without breaking a security seal or other approved means for providing security and will be called a "P," or**
>
> **(b) Programmable or loadable metrological software devices (Type U), aka not-built-for-purpose. A personal computer or other device and/or element with PC components with programmable or loadable metrological software and will be called "U." A "U" is assumed if the conditions for embedded software devices are not met.**
>
> **Software-based devices – See Electronic devices, software-based.**

At the 2009 NCWM Interim Meeting, the Committee received comments from the SMA stating that it now opposes this item since there is no technological justification for making a distinction in software-based device types. Mr. Darrell Flocken added that the SMA can only provide limited responses. SMA continues to support the efforts of

the Software Sector and the SMA response is based on the concern that the proposed definitions in this recommendation and the marking requirements proposed in agenda Item 310-3 will require weighing devices be more complex than those currently produced.

The Meter Manufacturers Association indicated that it supports the item as written in the recommendation.

Mr. Will Wotthlie, Maryland, did not agree with the SMA position that there are no technological difference between the types of software-based devices. He added that Type P devices and separable elements have limited flexibility in changing software and indications and frequently include the sensing elements necessary for the measurement (e.g., load cells, meters, etc.). Whereas, Type U devices and separable elements are typically devices that do not contain measuring elements; can be replaced with compatible equipment and display devices purchased from any number of sources; and only process metrological information received from measuring and other sensing elements.

Mr. Stephen Patoray, Consultants in Certification, agrees with the SMA that there are few differences between Type P and U software-based devices. However, there are significant differences between Type P and U devices in that a Type P device is defined as an instrument that requires a security means since the instrument has fixed hardware (including sensing components) where the metrological software is ***embedded*** into the instrument. Type U devices do not include fixed components and metrological software cannot be sealed using physical security seals or the minimum form of an audit trail (i.e., two event counters).

Software Sector Co-Chair, Jim Pettinato,FMC Technologies, added that international recommendations recognize the differences between embedded software and programmable/loadable software. Additionally, the Software Sector recommends that this item remain informational to allow conference members to further study that proposed definitions.

The S&T Committee agreed with the comments received during the open hearing and the request from the co-chairman of the software sector and agreed that this item should remain an Informational item for further review.

Additional background information on this item can be reviewed in the 2009 Interim Agenda (NCWM Pub 15).

Discussion: It was reiterated by several individuals that again it seems that resistance to this item stems not from a disagreement with the intention, but from either a misunderstanding of the applicability or unrelated concerns over marking requirements.

Further discussion was related to how to best present the opinion/goals of the Sector to the interested external parties, such as the NCWM standing committees and the individual states. Some discussion on the wording of the definitions took place as well, with the slightly modified version being proposed:

Electronic devices, software-based. Weighing and measuring devices or systems that use metrological software to facilitate compliance with Handbook 44. This includes:

(a) Type 'P' (aka built-for-purpose) software-based electronic devices. A device or element with software used in a fixed hardware and software environment that cannot be modified or uploaded via any interface without breaking a security seal or other approved means for providing security; or

(b) Type 'U' (aka not-built-for-purpose) software-based electronic devices. All metrological software-based devices not meeting the conditions of a Type 'P' device. Example: a personal computer or other device and/or element with PC components with programmable or loadable metrological software.

Software-based devices – See Electronic devices, software-based.

Conclusion: No consensus was reached on any language change. The Sector did agree that including the reason(s) for proposing these definitions as part of the effort to educate/promote external parties would be

beneficial; and that we would attempt to explain the reasoning/intent of the proposed definitions together with/as part of the action items for Item 1.

3. Marking of Software Identification – G-S.1. (2009 Interim Agenda Item 310-3)

Source: 2008 Carryover Item

Background: Starting at the October 2007 meeting, the Software Sector has discussed the value and merits of required markings for software. After several iterations, the Sector developed a table to reflect their positions:

Method	NTEP CC No.	Make/Model/Serial No.	Software Version/Revision[1]
TYPE P electronic devices shall meet at least one of the methods in each column:			
Hard-Marked	X	X	Not Acceptable[1]
Continuously Displayed	X	X	X
By command or operator action	Not Acceptable	Not Acceptable	X[2]

[1] If the manufacturer declares that the primary **sensing** element "software" is integral, has no end user interface and no print capability, ~~**the element may be considered exempt from the marking requirement for version/revision.**~~ **the version/revision shall be hard marked on the device**. Example: Primary sensing element may be Positive Displacement (P.D.) meter with integral correction, digital load cell (only for reference, not limiting).
[2] Information on how to obtain the Version/Revision shall be included on the NTEP CC.
Metrologically significant software shall be clearly identified with the software version. The identification may consist of more than one part but one part shall be only dedicated for the metrologically significant portion.

Method	NTEP CC No.	Make/Model~~/Serial No.~~	Software Version/Revision
TYPE U electronic devices shall meet at least one of the methods in each column:			
Hard-Marked	X[3]	X	Not Acceptable
Continuously Displayed	X	X	X
Via Menu (display) or Print Option	Not Acceptable	X[4]	X[4]

[3] Only if no means of displaying this information is available.
[4] Information on how to obtain Make/Model, Version/Revision shall be included on the NTEP CC.
Metrologically significant software shall be clearly identified with the software version. The identification may consist of more than one part but one part shall be only dedicated for the metrologically significant portion.

