Report of the Specifications and Tolerances (S&T) Committee

Dr. Matthew Curran, Committee Chair
Florida

3000 INTRODUCTION

This is the final report of the Committee on Specifications and Tolerances (S&T) (hereinafter referred to as the "Committee") for the 102nd Annual Meeting of the National Conference on Weights and Measures (NCWM). This report is based on the Interim Report offered in the NCWM Publication 16, "Committee Reports," testimony at public hearings, comments received from the regional weights and measures associations and other parties, the addendum sheets issued at the Annual Meeting, and actions taken by the membership at the voting session of the Annual Meeting. The Informational items shown below were adopted as presented when this report was approved. This report contains those recommendations to amend National Institute of Standards and Technology (NIST) Handbook 44 (2017), "Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices."

Table A identifies the agenda and appendix items by reference key, title of item, page number, and the appendices by appendix designations. The acronyms for organizations and technical terms used throughout the agenda are identified in Table B. The first four digits of the Reference Key Numbers of the items are assigned from the Subject Series List. The status of each item contained in the report is designated as one of the following: **(D) Developing Item:** the Committee determined the item has merit; however, the item was returned to the submitter or other designated party for further development before any action can be taken at the national level; **Informational (I) Item:** the item is under consideration by the Committee but not proposed for Voting; **(V) Voting Item:** the Committee is making recommendations requiring a vote by the active members of NCWM; **(W) Withdrawn Item:** the item has been removed from 9consideration by the Committee.

Table C provides a summary of the results of the voting on the Committee's items and the report in its entirety. Some Voting Items are considered individually; others may be grouped in a consent calendar. Consent calendar items are Voting Items that the Committee has assembled as a single Voting Item during their deliberation after the open hearings on the assumption that the items are without opposition and will not require discussion. The Voting Items that have been grouped into consent calendar items will be listed on the addendum sheets. Prior to adoption of the consent calendar, the Committee entertains any requests from the floor to remove specific items from the consent calendar to be discussed and voted upon individually.

Proposed revisions to the handbook(s) are shown as follows: 1) deleted language is indicated with a **bold face font using ~~strikeouts~~** (e.g., **~~this report~~**), 2) proposed new language is indicated with an **underscored bold-faced font** (e.g., **new items**), and 3) nonretroactive items are identified in *italics*. When used in this report, the term "weight" means "mass."

Note: The policy of NIST and NCWM is to use metric units of measurement in all their publications; however, recommendations received by NCWM technical committees and regional weights and measures associations have been printed in this publication as submitted. Therefore, the report may contain references to U.S. customary units.

Subject Series List

Table A
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Table B
Glossary of Acronyms and Terms

Acronym	Term	Acronym	Term
ABWS	Automatic Bulk Weighing System	NEWMA	Northeastern Weights and Measures Association
AAR	Association of American Railroads	NIST	National Institute of Standards and Technology
API	American Petroleum Institute	NTEP	National Type Evaluation Program
CNG	Compressed Natural Gas	OIML	International Organization of Legal Metrology
CWMA	Central Weights and Measures Association	OWM	Office of Weights and Measures
EPO	Examination Procedure Outline	RMFD	Retail Motor Fuel Dispenser
FHWA	Federal Highway Administration	S&T	Specifications and Tolerances
GMM	Grain Moisture Meter	SD	Secure Digital
GPS	Global Positioning System	SI	International System of Units
HB	Handbook	SMA	Scale Manufactures Association
LMD	Liquid Measuring Devices	SWMA	Southern Weights and Measures Association
LNG	Liquefied Natural Gas	TC	Technical Committee
LPG	Liquefied Petroleum Gas	USNWG	U.S. National Work Group
MMA	Meter Manufacturers Association	VTM	Vehicle Tank Meter
MDMD	Multiple Dimension Measuring Device	WIM	Weigh-in-Motion
NCWM	National Conference on Weights and Measures	WWMA	Western Weights and Measures Association

Table C
Summary of Voting Results

Reference Key Number	***House of State Representatives***		***House of Delegates***		***Results***
	Yeas	***Nays***	***Yeas***	***Nays***	
Consent Calendar: 3300-1, 3301-1, 3301-3, 3302-3, 3305-1, 3306-1, 3307-1, 3508-1	38	0	57	2	Adopted
3200-1	22	14	33	27	Returned to Committee
3200-2	35	0	61	1	Adopted
3200-3	26	11	48	13	Returned to Committee
*3504-1	36	0	57	4	Adopted
3504-2	36	0	54	8	Adopted
*3600-6	36	0	57	4	Adopted
To Accept the Report	Voice Vote				Adopted

* Items 3504-1 and 3600-6 were voted upon as a block.

Details of All Items
(In order by Reference Key)

3100 GENERAL CODE

3100-1 D G-S.5.2.2. DIGITAL INDICATION AND REPRESENTATION (SEE RELATED ITEMS 3200-5 AND 3600-2)

Source:
Ross Andersen, Retired (2017)

Purpose:
Address the application of the code requirements across multiple devices.

Item under Consideration:
Amend NIST Handbook 44 General Code as follows**:**

G-S.5.2.2. Digital Indication and Representation. – Digital elements shall be so designed that:

(a) All digital values of like value in a system agree with one another.

(b) A digital value coincides with its associated analog value to the nearest minimum graduation.

(c) A digital value "rounds off" to the nearest minimum unit that can be indicated or recorded.

(d) A digital zero indication includes the display of a zero for all places that are displayed to the right of the decimal point and at least one place to the left. When no decimal values are displayed, a zero shall be displayed for each place of the displayed scale division.
[Nonretroactive as of January 1, 1986]

(e) A digital value that is electronically summed from the digital indications of multiple independent devices shall be mathematically correct.
[Nonretroactive as of January 1, 20XX]

(Amended 1973**, ~~and~~** 1985**, and 20XX**)

Background/Discussion:
The submitter provided the following comments:

> Some are now coming to understand that the NCWM made a mistake in 1990 in interpreting how we apply the code requirements to the three-platform, three-indicator truck scale with a fourth summed indication. In any suggestion that a Code should be changed or reinterpreted, there is an unstated requirement that there must be some conflict that needs resolution. Often the difficult part is in just identifying the conflict or in finding the right question to expose the conflict to others and, in doing so, possibly point to the resolution. Some might think there is no conflict and there is no issue, but I must disagree.
>
> What stands out on this issue to me is the huge divide between the public sector and private sector on this issue. It was black and white in 1989, good guys vs the bad guys. The public sector, me included, saw the issue one way, while the scale industry almost unilaterally saw it differently. As I think back over my career, I find it hard to find many issues where consensus between the two sides eluded the NCWM as it did for this issue. In my experience, the scale industry works toward consensus as earnestly as the public sector. If there is no consensus here, this should bother us all and encourage us to try to understand why.

If we ask the question on our current issue, as Henry Oppermann has, it goes like this: How do we apply the Scales Code requirements to a three-platform scale with three independent weight indications and a fourth indication of the sum of the three independent platforms? His answer follows his logic of the "duck test." Quoting him, "if a scale looks like truck scale, operates like a truck scale, and weighs trucks, then it is a truck scale."

It is important to note that a parallel issue was on the 2016 S&T agenda dealing with the v_{min} requirement for these three-platform scales with three independent indicators. However, in dealing with this small part of the larger issue, the Committee has chosen to ignore the larger issue for now. In my testimony at the 2016 Interim Meeting, I pointed out that the v_{min} change would result in a mixed state of being. Part of our interpretation for v_{min} would treat the three scales as three, but treat them as one for all other requirements. Does this make sense?

I see an immediate problem here, as Henry's quote is based on thinking from 1989; and I'll suggest much earlier, pre-1986 to be exact. We can see this in Tables 7b. and 7a. in the Scales Code. These tables deal with selection requirements for unmarked scales and marked scales. Table 7b. reflects that pre-1986 thought process where the application of the unmarked device determined what technical and performance requirements would apply. This is the model implied in Henry's comment and in the thought process we see from the S&T Committee as it wrestled with this issue in 1990. Quoting from page 157 of the 1990 S&T Final Report: "The classification of a scale or weighing system into an accuracy class should be based upon its application and method of use, not on the design of the device." In the same paragraph the report also notes, "The significance of this interpretation is that not only must each independent weighing device meet the requirements of Handbook 44, but the entire weighing system must meet all requirements that would apply <u>if the device were a single scale</u>" (emphasis added). This was voted on and approved by the public-sector voters of the NCWM with strong opposition from the (non-voting) scale industry.

Looking at that last statement in the S&T report today, does it even make sense? Table 7a. made a radical departure from the pre-1986 way of thinking. Under the "New" Scales Code which took effect January 1, 1986, the technical and performance requirements were determined by the class designation that was chosen and marked on the device by the manufacturer. In the wording of the table, it is a typical application of the class. Thus, the requirements apply based on the class designation as marked by the manufacturer and the device is adapted to the application. To me this contradicts the S&T conclusions in 1990.

I'm suggesting that a "duck test" is not valid for marked devices. For example, there is no single set of requirements for a marked truck scale. By this, I mean one can use a class III or a class IIIL scale to weigh trucks and the requirements are, therefore, very different. This was impossible to imagine prior to 1986 under the "Old" Scales Code. It is the manufacturer, in the design and production phases, who determines and marks the class. It is the marked class that determines which technical requirements will be applied to the device, and this is done before it leaves the plant. The code recognizes that the manufacturer has no means to limit the application once the purchaser buys the device. Whether a device is suitable is a separate question and has a separate requirement; that is, General Code Paragraph G-UR.1. Selection Requirements.

I believe the "duck test" is not valid for the entire Handbook. For me, the critical issue we have to address is how to apply code requirements in general. The simple, direct answer is: we apply code requirements to <u>a</u> device. That is how the requirements are written; in the singular. Why is this singularity important? The answer lies in unstated, general principles in Handbook 44 which we can elicit by asking, "How do we measure quantities of things in commerce, generally?" By generally, I mean across all codes. My answer is that the codes clearly allow multiple solutions to that question. I'll state this more specifically:

A commodity exchanged in commerce may be measured:

A. as a single draft measured using a single measuring instrument;

B. as the sum of measurements of sub-parts of the whole using multiple drafts on a single measuring instrument; or

C. as the sum of measurements of sub-parts of the whole using multiple drafts of multiple measuring instruments.

It must be noted that the instrument used in any of the options A through C, must be suitable for service when measuring the whole or the sub-part in conformance with G-UR.1. For the purposes of this discussion we will stipulate that all measuring instruments involved are suitable for service, whether measuring the whole or the sub-part. For example, all weighments are stipulated to be greater than the recommended minimum load in Table 8 or liquid quantities in conformance with G-UR.1.3.

A couple of examples might help. I don't think I need to illustrate option A, as it is the most common solution. Option B can be seen with an Automatic Bulk Weighing system which operates by summing multiple drafts weighed on the same scale to provide a total weight of the whole commodity. But I could also do option B using VTMs. I could make multiple deliveries from a single VTM unit to fill a large customer order; that is, larger than the tank capacity of the single VTM. Alternatively, I could fill that order using drafts from multiple VTM units, option C.

Our assumption in accepting each of these options is that the sum of measurements from multiple compliant instruments is *de facto* compliant. In fact, the reason that we use multiple drafts in the first place is that the total will probably exceed our ability to verify the quantity of the whole, even if we wanted to! Going back to our examples, how could we verify, after the fact, that the 1,000 tons of grain loaded on a barge from an ABWS system with a 50 000 lb capacity scale is accurate? That's at least 40 drafts.

What becomes very clear to me in the general case is that the technical and performance requirements are applied to the individual device without regard to the summed total. It seems this summed total has always been the crux of the issue. Does this summed indication now link the three independent platforms with their independent indication in a way that makes them one device for legal purposes? This is what the S&T Committee decided in 1990. Some would continue to say "yes" and some would say "no." However, there is the law to consider. By law, I mean the general rules of construction of legal requirements. In construction, we must not be arbitrary and capricious. I believe those that say the three scales are one scale are being arbitrary and capricious.

To see how this is so, consider what UR.3.3. Single-Draft Weighing means. Below is the current HB44 text.

> **UR.3.3. Single-Draft Vehicle Weighing.** – A vehicle or a coupled-vehicle combination shall be commercially weighed on a vehicle scale only as a single draft. That is, the total weight of such a vehicle or combination shall not be determined by adding together the results obtained by separately and not simultaneously weighing each end of such vehicle or individual elements of such coupled combination. However, the weight of:
>
> (a) a coupled combination may be determined by uncoupling the various elements (tractor, semitrailer, trailer), weighing each unit separately as a single draft, and adding together the results; or
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> (b) a vehicle or coupled-vehicle combination may be determined by adding together the weights obtained while all individual elements are resting simultaneously on more than one scale platform.

The first sentence makes it clear that this is not a general provision as it limits the scope of the requirement to "a vehicle or a coupled-vehicle combination." It now goes on to say that any entity fitting one of those two descriptions shall be weighed as a single draft. Note that this is "option A" from the general case above. The paragraph goes on to provide more explanation of what "single-draft" means.

Then we come to a "However," indicating there are viable alternatives to the single-draft requirement. Alternative (a) allows the coupled combination to be divided into sub-parts that are weighed separately and the weight of the coupled combination is found by summing the individual weights of the sub-parts. Alternative (b)

says that a vehicle or a coupled combination may be suspended simultaneously on more than one scale and the weight is found by summing the indications of the multiple scales.

On first glance, we might think that alternative (a) is option B from the general case, and alternative (b) is option C. However, closer reading will show that is not the case. Look carefully at the wording of alternatives (a) and (b). You cannot equate (a) with option B since (a) does not limit you to a single scale. You might assume that the multiple parts would be weighed on the same scale, but the code does not stipulate that. To do that, the code would have to add the words, "on the same scale;" that is, weighing each unit separately on the same scale and adding together the results." What I'm pointing out is that (a) as it is now written allows either general option B or C. By this I am considering the case where there are multiple scales available at the site. Each of those scales might have a capacity and division size of 200 000 × 20 lb. For example, think about one of those three component trucks (tractor, trailer, and pup). Alternative (a) allows you to uncouple and weigh the three sub-parts on three scales, two scales, or one scale in full compliance with the code.

Now it becomes clear that UR.3.3. is addressing the real issue with weighing large vehicles and coupled-vehicle combinations, and that is shifting loads and coupler interactions. In alternative (a) you eliminate both interferences by isolating each part on its own scale. In alternative (b) by supporting the vehicle or combination on multiple scales, any shift in the load or coupler interaction cancels out. If load shift or coupler interference reduces the weight on one platform, it increases it on another. Of critical importance, the three-platform scale that is the focus of this discussion, is an application of (b) where the load is supported simultaneously on more than one platform and the individual indications of the three scales are summed to get a total. There is no other way to describe what is happening since the total indication is, in fact, a sum of the weights from the three separate platforms. Also of critical importance, there should be no expectation whatsoever that the sum valued obtained in alternative (a) will be identical to alternative (b).

However, getting back to the question about three scales or one, it should now be clear that the Handbook clearly allows summed indications from multiple devices using options B or C. If the S&T statement is correct, then the code requirements must be applied across two scales or three scales in the example of multiple scales at a site. Thus, the three, one hundred-ton scales have a combined 30 000 divisions according to that interpretation. This would virtually preclude having multiple scales at the same site as they might be used to weight a single coupled-vehicle combination in pieces. Even going to 50 lb divisions still puts them out of compliance. Also, you have to consider the shift test requirements, which now require agreement of sections across all three scales!

Finally, we have to consider other cases of three independent scale platforms configured to weigh trucks. In case one, each platform has a stand-alone independent indicator and the three indications are manually summed by the operator. In case two, each platform has an individual indicator but all three indicators are housed in a single enclosure. Again, the summing is done manually by the operator. In both of these cases, the three independent instruments remain independent under the 1990 decision. This is what I mean by arbitrary and capricious.

Now, suppose I can weigh a coupled-vehicle combination on three platforms with three separate indicators and manually add the indications to obtain a total weight for the combination. As I understand the 1990 decision, those three scales do not have to meet requirements like the number of scale divisions extended across all three scales. That extension only applies if there is a single weight display for the three scale indications and a fourth electronic indication for the sum. The results obtained are absolutely identical in function (adding manually on paper or having the system add them up) yet you are applying different requirements to the three scales depending on whether you are doing it manually or electronically. Isn't that being blatantly arbitrary and capricious?

Move over to the VTM example, and the three VTM units used to fill that order, must those three meters be treated as one meter, think about repeatability tests. It doesn't make sense for scales, nor does it make sense for any of the other codes. Thus, I argue that options B and C allow the summing of multiple devices without forcing them to be considered one instrument for applying code requirements. I believe the handbook needs to say that explicitly to avoid confusion.

I offer one additional item of support. I found reference that this issue has been raised internationally. Sections of the 2009 WELMEC Guide to Non-Automatic Weighing Instruments addresses this issue quite clearly (see

pertinent sections on the final pages of this document). Point 3.1.16. in the Guide addresses the same issues as UR.3.3. where multiple platforms are used. The applications coincide with those I expressed in this discussion paper. Also, I believe point 3.1.54. addresses the use of multiple axle-load scales to weigh a vehicle. It also supports the conclusion that the individual axle-load scales do not become a single instrument for compliance purposes. In extension, if 3.1.54. does not apply MPE (tolerances) to the summed indication, it also does not extend other technical requirements such as v_{min} [which the NCWM has addressed], n_{max}, shift test, etc.

The Fundamental Considerations change is necessary to spell out clearly that code requirements do not extend across multiple devices unless specifically stated. A good example is the application of the code to wheel-load weighers designated as and used in pairs. For those scales designated as pairs, many authorities apply the tolerances only to the combined indication of the pair. None of the other requirements applicable to the wheel-load weigher are affected by this exception. For example, the combined number of divisions for the pair is not limited to 1200 as in Table 3. Other requirements like identification markings, rules for indicators, zero-load adjustments, etc., remain applicable only to the individual wheel-load weigher and not to the pair.

The addition to G-S.5.2.2. is necessary since you can't write requirements into the Fundamental Considerations. That section is there to help understand how to apply what is written in the codes. You must have a specification that the electronic sum be mathematically correct to reference if there is non-compliance. That is, readings from three scales of 107, 206, and 98 must result in an electronic sum of 411.

Note 4 in Table 3 has to be changed, since the last two sentences address these instances of multiple independent scales and reflect the 1990 decision. The removal of the last sentence removes the summed indicator from consideration under the classification system as discussed above, since the summed indication is not a directly measured quantity and is not subject to class requirements. The summed indication is also not subject to requirements for n_{max}, tolerances, etc. When this last sentence is removed, it makes the next to last sentence unnecessary for each independent scale is already covered under the general provisions of the Table.

There is a small side issue regarding multiple devices using option C where the division size is not the same for all the devices. The general principle (i.e., summing the indications from compliant devices is a valid way to measure a commodity) does not necessarily require that division sizes of the individual devices be identical. Note that you might want to apply UR.1.3. to printed records from the three scales. However, the proposed new Fundamental Considerations paragraph exempts the summed indication since code requirements do not apply to the summed indication except the mathematical correctness. Also, the summed indication is a sum, not a representation of a scale division. It is just a sum of the values obtained from the individual compliant devices. The individual weights are also required to be shown on any record of the transaction. While the different division sizes may offend our sensibilities a little bit, on what objective basis can we say it violates the general principle; that is, the sum of multiple compliant measurements is also *de facto* compliant. It is this compilation of original sources for the sum and the sum that provides the transparency for the transaction. Note the WELMEC reference indicates this is the position taken by many internationally.

I can think of another possible situation in the case of multiple ABWS systems. Suppose you are loading to a single barge from two sources where the two ABWS scales have different division sizes. The scale controller interfaced to the two scales now can print each of the weighments from each of the two scales and a single total for the entire transaction. The sum need only be mathematically correct since it is a mathematical sum of independent, compliant weighments.

The following is taken from the May 2009 version of WELMEC Directive 90/384/EEC: Common Application Non-Automatic Weighing Instruments (available at **www.welmec.org/latest/guides/**):

3.1.2 Calculated weight (Meeting 10, Decision 10)

Where the indication represents an actual determination of the weight then the indication must respect the error allowance and be presented in the correct format.

When gross, net and tare are printed together, weight may be calculated from two actual determinations of weight. In the case of a multi-interval instrument it would be allowed to print a calculated value with the least significant digit which need not be rounded to the relevant scale interval.