This table was submitted to NCWM S&T Committee and was assigned Developing status in 2008.

Prior to the 2009 Interim NIST Weights/Measures Division commented on this item and presented an alternate proposal with significant modifications, which were included in the Interim Meeting Agenda background for the item (See 2009 Pub 15 for more details).

This item was assigned Informational status for the NCWM 2009 Annual Meeting.

Discussion: It was noted by several Sector members that the perceived scope of the original proposal has been extended by the modifications made by WMD and now appears to exceed both the purview and the intent of the Sector, and it has become difficult to discern what our intentions were. Based on the fact that the table seems to have actually made the Sector's intent less clear, it was proposed by the chair to revisit this item in relation to the current text of G-S.1. to clarify exactly what real changes to Handbook 44 would be required to achieve the intent of the Sector. It was also noted that there was some validity to the SMA argument that there is no justification for differentiation of marking requirements based on device type (P or U). After additional lengthy discussions, the following modified versions of G-S.1./G-S.1.1. were drafted:

> **G-S.1. Identification. –** All equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect **and manufactured** ~~**prior to**~~**after January 1, 201X**, shall be clearly and permanently marked for the purposes of identification with the following information:
>
> (a) the name, initials, or trademark of the manufacturer or distributor;

(b) a model identifier that positively identifies the pattern or design of the device;

(1) The model identifier shall be prefaced by the word "Model," "Type," or "Pattern." These terms may be followed by the word "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.). The abbreviation for the word "Model" shall be "Mod" or "Mod." Prefix lettering may be initial capitals, all capitals, or all lowercase.
[Nonretroactive as of January 1, 2003]

(Added 2000) (Amended 2001)

(c) a non-repetitive serial number, except for equipment with no moving or electronic component parts and ~~***not-built-for-purpose-software-based***~~ ***software that is not part of a Type P (built-for-purpose) device.****;*
[Nonretroactive as of January 1, 1968]

(Amended 2003 **and 201X**)

(1) The serial number shall be prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required serial number.
[Nonretroactive as of January 1, 1986]

(2) Abbreviations for the word "Serial" shall, as a minimum, begin with the letter "S," and abbreviations for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., S/N, SN, Ser. No., and S. No.).
[Nonretroactive as of January 1, 2001]

(d) the current software version or revision identifier for ~~***not-built-for-purpose***~~ ***software-based electronic devices;***
[Nonretroactive as of January 1, 2004]

(Added 2003) **(Amended 201X)**

(1) The version or revision identifier shall be prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required version or revision.
[Nonretroactive as of January 1, 2007]

(Added 2006)

(2) Abbreviations for the word "Version" shall, as a minimum, begin with the letter "V" and may be followed by the word "Number." Abbreviations for the word "Revision" shall, as a minimum, begin with the letter "R" and may be followed by the word "Number." The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.).
[Nonretroactive as of January 1, 2007]

(Added 2006)

(e) an NTEP CC number or a corresponding CC Addendum Number for devices that have a CC. The CC Number or a corresponding CC Addendum Number shall be prefaced by the terms "NTEP CC," "CC," or "Approval." These terms may be followed by the word "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.)
[Nonretroactive as of January 1, 2003]

The required information shall be so located that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device.

(Amended 1985, 1991, 1999, 2000, 2001, 2003~~, and,~~ 2006 **and 201X**)

G-S.1.1. ~~***Location***~~ ***Method*** *of Marking Information for* ~~***Not Built For Purpose***~~ ***all*** *Software-Based Devices. –* ***For*** ~~***not built for purpose, software based***~~ ***devices*** *manufactured* ~~*prior to*~~***after*** *January 1, 201X,* ***either****:*

(a) The required information in G-S.1. Identification. ~~***(a), (b), (d), and (e)***~~ *shall be permanently marked or continuously displayed on the device; or*

(b) The CC Number shall be:

(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."

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.*

[Nonretroactive as of January 1, 2004]

(Added 2003) (Amended 2006 **and 201X**)

It was noted that though currently it is allowable to display the CC number via a menu, there has been some challenges locating this information in the field due to the vagueness of the term 'easily recognized.' Hence, since it is left to the interpretation of the NTEP laboratory to ascertain whether a device's method for displaying the CC number meets the requirements, this vagueness has not been addressed in this new recommendation.

Mr. John Roach, California NTEP Lab, indicated that if the proposed table (or some version thereof) is not eventually included as part of G-S.1. that it may be useful to incorporate a suitable table into Pub 14.

Conclusion: The Sector wishes to address concerns related specifically to software and does not wish to debate the merits of general marking requirements beyond that related to software identification. We feel the above proposed changes better reflect the Sector position. If WMD and NCWM S&T feel a table outlining general marking requirements would clarify the intent of G-S.1., then the Sector suggests that following simplified version may better suit the purpose.

Table G-S.1.~~a~~ Identification for Devices Manufactured on or after January 1, 201X		
Required Marking	**Full Mechanical Devices and Separable Mechanical Elements**	**Electronic Devices, Software Based**
Manufacturer or CC holder ID	**Hard Marked**	**Hard Marked, Continuously Displayed, or Via Menu (display) or by command or operator action**
Model identification	**Hard Marked**	**Hard Marked, Continuously Displayed, or Via Menu (display) or by command (operator action)**
Serial number	**Hard Marked**	**Hard Marked, Continuously Displayed** [1]
Metrologically Significant significant Software software version	**Not Applicable**	**Continuously Displayed, Via Menu (display) or by command (operator action)** [2]
Certificate of ConformanceCC number	**Hard Marked**	**Hard Marked or Continuously Displayed, or Via Menu (display) or by command (operator action)**[3]

[1] **Type 'U' devices need not have a non-repetitive serial number.**

[2] **If the manufacturer declares that the primary sensing element "software" is integral, has no end user interface and no print capability, the version/revision shall be hard marked on the device. Example: Primary sensing element may be Positive Displacement (P.D.) meter with integral correction, digital load cell (only for reference, not limiting).**

[3] **If the Certificate of ConformanceCC number is to be displayed via menu and/or submenu, the means of access must be easily recognizable. In addition, instructions on how to obtain the remaining required information not hard-marked or continuously displayed shall be included on the NTEP CC.**

(Added 201X)

Note that this new version of the table reflects the aforementioned changes proposed for the G-S.1. text as well as homogenizing Type P and Type U requirements, with the exception of the serial number requirement being waived for standalone software. It was also noted that much of the information previously included in the separate proposed Table G-S.1.b was redundant as it is already stated verbatim in the text of G-S.1.; hence the Sector questions the benefit of the WMD - proposed separate Table G-S.1.b.

4. Identification of Certified Software

Source: NTETC Software Sector

Background: This item originated as an attempt to answer the question "How does the field inspector know that the software running in the device is the same software evaluated and approved by the lab?" In previous meetings it was shown that the international community has addressed this issue (both WELMEC and OIML). From WELMEC:

Required Documentation:
The documentation shall list the software identifications and describe how the software identification is created, how it is inextricably linked to the software itself, how it may be accessed for viewing and how it is structured in order to differentiate between version changes with and without requiring a type approval**.**

From OIML:

Example from DSW 2 CD (now D 31):

> The executable file "**tt100_12.exe**" is protected against modification by a checksum. The value of checksum as determined by algorithm **XYZ** is **1A2B3C**.

Previous discussions have included a listing of some additional examples of possible valid methods (not limiting):

- CRC (cyclical redundancy check)
- Checksum
- Inextricably Linked version No
- Encryption
- Digital Signature

Is there some method to give the W&M inspector information that something has changed? (Yes, the Category III audit trail or other means of sealing). How can the W&M inspector identify an NTEP Certified version? (They cannot, without adding additional requirements like what is described here, in conjunction with including the identifier on the CoC).

Recommendation: The Sector believes that it should work towards language that would include a requirement similar to the OIML requirement in HB 44. It is also the opinion of the Sector that a specific method should not be defined; rather the manufacturer should utilize a method and demonstrate the selected identification mechanism is suitable for the purpose. It is not clear from the discussion where such proposed language might belong.

NTEP strongly recommends that metrological software be separated from non-metrological software for ease of identification and evaluation. From OIML:

> Separation of software parts - All software modules (programmes, subroutines, objects, etc.) that perform metrologically significant functions or that contain metrologically significant data domains form the metrologically significant software part of a measuring instrument (device or sub-assembly). The conformity requirement applies to all parts and parts shall be marked according to Section G-S-X.X.
>
> If the separation of the software is not possible or needed, then the software is metrologically significant as a whole.

(Segregation of *parameters* is currently allowed - see table of sealable parameters)

Initial draft proposed language: (G-S.1.1.?)

Identification of Certified Software:

Software-based electronic devices shall be designed such that the metrologically significant software is clearly identified. The identification of the software shall be inextricably linked to the software itself.

- **Unique identifier must be displayable/printable on command or during operation, etc. (marking req't in addition)**

- **At a minimum, a version/revision indication (1.02.09, rev 3.0 a, etc). Could also consist of / contain checksum, etc (crc32, for example)**

Discussion: Discussion on this item was brief, as it was the general consensus that those in attendance understood the goals of this item and were in agreement of those goals. However, the conceptual language was not far enough along to warrant detailed discussion specific to a draft proposal and more work offline should be done.

Conclusion: A work group will be designated by the Sector Co-Chairs prior to the NCWM Annual Meeting to further promote the state of this item, to be discussed at the next Sector meeting.

5. Software Protection/Security

Source: NTETC Software Sector

Background: The sector agreed that Handbook 44 already has audit trail and physical seal, but the question on the table is does the Handbook need to be enhanced to sufficiently discourage the facilitation of fraud, intentional or accidental, where software is concerned?