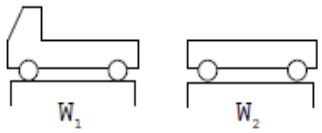
Any printout of the calculated weight values should be identified as calculated weight values.

(See also Sections 3.1.16 and 3.1.54)

3.1.16 Combined and multi-plate weighbridges (Meeting 14, Point 4, Meeting 15, Point 2 and Meeting 18, Point 9)

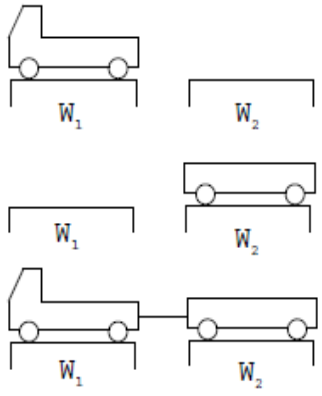
This concerns weight obtained by using adjacent weighbridges. Acceptable solutions, with examples, are shown below:

Two weighbridges, each with its own indicator:



W_1 = 30 t x 10 kg
W_2 = 30 t x 10 kg
(Two indicators; simultaneous indication necessary)
Calculated weight 60 t x 10 kg
(mpe does not apply to calculated weight)

Multi-plate weighbridge with one indicator:



W_1 = 30 t x 10 kg

W_2 = 30 t x 10 kg

W_{1+2} = 60 t x 20 kg

W_{1+2} is a weighing range (Compatibility of modules and mpe must be satisfied for it)

(See also Sections 3.1.2 and 3.1.54)

3.1.54 Vehicle weighing by summation of individual wheel load NAWIs ("axle weighers") (Meeting 25, Point 9)

If the total weight of a vehicle is calculated automatically by summing the individual weight values produced by individual wheel load NAWIs ("axle weighers"), the system is not to be regarded as being one single NAWI. The mpe does not apply to calculated weight.

(See also Sections 3.1.2 and 3.1.6)

3.1.6 Load cells

(Note that throughout this guide, "load cells" refers to analogue load cells rather than digital load cells unless stated otherwise.)

At the 2017 NCWM Interim Meeting, the Committee grouped agenda Items 3100-1, 3200-5, and 3600-2 together and took comments on these items simultaneously because it considered them related.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported that the SMA opposes these items as it believes they restrict the use of multiple scales operating using internal resolution to create an additional scale that provides the total weight.

Mr. Henry Oppermann (Weights and Measures Consulting, LLC) submitted written comments in opposition to the items stating "I am opposed to these items and the items should be Withdrawn. The proposed changes go against the principles of NIST Handbook 44, the principles of OIML R 76, and violate the WELMEC guideline. The adoption of accuracy classes for scales established relationships among accuracy classes; scales within accuracy classes; the number of scale divisions in scales; and the sizes of scale divisions. The adoption of accuracy classes DID NOT CHANGE the suitability of equipment criteria used to determine which scales are acceptable for use in specific applications."

Mr. Ross Andersen (New York, Retired) stated he submitted these items to address what he considers to be a "multiple scale array." He said that he had voted in support of the 1990 S&T Committee's interpretation of how NIST Handbook 44 requirements are to apply to these systems, but now questions that decision. He indicated that the code doesn't dictate testing the scale the way it's used, but that's what regulators do. He also indicated that NIST Handbook 44 tolerances are not intended to apply to summed indications and questioned how it could be that the v_{min} formula only applies to the independent scales of a system and all other Handbook 44 requirements apply not only to the independent scales, but also to the whole system. He asked, "How can we tell a manufacturer to tell us what the scale is, but we then change that in the field?" Mr. Andersen noted that the fourth indicator only provides a summed indication of the individual scales in the system, and is not to be considered a fourth scale because it is the combined total and is acceptable under the code. Mr. Andersen made note of the following to support his position on this issue:

Nowhere in NIST Handbook 44 code does it specify that a summed indication must comply with Handbook 44 tolerances.

1. Scales Code paragraph UR.3.3. Single-Draft Vehicle Weighing allows for the summing of indications to weigh a vehicle when different portions of the vehicle are resting simultaneously on more than one scale.

2. The Fundamental Considerations section is to clarify for "all times" that a device is a singular device.

Mr. Andersen acknowledged that his proposals are not ready for voting this year, but need discussion.

Mr. Rick Harshman (NIST, OWM) provided the following comments and recommendations on behalf of OWM:

- The changes proposed by this group of items, if adopted, would have the effect of loosening the current tolerances applicable to those vehicle scales that are equipped with multiple independent weighing/load-receiving elements, each with its own digital weight display and an additional display that provides an electronic summed indication of all elements. It is possible because of how the tolerance bands in NIST Handbook 44, Table 6 are structured and due to the effect of digital rounding of the different indications provided by such a system, that each independent scale within the system could be within applicable tolerance, yet the summed total may not. Mr. Harshman noted that OWM had provided an example in its analysis of this item to the Committee that shows this to be true. Thus, if you are willing to buy into the concept that Handbook 44 requirements should not apply to summed indications, then you must also be willing to accept some additional allowable error in the results obtained from these systems. OWM doesn't think this is necessary nor does it believe that the submitter has provided any technical justification for doing so. OWM's expectation of any commercial vehicle scale, regardless of how it is configured, is that it performs to within the current tolerances specified in NIST Handbook 44.

In commercial applications where these systems are used, it is the summed indication that serves as the basis for commercial transaction. Not only do truckers rely on the weights obtained from these systems to verify compliance of their loads with legal load limits for individual axles, tandem axles, and gross vehicle weight, but oftentimes so do small local businesses needing to determine the weight of vehicles for commercial purposes. The various truck stops providing these scale systems normally charge a fee for the weight determination, which includes a printed receipt of the load applied to each individual weighing/load-receiving element and the summed result. The expectation of those receiving this service is that each weight, including the summed indication, accurate to the tolerances specified in NIST Handbook 44. Additionally, many of the truck stops throughout the country offering this weighing service post signs visible from the roadway indicating "Certified Scale." OWM considers a "certified scale" to be one that provides indications and recorded representations that are certifiable. OWM's interpretation of a certifiable weight is one that meets or exceeds the applicable tolerance specified in Handbook 44. Failure to apply code requirements to the summed indications of these systems would, in OWM's view, cause such advertising to be deceptive. That is, it could no longer be claimed, nor would it be necessary for officials to verify, that a load applied to the scale when positioned on more than one independent weighing/load-receiving element is accurate to within applicable tolerance specified in Handbook 44 for that load. OWM notes too, that many of these systems are used by truck weight enforcement agencies and the weights obtained are used to determine fines for exceeding legal load limits. The expectation of their accuracy is the same regardless of the application; each individual scale must be accurate and the summed total must also be accurate to within the tolerances specified in Handboook 44.

In conclusion, OWM believes the interpretation provided by the 1990 S&T Committee was reasonable and accurate, and it is still appropriate today. It would be unfair to apply a different performance standard to one vehicle scale over another (that is, a single platform scale used to make the same kind of weighment) when the application of those scales is the same. The requirements as described have been applied to these systems for more than 25 years (i.e., since the date the Committee's interpretation took effect) and scale manufactures and service agencies have been installing these systems into commercial and law enforcement applications with no apparent issues concerning their accuracy when applying tolerances based on the 1990 Committee's interpretation. The total vehicle weight determined from these weighing systems is being represented as a weight that complies with HB 44.

Ms. Julie Quinn (Minnesota) stated that this addresses uniformity and further noted that some states are already doing what is contained in the proposal, whereas other states are not.

In considering this group of items, the Committee agreed to assign them a "Developing" status to allow the submitter additional opportunity to address the comments and concerns of OWM and others.

At the 2017 NCWM Annual Meeting, S&T Committee Chair, Dr. Matthew Curran (Florida), stated the Committee would only hear comments/updates from the submitter on developing items during open hearings. The Committee grouped agenda Items 3100-1, 3200-5, and 3600-2 together because it considered them related. Mr. Ross Andersen (New York, retired) provided an update on the development of this group of items, as their submitter. Mr. Andersen reported he had received some good feedback at the NEWMA Annual Meeting in May 2017. He later met with members of the Scale Manufacturers Association (SMA) to work on advantages and clarification of his proposal. He stated, he would like to develop these items electronically, "off line," and that he is nearing completion of a draft

PowerPoint presentation to serve as a "walk through" to his proposals. Once completed, he plans to forward it to OWM's S&T Committee Technical Advisor, Mr. Rick Harshman, to share with the Committee. His presentation slides will include notes and thoughts on each point. Mr. Andersen also indicated that he hopes to have a second draft of his proposals completed by the 2017 fall regional meetings for the different regions to consider.

The Committee agreed to carry over this group of items on its agenda as Developing items to allow Mr. Andersen the opportunity to further develop and garner support for his proposals.

Regional Association Comments and Recommendations:
At its 2016 Annual Meeting, the WWMA only heard comments from NIST, OWM. There was a concern that this would increase the tolerance applied to this type of device and may also cause conflicting tolerances. The WWMA heard Items 3100-1 and 3600-2 together. The WWMA forwarded this item to the NCWM, recommending a "Developing" status.

At its fall 2016 Interim Meeting, the CWMA reported that while the appendix related to this item was very informative, but due to the volume of information, it was unable to determine the issue this item was addressing. The CWMA would welcome a concise explanation regarding this item. At its spring 2017 Annual Meeting, the CWMA reported that the SMA opposes the item, but noted that the item's submitter had agreed to rewrite portions of the proposal to address SMA's concerns. The CWMA recommended at both meetings, the item be forwarded to the NCWM as a Developing item.

The SWMA batched items 3100-1, 3200-5, and 3600-2 together at its 2016 Annual Meeting and heard comments for all at the same time. Mr. Henry Oppermann (Weights and Measures Consulting) disagrees with these items and opposes them. He recommends withdrawing all three items in this batch. Mr. Oppermann contends they violate the principles of NIST Handbook 44. He further contends this should be on performance and not design. Mr. Oppermann concluded by saying the submitter misinterpreted the WELMEC guidelines and multi-platform truck scales used together must function as a single scale. The Committee did not forward these items to the NCWM and recommends they be Withdrawn because the proposed language is unnecessary.

At its fall 2016 Interim Meeting, NEWMA reported it believes this item has merit, but would like an example of how this applies to independent/multiple devices. At its spring 2017 Annual Meeting, NEWMA reported the item was not ready for vote with impending changes to be proposed by the item's submitter. NEWMA forwarded the item to the NCWM and recommended Developing status at both meetings.

3100-2 W G-UR.3.3. POSITION OF EQUIPMENT

(This item was Withdrawn.)

Source:
Illinois (2017)

Purpose:
Eliminate the interpretation differences, while also demonstrating a need for customer readability and giving the official with statutory authority permission to require visible indications for ease of test procedures.

Item under Consideration:
Amend NIST Handbook 44, 1.10. General Code as follows**:**

> **G-UR.3.3. Position of Equipment.** – A device or system equipped with a primary indicating element and used in direct sales, except for prescription scales, shall be positioned so that its indications may be accurately read and the weighing or measuring operation may be observed from some reasonable "customer" and "operator" position. The permissible distance between the equipment and a reasonable customer and operator position shall be determined in each case ~~**upon the basis of the individual circumstances**~~ **by the official with statutory authority, who shall base the determination on "customer readability" and ease of testing procedures,** particularly the size, character, and **position** of the indicating element **(e.g., A deli customer shall be able to**

read the indications from the patron side of the deli counter, whereas a truck driver shall be able to read the indications from the cab of the vehicle.). (Also see G-UR.4.4. Assistance in Testing Operations and Appendix D. direct sales.)

Background/Discussion:
Over the years, due to the verbiage of the current G-UR 3.3. Position of Equipment regulation, there has been a variety of different interpretations of which devices require indicating elements (e.g., scoreboards/remote indicators) located outside with the load-receiving element and which do not. Some businesses believe if they allow their customers to get out of their vehicles to come into the office/scale house, this satisfies the regulation. However, many inspectors, service people, and customers believe that any device that requires indications to be accurately read from the position the load-receiving element is located needs to have outside indicating elements installed.

With the terms more specifically defined, remote indicators/scoreboards would be required to be installed on most vehicle scales. This would not only help the inspectors, but would be a convenience for the service companies and in the long run save the businesses money due to the amount of time it takes to walk from the weigh load-receiving element to the indicating element. Safety is another important reason. Fewer drivers leaving their vehicle to verify indications would result in fewer accidents.

The cost of installing remote indicators/scoreboards is primarily the only reason against this proposal.

During open hearings at the 2017 NCWM Interim Meeting, the Committee received numerous comments from industry, NIST, and regulatory officials expressing concern and opposition to this item including:

- The proposal does not provide clarification to existing requirements for visibility.
- It was noted the proposed changes are retroactive and it was questioned how compliance could be met for existing mechanical-type scales, such as a vehicle scale with a beam indication.
- The changes proposed fail to consider that some (particularly older) devices will be unable to comply without significant and potentially costly modifications.
- The use of examples in NIST Handbook 44 is not recommended.
- The item could have overreaching impacts to existing installations for various device types.

The Committee did not receive any comments in support of the item. During its work session, members of the Committee reviewed existing paragraph G-UR.3.3. Position of Equipment, and it was agreed that the current paragraph already provides officials the necessary discretion to decide on a case-by-case basis, whether a particular device used in a direct sale complies with the provisions of this paragraph. For this reason, and in consideration of the comments received in opposition to the item during the open hearings, the Committee agreed to Withdraw this item.

Regional Association Comments and Recommendations (Fall 2016 Conferences):
The WWMA believed the proposed changes to G-UR.3.3. will influence all devices and is over reaching. It will require currently approved (even currently in use) devices/systems to be modified if any regulator desires supplementary readouts. If the submitter believes a specific device type (such as truck scales) should have additional readouts, it would be better addressed in the specific device code sections, not the General Code. WWMA did not forward this item to NCWM, recommending that it be Withdrawn.

The CWMA believes this strengthens the requirement and will promote consistency in enforcement. CWMA forwarded this item to the NCWM and recommended a Voting status.

The SWMA received comment from Mr. Hal Prince (FL) that the State of Florida already interprets this item the way it is written. Mr. Prince also stated that “ease of testing” applies to all types of devices since this proposal is for the General Code and could result in increased testing costs. The SWMA did not forward this item to NCWM and recommends that it be withdrawn because the language is unnecessary.

NEWMA believes, based on the comments heard, that this item allows more stringent authority to the official, requiring devices ranging from jewelry scale indicators to remote scoreboards at truck scale sites to be positioned for the customer. NEWMA forwarded the item to NCWM, recommending a Voting status.

3200 SCALES

3200-1 V S.1.2. VALUE OF SCALE DIVISION UNITS AND APPENDIX D – DEFINITIONS: BATCHING SCALE

(This item was returned to Committee.)

Source:
Richard Suiter Consulting (2017)

Purpose:
Recognize batching systems as a device type in the Scales Code to help officials differentiate between them and automatic bulk weighing systems.

Item under Consideration:
Amend NIST Handbook 44, Scales Code as follows:

S.1.2. Value of Scale Division Units. *– Except for* ~~***batching scales and***~~ *weighing systems used exclusively for weighing in predetermined amounts, the value of a scale division "d" expressed in a unit of weight shall be equal to:*

(a) 1, 2, or 5; or

(b) a decimal multiple or submultiple of 1, 2, or 5; or

Examples: scale divisions may be 10, 20, 50, 100; or 0.01, 0.02, 0.05; or 0.1, 0.2, 0.5, etc.

(c) a binary submultiple of a specific unit of weight.

Examples: scale divisions may be ½, ¼, ⅛, 1/16, etc.

[Nonretroactive as of January 1, 1986]

And add a new definition for the term "batching scale" into NIST Handbook 44, Appendix D – Definitions as follows:

batching scale. – Any scale which by design or construction, lends itself readily to use in proportioning ingredients by weight. [2.20]

Background/Discussion:
Item 360-3 on the 2016 agenda of the NCWM S&T Committee was carried over as an Informational item at the 2016 Annual Conference. The item was opposed by NIST, OWM and the SMA because the Scales Code does not include the specific words "Batching System." The submitter of the item believed that the wording "batching scales and weighing systems" in paragraph S.1.2. was sufficient; however, the submitter agreed to work with the S&T Committee to submit an additional proposal to clarify the language. At the 2015 NCWM Interim Meeting the SMA had voiced support for the definition of "batching system" and suggested that a definition for "batching scale" be added to NIST Handbook 44, Appendix D. The proposed definition for batching scale is taken directly from the SMA book of "Terms and Definitions" published in their 1981 Fourth Edition.

There are many "batching scales" and "batching systems" already in the marketplace, some of which have an NTEP Certificate of Conformance. The proposed change to paragraph S1.2. and accompanying definitions will assist

weights and measures officials in identifying some devices as falling under the Scales Code for evaluation and testing purposes.

Some individuals believe that all automated systems utilizing a hopper scale belong in the Automatic Bulk Weighing Systems Code (ABWS). The submitter believes NTEP and the marketplace have already demonstrated there are devices and systems that do not need to meet some of the stringent requirements of the ABWS Code. These devices and systems can provide accurate net weight determinations without the necessity of some of the added requirements of the ABWS Code. Those requirements add unnecessary additional manufacturing costs and testing burdens for weights and measures field officials.

At the 2017 NCWM Interim Meeting, the Committee grouped agenda Items 3200-1 and 3600-3 together and took comments on these items simultaneously because it considered these items related.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported the SMA opposes both items in this batch because it feels there are no specifications and tolerances defined to support the definition of either "batching scale" or "batching system." He also reported the SMA would not be opposed to the creation of a new NIST Handbook 44 code to address some of the weighing systems that prompted the submitter to initiate these proposals.

Mr. Henry Oppermann (Weights and Measures Consulting, LLC) submitted written comments in opposition to this item stating, "I am opposed to these items and the items should be Withdrawn. The proposed definitions will confuse the categorization of scales, rather than clarify the distinction between batching scales, hopper scales, and automatic bulk weighing systems. What type of scale is a scale that automatically weighs a single commodity in multiple drafts for a single transaction? I hope that the answer is that this type of scale is an automatic bulk weighing system."

Mr. Rick Harshman (NIST, OWM) stated that OWM could not think of anything unique about a scale used in a batching operation necessitating the need for the terms "batching scale" and "batching system" to be defined in NIST Handbook 44 or for the Scales Code be amended to include the term "batching system" as proposed. OWM questioned whether the exemption provided in Scales Code Paragraph S.1.2. applicable to "batching scales" and "weighing systems used exclusively for weighing in predetermined amounts" should still be provided for batching scales. Mr. Harshman noted that the term "batching scale" refers to some older mechanical scales used in batching operations that are unlikely to still be in commercial service today. To this point, OWM proposed deleting the term from the Scales Code in the only two places that it appears; that is, in paragraphs S.1.2. and T.3. Mr. Harshman further noted that OWM believes the definition proposed for "batching scale" is ambiguous and could be applied to just about any scale manufactured today; inserting the term into paragraph S.1.2., as proposed, would allow manufacturers to design scales with weight units other than those specified in the paragraph.

Mr. Richard Suiter (Richard Suiter Consulting), noting his intention to address the comments made by the SMA, reported that the two definitions in his proposals came from a handbook of definitions, which had been developed and published previously by the SMA. He further noted that the "batching system" definition in the proposal was only expanded very slightly and that the definition of "batching scale" was taken directly from the SMA's handbook. He went on to address comments made by a NIST representative, which contended that batching scales are older mechanical scales and possibly not being used in the marketplace. He stated there are, in fact, suspended hoppers in existence and in commercial use. Mr. Suiter stated that the ABWS Code is an older code and that the State of Nebraska was a key developer, so he was familiar with much of the history of its development. In countering comments submitted in writing by Mr. Oppermann, Mr. Suiter indicated that Mr. Oppermann appears to be of the opinion any weighing system that can be operated in an automatic mode and weighs more than one draft to obtain some targeted amount for loadout is to be considered an ABWS and that the ABWS Code applies. This is not the case. There are systems that can weigh multiple drafts accurately while in automatic operation, returning to zero after each load is discharged. Mr. Suiter also clarified the comment that his proposals were submitted on behalf of KSi, "when, in fact, they were not." However, he stated he did notice it when he was affiliated with KSi. Mr. Suiter also said in response to Mr. Oppermann's comments that a lot of the scales used to weigh grain require a higher NIST Handbook 44 accuracy class, which may be true; however, that was based on grain being a valuable commodity, which is no longer the case in relation to other commodities. He noted that the current commodity prices for grain are literally cents per pound. Mr. Suiter concluded by stating that he believes these proposals are ready for vote, but would like to keep the items alive if the Committee feels otherwise.

During the Committee's work session, Mr. Harshman stated that he favored following through on a comment made during the open hearings by Mr. Vires to possibly develop an entire new NIST Handbook 44 code to address these systems. Mr. Harshman said he questions now whether it is appropriate to try and expand the application of the ABWS Code to address some of these automatic systems known to be in commercial service because a number of these systems weigh more than one product at a time. The ABWS Code was developed to address a particular automatic weighing system intended to weigh only one product at a time in multiple drafts to achieve some targeted amount. Mr. Suiter, who was in attendance, was asked what he thought of this idea. Mr. Suiter indicated that he too favored the concept of developing a new code, but that would take a long time and he, therefore, suggested the Committee present the current proposals for vote to help alleviate existing confusion.

Upon reviewing the current proposals, one member of the Committee asked other members if they considered "batching scales" and "batching systems" a weighing system used exclusively for weighing in predetermined amounts. The same Committee member indicated that if others agreed this were the case, these terms could be eliminated from paragraph S.1.2. of the proposal. Other members agreed they believed this to be true. Mr. Suiter, who was present during the session, was asked if the Committee removed these terms from the paragraph and kept the proposed definition of "batching scale" as part of the proposal would this satisfy his objective. He indicated that it would. In consideration of these discussions and the comments received during the open hearings on this group of items, the Committee amended the original proposal shown below to that which now appears in the Item Under Consideration for this item and agreed to present the item for Vote at the 2017 NCWM Annual Meeting.

***Original proposal presented in the "Item under Consideration" in the 2017 S&T Publication 15*:**

Amend NIST Handbook 44, Scales Code as follows:

S.1.2. Value of Scale Division Units. *– Except for batching scales**, batching systems** and **other** weighing systems used exclusively for weighing in predetermined amounts, the value of a scale division "d" expressed in a unit of weight shall be equal to:*

(a) 1, 2, or 5; or

(b) a decimal multiple or submultiple of 1, 2, or 5; or

Examples: scale divisions may be 10, 20, 50, 100; or 0.01, 0.02, 0.05; or 0.1, 0.2, 0.5, etc.

(c) a binary submultiple of a specific unit of weight.

Examples: scale divisions may be ½, ¼, ⅛, 1/16, etc.
[Nonretroactive as of January 1, 1986]

And amend NIST Handbook 44, Appendix D – Definitions as follows:

batching scale. – Any scale which by design or construction, lends itself readily to use in proportioning admixtures by weight. [2.20]

The Committee also agreed to Withdraw agenda Item 3600-3 at the recommendation of the submitter, which was discussed at the same time as this item.

At the 2017 NCWM Annual Meeting, the Committee received very similar comments during its open hearings as those provided during the 2017 Interim Meeting. Mr. John Barton (NIST, OWM) stated the changes proposed to Scales Code Paragraph S.1.2. address a requirement that excluded some scales used in the production of a product based upon a specific recipe that called for amounts of ingredients in values not in synch with customary scale division sizes (i.e., concrete & cement, etc.). It is questionable whether these older systems are still in service. He further stated that OWM believes the term "batching scales" could be eliminated (appearing only in paragraphs S.1.2. and T.3. SR, Equilibrium Change Required) from NIST Handbook 44 without having any significant effect.

Mr. Barton acknowledged there may be some confusion among regulatory officials when classifying automated weighing systems (e.g., Are they an ABWS or simply a system comprised of scales used in a batching operation?). Proper classification is necessary to determine which NIST Handbook 44 Code paragraphs to apply. OWM fails to see any unique qualities that are consistent with various scales used in a batching operation that would prompt the need for a definition of the term "batching scales." The definition proposed does not clearly and definitively identify any particular type or class of scale. This definition is not seen as a benefit to an inspector trying to determine which NIST Handbook 44 Code requirements are appropriate. As OWM has noted previously, if there is a perceived gap that exists in the Handbook 44 Scales Code regarding the application of that code to a specific use of scales, then a proposal that positively identifies the specific type of device and appropriate requirements should be submitted.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported that the SMA opposes the item. The SMA does not support adding the submitter's provided definition of "batching scale" to NIST Handbook 44. The SMA feels this definition is for the application of a scale and not a performance specification.

Mr. Henry Oppermann (Weights and Measures Consulting, LLC) submitted written comments to the Committee in advance of the Annual Meeting opposing this item. During the open hearings, Mr. Oppermann stated he is opposed to the item, particularly the proposed definition, and he encouraged a Vote against the proposed changes. He noted that the proposed definition describes a batching scale as "Any scale which … lends itself to use in proportioning ingredients by weight." Mr. Oppermann asked, "What is meant by 'use in proportioning ingredients'?" He further indicated the proposed definition incorrectly and inappropriately defines a batching scale in terms of how the weighed commodity is processed subsequent to the weighing operation. He said that NIST Handbook 44 categorizes scales based upon a combination of factors, including the design of the scale (e.g., hopper scale and monorail scale), use (e.g., as a grain hopper scale and animal or livestock scale), method of operation (e.g., static weighing or in-motion weighing) and commodity weighed (e.g., grain or aggregate). How a commodity is processed after the weighing operation is completed is irrelevant to the categorization of the scale.

Mr. Oppermann also said he believes the objective of the submitter is to get automatic bulk-weighing systems used in seed treatment systems classified as batching scales so these scales do not have to comply with the Automatic Bulk Weighing Systems Code. He noted all scales that automatically weigh individual commodities in multiple successive drafts of predetermined amounts should be required to comply with the Automatic Bulk Weighing Systems Code. He further indicated the submitter wants to call scales that automatically weigh a single commodity in multiple drafts a "batching scale." For an individual customer order, these scales weigh a single commodity (one of various seed grains used for different customer orders), which is then delivered into a mixer, into which other seed treatment ingredients are added and mixed. The critical aspect of the weighing operation is the automatic weighing a single commodity in multiple drafts; not by how the grain is processed after weighing.

Mr. Richard Suiter (Richard Suiter Consulting) provided some background information relating to the historical use of batching scales in the United States, and concluded his historical account by saying batching scales are ingrained in our weights and measures system. He noted that the definition submitted in his proposal was developed by the SMA years ago and was copied from an older SMA publication of weights and measures terms and definitions. Mr. Suiter, in countering Mr. Oppermann's statements concerning the objective of his proposal, he reported the intent of his proposal was not to primarily address seed treatment scales. He came to realize, rather, in working with a manufacturer of seed treatment systems, the difficulty officials sometimes have in classifying the scales used in some automated weighing systems, and just because a scale system completes multiple drafts, it is not necessarily an ABWS. There are thousands of scales used for recipes that make greater than a single draft (e.g. asphalt and aggregate scales, etc.) that are not an ABWS. There are smaller scales too that are used for weighing multiple drafts for recipes. The intent of my proposal is to provide officials with another tool to help identify the different types of devices.

In discussing this item during the Committee's work session, members of the Committee acknowledged there remained opposing positions concerning whether the changes proposed to this item are appropriate or would benefit officials. Members of the Committee agreed the item was fully developed and further agreed to present the item for Vote to allow the voting body the opportunity to decide whether the changes were appropriate.

Regional Association Comments and Recommendations:
The WWMA heard Items 3200-1 and 3600-3 together at its 2016 Annual Meeting. The Committee did not believe the language submitted agrees with the submitter's goal and believes further development is needed by the source. WWMA sent this item to NCWM and recommended "Developing" status.

At its fall 2016 Interim Meeting, the CWMA reported it believes this may provide clarification when determining if a device is operating as a batching system or as an Automatic Bulk Weighing System. The CWMA forwarded the item to NCWM and recommended Voting status. At its spring 2017 Annual Meeting, the CWMA reported, based on the comments received in opposition to this item, it believes this item is an unnecessary addition to the handbook and recommends it be Withdrawn.

The SWMA batched Items 3200-1 and 3600-3 together at its 2016 Annual Meeting and heard comments on all items at the same time. Mr. Henry Oppermann (Weights and Measures Consulting) stated he was opposed to these items because they'll make it more difficult for the weights and measures official because the definition is not specific enough. These scales are "automatic bulk weighting systems" and this proposal was designed to exempt some scales from the automatic bulk weighing code. It was also stated that, "many are already in the marketplace, some of which have an NTEP certificate," but the submitter doesn't want to bring them into compliance with the automatic bulk weighing system code. Further, Mr. Oppermann stated this device has an unsealed parameter allowing the user to program a tolerance on the return to zero, which should not be allowed. The SWMA forwarded the item to NCWM and recommended Developing status. The SWMA asks the submitter to address why this is not covered in the bulk weighing code and present the overall picture of the items necessity.

At its fall 2016 Interim Meeting, NEWMA reported receiving a comment indicating Mr. Suiter (Richard Suiter Consulting) was asked by the NCWM S&T Committee to clarify the language for the Scales Code. NEWMA believes the language is pertinent to defining a batching scale. NEWMA forwarded the item to NCWM and recommended Voting status. At its spring 2017 Annual Meeting, NEWMA reported it believes the submitter has finished developing this item and that it is at an appropriate stage to be Voted on.

3200-2 V S.1.2.2. VERIFICATION SCALE INTERVAL

(This item was Adopted.)

Source:
Oregon (2017)

Purpose:
Reduce confusion for the buyer and seller by prohibiting the display of a "d" value that is smaller than an "e" value for Class I and II scales when used in direct sales.

Item under Consideration:
Add a new Scales Code Paragraph S.1.2.2.2. to NIST Handbook 44 and renumber existing paragraph S.1.2.2.2. as follows:

S.1.2.2. Verification Scale Interval.

S.1.2.2.1. Class I and II Scales and Dynamic Monorail Scales. – If $e \neq d$, the verification scale interval "e" shall be determined by the expression:

…

S.1.2.2.2. Class I and II Scales used in Direct Sales. – When accuracy class I and II scales are used in direct sale applications the value of the displayed division "d" shall be equal to the value of the verification scale interval "e."
[Nonretroactive as of January 1, 2020 to become retroactive January 1, 2023]
(Added 2017)

S.1.2.2.~~2~~3. Class III and IIII Scales. – The value of "e" is specified by the manufacturer as marked on the device. Except for dynamic monorail scales, "e" must be less than or equal to "d."
(Added 1999) **(Amended 2017)**

Background/Discussion:
With the massive increase of the direct sale of precious metals, cannabis, and other high value commodities in the marketplace a large number of high-resolution scales are entering the market place. Many of these scales have a display that displays a "d" value that is smaller than the "e" value. This creates confusion for both parties in the transaction. The "d" value should not be used in any direct sale transaction since it is not evaluated during device examinations and is not considered during NTEP evaluations. Conflict ensues when one of the two parties demands that the "d" value be used in the transaction while the other party, understanding the device requirements, refuses to do so. Should both parties agree to use the non-validated "d" value, the accuracy of the transaction is very much in doubt.

During performance testing of the device, the evaluator essentially "ignores" the smallest displayed number when "d" is less than "e." This applies even when the "e" value would round up or down if the device were not displaying the smaller "d" value. This can lead to an evaluation that is potentially not as accurate as it could be.

Oregon officials have found rampant misuse of the non-validated "d" value on devices that have a verification scale interval ("e" that is greater than "d") used in direct sale applications.

During the 2017 NCWM Interim Meeting S&T Committee open hearings, the Committee heard comments from Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA. Mr. Vires reported that the SMA supported the item with clarification to the order in which "e" and "d" appear in proposed new paragraph S.1.2.2.2. He stated that the order appeared reversed and further indicated that the SMA recommends the paragraph be made non-retroactive as of January 1, 2020, if adopted.

Mr. Steven Harrington (Oregon), submitter of the item, agreed to the SMA's requests to change the order of "e" and "d" in the proposal and to recommend the paragraph be assigned a nonretroactive date of January 1, 2020. Following the Committee's open hearings, Mr. Harrington submitted amended language to the Committee for consideration that addressed these issues.

Mr. Rick Harshman (NIST, OWM) stated that there may be some misunderstanding concerning how NIST Handbook 44 tolerances and other requirements are intended to apply to Class I and Class II scales equipped with a value of "d" that differs from "e." He provided an overview of how NIST Handbook 44 tolerances are intended to apply such scales. He acknowledged users of the scales are going to read the displays to the smallest increment "d" and the tolerances and test loads specified in Scales Code, Table 6, are based on the value of "e." He noted that, even though the tolerances and test loads are based on "e," the scales should be considered by officials to be noncompliant if during testing the applicable tolerance is exceeded by as little as 1 "d." With respect to the disabling of the smaller value as proposed, Mr. Harshman noted that OWM raised the following questions:

- What must the scale display look like when "d" has been disabled?
- How are officials to test the scale and should "d" be enabled when testing occurs?
- Should the switch that enables and disables "d" be a sealable parameter?

During the Committee's work session, the amended language that had been submitted by Mr. Harrington shortly after the Committee's open hearings, was reviewed by members of the Committee. The revised language reversed the

order in which "d" and "e" had previously appeared in the proposal and eliminated a portion of the proposal that addressed how the smaller value "d" could be disabled.

Mr. Josh Nelson (Oregon) was asked by another Committee member to identify the issue the State of Oregon was attempting to resolve from its submission of the original proposal. Mr. Nelson stated Oregon had discovered in its inspections of scales used commercially to weigh cannabis, that users of the scales were reading them to and basing transactions on the closest value of "d." He stated the value of "d" on a Class I and Class II scale equipped with a value of "d" that differs from "e" was never intended to be used in commercial trade. Mr. Darrell Flocken (NTEP Specialist and NCWM Technical Advisor to the Committee) and Mr. Luciano Burtini (Measurement Canada's Technical Advisor to the Committee) voiced agreement that scale manufacturers did not intend for commercial transactions to be based on the value of "d" on scales equipped with a value of "d" that differed from "e." It is the value of "e" that is intended for use in commercial trade. Mr. Flocken and Mr. Burtini also confirmed agreement with the assessment Mr. Harshman had provided during the Committee's open hearings regarding how Scales Code Table 6. Maintenance Tolerances are to be applied to Class I and Class II scales equipped with a value of "d" that differs from "e."

The discussion of these issues by members of the Committee resulted in a suggestion being made to 1) simplify the proposal by amending it to require only that the value of "d" be equal to "e" on all Class I and II scales used in direct sale applications; and 2) assigning a nonretroactive enforcement date of January 1, 2020, (this being the date suggested by the SMA in comments provided during open hearings). The Committee believed that by assigning a 2020 enforcement date, scale manufacturers would be provided sufficient time to decide how best to design scales to comply with the revised proposal given a particular scale's intended application. Other Committee members agreed this suggestion was a good idea. Mr. Harrington, who was also present during these deliberations, was asked his opinion, and he too voiced agreement. Consequently, the Committee agreed to replace the original proposal with that shown in the "Item under Consideration" and present the item for Vote at the 2017 NCWM Annual Meeting.

During the Committee's open hearings at the 2017 NCWM Annual Meeting, the Committee received mixed comments on this item. There were those who commented that they supported the proposal. Others questioned the rationale and benefit for making changes, with one concern being that the new paragraph, if adopted, might result in the use of a scale with a lower resolution.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported that the SMA supported the item.

Mr. Ross Andersen (New York, Retired) expressed concern that this was "much ado about nothing," stating that there are always issues between resolution and accuracy. Mr. Andersen stated that he doesn't see why the difference between "d" and "e" would cause confusion to anyone in actual use; buyers or sellers. He spoke to there being an advantage to "d" displaying finer than "e," in that it reduced the cost of the value ten times, and that the customer didn't need to know that the tolerance was based on "e." He later returned to the microphone to add that when "d" is smaller than "e," officials can use "d" to refine the tolerance, and he gave some mathematical examples. He wondered if the confusion wasn't more with weights and measures officials than users.

Mr. John Barton said NIST, OWM recognizes Class I and II scales are being used more and more frequently to weigh high-cost items and displaying different increment values for "d" and "e" could very well cause confusion to the customer concerning which value is to be used when determining charges. OWM recommended the Committee, in consideration of the January 1, 2020, nonretroactive date proposed, specify a date to be added to the proposal in which the paragraph is to become retroactive. This is to avoid allowing owners of "pre-2020" Class I or II Scales from being able to use the "d" value (on scales in which "d" and "e" are different) in direct sale applications indefinitely. It would also make possible the elimination of all Class I and II scales equipped with a value of "d" that differs from "e" from direct sale applications at some specified date in the future.

Mr. Barton noted NIST, OWM's understanding of proposed new subparagraph S.1.2.2.2. is that it would require the value of the scale division (d) to be equal to the value of the verification scale interval (e) on Class I and II scales manufactured as of January 1, 2020, when these scales are used in direct sale application. It is also OWM's understanding that deactivation of a "d" resolution on a Class I or II scale equipped with a value of "d" that differs from "e" causes a scale roundoff problem on some scales. That is, once the "d" resolution has been deactivated, "e" values do not round to the nearest minimum increment, which paragraph G-S.5.2.2. Digital Indication and

Representation requires. Due to this possible roundoff problem, NIST, OWM suggested the Committee draft a new proposal to be considered in the next (2018) NCWM cycle prohibiting the deactivation of a "d" resolution on a Class I and II scale equipped with a value of "d" that differed from "e," if such action affects a scale's ability to round digital values to the nearest minimum unit that can be indicated or recorded. NIST, OWM presented the written draft proposal it had developed for the Committee to consider should members of the Committee decide to follow through on NIST, OWM's recommendation.

Mr. Steven Harrington (Oregon), submitter of the item, had reviewed NIST, OWM's suggestions and stated he supported the proposed recommended changes.

Mr. Ken Ramsburg (Maryland) supported the item and reported Maryland is starting into medical marijuana, and he believes this is an important issue.

Ms. Fran Houston (Ohio) stated she initially considered fully supporting the item, but in consideration of the comments offered by Mr. Andersen, she is now able to support only a portion of it. She agreed with Mr. Andersen that viewing of the "d" resolution is important during the testing of such scales and questioned why the "d" resolution couldn't be displayed only on the operator's side of the scale so officials could see it when performing tests. She also reported that Ohio is moving towards allowing medical marijuana and this issue will be of importance.

During the Committee's work session, Ms. Tina Butcher (NIST, OWM's Technical Advisor to the Committee) reiterated NIST, OWM's recommendation provided by Mr. Barton during Committee open hearings that a retroactive date be added to the proposal so all commercial equipment would eventually have to comply with the proposed new requirement (i.e., proposed new paragraph S.1.2.2.2.). Members of the Committee agreed with OWM's assessment that it would be important to include a retroactive date to avoid the indefinite allowance made evident by OWM. Members of the Committee, in considering an appropriate date to include, agreed to the date "2023," with the understanding this date would provide an adequate amount of time for those most affected by this change to comply. Consequently, members of the Committee agreed to amend the proposal to include a date that paragraph S.1.2.2.2. is to become retroactive as shown in the Item Under Consideration and present the item for Vote as amended. The Committee also considered NIST, OWM's recommendation for the Committee to submit a new NCWM proposal prohibiting the deactivation of a "d" resolution on Class I and II scales that fail to round properly once the "d" resolution has been deactivated. Members of the Committee agreed that it would be beneficial to include such a requirement in NIST Handbook 44, but preferred OWM submit the proposal.

Regional Association Comments and Recommendations:
At its 2016 Annual Meeting, the WWMA reported it believes this item may have merit. Per request of the submitter, the WWMA forwarded the item to NCWM and recommended a "Developing" status.

At its fall 2016 Interim Meeting, the CWMA reported it believes it is necessary to clarify which indication shall be used when commercial transactions are conducted using weights from a Class II device. The CWMA forwarded the item to the NCWM and recommended Voting status at both its 2016 Interim and 2017 Annual Meetings.

The SWMA, at its 2016 Annual Meeting, heard comment from Mr. Henry Oppermann (Weights and Measures Consulting) that he appreciates attempting to address the confusion in transactions when *d* is smaller than *e*, but the submitter has a misunderstanding in the relationship between the two. He stated that he is opposed to this item and made a recommendation to keep this item developing; he would not support a Voting status. The SWMA forwarded this item to the NCWM recommending a "Developing" status based on comments received.

NEWMA requested clarification on the "disabling" language in S.1.2.2.2. Class I and II Scales Used in Direct Sales at its fall 2016 Interim Meeting and forwarded this item to NCWM, recommending a "Developing" status. At its 2016 Annual Meeting, NEWMA reported the item has been fully developed and recommended it move forward as a Voting item.