WELMEC and OIML again have addressed this issue specifically when dealing with software. From WELMEC:

Protection against accidental or unintentional changes:
Metrologically significant software and measurement data shall be protected against accidental or unintentional changes.

Specifying Notes:
Possible reasons for accidental changes and faults are: unpredictable physical influences, effects caused by user functions and residual defects of the software even though state of the art of development techniques have been applied.

This requirement includes:

a) Physical influences: Stored measurement data shall be protected against corruption or deletion when a fault occurs or, alternatively, the fault shall be detectable.

b) User functions: Confirmation shall be demanded before deleting or changing data.

c) Software defects: Appropriate measures shall be taken to protect data from unintentional changes that could occur through incorrect program design or programming errors(e.g., plausibility checks).

Required Documentation:
The documentation should show the measures that have been taken to protect the software and data against unintentional changes.

Example of an Acceptable Solution:

- The accidental modification of software and measurement data may be checked by calculating a checksum over the relevant parts, comparing it with the nominal value and stopping if anything has been modified.

- Measurement data are not deleted without prior authorization (e.g., a dialogue statement or window asking for confirmation of deletion).

- For fault detection, see also Extension I.

Recommendation: The Sector derived a suitable checklist for Pub 14 from the OIML checklist, and asked the current NTEP labs to begin using this checklist on a trial basis for new type approval applications.

Devices with embedded software TYPE P (aka built-for-purpose)			
	Declaration of the manufacturer that the software is used in a fixed hardware and software environment, and		**Yes ☐ No ☐ N/A ☐**
	cannot be modified or uploaded by any means after securing/verification		**Yes ☐ No ☐ N/A ☐**
	Note: *It is acceptable to break the "seal" and load new software, audit trail is also a sufficient seal.*		
	The software documentation contains:		
		description of the (all) metrologically significant functions OIML states that there shall be no undocumented functions	**Yes ☐ No ☐ N/A ☐**
		description of the securing means (evidence of an intervention)	**Yes ☐ No ☐ N/A ☐**
		software identification	**Yes ☐ No ☐ N/A ☐**
		description how to check the actual software identification	**Yes ☐ No ☐ N/A ☐**
	The software identification is:		
		clearly assigned to the metrologically significant software and functions	**Yes ☐ No ☐ N/A ☐**
		provided by the device as documented	**Yes ☐ No ☐ N/A ☐**
Personal computers, instruments with PC components, and other instruments, devices, modules, and elements with programmable or loadable metrologically significant software TYPE U (aka not built-for-purpose)			
	The *metrologically significant* software is:		
		documented with all relevant (see below for list of documents) information	**Yes ☐ No ☐ N/A ☐**
		protected against accidental or intentional changes	**Yes ☐ No ☐ N/A ☐**
	Evidence of intervention (such as changes, uploads, circumvention) is available until the next verification / inspection (e.g., physical seal, Checksum, CRC, audit trail, etc. means of security)		**Yes ☐ No ☐ N/A ☐**
Software with closed shell (no access to the operating system and/or programs possible for the user)			
	Check whether there is a complete set of commands (e.g., function keys or commands via external interfaces) supplied and accompanied by short descriptions		**Yes ☐ No ☐ N/A ☐**
	Check whether the manufacturer has submitted a written declaration of the completeness of the set of commands		**Yes ☐ No ☐ N/A ☐**
Operating system and / or program(s) accessible for the user:			
	Check whether a checksum or equivalent signature is generated over the machine code of the metrologically significant software (program module(s) subject to ~~legal control~~ W&M jurisdiction and type-specific parameters)		**Yes ☐ No ☐ N/A ☐**
	Check whether the metrologically significant software will detect and act upon any unauthorized alteration of the metrologically significant software using simple software tools (e.g., text editor).		**Yes ☐ No ☐ N/A ☐**
Software interface(s)			
	Verify the manufacturer has documented:		
		the program modules of the metrologically significant software are defined and separated	**Yes ☐ No ☐ N/A ☐**

		the protective software interface itself is part of the metrologically significant software	**Yes ☐ No ☐ N/A ☐**
		the *functions* of the metrologically significant software that can be accessed via the protective software interface	**Yes ☐ No ☐ N/A ☐**
		the *parameters* that may be exchanged via the protective software interface are defined	**Yes ☐ No ☐ N/A ☐**
		the description of the functions and parameters are conclusive and complete	**Yes ☐ No ☐ N/A ☐**
		there are software interface instructions for the third party (external) application programmer.	**Yes ☐ No ☐ N/A ☐**

Discussion: The Chair requested feedback from the NTEP Labs as to whether they had the opportunity to utilize the checklist; each lab reported either they have not had any applications for devices where the checklist could be used, or were unaware of the request to try the checklist. The labs were again asked to try to use the checklist should the opportunity present itself.

Conclusion: The Sector will again wait for laboratory feedback on this item; discussion on this item will continue as part of the next agenda item since the two are closely related.