3200-3 V S.1.8.5. RECORDED REPRESENTATIONS, POINT OF SALE SYSTEMS

(This item was returned to Committee.)

Source:
Kansas, Minnesota, and Wisconsin (2017)

Purpose:
Provide verification to consumers through recorded representation that tare has been taken at point of sale for sales from bulk.

Item under Consideration:
Amend NIST Handbook 44, Scales Code as follows:

S.1.8.5. Recorded Representations, Point-of-Sale Systems. – The sales information recorded by cash registers when interfaced with a weighing element shall contain the following information for items weighed at the checkout stand:

(a) the net weight;[1]

(b) the tare weight;[1]

(~~b~~c) the unit price;[1]

(~~c~~d) the total price; and

(~~d~~e) the product class or, in a system equipped with price look-up capability, the product name or code number.

[Non-retroactive January 1, 2020]

(Amended 20XX)

[1] For devices interfaced with scales indicating in metric units, the unit price may be expressed in price per 100 grams. Weight values shall be identified by kilograms, kg, grams, g, ounces, oz, pounds, or lb. *The "#" symbol is not acceptable.*
[Nonretroactive as of January 1, 2006]
(Amended 1995 and 2005)

Background/Discussion:
This proposal would help consumers by enabling them to see at a glance that tare is being taken on the commodities they purchase. It would also educate the public about tare and make them better and more aware consumers.

Retailers would benefit because this proposal would aid their quality control efforts behind the counter and at the cash register. Retailers would be able to see their employees are taking tare on packages, and the tare employees take is an appropriate tare. For example, a meat manager would be able to spot packages of 1 lb hamburger, which had been packaged on the night shift mistakenly using the tare for family packs of chicken, just by walking down the meat counter and noticing a 0.06 lb tare on a package size that would normally have a 0.02 or 0.03 lb tare. The manager could also spot a 0.03 lb tare on packages that should have a 0.06 lb tare. Either way, the manager would be able to remove the items from the shelf and make corrections before the store or its customers were harmed. The manager would also be able to re-educate the employees responsible for the error. This improved quality control and transparency would build consumer confidence in retailers' establishments. It might even reduce the time and disruption retailers experience from official package inspections.

Package checking inspections could potentially be reduced because weights and measures officials could make risk-based assessments on the need to do package checking inspections at any given location. If an official notes gross

weights or tares are visible on all random-weight packages and the tares seem appropriate to the package sizes, the official may be able to skip that location and focus package checking efforts on locations where tares are absent or seem inappropriate for the package sizes. That would be more efficient for both retailers and weights and measures jurisdictions.

Finally, this proposal would aid weights and measures officials investigating complaints about net contents of items by creating written proof of how much tare was taken on a given package or transaction.

Scale manufacturers will need to modify software, label, and receipt designs before the non-retroactive date. Retailers with point-of-sale systems and packaging scales may feel pressured to update software or purchase new devices in response to consumer demand for tare information on labels and receipts. The amount of paper needed to print customer receipts may increase depending on the formatting of the information and the size of the paper being used. Some retailers may not want consumers to have this information as it will allow consumers and weights and measures officials to hold them accountable and would be written proof tare was not taken when, and if, that happens.

During the 2017 NCWM Interim Meeting S&T Committee open hearings, Mr. Doug Musick (Kansas), one of three co-submitters of this item, proposed splitting the item into two separate items: Item 3200-3A and 3200-3B. He suggested Item 3200-3A contain only the changes proposed to existing Scales Code Paragraph S.1.8.5. Recorded Representations, Point-of-Sale Systems, and Item 3200-3B contain only proposed new Scales Code Paragraph S.1.9.3. Recorded Representations, Random Weight Package Labels. Mr. Musick also proposed, for the sake of clarity, removing the term "gross weight" from proposed new subsection "(b)" of paragraph S.1.8.5. Recorded Representation, Point-of-Sale Systems, leaving the term "tare weight" in the subsection and assigning the subsection a non-retroactive enforcement date of January 1, 2020. Mr. Musick commented that the changes proposed to paragraph S.1.8.5., if adopted, would provide consumers the additional sales transaction information needed to determine if an adequate amount of tare was taken on weighed items.

The Committee received numerous comments in support of amending NIST Handbook 44, Scales Code Paragraph S.1.8.5., some of which proposed additional changes to those proposed by the submitters of the item. Ms. Tina Butcher (NIST, OWM), in presenting OWM's comments and recommendations regarding this item, emphasized the need for additional information to be provided on the receipt. She stated it is very difficult for customers at a checkout stand to determine if tare has been taken on products weighed by a store cashier in their presence on POS systems. The display shows only a gross weight when the net weight of each package weighed is the only weight information appearing on the sales receipt. This is especially true, she said, when there are multiple items in a customer's shopping cart to be weighed. Consumers are not always able to focus their attention on the indication when individual items are being weighed and, for systems that do not display both a gross and net weight, to recall those indications when reviewing a sales receipt.

Ms. Butcher noted too, that by allowing either gross weight or tare weight to be recorded on the receipt as proposed, stores would be provided the option of selecting one method over the other. Consequently, competing stores in an area might opt to provide different information on the receipts, thereby, causing customer confusion to those customers that frequent different stores. For this reason, OWM suggested amending the proposal that the receipt provide the gross, tare, *and* net weight. As an alternative to requiring additional information be recorded on the sales receipt, OWM suggested the Committee may wish to draft language to require the *net weight* also be displayed on the indicator of such systems and provide some future date in which these systems must comply.

Officials from several different states highlighted, in comments provided to the Committee, the need for additional information to be provided on the sales receipt to make it possible for consumers to ensure tare had been taken on items weighed at a POS checkout.

Ms. Julie Quinn (Minnesota), co-submitter of the item, in response to OWM's suggestion to alternatively require the net weight be displayed on the indicator, stated that even if a customer can view the tare indication from a POS display, there still needs to be a paper trail of the recorded transaction information for enforcement purposes. She said that she was supportive of splitting the item into two parts so as not to derail moving forward with the changes proposed to paragraph S.1.8.5. She also made note of the existence of labels on packages currently being offered for sale in the marketplace that include recorded tare values.

The Committee received several comments in opposition to adding the proposed new paragraph S.1.9.3. Recorded Representations, Random Weight Package Labels and to agenda Item 3200-3 as a whole.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported that the SMA opposes the agenda item and feels it would be too costly with little benefit.

Mrs. Butcher reported that OWM recommends deleting the proposed new paragraph S.1.9.3. from the proposal because it conflicts with NIST Handbook 130, Uniform Packaging and Labeling Regulation, which requires a declaration of the "net" quantity of contents. Mrs. Butcher made note of a few additional points to consider relating to this portion of the item as follows:

- Those who package products in advance of sale often increase tare values to take into account moisture loss and good distribution practices. Thus, it cannot be determined from a tare value specified on a package how much of the value represents the packaging material and how much represents additional deduction.
- Tare values on packages cannot be enforced and do not provide indication of whether or not the declaration of net contents specified on a package is correct.
- Displaying a declaration of both gross weight and net weight on a package would confuse consumers.

Mr. Ross Andersen (New York, retired) commented that he didn't see a great amount of benefit to Item 3200-3B.

Additionally, the Committee acknowledged receiving written comments from Ms. Elizabeth K. Tansing, on behalf of the Food Marketing Institute (FMI), opposing the item and requesting that the Committee withdraw it (i.e., the item as a whole).

During the Committee's work session, members of the Committee agreed, based on comments received during open hearings, to simply delete proposed new paragraph S.1.9.3. from the proposal, rather than split the agenda item into two separate items as suggested by Mr. Musick during the Committee's open hearings. Members of the Committee also agreed to amend proposed new subsection (b) of paragraph S.1.8.5. by deleting the words "gross weight or" from the proposal and assigning subsection (b) a nonretroactive enforcement date of January 1, 2020. The Committee agreed to present the item, as amended by the Committee, for Vote at the 2017 NCWM Annual Meeting. All the changes agreed to by the Committee are included in the proposal as shown in the Item Under Consideration.

At the 2017 NCWM Annual Meeting open hearings, Ms. Tansing reported the FMI opposes Item 3200-3. Ms. Tansing stated that all tare weights would be required on the receipt, regardless of if it were 1 or 100 weight transactions. FMI could not find one customer that wants tare printed on the receipt. The requirement would be costly to industry (e.g., increased costs for software development, employee training, and consumer education) and the added costs would be passed on to the consumer. Customers have not asked for this information. Chain and single store operators would suffer in trying to comply. In addition to the cost concern, Ms. Tansing stated other consequences of the proposal would be more paper used in receipts and longer wait times for customers.

Mr. Russ Vires (Mettler-Toledo, LLC) speaking on behalf of the SMA reported that the SMA opposes Item 3200-3. The implementation cost would be prohibitive for industry and retailers, and the cost would be passed on to consumers who would receive little or no benefit.

Mr. John Barton (NIST, OWM) commented that it is extremely difficult for customers at a checkout stand to determine whether tare has been taken on packages weighed by a store cashier in their presence when the weight display of the POS system provides only an indication of the gross weight and the net weight of those same packages gets recorded on the sales receipt, which is provided to the customer after all items have been priced. Consumers are not always able to focus their attention on the indication when individual items are being weighed and recall those indications when reviewing a sales receipt. This is especially true when there are multiple items in a customer's shopping cart to be weighed. The proposed item would benefit consumers and provide more information for investigations of consumer complaints.

Mr. Tim Chesser (Arkansas) stated his concerns with this requirement resulting in requirements for all packages to have tare weights printed on the package label. Arkansas receives very few complaints on net weight and for these reasons Arkansas opposes this item.

Mr. Matthew Morris (Nebraska Grocers Association) opposes this item. The requirement places a burden on retailers and would be costly for consumers. Very few complaints have been received, and this would create mass confusion for consumers.

Ms. Julie Quinn (Minnesota) commented that printing tare values on POS register receipts is a tool for regulators and store managers to audit how personnel are doing with taking tares. Consumers deserve to be protected. This is a non-retroactive requirement that impacts equipment installed after the non-retroactive date.

One of the original submitters, Mr. Doug Musick (Kansas), showed a video with mathematical examples of the overcharges for several produce transactions. The video highlighted how difficult it is to tell if tare was taken and if taken correctly. Mr. Musick stated the proposed requirement is simple, inexpensive to implement, and would provide equity in the marketplace. Mr. Loren Minnich (Kansas) also commented on the video, stating that if customers were asked if they wanted to be charged correctly they would say "yes," regardless if they knew what the term "tare" meant. Mr. Minnich also said that many grocers deliver products from the store to customers' homes and customers are not present during the weighment of these items to witness whether tare was taken or not during the transaction.

Mr. Bart O'Toole (Nevada) supports the item and commented that this requirement also involves other retailers outside of grocery stores. He gave a personal example of being overcharged at a frozen yogurt store because they failed to deduct tare for cup containers.

The Committee heard numerous comments from regulatory jurisdictions and consumers in support of this item.

No changes were made to the item. However, the Committee elected to delete S.1.9.3. Recorded Representations, Random Weight Package Labels from the title of the item since the Committee had earlier agreed at the 2017 NCWM Interim Meeting to delete proposed new paragraph S.1.9.3. from the proposal. Consequently, the paragraph name should also no longer appear as part of the title of the proposal. The Committee agreed to present the item for Vote.

Technical Advisor's Note: Shortly following the 2017 NCWM Annual Meeting, the Committee received a request from Kansas and Minnesota (two of the three original submitters of the item) to amend the proposal to better clarify "the tare weight" portion of the information to be included on the receipt is being proposed as a nonretroactive requirement. That is, the "tare weight" information on items weighed at a checkout stand would be required to be recorded on the receipts generated from POS systems that meet any of the four conditions specified in paragraph G-A.6. nonretroactive requirements as of the effective date of the requirement. The two states, to clarify that the change to paragraph S.1.8.5. is nonretroactive, proposed repositioning item (b), in the list of information required to be printed, to (d) so that "the tare weight" portion of the information required would appear at the very bottom of the list and directly above the nonretroactive date proposed. The submitters also requested the enforcement date specified in the original proposal be extended an additional two years (i.e., until 2022); this extension is proposed in consideration of some of the concerns raised by FMI and other industry representatives during the Committee's open hearings relating to the cost of implementation and the burden the changes would impose on grocery businesses having to comply with them. The submitters reported they had decided to extend the effective date of enforcement so that the cost of implementation could be spread over a longer period. A final suggested change was to amend the "Purpose" section of the item in the Committee's agenda to better reflect the true intent of the proposal; that is, to provide consumers the same opportunity afforded them by other scales that are used for direct sales (e.g., a retail-computing scales used to weigh lunch meat, cheeses, etc.) to be able to easily recognize that a tare deduction for packaging material, etc., is taken on items weighed in their presence. The State of Wisconsin, upon being contacted by Kansas and Minnesota and asked to consider these changes, reported that it wished to bow out of further involvement with the item.

The Committee, in considering the changes proposed to the item and the rationale provided by the submitters for requesting them, concurred that they were appropriate. Consequently, the Committee agreed to amend the proposal and replace the text in the "Purpose Section" as requested by the submitters and recommend the item move forward for consideration as follows:

Purpose:
Provide consumers the same opportunity to be able to easily verify whether tare is taken on items weighed at a checkout stand using a POS system, which is currently afforded to them when witnessing items being weighed and priced in their presence using other scales in the store.

Item under Consideration:
Amend NIST Handbook 44, Scales Code as follows:

S.1.8.5. Recorded Representations, Point-of-Sale Systems. – The sales information recorded by cash registers when interfaced with a weighing element shall contain the following information for items weighed at the checkout stand:

(a) the net weight;[1]

(b) the unit price;[1]

(c) the total price; and

(d) the product class or, in a system equipped with price look-up capability, the product name or code number.

(e) ***the tare weight[1]***

[Non-retroactive January 1, 2022]

(Amended 20XX)

[1] For devices interfaced with scales indicating in metric units, the unit price may be expressed in price per 100 grams. Weight values shall be identified by kilograms, kg, grams, g, ounces, oz, pounds, or lb. *The "#" symbol is not acceptable.*
[Nonretroactive as of January 1, 2006]
(Amended 1995 and 2005)

Regional Association Comments and Recommendations:
At its 2016 Annual Meeting, the WWMA reported it believes the addition to section S.1.8.5. has merit and should be considered as a voting item. However, it also believed Section S.1.9.3. should be withdrawn and perhaps a better place for this consideration would be with the L&R Committee. The WWMA forwarded the item to NCWM and recommended that it be a voting item as modified below.

S.1.8.5. Recorded Representations, Point-of-Sale Systems. – The sales information recorded by cash registers when interfaced with a weighing element shall contain the following information for items weighed at the checkout stand:

(a) the net weight;[1]

(b) the gross weight or tare weight;[1]

(~~b~~**c**) the unit price;[1]

(~~c~~**d**) the total price; and

(~~d~~**e**) the product class or, in a system equipped with price look-up capability, the product name or code number.

[Non-retroactive January 1, 20XX]

[1] For devices interfaced with scales indicating in metric units, the unit price may be expressed in price per 100 grams. Weight values shall be identified by kilograms, kg, grams, g, ounces, oz, pounds, or lb. *The "#" symbol is not acceptable.*
[Nonretroactive as of January 1, 2006]
(Amended 1995 and 2005)

And

S.1.9.3. Recorded Representations, Random Weight Package Labels. A prepackaging scale or a device that produces a printed ticket as the label for a random weight package shall produce labels which must contain the following information:

(a) the net weight;[1]

(b) the gross weight or tare weight;[1]

(c) the unit price;[1]

(d) the total price; and

(e) the product class or, in a system equipped with price look-up capability, the product name or code number.

[Non-retroactive as of January 1, 20XX]

At its fall 2016 Interim Meeting, the CWMA reported it believes that this code requirement provides consumers with the necessary information to determine if tare is taken when an item is pre-packaged or at the point of sale. At its spring 2017 Annual Meeting, the CWMA reported it believes this will be a benefit to consumers and regulatory officials as well. CWMA forwarded this item to NCWM and recommended Voting status at both its 2016 Interim and 2017 Annual Meetings.

The SWMA, at its 2016 Annual Meeting, did not receive comments on this item and requested the submitters provide information based on costs involved, in particular for the POS component. The SWMA forwarded the item to NCWM and recommended Developing status.

At its fall 2016 Interim Meeting, NEWMA reported it believes the upgrade to POS systems, education to all store owners – large and small grocery stores, time to implement, and confusion of the customer are a concern. NEWMA did not forward this item to NCWM and recommended it be Withdrawn. At its 2017 Annual Meeting, NEWMA reported there was some discussion questioning the benefit of the item; however, it agreed to recommend it move forward as a Voting item.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf**.

3200-4 D TABLE 3, PARAMETERS FOR ACCURACY CLASSES (SEE RELATED ITEM 3200-8)

Source:
Meridian Engineers Pty Ltd. (2017)

Purpose:
Reduce the required minimum scale division value for coupled-in-motion railroad weighing systems that are not used for static reference weighing.

Item under Consideration:
Amend NIST Handbook 44, Scales Code as follows:

Table 3.
Parameters for Accuracy Classes

Class	*Value of the Verification Scale Division (d or e[1])*	*Number of Scale[4] Divisions (n)*	
		Minimum	*Maximum*
SI Units			
I	*equal to or greater than 1 mg*	*50 000*	--
II	*1 to 50 mg, inclusive*	*100*	*100 000*
	equal to or greater than 100 mg	*5 000*	*100 000*
III[2,5]	*0.1 to 2 g, inclusive*	*100*	*10 000*
	equal to or greater than 5 g	*500*	*10 000*
III L[3]	*equal to or greater than 2 kg*	*2 000*	*10 000*
IIII	*equal to or greater than 5 g*	*100*	*1 200*
U.S. Customary Units			
III[5]	*0.0002 lb to 0.005 lb, inclusive*	*100*	*10 000*
	0.005 oz to 0.125 oz, inclusive	*100*	*10 000*
	equal to or greater than 0.01 lb	*500*	*10 000*
	equal to or greater than 0.25 oz	*500*	*10 000*
III L[3]	*equal to or greater than 5 lb*	*2 000*	*10 000*
IIII	*greater than 0.01 lb*	*100*	*1 200*
	greater than 0.25 oz	*100*	*1 200*

[1] For Class I and II devices equipped with auxiliary reading means (i.e., a rider, a vernier, or a least significant decimal differentiated by size, shape, or color), the value of the verification scale division "e" is the value of the scale division immediately preceding the auxiliary means.

[2] A Class III scale marked "For prescription weighing only" may have a verification scale division (e) not less than 0.01 g.
(Added 1986) (Amended 2003)

[3] The value of a scale division for crane and hopper (other than grain ***hopper*** **and coupled-in-motion railroad weighing systems (not used for static reference weighing)** *scales shall be not less than 0.2 kg (0.5 lb). The minimum number of scale divisions shall be not less than 1000.*

[4] On a multiple range or multi-interval scale, the number of divisions for each range independently shall not exceed the maximum specified for the accuracy class. The number of scale divisions, n, for each weighing range is determined by dividing the scale capacity for each range by the verification scale division, e, for each range. On a scale system with multiple load-receiving elements and multiple indications, each element considered shall not independently exceed the maximum specified for the accuracy class. If the system has a summing indicator, the n_{max} for the summed indication shall not exceed the maximum specified for the accuracy class.
(Added 1997)

[5] The minimum number of scale divisions for a Class III Hopper Scale used for weighing grain shall be 2000.)

[*Nonretroactive as of January 1, 1986*]
(Amended 1986, 1987, 1997, 1998, 1999, 2003, and 2004)

Background/Discussion:
The content of NIST Handbook 44 has been driven by the ongoing development of weighing devices. This is quite apparent when viewed for the purpose of certifying in-motion rail weighing systems. These devices have been developed from static, platform-type scales, which utilize one or more very accurate load cells, and the handbook seems to assume the devices will also be used for static reference weighing.

Meridian Engineers asks the NCWM to consider Meridan's in-motion rail weighing system, which has been in production and development for 15 years. It already has trade approval in Australia (National Measurement Institute) and the EU (National Measurement Regulation Office), and they are now looking to gain NTEP Certification.

The product utilizes what they refer to as bolt-on transducers, which make the rail a pseudo load cell. They are not designed to be used as a conventional load cell, which can be connected to a standard load cell indicator. They are only designed for the end application; that is, coupled-in-motion train weighing. Furthermore, their product is not attempting to perform static reference weighing.