6. Software Maintenance and Reconfiguration

Source: NTETC Software Sector

Background: The following Items were reviewed by the Sector in previous meetings.

a. Verify that the update process is documented (OK)
b. For traced updates, Installed Software is authenticated and checked for integrity
   Technical means shall be employed to guarantee the authenticity of the loaded software (i.e., that it originates from the owner of the type approval certificate). This can be accomplished (e.g., by cryptographic means like signing). The signature is checked during loading. If the loaded software fails this test, the instrument shall discard it and either use the previous version of the software or become inoperative.
   Technical means shall be employed to guarantee the integrity of the loaded software (i.e., that it has not been inadmissibly changed before loading). This can be accomplished e.g. by adding a checksum or hash code of the loaded software and verifying it during the loading procedure. If the loaded software fails this test, the instrument shall discard it and either use the previous version of the software or become inoperative.
   Examples are not limiting or exclusive.
c. Verify that the sealing requirements are met
   The Sector asked, what sealing requirements are we talking about?
   This item is only addressing the software update, it can be either verified or traced. It is possible that there are two different security means, one for protecting software updates (software log) and one for protecting the other metrological parameters (Category I II or III method of sealing).
   Some examples provided by the Sector members include but are not limited to.
      Physical Seal, software log
      Category III method of sealing can contain both means of security
d. Verify that if the upgrade process fails, the device is inoperable or the original software is restored

The manufacturer shall ensure by appropriate technical means (e.g., an audit trail) that traced updates of metrologically significant software are adequately traceable within the instrument for subsequent verification and surveillance or inspection. *This requirement enables inspection authorities, which are responsible for the metrological surveillance of legally controlled instruments, to back-trace traced updates of metrologically significant software over an adequate period of time (that depends on national legislation).* The statement in italics will need to be reworded to comply with U.S. weights and measures requirements.

Recommendation: The Sector **agreed** that the two definitions below for Verified update and Traced update were acceptable.

> **Verified Update**
> A verified update is the process of installing new software where the security is broken and the device must be re-verified. Checking for authenticity and integrity is the responsibility of the owner/user.
>
> **Traced Update**
> A traced update is the process of installing new software where the software is automatically checked for authenticity and integrity, and the update is recorded in a software update log or audit trail.

The Sector also worked towards language proposed for defining the requirements for a Traced Update (currently considered as relevant for Publication 14):

> **For a Traced Update, an event logger is required. The logger shall be capable of storing a minimum of the 10 most recent updates. An entry shall be generated for each software update.**
>
> **Use of a Category 3 audit trail is acceptable for the software update logger. In this case, the existing requirement of 1000 entries supersedes the 10 entry requirement. A software update log entry shall include the following:**
>
> - **An event counter;**
> - **the date and time of the change;**
> - **the event type/parameter ID, which indicates a software update event (if not using a dedicated update log); and**
> - **the new value of the parameter, which is the *software identification* of the newly installed version.**
>
> **A Category III device may include the software update events in the Category III audit log in lieu of a separate software update log; the existing requirement for 1000 entries supersedes the requirement for 10 entries.**
>
> **The traceability means and records are part of the metrologically significant software and should be protected as such. If software separation is employed, the software used for displaying the audit trail belongs to the fixed metrologically significant software. *(Note: This needs to be discussed further due to some manufacturer's concerns about where the software that displays the audit trail information is located and who has access if this feature is provided. Manufacturers did indicate that there are methods available to encrypt the audit trail information; however, it cannot be protected from being deleted.)* (include flowchart from OIML D 31)**

Discussion: The Sector discussed how to best move this item forward, and there was also some discussion as to whether new language for the General Code was required. The following new text was proposed:

> **G-S.9. Metrologically Significant Software Updates**
>
> **The updating of metrologically significant software shall be considered a sealable event.**
>
> **Metrologically significant software that does not conform to the approved type is not allowed for use.**

Mr. Jim Truex indicated that the current requirements in G-S.8. already make the statement that any changes that affect metrological function are sealable, hence, software updates may be covered and the proposed G-S.9. unnecessary. Mr. Todd Lucas suggested to go ahead and submit the proposed G-S.9. to the Committee and request a clarification/interpretation of G-S.8.

Conclusion: The Sector feels that the explicit language proposed for G-S.9. is clearer than any implied requirement in G-S.8.. The Sector would like a clarification/interpretation of G-S.8. as it relates to software updates from the S&T Committee (with their response preferably to be included in Pub 16). The Sector will also continue to develop the proposed text (and flow chart) targeted for inclusion in Pub 14.

(Note to S&T Tthis item assumes additional requirements in individual codes will be eventually added to address this requirement; (e.g., L.M.D. code has philosophy of sealing section that could be enhanced to include processes described.)

7. Verification in the Field, by the W&M Inspector

Source: NTETC Software Sector

Background: What tools does the field inspector need as relates to software-based electronic devices? Some possible answers:

NTEP CC – hard marked, continuously displayed, via menu command or operator action
Clear and simple instructions on NTEP CC to get to the other Inspection Information
The metrologically significant software identifier needs to be easily accessible from operator console
Clear and simple instructions on NTEP CC to access audit trail(s)

Recommendation: The Sector needs to continue to develop this item.