Because Meridian bolts their transducers onto an existing railway line, they cannot change its sectional properties to increase performance or accuracy. Also, their transducers do not carry zero-shift compensation because the overall system is constantly digitally zeroing the system typically after every fourth axle weighed. Hence, there has been no need to incorporate conventional zero-shift compensation into the manufacturing of our transducers.

In this application, the errors from the quality of the rolling stock, the track foundation condition, as well as how smoothly the locomotive drives across the system are significantly higher than the individual class IIIL permissible errors.

All this means the accuracy of their "load cell" would struggle to meet Class IIIL requirements as they currently stand. Yet the submitter states the accuracy of their system is as good as any system designed with Class IIIL load cells for coupled in-motion weighing.

The requirement to have load cells pass IIIL accuracy requirements for coupled in-motion train weighing is not appropriate and restricts the design of the final system to more conventional platform style systems, which is detrimental to innovation. This requirement is too stringent, and the submitter would argue the final accuracy of the complete system should dictate how accurate the load cells need to be.

At the 2017 NCWM Interim Meeting, the Committee grouped agenda Items 3200-4 and 3200-8 together and took comments on these items simultaneously because it considered them related.

Mr. Richard Suiter (Richard Suiter Consulting) gave a short presentation on behalf of Meridian Engineers Pty Ltd. that provided an indication how the Meridian Engineering equipment functioned and showed some of the test data Meridian had collected to support the changes proposed. Mr. Suiter said the proposed changes would harmonize the tolerances for in-motion railroad weighing systems in NIST Handbook 44 with those in OIML R 106, Automatic Rail-Weighbridges. Mr. Suiter acknowledged that the impact of changing the Handbook 44 tolerances is not yet fully known and needed further study. Mr. Anthony Pruiti (Meridian Engineers Pty Ltd.) stated he intended to continue working on this item and planned to have more information available at the upcoming NCWM Annual meeting.

Ms. Tina Butcher (NIST, OWM) noted, while establishing different accuracy classes for weighing devices would not be unprecedented, if this were done specifically for coupled-in-motion railroad weighing systems as proposed, each accuracy class would also need to define the application of the weighing systems assigned that accuracy class. She further noted, while OWM could envision this possibly being done, it questioned the need for the proposed changes and wished to defer opinion until more information has been made known justifying the reason.

Mr. Rafael Jimenez (Association of American Railroad Transportation Technology Center [AAR]) commented that the AAR takes no position on this item and the American Railway Engineering and Maintenance-of-Way Association's (AREMA) Committee 34 planned to review and analyze the test data, which had been collected on the Meridian systems.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, stated that the SMA takes no position on this group of items. This is a significant change to the code, and the impacts are not fully known. The proposal introduces new classes and changes the concept of a scale being comprised of an NTEP-certified indicator, a weighing/load receiving element, and load cell(s). The SMA looks forward to the review and input from other interested stakeholders.

A regulatory official from Oregon cautioned against "relaxing" the tolerances and the negative impact such action would have on customers.

Mr. Steve Beitzel (Systems Associates, Inc.) stated the railroad weighing systems offered by Systems Associates can consistently pass the current tolerances in NIST Handbook 44. Adoption of these proposals would create an unfair playing field and an imbalance in the market. He said when Systems Associates installs a railroad weighing system outside the United States, it tests those weighing systems using U.S. tolerances.

It was noted, during the Committee's work session, this item did not appear on the regional agendas of the S&T Committee in three of the four regional weights and measures association meetings. In consideration of the comments received during the open hearings, the Committee agreed to assign a "Developing" status to the two items in this group.

At the Committee's 2017 NCWM Annual Meeting open hearings, the Committee grouped agenda Items 3200-4 and 3200-8 together and took comments on the two items at the same time. A rather lengthy presentation was given by the item's submitter, Mr. Anthony Pruity (Meridian Engineers Pty Ltd.). The presentation provided an explanation for the changes being proposed and Meridian's perspective supporting the changes. The changes, if adopted, would align the performance requirements corresponding to coupled-in-motion (CIM) railroad weighing systems in NIST Handbook 44 with those in OIML R 106 Automatic rail-weighbridges. OIML R 106 provides multiple accuracy classes for CIM railroad weighing, whereas, Handbook 44 currently provides only a single accuracy class. The Committee received few comments after Mr. Pruiti's presentation, and these were mostly questions repeated from one or more of the recent regional weights and measures association meetings. Examples of questions include:

- If this scale in not capable of meeting NIST Handbook 44 (Table 3) Parameters for Accuracy Classes, what can of worms will we be opening? What will be changed?
- Will this be beneficial?
- Does this tighten accuracy classes?

The Committee agreed to maintain the Developing status of this item based on the comments received.

Regional Association Comments and Recommendations:
At its 2017 Annual Meeting, the CWMA recommended Withdrawing this item based on input received from industry representatives, the lack of data associated with this system, and the possible inequity among similar systems that this item could create. The CWMA reported it believes this is an unnecessary change to the handbook.

NEWMA reported at its 2016 Interim Meeting that the item is not so pertinent in the Northeast, but other regions may benefit from the proposal. So, NEWMA forwarded the item to NCWM and recommended a Developing status. This item did not appear on the Committee's agenda at NEWMA's fall 2016 Interim Meeting. At its 2017 Annual Meeting, NEWMA reported this item requires further development from the submitter, or the submitter needs to specify they are not willing to develop the item any further in order for it to be moved to Voting. Consequently, NEWMA recommended the item move forward as a Developing item on the NCWM agenda.

3200-5 D TABLE 3, PARAMETERS FOR ACCURACY CLASSES (SEE RELATED ITEMS 3100-1 AND 3600-2)

Source:
Ross Andersen, Retired (2017)

Purpose:
Address application of the code requirements across multiple devices.

Item under Consideration:
Amend NIST Handbook 44, Scales Code as follows:

Table 3. *Parameters for Accuracy Classes*			
Class	***Value of the Verification Scale Division (d or e[1])***	***Number of Scale[4] Divisions (n)***	
		Minimum	***Maximum***
SI Units			
I	*equal to or greater than 1 mg*	*50 000*	--
II	*1 to 50 mg, inclusive*	*100*	*100 000*
	equal to or greater than 100 mg	*5 000*	*100 000*
III[2,5]	*0.1 to 2 g, inclusive*	*100*	*10 000*
	equal to or greater than 5 g	*500*	*10 000*
III L[3]	*equal to or greater than 2 kg*	*2 000*	*10 000*
IIII	*equal to or greater than 5 g*	*100*	*1 200*
U.S. Customary Units			
III5	*0.0002 lb to 0.005 lb, inclusive*	*100*	*10 000*
	0.005 oz to 0.125 oz, inclusive	*100*	*10 000*
	equal to or greater than 0.01 lb	*500*	*10 000*
	equal to or greater than 0.25 oz	*500*	*10 000*
III L3	*equal to or greater than 5 lb*	*2 000*	*10 000*
IIII	*greater than 0.01 lb*	*100*	*1 200*
	greater than 0.25 oz	*100*	*1 200*

[1] For Class and II devices equipped with auxiliary reading means (i.e., a rider, a vernier, or a least significant decimal differentiated by size, shape, or color), the value of the verification scale division "e" is the value of the scale division immediately preceding the auxiliary means.

[2] A Class III scale marked "For prescription weighing only" may have a verification scale division (e) not less than 0.01 g.
(Added 1986) (Amended 2003)

[3] The value of a scale division for crane and hopper (other than grain hopper) scales shall be not less than 0.2 kg (0.5 lb). The minimum number of scale divisions shall be not less than 1000.

[4] On a multiple range or multi-interval scale, the number of divisions for each range independently shall not exceed the maximum specified for the accuracy class. The number of scale divisions, n, for each weighing range is determined by dividing the scale capacity for each range by the verification scale division, e, for each range. ~~***On a scale system with multiple load-receiving elements and multiple indications, each element considered shall not independently exceed the maximum specified for the accuracy class. If the system has a summing indicator, the n_{max} for the summed indication shall not exceed the maximum specified for the accuracy class.***~~
(Added 1997) **(Amended 20XX)**

[5] The minimum number of scale divisions for a Class III Hopper Scale used for weighing grain shall be 2000.)

[*Nonretroactive as of January 1, 1986*]
(Amended 1986, 1987, 1997, 1998, 1999, 2003, and 2004)

Background/Discussion:
This item was submitted as a companion item to agenda Items 3100-1 and 3600-2. See agenda Item 3100-1 of this report for additional Background/Discussion information for this item.

As reported under agenda Item 3100-1, the Committee agreed to carryover this group of items on its agenda as Developing items to allow Mr. Andersen the opportunity to further develop and garner support for his proposals.

Regional Association Comments and Recommendations:
This item did not appear on the (regional) Committee's agenda at the WWMA's 2016 Annual Meeting.

At the CWMA's fall 2016 Interim Meeting, the Committee believed this item to be fully developed and forwarded it to NCWM with the recommendation of Voting status. At its spring 2017 Annual Meeting, the CWMA reported, based on the amount of opposition to this item as written, it recommends this to remain a Developing item, and for the submitter to rewrite portions of this item to address the possible restrictions related to the use of multiple scales operating using internal resolution to create an additional scale that provides the total weight value.

The SWMA batched items 3100-1, 3200-5, and 3600-2 together at its 2016 Annual Meeting and heard comments for all at the same time. Mr. Henry Oppermann (Weights and Measures Consulting) disagrees with these items and opposes their use. He recommends Withdrawing all three items in this batch. Mr. Oppermann contends they violate the principles of NIST Handbook 44. He further contends this should be based on performance and not design. Mr. Oppermann concluded by stating the submitter misinterpreted the WELMEC guidelines and multiplatform truck scales used together must function as a single scale. The Committee did not forward these items to NCWM and recommends they be Withdrawn because the proposed language is unnecessary.

At its fall 2016 Interim Meeting, NEWMA reported the Committee believes this item has merit but would like an example of how this applies to independent/multiple devices. At its spring 2017 Annual Meeting, NEWMA reported the item was not ready for Vote given impending changes agreed to by the item's submitter. NEWMA forwarded the item to NCWM and recommended Developing status at both meetings.

3200-6 W N.1. TEST PROCEDURES

(This item was Withdrawn.)

Source:
RAVAS Europe b.v. (2017)

Purpose:
Provide safe test procedures for one-side supported mobile weighing systems such as forklift scales.

Item under Consideration:
Amend NIST Handbook 44, Scales Code as follows:

N.1.1. Increasing-Load Test. – The increasing-load test shall be conducted on all scales with the test loads approximately centered on the load-receiving element of the scale **or for forklift scales approximately centered on the load-gravity point as prescribed by the typeplate of the truck,** except on a scale having a nominal capacity greater than the total available known test load. When the total test load is less than the nominal capacity, the test load is used to greatest advantage by concentrating it, within prescribed load limits, over the main load supports of the scale.

N.1.2. Decreasing-Load Test (Automatic Indicating Scales – The decreasing-load test shall be conducted with the test load approximately centered on the load-receiving element of the scale **or for forklift scales approximately centered on the load-gravity point as prescribed by the typeplate of the truck.**

N.1.3.2. Equal-Arm Scales. – A shift test shall be conducted with a half-capacity test load centered successively at four points positioned equidistance between the center and the front, left, back, and right edges of each pan as shown in the diagrams below. An equal test load shall be centered on the other pan.

For forklift scales front and back shift test shall be conducted with a half-capacity test load centered successively at the front and back edges of the pallet. For safety reasons the shift test shall not be

performed for the left and right sides of the pallet since the pallet is hanging in the air and has no support on those sides.

Background/Discussion:
During an NTEP evaluation of a forklift scale, a dangerous situation arose during the shift test when the "left" and "right" side shift tests were performed with a half-capacity test load. The pallet on which the test weights were placed was not supported adequately in that direction and tended to tip over. To prevent accidents from happening with inspectors in the field, the submitter advises skipping this side-shift test and concentrating on the front/back shift test because that's more in accordance with the practical use of the forklift truck.

Safety should be a priority. In practice, forklifts are never loaded sideways because the load could be dropped when turning the vehicle, possibly damaging valuable goods.

During the Committee's opening hearings at the 2017 NCWM Interim Meeting, comments were heard from representatives of NIST and the SMA.

Mr. John Barton (NIST, OWM) stated NIST, OWM recognizes the unique design characteristics of the load-receiving elements associated with on-board weighing systems (which include forklift scales), and believes it is appropriate for testing be performed in consideration of the design of a device. He noted the proposal omits testing involving centering the test load to either side (right or left) of the load-receiving element due to safety concerns; testing needs to encompass the usual and customary manner in which a device is used. Normal use would predictably include loads concentrated on either side of the load-receiving element and if so, practical procedures that do not compromise safety should be developed and provided. He further noted NCWM Publication 14 contains procedures for conducting shift tests on forklift scales and said it may be appropriate to include those procedures in the proposal.

With respect to the two-sentence paragraph proposed for addition to existing paragraph N.1.3.2. Equal-Arm Scales, Mr. Barton noted it is more appropriately associated with paragraph N.1.3.6. Vehicle On-Board Weighing Systems, which already includes some details regarding shift-tests for this type of device. Mr. Barton also noted some of the verbiage in the proposal (e.g., "load-gravity point") is not clearly understood and may need to be defined in NIST Handbook 44.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported that the SMA supports this item with the following recommended change:

- remove the proposed language in N.1.1. and N. 1.2.; and
- create a new subsection N.1.3.X. for the proposed paragraph currently listed under N.1.3.2 Equal-Arm Scales.

In consideration of the discrepancies identified by those offering comments to the Committee on this item and the need to further develop the proposal, the Committee agreed to assign this item a "Developing" status.

Prior to the 2017 NCWM Annual Meeting, the Committee received an e-mail from Mr. Michel Rijk (RAVAS) requesting clarification on the out-of-level calculations, specifically converting percentage off level to degrees of tilt. He also asked that the proposal be Withdrawn from the Committee's agenda.

The Committee agreed to Withdraw this item during the 2017 NCWM Annual Meeting after receiving a request to do so from the submitter of the item.

Regional Association Comments and Recommendations (Fall 2016 Conferences):
The WWMA reported at its 2016 Annual Meeting that it recognizes safety is important and perhaps the concept of the submission has merit. However, this submission uses several names for forklift scales, none of which are believed to be correct or defined. It asks for information be added to the nameplate that is not regulated by NIST Handbook 44. How to safely test this type of device could be explained in the Examination Procedure Outline (EPO). The WWMA recommended Withdrawing the item.

The CWMA reported at its fall 2016 Interim Meeting it believes this item has merit, but additional tests may need to be developed to evaluate the ability of these devices to adjust the weighing element from side to side and in a tilting motion forward and back. The CWMA recommended at its spring 2017 Annual Meeting removing the proposed language shown in N.1.1. and N.1.2. and creating a new subsection N.1.3.X for the proposed paragraph currently listed under N.1.3.2 Equal Arm Scales. The CWMA recommended at both meetings for this item to be forwarded to the NCWM as a Developing item.

The SWMA did not receive comments on this item at its 2016 Annual Meeting and reported it believes it would be better addressed in an EPO. The SWMA did not send this item to NCWM and recommended for it be Withdrawn.

NEWMA reported at its fall 2016 Interim Meeting that it believes the test procedures are adequate in this section. NEWMA did not forward this item to NCWM and recommended it be Withdrawn. At its spring 2017 Annual Meeting NEWMA recommended the item move forward as Developing and reported that the item requires further development from the author, or the author needs to state he is not willing to develop it any further for it to be moved to voting.

3200-7 W T.1. GENERAL AND T.N.2.1. GENERAL (SEE RELATED ITEMS 3201-1, 3204-1, 3205-2, 3508-2, 3509-1 AND 3600-4)

(This item was Withdrawn.)

Source:
Mr. Ross Andersen, Retires (2017)

Purpose:
Provide language in this code that is consistent with the General Code.

Item under Consideration:
Amend NIST Handbook 44 Scales Code as follows**:**

T.1. General. – **The tolerances hereinafter prescribed shall be applied equally to errors of underregistration and errors of overregistration.** The tolerances applicable to devices not marked with an accuracy class shall have the tolerances applied as **are as** specified in Table T.1.1. Tolerances for Unmarked Scales.

T.N.2.1. General. – The tolerance values are positive (+) and negative (−) **hereinafter prescribed shall be applied equally to errors of underregistration and errors of overregistration** with the weighing device adjusted to zero at no load. When tare is used, the tolerance values are applied from the tare zero reference (zero net weight indication); the tolerance values apply to the net weight indication for any possible tare load using certified test loads.'

(Amended 2008)

Background/Discussion:
The submitter (Mr. Ross Andersen) provided the following comments:

General Code Paragraph **G-T.3. Application** explains that tolerances in the Handbook are expressed either in excess/in deficiency or, on overregistration/on underregistration. For the most part, one of these two formats are used in each code as applicable. Specifically, one of the Tolerance paragraphs in each code has a specific statement along the lines of:

> The tolerances hereinafter prescribed shall be applied equally to errors of underregistration and errors of overregistration or the tolerances hereinafter prescribed shall be applied equally to errors in excess and errors in deficiency.

However, I was reviewing tolerances in a few codes and noticed that there were codes that were not consistent with these two formats. I am proposing the S&T Committee amend the code where necessary to make all

codes consistent with G-T.3. I have identified those codes in the table below. In all cases the tolerances are clearly meant to be or overregistration/underregistration in these codes, but the text in the code either has no specified format or just describes the tolerances as positive and negative.

2.20.	Scales	not specified & positive/negative
2.21.	Belt-Conveyor	not specified
2.24.	AWS	positive/negative
2.25.	Weigh-in-Motion	not specified
5.58.	MDMD	not specified
5.59.	Electronic Livestock, Meat, etc.	not specified

I note that describing tolerances as positive and negative is relative and can mean different things to different people. One person's plus can be another's minus. That is not a desirable situation. The use of "in excess," "in deficiency, "on overregistration," or "on underregistration" eliminate that ambiguity.

Note that our convention in the United States is to express LMD errors as "errors in delivery" while most other codes we express "errors in indication." G-T.3. is referring solely to errors in indication. For example, a dispenser test at 5 gal that is in error by − 3 in^3 is overregistering. In contrast, a scale test at 5 lb that is in error by − 0.03 lb is underregistering. The distinction is most critical when the code does not apply tolerances equally to overregistration and underregistration.

It turns out the codes that do not specify the tolerance application format all apply the tolerances equally to overregistration/underregistration, so I believe these changes would be entirely editorial. I would further recommend that any "+/−" designation in the tolerance values or tables be eliminated as they are redundant and inconsistent with the principles in G-T.3.

In a related item, I believe it is necessary to bring the definition of overregistration/underregistration in line with modern measurement terminology. The definition now uses the expression "true value" in its examples. My understanding is that the expression "true value" is highly discouraged mainly because no one knows what it really is. I am suggesting that we replace "true value" with "verified value" as indicated below. I opted for "verified" since we added the term verification to the HB44 definitions just a few years ago.

The proposed changes would make the Handbook treatment of tolerances consistent with G.T.3. It might be possible to make these changes editorially if the Committee agrees. However, because the deadline for proposals for the 2017 cycle nears, I am submitting this as a formal proposal.

At the 2017 NCWM Interim Meeting, the Committee grouped agenda Items 3200-7, 3201-1, 3204-1, 3205-2, 3508-2, 3509-1, and 3600-4 together and took comments on these items simultaneously because it considered them related.

The Committee received comments from Ms. Tina Butcher (NIST, OWM), who reported OWM believes the application of tolerances is already adequately addressed in the General Code of NIST Handbook 44 and the changes being proposed to the different device codes is unnecessary. She also indicated that perhaps a more practical solution, should the concepts of overregistration and underregistration not be understood, would be to amend the definitions of these terms in Handbook 44.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported that the SMA took no position on this group of items.

Mr. Ross Andersen (New York, retired) stated he had submitted these proposals in an attempt to make the language in the different codes of NIST Handbook 44 consistent. The meaning of the terms "underregistration" and "overregistration" is confusing to officials because of the way they typically view the errors observed during the

testing of different device types. He offered the following two examples to substantiate his comment that the meaning of the two terms is confusing:

1. The direction of error observed during a scale test is typically determined relative to the indication (i.e., error of indication) when a test weight is applied. Thus, a plus error occurs when a scale provides an indication greater than the value of the test weights applied, and for this reason, the scale is said to be "*overregistering*" (i.e., registering more than the amount of test weight applied).