Discussion: Some discussion about system information requirements for the inspector took place. Does the inspector really need to have access to OS, RAM information, etc? (General opinion seems to be if there is a dependency, then the NTEP Lab would specifically include that requirement in the CoC.)

Audit trail info – the question was asked, does there need to be a specific requirement for providing access to this information?

Regarding the concept of First Final – There was some concern expressed as to how the inspectors are able to discern where the indication of first final be found for the SYSTEM (as opposed to the DEVICES in the system). What devices in the system are of concern to the inspector? The NTEP Administrator indicated that field inspectors need to follow the system all the way to receipt/bill generation.

Data transmission is an issue when considering systems as opposed to devices. How far does the inspector's jurisdiction extend? (Should we model future requirements on the WELMEC section concerning DTD/DSD?) Data transmission/storage is not currently being addressed by the Sector at this time.

Since part of the Sector's mission is education, do we want to assist in developing training aids for labs/inspectors related to evaluating/inspecting software-based devices? This will be a topic to be added to the Sector's agenda for the next meeting.

Conclusion: The Sector will continue to develop this item, and initiate a new agenda item specific to inspector training in relation to evaluating/validating software-based devices.

8. NTEP Application for Software Requiring a Separate CC

Source: NTETC Software Sector

Background: This item had been on the agenda of previous meetings, but was not discussed due to time limitations.

Recommendation: Identify issues, requirements and processes for type approving type U device applications.

Discussion: It was suggested that it may be useful to the labs to devise a separate submission form for software for Type U devices. What gets submitted? What requirements/mechanisms for submission should be available?

Validation in the lab – all required subsystems shall be included to be able to simulate the system as installed.

It was noted this agenda item is irrelevant if the NTEP Committee does not approve the pending item up for vote.

Mr. John Roach, California NTEP Lab, stated that if the software package being evaluated supports platforms/subsystems from multiple manufacturers, testing should be done using at least two platforms/subsystems. Scale labs and scale manufacturers indicated that this is not usually done for scale evaluations.

Conclusion: The Sector will continue to develop this item, contingent on the status of the related NTEP Committee agenda item after the 2009 Annual meeting.

New Items:

9. Sealing Requirements for Electronic Devices

Source: Weighing Sector Tech Advisor

Background: Steve Cook of NIST has been involved in attempting to address some concerns with the current wording of G-S.8. as it relates to the sealing of electronic devices and configuration modes. Since this is related in some respects to other items within the purview of the Software Sector, it was suggested that it may be beneficial for the Sector to review and comment on the proposed language.

Discussion: The Sector discussed the relevance of this item, and though it is related somewhat to the discussions on software security and maintenance/reconfiguration, it is broader in scope and hence it was decided that the item was not wholly relevant to the Sector's mission.

Conclusion: The Software Sector takes no position on these proposed changes.

10. Next Meeting

Recommendation: The Sector was asked to develop a proposed date and location for the next meeting.

Discussion: The Sector discussed two options for the next meeting; continuing to meet in Ohio or alternating to a Western location to maintain equity in travel for the various participating labs. There appeared to be a preference (after an informal polling) to alternate the meeting location from year to year.

Conclusion: The Sector recommends that the next meeting be held in Sacramento in or around March 2010. Sector Co-Chair Norm Ingram will investigate suitable hotels and meeting facilities and report back to NCWM. Details need to be firmed up by December of this year.

Appendix A
2009 Software Sector Attendees

2009 Software Sector Meeting Attendee List
March 11-12, 2009 / Reynoldsburg, Ohio

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Appendix B

Slide Show (Draft) for Presentation at Regional Meetings

Software COC

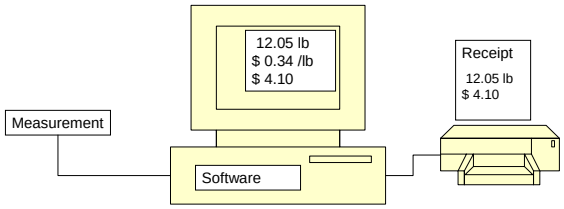
What is it and why do we need it?

Why? What's Broken?

- Software that runs on a PC may execute metrological functions
  - Display indication
  - Tare manipulation
  - Price computation
  - Receipt printing
- PC based software is often difficult to
  - Identify
  - Verify
  - Protect

First Final

- Refer to first final requirement here (Pub 14 admin policy)



PC-based Software Examples

- Point of Sale Cash Register
- Gas Station Pump Control
- Vehicle Scale In-Out

Point of Conflict?

- Current NTEP policy states that software shall not be separately evaluated and given a CoC
- It could be interpreted that Type Evaluation of the example systems is in conflict with the above rule.
  - No hardware was evaluated in these

What Software is NOT Affected?

- Software that executes confined within purpose-built hardware is generally not an issue
  - Hardware provides a ready place to mark for identification
  - Software is not easily modified (by design)
  - Physical seal is often an option

Appendix C
Draft Article for NCWM Newsletter
Software and Software-Based Measuring Equipment

Throughout most of the history of measurement, measuring equipment was purely mechanical in construction. The Industrial Revolution enabled the manufacture of mechanical devices that were identical to all other devices of its type, thus enabling the concept of metrological Type Evaluation. Critical adjustment points, being mechanical, could be readily identified and protected by a physical seal, which, when broken, provided visible evidence of tampering. Purely mechanical devices were (and remain) difficult to repurpose. A device, once installed, could be expected to continue throughout its working lifetime to do only the job for which it was designed. For all stakeholders, including the manufacturer, type evaluator, equipment owner and the field inspector, life was good.

The first electronics added to measuring equipment merely assisted the mechanical design, adding electrical "muscle" to the mechanical signals and perhaps provided a remote or a printed indication of the measurement value. The addition of electronics to measuring equipment created some new type evaluation checklist items, but remained easy to understand during both type evaluation and field inspection.

Next equipment designers cut the mechanical measurement signal and inserted a transducer to convert the mechanical energy into an electrical signal. The first true electronic-based measurement equipment was thus created. This transformation of measurement technology was strange and mysterious; no longer could one see the measurement along the entire measurement path. Nevertheless, the new transducer and associated electronic devices could each be evaluated as a "black box"; each component was built for a specific purpose, had well defined physical input and output characteristics, had a special adjustment point that could accept a physical seal and remained difficult to repurpose in the field. More checklist items and new device types were required and eventually created.

Purely electronic measuring components did not last very long; perhaps only one equipment generation. The invention of the microprocessor allowed equipment designers to condense much of the electronics into a single chip, providing cost savings and increased reliability, and permitting the addition of many new features and functions. Software performed much of the work previously accomplished using electronic hardware. This revolution, being internal, went almost unnoticed for a time. Software within the device was built for purpose and was difficult or impossible to modify in the field. More checklist items were added to cover the new software features.

Alongside the development of the microprocessor that is now embedded within most measuring equipment was a similar development in general purpose computing. Rapidly falling costs for general purpose computers moved the computer out of the high security computer room and onto the desktop. New operating systems not only allowed but encouraged users to control the operation of and data stored on their computer. It was a natural consequence of the flexibility and usefulness of general purpose computers that they would eventually be employed to perform measurement functions. Today, general purpose computers are routinely used in retail Point of Sale (POS) cash registers, fuel dispensing systems and vehicle scale weigh-in/weigh-out systems, to name a few examples.

Example: Retail Point of Sale

In a grocery store a general purpose computer is connected to a combination bar code scanner/weighing platform. No local display is provided at the scale; instead the computer provides a continuously updating weight display along with its running tally of the grocery bill items. The computer is also connected to a receipt printer, a cash drawer, and a central database computer. The bar coded item number and gross weight are sent to the cash register computer, which performs an item record look up to obtain the tare value and unit price (price per pound). The computer subtracts the tare weight from the gross weight to create a net weight, multiplies the unit price by the net weight and rounds to obtain total price. It then displays the net weight, unit price, and total price for the customer and clerk to see. In this case, the first indication of the final value for the transaction is displayed on the computer screen.

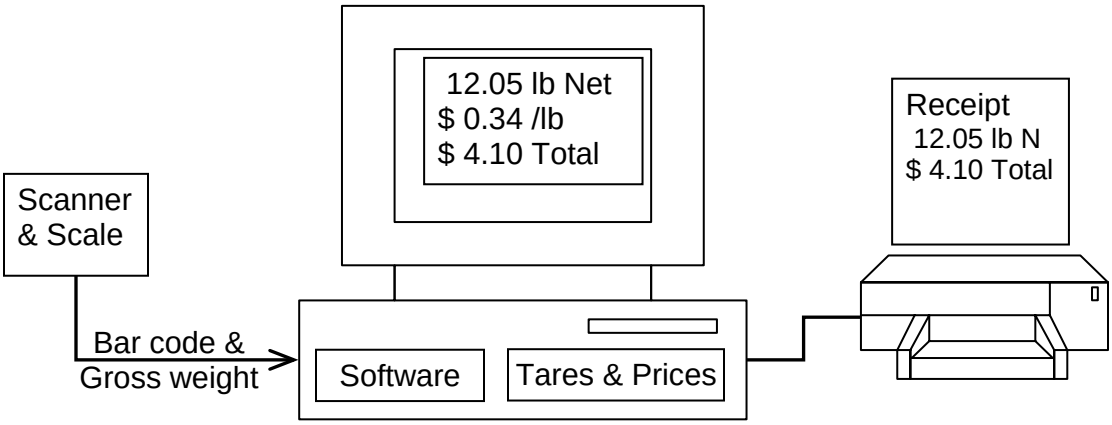
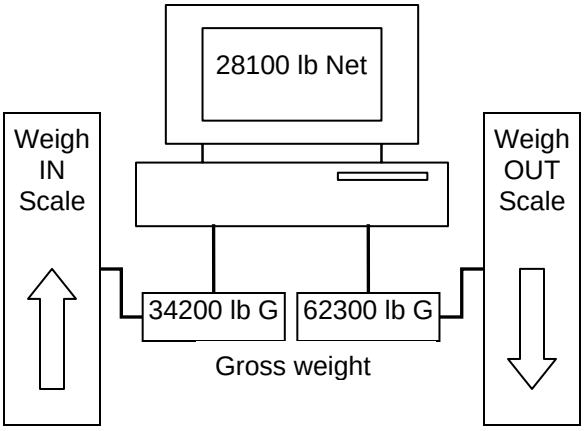