2. In contrast, the direction of error observed during the testing of a liquid-measuring device using a volumetric prover is typically determined relative to the amount of product delivered (i.e., error of delivery) into the prover during a test. Thus, a plus error occurs when the amount of product delivered into the prover is more than the amount indicated by the device being tested, and for this reason, the device is said to be "*underregistering*" (i.e., registering less than the amount delivered).

Mr. Andersen noted that all errors in OIML Recommendations are considered "errors of indication," thus, providing for a uniform way of expressing errors.

During the Committee's work session, the Committee agreed that uniform language in the codes is good when the application is such that there is enough commonality to permit it. However, with this proposal, the Committee felt the changes would potentially lead to confusion in codes, which currently have adequate language to facilitate application and the changes were unnecessary. Ultimately, the Committee agreed to Withdraw these items.

Regional Association Comments and Recommendations (Fall 2016 Conferences):
The CWMA believes the existing language is sufficient, and this item should be Withdrawn. The CWMA did not forward this item to the NCWM.

The SWMA batched Items 3200-7, 3201-1, 3204-1, 3205-2, 3508-2, 3509-1, and 3600-4 together and heard comments for all items at the same time. Mr. Rick Kimsey (Florida) stated Florida doesn't disagree with the items in the batch, but doesn't think they are necessary. He further stated the intent is already implied in the existing codes as written and adoption of these items could lead to confusion. The SWMA did not forward these items to the NCWM and recommended they be Withdrawn because the intent already exists.

The NEWMA believes this proposal has merit with making language uniform but the interpretation when applying errors of "overregistration" and errors of "underregistration" or in excess/in deficiency could lead to confusion. NEWMA forwarded the item to the NCWM and recommended a Developing status.

3200-8 D T.N.3.6. COUPLED-IN-MOTION RAILROAD WEIGHING SYSTEMS (SEE RELATED ITEM 3200-4)

Source:
Meridian Engineers Pty Ltd. (2017)

Purpose:
Align the acceptance tolerance values and assign accuracy classes for coupled-in-motion railroad weighing systems with OIML R 106-1 Edition 2011 (E) Automatic rail-weighbridges.

Item under Consideration:
Amend NIST Handbook 44, Scales Code as follows:

T.N.3.6. Coupled-In-Motion Railroad Weighing Systems. ~~— The maintenance and acceptance tolerance values for the group of weight values appropriate to the application must satisfy the following conditions:~~

~~T.N.3.6.1. — For any group of weight values, the difference in the sum of the individual in-motion~~ ~~car weights of the group as compared to the sum of the individual static weights shall not exceed 0.2 %.~~

~~**T.N.3.6.2. If a weighing system is used to weigh trains of five or more cars, and if the individual car weights are used, any single weight value within the group must meet the following criteria:**~~

~~**(a) no single error may exceed three times the static maintenance tolerance;**~~

~~**(b) not more than 5 % of the errors may exceed two times the static maintenance tolerance; and**~~

~~**(c) not more than 35 % of the errors may exceed the static maintenance tolerance.**~~
~~**(Amended 1990 and 1992)**~~

~~**T.N.3.6.3. For any group of weight values wherein the sole purpose is to determine the sum of the group, T.N.3.6.1. alone applies.**~~
~~**(Amended 1990)**~~

~~**T.N.3.6.4. For a weighing system used to weigh trains of less than five cars, no single car weight within the group may exceed the static maintenance tolerance.**~~
~~**(Amended 1990 and 1992)**~~

T.N.3.6.1. Accuracy Classes Systems are divided into four accuracy classes as follows:

0.2 0.5 1 2

A system may be in a different accuracy class for wagon weighing than that for train weighing.

T.N.3.6.2. Tolerance Values – The acceptance and maintenance tolerance values shall be as specified in Table T.N.3.6. below:

Table T.N.3.6.
Percentage of Mass of Single Wagon or Train as Appropriate

Accuracy Class	Acceptance Tolerance	Maintenance Tolerance
0.2	0.10 %	0.20 %
0.5	0.25 %	0.50 %
1	0.50 %	1.00 %
2	1.00 %	2.00 %

T.N.3.6.3. Wagon Weighing – The tolerance value for uncoupled or coupled wagon weighing shall be one of the following values, whichever is greater:

(a) the value calculated according to the appropriate accuracy class in Table T.N.3.6., rounded to the nearest scale interval;

(b) the value calculated according to the appropriate accuracy class in Table T.N.3.6., rounded to the nearest scale interval for the mass of a single wagon equal to 35 % of the maximum wagon mass (as inscribed on the descriptive markings); or

(c) 1 d.

On initial verification of an instrument weighing coupled wagons, the errors of not more than 10 % of the weighing results taken from one or more passes of the test train may exceed the appropriate tolerance value given in Table T.N.3.6.but shall not exceed two times that value.

T.N.3.6.4. Train Weighing – The tolerance value for train weighing shall be one of the following values, whichever is greater:

a) the value calculated according to the appropriate accuracy class in Table T.N.3.6., rounded to the nearest scale interval;

b) the value calculated according to the appropriate accuracy class in Table T.N.3.6., for the mass of a single wagon equal to 35 % of the maximum wagon mass (as inscribed on the descriptive markings) multiplied by the number of reference wagons in the train (not exceeding 10 wagons) and rounded to the nearest scale interval, or

c) 1 d for each wagon in the train but not exceeding 10 d.

Background/Discussion:

The proposed changes to NIST Handbook 44 come directly from OIML R 106-1 Edition 2011 (E) Automatic rail-weighbridges. Introducing a range of accuracy classes is more appropriate for these types of weighing systems, given they are mounted on continuous rail and are highly influenced by track conditions, the quality of the rolling stock as well as locomotive driving.

While clause T.N.3.6.1. can be achieved, the submitter contends that clause T.N.3.6.2. as it appears currently is simply not achievable for the vast majority of installations. Using a typical example of a weighing system required to weigh in the range of 15 t to 100 t and a 50 kg scale division, this clause essentially states that 65 % of individual wagons must have no more than 0.2 % error and no single wagon have an error of more than 0.6 %. According to the submitter, this is not possible for most real-life applications. The only way this could be achieved is with perfect track conditions; perfect locomotive driving; and perfect rolling stock couplers. The real word typically achieves 90 % of wagons at no more than 1 % error. The permissible errors currently detailed in T.N.3.6.2. are more akin to weighing wagons uncoupled statically on isolated rail, not for coupled-in-motion train weighing systems on continuous, uncut rail.

The submitter's equipment, when installed on the best tracks with best rolling stock achieves 0.1 % accuracy. However, the same equipment installed on substandard tracks and rolling stock will only achieve 1 % accuracy. Unless the client spends significant time and money on upgrading track and rolling stock, there is no way they can get a coupled in-motion train weighing system to weigh better than 1 %. So, in most cases this would not be financially viable.

Aligning NIST Handbook 44 with OIML R 106 also has wider advantages, which can be appreciated. That is, systems developed for NTEP certification will also be able to achieve certification in other countries, which have adopted the OIML R 106 standard and vice versa.

Establishing a range of accuracy classes will encourage innovation and bring a wider range in design and type of products to the table. There are also opportunities to establish the "lesser" classes as being suitable for infrastructure protection and safety.

The submitter stated the current requirements would mean far greater overall costs to implement an NTEP certified system. It would also typically be far less flexible, in terms of speed range and modes of weighing, than if the tolerances were widened as we are proposing. The submitter believes if the proposal is adopted, more efficient weighing systems would become available, which would be installed at a lesser cost, with a minimum reduction in accuracy.

At the 2017 NCWM Interim and Annual Meetings, the Committee grouped agenda Items 3200-4 and 3200-8 together and took comments on these items simultaneously because it considered them related. See agenda Item 3200-4 for a summary of the comments received and the resulting actions taken by the Committee on these items at these two meetings.

Regional Association Comments and Recommendations:
At its 2017 Annual Meeting, the CWMA recommended Withdrawing this item based on input received from industry representatives; the lack of data associated with this system; and the possible inequity among similar systems that this item could create. The CWMA reported it believes this is an unnecessary change to NIST Handbook 44. NEWMA reported at its 2016 Interim Meeting the item is not so pertinent in the Northeast, but other regions may benefit from the proposal, so NEWMA forwarded the item to NCWM and recommended Developing status. At its 2017 Annual Meeting, NEWMA reported this item requires further development from the submitter, or the submitter needs to state they are not willing to develop the item any further for it to be moved to Voting. Consequently, NEWMA recommended the item move forward as a Developing item on the NCWM agenda.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf.**

3201 BELT-CONVEYOR SCALE SYSTEMS

3201-1 W T.1. TOLERANCE VALUES (SEE RELATED ITEMS 3200-7, 3204-1, 3205-2, 3508-2, 3509-1 AND 3600-4)

(This item was Withdrawn.)

Source:
Ross Andersen, Retired (2017)

Purpose:
Provide language in this code that is consistent with the General Code.

Item under Consideration:
Amend NIST Handbook 44 Belt-Conveyor Scale Systems Code as follows**:**

T.1. Tolerance Values.[1] – <u>The tolerances hereinafter prescribed shall be applied equally to errors of underregistration and errors of overregistration.</u> Maintenance and acceptance tolerances on material tests, relative to the weight of the material, shall be ~~±~~ 0.25 % of the test load.

(Amended 1993)

[Note the "±" is stricken near the end of the second sentence.]

Background/Discussion:
This item was submitted as one of a group of items that includes agenda Items 3200-7, 3201-1, 3204-1, 3205-2, 3508-2, 3509-1, and 3600-4. The Background/Discussion information is the same for these items and included in agenda Item 3200-7 of this report. At the 2017 NCWM Interim Meeting, the Committee agreed to Withdraw these items in consideration of the comments received during the meeting.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf.**

3202 AUTOMATIC BULK WEIGHING SYSTEMS

3202-1 D A. APPLICATION, S. SPECIFICATIONS, N. NOTES, UR. USER REQUIREMENTS

Source:
Kansas (2016)

Purpose:
Modernize the ABWS code to more fully the reflect the types of systems in use and technology available while still maintaining the safeguards of the current code.

Item under Consideration:
Amend NIST Handbook 44, Automatic Bulk Weighing Systems Code as follows:

A. Application

A.1. General. – This code applies to ~~**automatic bulk**~~ weighing systems, ~~**that is, weighing systems**~~ **capable of**~~**adapted to the automatic**~~ **automatically** weighing ~~**of a commodity in**~~ successive drafts of **a bulk commodity without human intervention.**~~**predetermined amounts automatically recording the no-load and loaded weight values and accumulating the net weight of each draft.**~~
(Amended 1987)

S. Specifications

S.1. Design of Indicating and Recording Elements and Recorded Representations.

S.1.1. Zero Indication. – ~~**Provisions**~~ **An Automatic Bulk Weighing System (ABWS)** shall ~~**be made to**~~indicate and record a no-load reference value and, if the no-load reference value is a zero value indication, to indicate and record an out-of-balance condition on both sides of zero.

S.1.5. Recording Sequence. – ~~**Provision**~~ **An ABWS** shall ~~**be made so that**~~ **indicate** all weight values ~~**are indicated**~~ until ~~**the completion of the**~~ recording of the indicated value **is completed**.

S.1.6. Provision for Sealing Adjustable Components on Electronic Devices. – Provision shall be made for applying a security seal in a manner that requires the security seal to be broken before an adjustment can be made to any component affecting the performance of the device.

S.1.7. No Load Reference Values. – An ABWS shall indicate and record weight values with no load in the load-receiving element. No load reference values must be recorded at a point in time after product flow from the load receiving element is stopped and before product flow into the load receiving element has started. Systems may be designed to stop operating if a no load reference value falls outside of user designated parameters. If this feature is designed into the system then the no load reference value indicated when the system is stopped must be recorded, an alarm must activate, weighing must be inhibited, and some type of human intervention must be required to restart the system after it is stopped.

S.1.8. Loaded Weight Values. – An ABWS shall indicate and record loaded weight values for each weighment.

S.1.9. Net Weight Values. – An ABWS shall calculate and record net weight for each weighment.

S.1.10. Net Weight Accumulation. – An ABWS shall automatically accumulate and record the sum of all net weight values for each weighing process.

S.3. Interlocks and ~~Gate Control~~Product Flow Control.

S.3.1. ~~Gate Position~~Product Flow Control. – **~~Provision~~ An ABWS** shall **~~be made to~~** clearly indicate to the operator **product flow status ~~the position of the gates leading directly~~** to and from the **~~weigh hopper~~load receiving element. Many types of equipment can be used to control the flow of product into and out of a load receiving element automatically including but not limited to gates, conveyors, augers, robots, pipes, tubes, elevators, buckets, etc.**

S.3.2. Interlocks. – Each automatic bulk weighing system shall have operating interlocks to provide for the following:

(a) Product cannot be cycled and weighed if the weight recording element is disconnected or subjected to a power loss.

(b) The recording element **can only ~~cannot print~~ record** a weight if **~~either of the gates~~ equipment controlling product flow to or from the load-receiving element is in a condition that allows product to enter or leave the load receiving element. ~~leading directly to or from the weigh hopper is open.~~**

S.3.3. Overfill ~~Sensor~~and Interference Detection.

(a) **The system must have a means to detect when ~~T~~t**he **~~weigh hopper~~load-receiving element ~~shall be equipped with an~~is** overfill**ed. When an overfill condition exists ~~sensor which will cause the feed~~product flow to the load receiving element must be stopped, ~~gate to close,~~**an alarm must activate,**~~activate an alarm, and inhibit~~** weighing **must be inhibited** until the overfill condition has been corrected**, and some type of human intervention must be required to restart the system. An alarm could be many things including a flashing light, siren, horn, flashing computer screen, etc. The intent of an alarm is to make the operator aware there is a problem which needs corrected.**

(Added 1993)

(b) **~~If the system is equipped with a~~Downstream storage devices and other equipment, permanent or temporary, ~~lower garner or surge bin, that garner shall also~~ which have the potential to interfere with weighment when overfilled or not functioning properly must have a means to prevent interference. When interference exist the system must stop, an alarm must activate, product flow must stop, weighing must be inhibited until the interference has been corrected, and some type of human intervention is required to restart the system.~~be equipped with an overfill sensor which will cause the gate of the weigh hopper to remain open, activate an alarm, and inhibit weighing until the overfill condition has been corrected.**

[Nonretroactive as of January 1, 1998]

(Amended 1997)

N. Notes

N.1. Testing Procedures.

N.1.1. Test Weights. – The increasing load test shall be conducted using test weights equal to at least 10 % of the capacity of the system:

(a) on automatic **~~grain~~** bulk**~~-~~**weighing systems installed after January 1, 1984**, used to weigh grain**; and

UR. User Requirements

UR.4. System Modification. – **Components of ~~T~~t**he weighing system, shall not be modified except when the modification has been approved by a competent engineering authority, preferably that of the engineering department of the manufacturer of the scale, and the official with statutory authority having jurisdiction over the scale.

(Amended 1991)

Background/Discussion:
The submitter provided the following points of discussion:

- There are many systems in use that don't meet the definition for a "scale" or an "Automatic Bulk Weighing System" or anything else in NIST Handbook 44. These changes will make it easier for regulators/inspectors to determine if a system should be evaluated as an "ABWS."
- The wording "automatic bulk weighing systems" should not be used in the definition of the same.
- The no-load and loaded weight recordings are important, but they are specifications and should not be included in the Application Section of the code.
- The current code does not clearly define at what level of automation a system would be considered an ABWS versus a scale with some accessory equipment (hopper, tank, etc.). This is an attempt to more clearly distinguish which systems should be considered ABWS's.
- Human intervention could be many things. Some examples include, but are not limited to, pushing a reset button; turning power off then back on; typing a password; or entering a statement into a system log. The intent of including the term "human intervention" is to not include all systems, which have a high degree of automation, only the ones that cycle repeatedly and can potentially operate without anyone present to observe weighing malfunctions.
- There are many types of load receiving elements that will work with an ABWS, including, but not limited to tanks and hoppers so the previous language referring to hoppers was removed and replaced with the generic but accurate term "load receiving element."
- The old language implied separate overfill sensors (e.g., bindicators) were required. Newer systems have already bypassed the use of separate overfill sensors and utilize the weight indications to identify an overfilled condition, similar to how the indications are used to regulate product flow into the load receiving element for some devices. Concerns for this approach have been raised for situations when an indicator is not functioning properly. That is a legitimate concern, but my reply then is: What is the backup for an indicator not indicating properly on any other type of device? This is something we know happens with other devices and commonly may not be detected until a device inspection and test is completed. Thus, one reason routine inspections and testing are required.
- Many types of equipment can be used to control the flow of product into and out of a load receiving element automatically, including but not limited to gates, conveyors, augers, robots, pipes, tubes, elevators, and buckets. Examples would be a conveyer delivering product – in such a case the recording element should not record if the conveyer is still moving or in the case of a pneumatic transfer tube the recording element should not record if the blower forcing air through the tube is still operating. Therefore, the old language referring to gates was removed and replace with more generic terminology that can be applied to any equipment used to control product flow – not just gates.
- Many types of equipment can be used for downstream commodity storage, including, but not limited to, hoppers, tanks, bins, flat storage, trucks, totes, rail cars, and pits. The language referring to "lower garner," "surge bin," etc. has been removed and replaced with a more terms such as "downstream storage devices" to allow for all potentials types of product handling equipment.
- A downstream storage device itself may not interfere with the weighing process directly, but it also cannot create a situation in which an overfill condition or some other malfunction of the equipment interferes with the weighing process. An example would be a grain storage hopper located under a weigh hopper in a

position which, when grain is mounded up above the storage hopper, the grain touches the bottom of the weigh hopper and interferes with the weighing process. For this example, if the storage hopper can be lowered far enough below the weigh hopper so that the mounded grain, when it reaches its maximum potential height, cannot touch the weigh hopper, then it would not need the capability to detect an overfill condition. The same scenario would apply to a truck parked under the load receiving element or a conveyer under the load receiving element. Wording was added to ensure interference does not occur and if it does that the system activates controls to prevent weighment errors.

The original code was written for very specific equipment for a very specialized use. This is a drastic change from the original and introduces some new terminology that may present some confusion or uncertainty to those who were familiar with the existing code. Some individuals feel the proposed changes may add some uncertainty as to what systems should or shouldn't be considered an ABWS.

At the 2016 Interim Meeting, the Committee received an update on this item from its submitter, Mr. Doug Musick (Kansas). Mr. Musick indicated that the current proposal is an initial attempt to update the current ABWS Code to address some newer automated weighing systems known to exist in the marketplace. Some of these newer systems are not able to comply with the existing ABWS Code, which provides indication of the need to update the current code.

NIST, OWM commented that it recognized the need for NIST Handbook 44 to include requirements that address some ***automated*** weighing systems currently in the marketplace but for one reason or another, fail to meet the definition of an ABWS or the application of the ABWS Code. As is the case with an ABWS, these systems are also used to weigh bulk commodities in an automatic operation. A number of these weighing systems do ***not*** consistently return to zero following discharge of a draft load due to:

- the density of the commodity being weighed and its susceptibility to cling;
- structural deformations in the load-receiving element (which trap and prevent product from being completely discharged);
- venting issues;
- system vibration; etc.

OWM gave the example of *some* seed treatment systems known to exist in the commercial marketplace that will automatically fill to a load value targeted by the system operator by weighing multiple drafts *automatically* and *without* operator intervention. When these systems are operational, not all the weighed product necessarily gets discharged with the draft load. The remaining product is typically referred to as a "heel." Some of these systems only record the gross weight of the different drafts weighed; yet, the "heel" remaining for each draft load cycled through the system needs to be considered for an accurate determination of the net quantity to be made.

OWM noted the single-most important factor in determining if an automated weighing system needs to consider the no-load reference and gross-load reference to determine an accurate net weight for individual drafts weighed is the system's ability to consistently return to zero following discharge of the load. This determination must be made on a case-by-case basis and will vary depending on the design of the system and the products being weighed.

The Committee agreed more work was needed to develop the item and assigned it a "Developing" status. The Committee recommended the item's submitter review the 2015 SWMA S&T Annual Report for additional proposed revisions to the proposal by that region's S&T Committee.

The Committee received an update on this item at the 2016 Annual Meeting from Mr. Doug Musick. Mr. Musick reported that work on the proposal is ongoing, and he soon planned to submit an updated version of proposal to the Committee. He reiterated a comment made at the 2016 Interim Meeting that the proposal is an attempt to update the current ABWS Code to address some newer automated weighing systems known to exist in the marketplace today, which are not able to comply with the existing ABWS Code.

NIST, OWM reported it looked forward to being able to review an updated proposal to "modernize" the ABWS Code to more fully reflect the different types of systems currently in the marketplace.

The Committee agreed to recommend this item move forward as Developing to allow for additional time to fully develop the proposal. See the Committee's 2016 Final Report for additional details and background information.

At the 2017 NCWM Interim Meeting open hearings, the item's submitter, Mr. Doug Musick, noted he had submitted an amended version of the proposal following the 2016 NCWM Annual Meeting. Mr. Musick commented he felt the proposal was now fully developed and asked the Committee to move this item to a Vote.

Mr. Rick Harshman (NIST, OWM) recommended that the item remain Developing. He questioned whether the proposed changes belonged in the ABWS code or possibly in an entirely separate code intended to address some automatic weighing systems known to exist in the marketplace for which the Scales Code nor the ABWS Code seem to fit their design and operational characteristics. He noted the existing ABWS Code is intended to apply to systems that weigh only one commodity at a time in successive drafts. He asked if the proposed changes are intended to expand the existing code to include a wider range of systems and, if so, which additional systems is the submitter intending to address by expanding the ABWS Code? Mr. Musick answered that it addresses weighing systems capable of operating without human intervention.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported that the SMA takes no position on this item at this time and looks forward to more data.

Mr. Richard Suiter (Richard Suiter Consulting) urged the Committee to exercise caution in considering this item. He stated that he had concerns about striking the language for overfill sensors and described how the sensors are not just for over capacity of the container. He noted that they are also for sensing when the height of the product reaches a point higher than the edge of the container, even though the container may not be at capacity. He advised that this redefining be done with careful consideration.

In consideration of the comments received, the Committee agreed that this item remain as Developing to allow time to determine the impact of the changes on systems in this code.

At the 2017 NCWM Annual Meeting, S&T Committee Chair, Dr. Matthew Curran (Florida), stated the Committee will only hear comments/updates from the submitter on Developing items during open hearings. The Committee received an update on the item from Mr. Doug Musick (Kansas). Mr. Musick reported that work on the item is ongoing, and he expects to have the proposal completed and ready for review at the 2018 NCWM Interim Meeting. Based on the update provided and in consideration of the ongoing work on this item, the Committee agreed to carryover the item on its agenda as a Developing item.

Regional Association Comments and Recommendations:
At its 2016 Annual Meeting, the WWMA received one comment expressing that this item has merit and should remain a developing item. WWMA forwarded the item to the NCWM and recommended Developing status.

At the fall 2016 Interim Meeting, the CWMA reported it believes the submitter has developed this item to its full extent, and it is ready for input from the NCWM S&T Committee and other stakeholders. The CWMA recommended the item be upgraded to Informational status. At its spring 2017 Annual Meeting, the CWMA reported it supported the item but believes is should remain a Developing item.

At its 2016 Annual Meeting, the SWMA received no comments on this item. The Committee recommended the item remain in Developing status for continued progress by the submitter.

NEWMA forwarded this item to NCWM and recommended Developing status at both its spring 2016 Interim and fall 2017 Annual Meetings; noting it was still being developed by its submitter.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf.**

3204 AUTOMATIC WEIGHING SYSTEMS

3204-1 W T.N.2.1. GENERAL (SEE RELATED ITEMS 3200-7, 3201-1, 3205-2, 3508-2, 3509-1, AND 3600-4)

(This item was Withdrawn.)

Source:
Mr. Ross Andersen, Retired (2017)

Purpose:
Provide language in this code that is consistent with the General Code.

Item under Consideration:
Amend NIST Handbook 44, Automatic Weighing Systems Code as follows**:**

T.N.2.1. General. – The tolerance values ~~**are positive (+) and negative (-)**~~ **hereinafter prescribed shall be applied equally to errors of underregistration and errors of overregistration** with the weighing device adjusted to zero at no load. When tare is used, the tolerance values are applied from the tare zero reference (zero net weight indication); the tolerance values apply to the net weight indication for any possible tare load using certified test loads.

(Amended 2008)

Background/Discussion:
This item was submitted as one of a group of items that includes agenda Items 3200-7, 3201-1, 3204-1, 3205-2, 3508-2, 3509-1, and 3600-4. The Background/Discussion information is the same for these items and included in agenda Item 3200-7 of this report. At the 2017 NCWM Interim Meeting, the Committee agreed to Withdraw these items in consideration of the comments received during that meeting.

3205 WEIGH-IN-MOTION SYSTEMS USED FOR VEHICLE ENFORCEMENT SCREENING

3205-1 I A. APPLICATION AND SECTIONS THROUGHOUT THE CODE TO ADDRESS COMMERCIAL AND LAW ENFORCEMENT APPLICATIONS

Source:
Rinstrum, Inc. and Right Weigh Innovations (2016)

Purpose:
The original purpose of this item was to recognize a higher accuracy class and appropriate requirements in Section 2.25. Weigh-In-Motion Systems Used for Vehicle Enforcement Screening – Tentative Code by adding commercial and law enforcement applications. In particular, WIM vehicle scale systems capable of performing to within the tolerances specified for a higher accuracy class would be permitted for use in commercial applications and for highway law enforcement. The WIM Task Group (TG), however, agreed in 2016 that it would be more appropriate to address these higher accuracy WIM systems by proposing changes to Section 2.20. Scales Code, which remains the current focus of the TG.

Item under Consideration:
Amend the Scales Code of NIST Handbook 44 to recognize commercial WIM vehicle scale systems. A marked-up draft of the 2017 version of the Scales Code containing proposed changes by the WIM Task Group has been inserted into Appendix A of this report for consideration.

Background/Discussion:
Rinstrum and Right Weigh Innovation submitted a proposal in 2016 to modify the tentative WIM Code for Screening and Sorting. The idea was to keep all WIM applications within the same code section of Handbook 44. Rinstrum proposed to add slow-speed devices to the existing code (which is presently limited to screening and sorting with two separate applications; one for commercial (legal-for-trade) and one for law enforcement. Considering the changes proposed, there would be three different applications covered by the same Code, which would cause some confusion. Because the proposed changes were to include a legal-for-trade application, it was suggested that that modification probably belonged in the Scales Code.

Rinstrum manufactures the axleWEIGHr in-motion scale, which is a slow speed WIM axle scale system capable of being able to perform to within Class IIIL maintenance tolerance, according to Rinstrum. Rinstrum has indicated that the axleWEIGHr is a niche product, which creates a new segment for axle weighing devices. The axleWEIGHr calculates the Gross Vehicle Weight (GVW) and weighs individual axles while a truck crosses the scale at 1 mph to 3 mph. Rinstrum has also indicated the most common applications for its device will be agricultural farmers, small trucking companies, or manufacturers interested in determining GVW and axle weights before the vehicle enters the public roadway. The proposed requirements are based in part on requirements in OIML R 134, "Automatic instruments for weighing road vehicles in motion and measuring axle loads." The submitter stated they have test data and experience at multiple test sites that demonstrate this system can meet the proposed performance requirements.

At the 2016 NCWM Interim Meeting, Rinstrum requested the NCWM Chairman form a WIM TG to bring together regulators and private sector stakeholders to discuss Weigh-In-Motion technology. Rinstrum sought a Developing status so it could maintain ownership of the proposal and continue to work on its development.

During the 2016 NCWM Interim Meeting, Mr. John Lawn (Rinstrum) gave a short slide presentation on a slow speed WIM system, which Rinstrum manufactures. A copy of the slides from his presentation was inserted into Appendix B of the Committee's 2016 Final Report and is available from the following link:

nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf.

Mr. Lawn explained he had originally hoped the proposal could be considered for Vote in 2016, but had decided to request it move forward as Developing in 2016 to allow time for Rinstrum to address some of the concerns, which had been raised through the review process and to better familiarize the weights and measures community with the equipment. He also indicated he understood the need for Rinstrum to provide data in support of their claim that the equipment is capable of conforming to the tolerances specified in the proposal. At that time, Mr. Lawn stated Rinstrum's plan going forward is to amend the current proposal to address all the issues and have a new proposal ready in time that it can be considered for Vote in 2017.

OWM noted that the adoption of this proposal would, for the first time ever, make it permissible for WIM vehicle systems installed in the United States to be used not only for direct law-enforcement applications, but also for commercial applications. While encouraging the expansion of the code to recognize such applications, NIST, OWM further noted the proposal needs to be thoroughly vetted by all the different parties affected by the proposed changes, including (but not necessarily limited to):

- truck weight enforcement officials;
- representatives from the judicial system;
- WIM equipment manufacturers;
- weights and measures officials;
- FHWA and other transportation officials; and

- members of the trucking industry.

OWM also identified several areas of the proposal needing additional development including:

- The procedures developed by the WIM WG for establishing reference test loads for testing WIM systems used in law enforcement screening may not provide the level of accuracy needed (i.e., combined error and uncertainty less than one-third applicable tolerance) for testing commercial and law-enforcement WIMs given the more stringent tolerances proposed for these applications.
- Studies have shown that axle and tandem axle weights fluctuate depending on the position of a truck on a scale. How will this be addressed in the procedures for establishing the reference test loads for testing axle and axle-groups?
- Under what conditions are officials willing to accept a single tolerance (i.e., Class III L maintenance tolerance) for commercial applications?
- Why is there not an acceptance tolerance proposed? Is it because the amount of error in the WIM system is not expected to change as a result of routine, continued use?
- If a single tolerance is accepted, will this be limited to certain applications?

The Committee agreed with the submitter's request and recommended the item move forward as Developing.

In February 2016, the NCWM agreed to form a task group (TG), at the recommendation of the Committee, to consider a proposal that would expand the new NIST Handbook 44, Weigh-In-Motion Systems Used for Vehicle Enforcement Screening – Tentative Code to also apply to commercial use. Mr. Alan Walker (Florida) agreed to serve as chairman of the new TG.

The Committee received an update on this item during the 2016 NCWM Annual Meeting from Mr. John Lawn (Rinstrum). Mr. Lawn reported the TG had agreed the proposal needed to be changed to separate the requirements for WIM systems used in commercial application from those used for enforcement. Given the current proposal was no longer being considered, he requested the Committee replace the proposal included in the Item Under Consideration with a synopsis, which he offered to prepare and provide to the Committee.

In consideration of Mr. Lawn's request to do so, the Committee agreed to replace the proposal in the Item Under Consideration with the synopsis to be developed by him. The submitter's original proposal was replaced following the 2016 NCWM Annual Meeting and is available for review, as is the synopsis developed by Mr. Lawn, in the Committee's 2016 Final Report from the following link:

nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf

The Committee also changed the status of the item to Informational because an NCWM TG, under the direction of the Committee, is now assisting in the development of the proposal. This change in status is an indication the Committee has taken responsibility for the additional development of this item. (See the **S&T Committee's Final Report in the 2016 NCWM Annual Report, SP1212**.)

An update was given at the 2017 NCWM Interim Meeting on this Developing item by Mr. Alan Walker (Florida), Chairman of NCWM's Weigh-In-Motion TG and Mr. Lawn. Mr. Walker reported that the TG is currently reviewing the different paragraphs in the Scales Code of NIST Handbook 44 to determine needed amendments to address WIM vehicle scale systems. The review started with the "Application" section of the code and has now progressed to the "Notes" section of the code. Mr. Walker noted that there are few weights and measures regulatory officials participating on the TG and encouraged anyone who might be interested in participating, to please contact him. Mr. Lawn provided an update on some recent testing of a Rinstrum WIM vehicle scale system by the State of Illinois and witnessed by some members of the TG. Mr. Lawn indicated that the results of this testing proved inconclusive due to poor weather conditions on the day of the test.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported the SMA takes no position on this item at this time and looks forward to recommendations from the Weigh-In-Motion TG.

Mr. Rick Harshman (NIST, OWM) complimented the TG on its progress, while noting too, that OWM believes a significant amount of work remains to be done (particularly in defining appropriate test procedures) before the proposal would be ready for consideration as a Voting item.

The Committee agreed to maintain an Informational status on this item to allow the TG time to complete its work.

Mr. Walker, Chairman of the NCWM WIM TG gave an update to the Committee at the 2017 NCWM Annual Meeting on this Informational item and the status of the work. Mr. Walker reported the TG has made considerable progress this past year and has reached a point where it believes it would be of value to submit the revised document and ask for feedback. Mr. Walker also mentioned the TG will develop a 'white paper' identifying specific changes for which the TG is hoping to receive feedback. Mr. Walker asked the Committee to maintain the item's Informational status.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, stated the SMA takes no position on this item at this time and looks forward to recommendations from the recently formed Weigh-In-Motion TG.

Mr. Lawn supported the comments made by Mr. Walker. Mr. Lawn further reported that the TG needed feedback to determine the best way to test WIM vehicle scale systems intended for commercial application. He felt, if the device was tested statically, the tolerance values should be based on acceptance and maintenance tolerances currently defined for a Class III L device. He then indicated that testing for dynamic operation is different from static operation and that dynamic testing should consist of three consecutive test runs with the vehicle loaded with test weights followed by three consecutive test runs with the vehicle unloaded. Mr. Lawn stated WIMs tested dynamically should be required to comply with tolerances where acceptance and maintenance tolerances are the same and the rationale for this is the fact that dynamic tests on systems such as CIM RR scales and dynamic monorail systems use the same values for acceptance and maintenance tolerance. He further stated that tolerance values should only be applied to the value of the test weights used in the vehicle during the first three test runs. Mr. Lawn explained that the procedure consisting of three consecutive runs of a loaded vehicle followed by three consecutive runs of the vehicle unloaded would produce satisfactory results and would better avoid the introduction of unknown errors that may be incorporated if the testing involved a reference scale that was not installed at the same location as the WIM under test.

The Committee agreed with TG chairman's recommendation to keep the item "Informational."

Regional Association Comments and Recommendations:
The WWMA received one comment on the item during its 2016 Annual meeting relating to a concern with paragraph N.1.3. for the reference scale. WWMA recommended that the item be Informational as it is being worked on by a NCWM task group and looks forward to updates.

The CWMA supported the item as an Informational item at both its fall 2016 Interim Meeting and spring 2017 Annual Meeting and reported it looks forward to the changes proposed by the national WG.

At its 2016 Annual Meeting, the SWMA heard comment from Ms. Tina Butcher (NIST, OWM) that there are many things needing to be resolved still and this item should remain as a Developing item until the TG has time to make a proposal. Mr. Tim Chesser (Arkansas) stated the item is closer to getting this system to meet the requirements of the existing Scales Code but not the recently passed Weigh-in-Motion Code, which applies to law enforcement scales. Mr. Lou Straub (Fairbanks Scales), speaking as a member of the TG, stated they have had multiple conference calls already and another one scheduled for later October 2016; by January 2017 the TG should have something to present, although it may not be ready for a Vote in July. Mr. Straub also reiterated Mr. Chesser's comments and noted this is more likely to be a separate code rather than a modification of the existing Weigh-in-Motion Code. The SWMA recommended the item remain in Developing status for continued progress by the submitter. The SWMA would also like to see a proposal for consideration at the NCWM Interim Meeting in January.

NEWMA recommended this item remain in a Developing status at its spring 2016 Interim Meeting. NEWMA recommended the item move forward as an Informational item at its 2017 Annual Meeting, to allow time for the Task Group to complete its development.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf.**

3205-2 W T.1.1. DESIGN (SEE RELATED ITEMS 3200-7, 3201-1, 3204-1, 3508-2, 3509-1 AND 3600-4)

(This item was Withdrawn.)

Source:
Ross Andersen, Retired (2017)

Purpose:
Provide language in this code that is consistent with the General Code.

Item under Consideration:
Amend NIST Handbook 44, Automatic Weighing Systems Code as follows**:**

T.1.1. Design. – The tolerances for a weigh-in-motion system is a performance requirement independent of the design principle used. **The tolerances hereinafter prescribed shall be applied equally to errors of underregistration and errors of overregistration**.

Background/Discussion:
This item was submitted as one of a group of items that includes agenda Items 3200-7, 3201-1, 3204-1, 3205-2, 3508-2, 3509-1, and 3600-4. The Background/Discussion information is the same for these items and included in agenda Item 3200-7 of this report. At the 2017 NCWM Interim Meeting, the Committee agreed to Withdraw these items in consideration of the comments received during that meeting.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf.**

3300 LIQUID MEASURING DEVICES

3300-1 V S.2.1. VAPOR ELIMINATION (SEE RELATED ITEMS 3301-1, 3305-1, 3306-1 AND 3307-1)

(This item was Adopted.)

Source:
Liquid Controls and NIST, OWM (2017)

Purpose:
Align other measuring device codes with the changes adopted in 2016 under S&T LPG & NH_3 Code Item 332-3 (S.2.1. Vapor Elimination).

Item under Consideration:
Amend NIST Handbook 44, Liquid-Measuring Devices Code as follows:

S.2. Measuring Elements.

S.2.1. Air/Vapor Elimination.

~~(a)~~ A **~~liquid-measuring device~~** **measuring system** shall be equipped with a**n effective** **~~vapor or~~** air**/vapor** eliminator or other automatic means to prevent the passage of **~~vapor and~~** air**/vapor** through the meter.

~~(b)~~ Vent lines from the air**~~ or~~ /**vapor eliminator shall be made of **~~metal tubing or other rigid~~** **appropriate non-collapsible** material.

(Amended 1975 **and 2017**)

S.2.1.1. Air/Vapor Elimination on Loading Rack ~~Metering~~ Measuring Systems.

(a) A loading rack **~~metering~~** **measuring** system shall be equipped with **~~a vapor or air~~** **an effective air/vapor** eliminator or other automatic means to prevent the passage of **air/**vapor and air through the meter unless the system is designed or operationally controlled by a **means ~~method, approved by the weights and measures jurisdiction having control over the device,~~** such that air**/~~and/or~~** vapor cannot enter the system.

(b) Vent lines from the air**~~ or~~ /**vapor eliminator **~~(if present)~~** shall be made of **~~metal tubing or other rigid~~** **appropriate non-collapsible** material.

(Added 1994) **(Amended 2017)**

Background/Discussion:
The proposed changes would ensure consistency across the various measuring device codes in NIST Handbook 44. This would help ensure more uniform interpretation of the requirements and facilitate application by officials and industry.

The proposed changes will align other codes with the following changes that were made to the LPG code at the 2016 NCWM Annual Meeting.

S.2.1. Vapor Elimination.

(a) A device shall be equipped with an effective **automatic** **~~vapor eliminator or other effective~~** means to prevent the passage of vapor through the meter.

(b) Vent lines from the vapor eliminator shall be made of appropriate non-collapsible material.

(Amended 20XX)

The proposed changes make the requirement less design-specific and more focused on ensuring that the means for eliminating air or vapor are effective, including that the vent lines not be susceptible to restriction. The proposed changes also clarify that the provision for vapor elimination must be automatic in nature to be considered effective.

NIST, OWM in its analysis of the 2016 S&T agenda item referenced above suggested a similar change be proposed, where necessary, to corresponding requirements in other measuring codes and encouraged the Committee to consider including such an item on its agenda in the 2016 - 2017 NCWM cycle.

Note that the Mass Flow Meters Code states “means to prevent the measurement of vapor and air” while other codes state “means to prevent the passage of vapor and air through the meter,” but such distinction is probably justified.

Consequently, no modifications are proposed to align this portion of the language in the MFM Code with that in other codes.

During the 2017 NCWM Interim Meeting, the Committee grouped agenda Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 together and took comments on these items simultaneously because it considered these items related.

During open hearings, the Committee received several comments from industry in support of the grouped items, with one minor change requested to paragraph S.2.1. Vapor Elimination in "Item under Consideration" for agenda Item 3300-1. It was suggested the word "device" in part (a) of the paragraph be replaced with the word "system" so it reads:

(a) A liquid-measuring ~~**device**~~ **system** shall be equipped with **an effective,** ~~**a vapor or air eliminator or other**~~ automatic means to prevent the passage of vapor and air through the meter.

Others speaking in support of this group of items, also agreed with this change.