Figure 1 - Retail POS

Example: Vehicle Weigh-In / Weigh-Out

A user already owns one or two vehicle scale weighbridges and electronic weight indicating devices. The user then purchases a general purpose computer and a CDROM containing Vehicle Weigh-In/Weigh-Out software. The computer is loaded with the new software and is connected to the vehicle scales. In normal operation the gross weight is sent continuously from each scale to the computer, which provides an indication of the weight on its screen. Vehicles enter the facility by stopping on an inbound scale. A database record is created that includes the inbound weight and the vehicle ID. The vehicle either picks up or drops off a load and exits the facility by stopping on an outbound scale. The previously stored data record for this vehicle is retrieved and a net weight is calculated and displayed on the computer screen. A bill record or credit record is created and stored and the bill or credit amount is also displayed. The computer may provide net sign correction to prevent display of negative weights if the computer does not know whether the vehicle is empty or full when inbound. In some cases, the vehicle's empty weight is known and was previously stored in the computer. If the empty weight is available, the bill record or credit record may be created in a single transaction. In this case, the computer performs a gross/tare/net calculation, price computing, and net weight display. Note that the scale weighbridge, indicating device and computer software may each be provided by a different vendor. The computer is creating the "first final" indication of net weight and computing the transaction price/credit.



Also note that since times are hard, this computer will have other uses; during the 2nd shift an accounts payable software package is run and during 3rd shift the rather bored security guard plays *World of Warcraft* ®.

As we can see from history and examples, personal computer (PC) based software is a natural evolutionary step in the development of measuring devices. But how to handle PC based software during type evaluation and subsequent field inspection? This is exactly the same type of question that was asked each time the technology changed!

NCWM Publication 14, Administrative Policy, Section C (DEVICES TO BE SUBMITTED FOR TYPE EVALUATION) describes that the scope of NTEP evaluations is limited to equipment for which definitive criteria exist and to new technologies or applications where the development of criteria is deemed necessary. It further describes "…the minimum amount of equipment that must undergo type evaluation is all of the parts of a device or system that performs the measurement up to the first indicated or recorded value of the final quantity on which the transaction is based." Thus if a general purpose computer will execute software that is part of the chain up to that "first final" output, then that computer, or at the least, its software[1], must be evaluated for type approval.

But no one wants to evaluate a general purpose computer. They are not completely specified (a CoC only lists minimum requirements) and computer vendors and models change often. We are then left with evaluating the software, or rather the functions that the software performs. This in itself is not so bad; software can be treated like a "black box" with defined inputs and outputs. A major sticking point in the investigation is that a general purpose computer and its operating system are specifically designed to allow the user complete freedom to modify both the operating software and any data stored within!

Equipment Classification for Software Evaluation

Before any Type Evaluation can begin, it is necessary to know something about the design. When investigating software-based equipment this is especially true.

Software that executes confined within purpose-built hardware is generally not an issue.

- Hardware provides a ready place to mark for identification

[1] *Current NTEP policy states that software shall not be separately evaluated and given a Certificate of Conformance (CoC). It could be interpreted that Type Evaluation of some systems such as Vehicle Weigh-In/Weigh-Out is in conflict with the above rule since no hardware need be evaluated.*

- Software is not easily modified (by design)
- Physical seal is often an option for protection of software and parameters

A general purpose computer is by intent easy to modify; its value is derived from the ability to modify its data and its operation. A general purpose computer presents issues in the areas of:

- Identification and marking
- Verification of type
- Protection against intended and unintended changes to metrologically significant software and parameters

For the purposes of identifying and limiting the depth of investigation required, it is useful to create two classes; one of which is the well known Handbook 44 "built for purpose", also known as "Type P". The other class, based on a general purpose computer, is not presently defined by the NCWM but is known elsewhere as "Type U", which stands for Universal computer.

Software Identification Position Statement

- **The Software Sector recommends that all software-based devices be required to provide version identification for the metrologically significant portion of the software, regardless of whether such software runs on a built for purpose device (type "P") or a universal computer (type "U").**
- **Based on feedback from the Scale Manufacturers Association and other sources, there is a desire to eliminate the present device-type dependent differences in allowable marking/identification methods. The Software Sector agrees that all software-based devices should have identical marking options.**

The Software Sector is confident that both of these positions can be accommodated by simple text edits to Handbook 44 G-S.1. and G-S.1.1.

In addition, the Software Sector acknowledges that there are still reasons to differentiate between Type P and Type U software-based electronic devices (unrelated to the marking requirements) hence continues to support the proposed addition of these terms as definitions in Appendix D of Handbook 44, replacing the previously used term 'built-for-purpose'.