Ms. Tina Butcher (NIST, OWM) stated Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 Vapor Elimination were submitted jointly by Liquid Controls and NIST, OWM based on a suggestion made to the S&T Committee at the 2016 NCWM Annual Meeting. At that meeting, changes were made to the LPG and NH_3 Code to clarify vapor elimination means must be effective and automatic in nature and to update the language relative to ensuring the materials used for vent lines from the vapor/air eliminator prevent the lines from being restricted. When these changes were adopted, a suggestion was made to modify other measuring codes to align the language in those codes with that adopted in the LPG and NH_3 code. OWM believes these changes are appropriate and provide better alignment and consistency across the measuring codes. OWM concurs with the SWMA's suggestion to change the term "device" to "system" in Item 3300-1 (SWMA's reference agenda Item New 13), believing this broad reference would be more appropriate and less limiting. OWM asks that this change be made to the proposed language presented in the Item Under Consideration for 3300-1.

Mr. Michael Keilty (Endress + Hauser Flowtec AG USA) commented that he would prefer to see the language the same in all the codes, and he would be willing to support the items fully if this were the case. It was suggested the Committee develop additional draft proposals to align the vapor/air elimination paragraphs in all the measuring codes. Upon hearing this suggestion, the NIST Technical Advisor questioned whether those making such a suggestion might do this work and present completed drafts to the Committee for consideration. Committee members agreed those suggesting and/or supporting this action should complete this work rather than the Committee. Ms. Butcher and Mr. Dmitri Karimov (Liquid Controls) agreed to review the vapor/air elimination paragraphs in all the measuring codes and draft consistent language to propose for all the codes, which they completed and provided to the Committee the next morning. In addition to proposing changes to the vapor/air elimination paragraph(s) in Sections 3.30., 3.31., 3.35., 3.36., and 3.37. of NIST Handbook 44, for which there were already current proposals on the Committee's agenda, there were also proposed changes to align the vapor/air elimination paragraph(s) in Sections 3.32., 3.33., 3.34., and 3.38., which were new and not a part of the Committee's current agenda.

During the Committee's work session, all the draft proposals were reviewed and members of the Committee agreed that all should be presented for Vote at the upcoming Annual Meeting. The Committee believed it was within its discretion to create new agenda items, which were needed for the draft changes being proposed in the vapor/air elimination paragraph(s) of Sections 3.32., 3.32., 3.34., and 3.38., because it considered the proposed changes simply a continuation of the effort to align the language in the different measuring code sections of NIST Handbook 44. Consequently, the Committee agreed to create a new agenda item to be included in NCWM Publication 16 for each of these Sections, and Dr. Matthew Curran (Florida), S&T Committee Chairman, announced to the NCWM membership at the 2017 NCWM Interim Meeting, the Committee's plans to add new voting items to its agenda to harmonize the vapor/air elimination language in all the codes.

Shortly following the 2017 Interim Meeting, the NIST Technical Advisor drafted a document for Committee review that included the five current items on the Committee's agenda and four newly added items. The text of the four new items was highlighted in yellow to differentiate the new items from those already appearing on the Committee's agenda. Each of the new items appearing in this document also included a draft paragraph specifying that the item was new and a summary of why the item was being added by the Committee. The document was distributed to

members of the Committee to seek approval of the text shown in the Item under Consideration portion of each item. Mr. Don Onwiler (NCWM) was copied to make him aware of the Committee's intention of adding the new items to its agenda. Upon reviewing the document, Mr. Onwiler made it known to the Committee that he was concerned whether the NCWM bylaws would allow a Standing Committee to add new items to its agenda at the NCWM Interim Meeting. Mr. Onwiler agreed to ask the NCWM Board of Directors (BOD) for an opinion on the matter and subsequently hosted a teleconference involving members of the NCWM BOD, Dr. Curran, Mr. Rick Harshman (NIST Technical Advisor to the S&T Committee), additional staff of OWM, and others. During the teleconference, Dr. Curran was asked to provide a summary of the Committee's discussion at the Interim Meeting leading to the Committee's desire to add these new items to its agenda. Members of the BOD, upon hearing Dr. Curran's explanation of the discussion and rationale, while they understood the intent they expressed concern to adding the items to the agenda as they believed such action could violate the current bylaws of the NCWM. Since these items did not fall under the "priority" classification as agreed upon by Dr. Curran and the Committee, which would allow for the addition of such items, there was mutual agreement to remove these new items from this year's agenda and allow them to be submitted in fall 2017.

Members of the Committee were subsequently made aware of the BOD's concern for adding the new items and asked whether the five original items appearing on the Committee's current Interim Meeting agenda, as amended by the Committee during the 2017 NCWM Interim Meeting, should be presented for Vote at the upcoming NCWM Annual Meeting or held back until all proposals could be presented for Vote at the same time. Members of the Committee agreed to present the five current agenda items (as shown in Item under Consideration for each item) for Vote at the upcoming 2017 NCWM Annual Meeting.

At the 2017 NCWM Annual Meeting, the Committee grouped agenda Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 together and took comments on these items at the same time.

Ms. Tina Butcher (NIST, OWM) noted the OWM had submitted these items jointly with Liquid Controls, LLC. She then provided the Committee a summary of the changes proposed in each of the items and explained these changes were being recommended to harmonize the air/vapor elimination paragraphs in each of these codes with the changes that had been made to the LPG and NH_3 Code in 2016.

The MMA voiced support for the group of items but suggested retaining the word "measurement" in the first sentence of Mass Flow Meters Code Paragraph S.3.3. of agenda Item 3307-1 rather than replacing it with the word "passage" as proposed. The MMA noted it is not necessary to prevent air/vapor from passing through a mass flow meter to achieve accurate measurement. It is only necessary to require there be means to prevent the measurement of the air/vapor. Ms. Butcher and others supported the MMA's suggestion.

Hearing only comments in support of these items, the Committee agreed to the change proposed by the MMA to agenda Item 3307-1, which is reflected in the Item Under Consideration for this item, and to present the items for Vote.

Regional Association Comments and Recommendations:
The WWMA, at its 2016 Annual Meeting, considered Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 at the same time. NIST, OWM will update language adopted at the 2016 NCWM Annual Meeting to these additional devices. The WWMA considered these items developed and forwarded them to NCWM, recommending Voting status.

The CWMA reported at its fall 2016 Interim Meeting that it recognized the value of aligning the measuring device codes and forwarded this item to NCWM, recommending Voting status. The CWMA grouped Items 3300-1, 3301-1, 3301-1, 3306-1, and 3307-1 together and took comments at the same time on these items, which the Committee considered related, at its spring 2017 Annual Meeting. The CWMA reported it believes this group of items is sufficiently developed and recommended them be presented for Vote at the upcoming NCWM Annual Meeting.

The SWMA batched Items 3300-1, 3301-1, 3305-1, 3306-1 and 3307-1 together and heard comments for all items at the same time during its 2016 Annual Meeting. The SWMA agreed to amend the proposal in agenda Item 3300-1 by replacing the word "device" with the word "system" in subparagraph S.2.1.(a) after receiving comment from Mr. Gordon Johnson (Gilbarco). The change was necessary because the dispenser doesn't need the air eliminator, but

rather, it is the system that does the air elimination and not the dispenser itself. The following reflects the change agreed to by the SWMA:

S.2.1. Vapor Elimination.

(a) A liquid-measuring ~~**device**~~ **system** shall be equipped with **an effective,** ~~**a vapor or air eliminator or other**~~ automatic means to prevent the passage of vapor and air through the meter.

(b) Vent lines from the air or vapor eliminator shall be made of **appropriate non-collapsible** ~~**metal tubing or other rigid**~~ material.

(Amended 1975 **and 2017**)

S.2.1.1. Vapor Elimination on Loading Rack Metering Systems.

(a) A loading rack metering system shall be equipped with **an effective,** ~~**a vapor or air eliminator or other**~~ automatic means to prevent the passage of vapor and air through the meter unless the system is designed or operationally controlled by a method, approved by the weights and measures jurisdiction having control over the device, such that air and/or vapor cannot enter the system.

(b) Vent lines from the air or vapor eliminator (if present) shall be made of **appropriate non-collapsible** ~~**metal tubing or other rigid**~~ material.

(Added 1994) **(Amended 2017)**

The SWMA then agreed to recommend all the batch items be forwarded as Voting items on the NCWM agenda.

NEWMA recommended adding the word "system" following the words, "a liquid measuring device," at its fall 2016 Interim Meeting and forwarded the item to the NCWM with the recommendation it be a Voting item with this change. At its spring 2017 Annual Meeting, NEWMA recommended the item be a Voting item on the NCWM agenda.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf.**

3300-2 D UR.3.4. PRINTED TICKET

(The status of this item was changed from Voting to Developing.)

Source:
Morrow County, Ohio (2017)

Purpose:
Require that printed receipts declare an alpha or numeric pump designation that coincides with the dispensing device used for a specific transaction.

Item under Consideration:
Amend NIST Handbook 44, Liquid Measuring Devices Code as follows:

UR.3.4. Printed Ticket. – This requirement applies only to devices that are capable of issuing a printed ticket. The total price, the total volume of the delivery, **a corresponding alpha or numeric dispenser designation** and the price per liter or gallon shall be shown, either printed by the device or in clear hand script, on any printed ticket issued by a device and containing any one of these values.

(Amended 2001 **and 2017)**

Background/Discussion:
The consumer as well as the weights and measures official would be able to verify that all transaction information corresponds accurately at locations with multiple dispensers on site. If no pump designation is on the receipt, it hinders the consumer's ability to know they were given the correct receipt for the transaction. Similarly, a pump designation on the receipt will asset weights and measures officials in verifying correct communication between devices as well as follow up as needed in case of a consumer complaint.

The submitter recognizes software updates would be required for those establishments that do not already meet this proposed requirement.

During the 2017 NCWM Interim Meeting at the S&T Committee's open hearings, Ms. Tina Butcher (NIST, OWM) noted that paragraph UR.3.4. Printed Ticket was originally added to NBS Handbook 44 in 1967 at the request of industry to address technology limitations, which would have made it impractical from a cost perspective to print all three values (i.e., total price, total volume of delivery, and the price per liter or gallon). She said one question that might be considered given today's technology is whether the provision to allow values to be written in hand script is still appropriate or if a system that can provide a printed ticket should be required to print all the values. She also noted this item didn't propose corresponding amendments to paragraphs S.1.6.7. or S.1.6.8. To this point, she indicated that the Committee may want to consider recommending changes to those two requirements to align the requirements for printed receipts. As a final comment, she said should the Committee decide to recommend paragraph UR.3.4. be changed, it may want to reorganize the paragraph so it is clearer and intended only to apply to devices that issue a printed ticket. She provided the Committee a revised version of the paragraph, which had been developed by members of OWM's Legal Metrology Devices Program for the Committee to consider.

Mr. Dmitri Karimov (Liquid Controls), speaking on behalf of the MMA, reported that the MMA supported the NIST observations.

In discussing this item during the Committee's work session, members of the Committee agreed the way paragraph UR.3.4. is currently structured it needs improvement. Some members of the Committee described the paragraph as being "messy" and difficult to follow. The Committee reviewed the revised version of the paragraph developed by members of OWM's LMDP, and it was agreed that, although still not ideal, it was an improvement over the version included under this item. Consequently, members of the Committee agreed to replace the submitter's version of the proposal with the revised version offered by NIST shown in Item under Consideration and present this item for Vote at the upcoming NCWM Annual Meeting.

At the Committee's 2017 NCWM Annual Meeting open hearings, Ms. Tina Butcher reiterated comments provided by OWM during the 2017 Interim Meeting. She said, OWM understands the benefit of identifying the alpha or numeric designation of the dispenser on printed receipts, but, questions given today's technology, why a provision for providing the customer the required information in hand script is needed. She suggested specification paragraphs S.1.6.7. and S.1.6.8 (which include requirements for printed receipts) should also include provisions for the dispenser designation, providing this information is deemed beneficial to inspectors and consumers. The proposed paragraph UR.3.4. would require users to hand print this information on receipts even on devices which comply with the current S.1.6.7. and S.1.6.8. The printer should be capable of printing all the values.

Mr. Dimitri Karimov (Liquid Controls), speaking on behalf of the MMA, recommended the item status be changed to "Informational" so the specification and existing user requirement paragraphs can be revised. Additional consideration needs to be given in the drafting of the changes proposed to paragraph UR.3.4. to wholesale versus retail applications.

Based on comments received during the open hearings the Committee felt the submitter should consider modifying specification paragraphs S.1.6.7. and S.1.6.8. of the LMD code and the existing user requirement. Based on these needed amendments, the Committee decided to change the status of the item from Voting (V) to Developing (D).

Regional Association Comments and Recommendations:
This item did not appear on the WWMA or SWMA Committees' agendas in 2016 and, therefore, was not considered during their 2016 Annual Meetings.

This item was not on the NEWMA Committee's agenda in 2016 and, therefore, not considered at its Interim Meeting. At its 2017 Annual Meeting, NEWMA recommended the item be changed from Voting to Developing; the item requires further development with proposed amendments as "specifications" in addition to "user requirements," and also be included in POS applications (as well as the current RMFD in the item as written). The CWMA fully supported this item at its 2016 Interim Meeting, reporting that it believes this will be beneficial when investigating complaints. CWMA forwarded the item to NCWM and recommended Voting status. At its 2017 Annual Meeting, the CWMA also supported the item, agreeing that the addition of the pump number will be beneficial to the consumer and regulatory officials. While recognizing the current version of the item proposed by the OWM LMDP, the CWMA believes its structure is difficult to follow and recommended a Developing status.

3300-3 W RECOGNIZED THE USE OF DIGITAL DENSITY METERS

(This item was Withdrawn.)

Source:
Missouri (2016)

Purpose:
Allow the use of digital density meters for inspections of meters used to measure viscous fluids such as motor oils, diesel exhaust fluid (DEF), and antifreeze.

Item under Consideration:
Amend NIST Handbook 44, Liquid Measuring Devices Code as follows:

Develop provisions in various LMD Codes of NIST Handbook 44 that would recognize the use of digital density meters in lieu of volumetric provers, or the use of flasks and thermometers in the case of gravimetric testing when testing meters used to dispense certain viscous fluids such as motor oil, DEF, antifreeze, syrups, etc.

"Digital density meters may be a solution for testing motor oil, DEF, and anti-freeze meters."

Background/Discussion:
Current test procedures are slow and awkward due to the need of using borosilicate glassware for package checking. Digital density meters are fast, use small samples size (2 ml), and have built in thermometers.

When conducting volumetric testing of meters used for dispensing viscous fluids such as motor oil, DEF, antifreeze, syrups, etc., air becomes entrapped in the fluid and clings to the sides of the prover, which adversely affect the results of the test. To conduct gravimetric tests, it is necessary to determine the density of the product. Digital density meters are fast and accurate in comparison with recognized gravimetric testing procedures using flasks and thermometers. There is no need to "wet down" volumetric flasks before each measurement. Most non-food products may be recovered without contamination. Only a small sample size (2 ml) of the product is needed for testing. Using digital density meters equipped with built-in API density tables will not require cooling samples to 60 ^{o}F. There is no need for a partial immersion thermometer or volumetric flasks.

Well-established ASTM and other international standard test methods are available with precision statements.

The Committee agreed, at the 2016 NCWM Interim Meeting, to assign a "Developing" status to this item and to maintain that status at the 2016 NCWM Annual Meeting based on comments heard in support of the concept of recognizing the use of digital density meters in testing metering systems. The submitters request time to complete work on the item.

OWM reported, during the 2016 NCWM Annual Meeting, its Laboratory Metrology Program had previously conducted some testing of portable density meters in 2006. The results from the testing showed the units do not work very well for liquids that are likely to produce air bubbles, for example, oils or any product with carbonation. At the time, NIST, OWM was considering their use in determining density for package checking and found the accuracy is

suspect with products that form bubbles. Measurements are inaccurate when there are bubbles present in the oscillating tube and repeatability suffers when some samples have bubbles and others do not.

See the Committee's 2016 Final Report for additional details and background information.

At the Committee's 2017 NCWM Interim Meeting open hearings, Mr. Ron Hayes (Missouri), submitter of the item, reported he is still actively working to further develop the proposal. He noted the existence of a portable density meter that is currently available on the market, which contains a built-in camera aimed at a vibrating tube inside of the meter. When a photo is taken, it captures the amount of bubbles suspended in the product in which the density is being measured and records the time of the photo. He indicated the device is *not* inexpensive.

Mr. Michael Keilty (Endress + Hauser Flowtec AG USA), stated he too has been studying density meters, although his focus has been on high-end density meters.

Ms. Tina Butcher (NST, OWM) reported OWM supports the concept of using digital density meters in testing metering systems and looks forward to the further development of this item. She suggested the Fundamental Considerations of NIST Handbook 44 be considered in defining the suitability criteria of any density meter used in testing. She also suggested it may be that the NIST EPOs, training materials, or other guidance documents might be a more appropriate place(s) to specify details regarding the selection and use of this equipment and to provide details on its specifications.

During the Committee's work session, it was noted this item has been on the Committee's agenda since 2016 and yet, the item still lacks a definitive proposal. A motion initiated by a Committee member recommending the item be Withdrawn with the understanding that such action by the Committee would not prevent the submitter from continuing efforts to develop a more definitive proposal and submitting it later as a new proposal. Given the lack of progress to develop this item, the Committee agreed to recommend it be Withdrawn from its agenda.

Regional Association Comments and Recommendations (Fall 2016 Conferences):
The WWMA did not receive comments on this Developing item.

The CWMA believed this item has merit but does not belong in NIST Handbook 44. The item should be included in other documents such as NIST Handbooks 112 and 105. CWMA recommends that this item be Withdrawn.

The SWMA received no comments on this item and looks forward to the development of this item by the submitter. The SWMA recommended this item remain in Developing status.

NEWMA recommended this item remain a Developing item.

3301 VEHICLE-TANK METERS

3301-1 V S.2.1. VAPOR ELIMINATION (SEE RELATED ITEMS 3300-1, 3305-1, 3306-1 AND 3307-1)

(This item was Adopted.)

Source:
Liquid Controls and NIST, OWM (2017)

Purpose:
Align other measuring device codes with the changes adopted in 2016 under S&T LPG and NH_3 Code Item 332-3 (S.2.1. Vapor Elimination).

Item under Consideration:
Amend NIST Handbook 44, Vehicle-Tank Meters Code as follows:

S.2. Design of Measuring Elements.

S.2.1. Air/Vapor Elimination. – A ~~**metering**~~ **measuring** system shall be equipped with an effective ~~**vapor or**~~ air**/vapor** eliminator or other automatic means to prevent the passage of ~~**vapor and**~~ air**/vapor** through the meter. Vent lines from the air~~**or**~~/vapor eliminator shall be made of ~~**metal tubing or some other suitable rigid**~~ **appropriate non-collapsible** material.
(Amended 1993 **and 2017**)

Background/Discussion:
The proposed changes would ensure consistency across the various measuring device codes in NIST Handbook 44. This would help ensure more uniform interpretation of the requirements and facilitate application by officials and industry.

The proposed changes will align other codes with the following changes made to the LPG code at the 2016 NCWM Annual Meeting.

S.2.1. Vapor Elimination.

(a) A device shall be equipped with an effective **automatic** ~~**vapor eliminator or other effective**~~ means to prevent the passage of vapor through the meter.

(b) Vent lines from the vapor eliminator shall be made of appropriate non-collapsible material.

(Amended 20XX)

The proposed changes make the requirement less design-specific and more focused on ensuring the means for eliminating air or vapor are effective, including that the vent lines not be susceptible to restriction. The proposed changes also clarify the provision for vapor elimination must be automatic in nature to be considered effective.

NIST, OWM in its analysis of the 2016 S&T agenda item referenced above suggested a similar change be proposed, where necessary, to corresponding requirements in other measuring codes and encouraged the Committee to consider including such an item on its agenda in the 2016 - 2017 NCWM cycle.

Note the Mass Flow Meters Code states, "means to prevent the measurement of vapor and air" while other codes state "means to prevent the passage of vapor and air through the meter," but such distinction is probably justified. Consequently, no modifications are proposed to align this language with other codes.

During the 2017 NCWM Interim and Annual Meetings, the Committee grouped agenda Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 together and took comments on these items simultaneously because it considered these items related. See agenda Item 3300-1 for a summary of the comments received and the resulting actions taken by the Committee on these items.

Regional Association Comments and Recommendations:
The WWMA considered Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 at the same time at its 2016 Annual Meeting. NIST, OWM will update language adopted at the 2016 NCWM Annual Meeting to these additional devices. The WWMA considered these items developed and forwarded them to NCWM, recommending Voting status.

The CWMA reported at its fall 2016 Interim Meeting the Committee recognized the value of aligning the measuring device codes and forwarded this item to the NCWM, recommending Voting status. The CWMA grouped Items 3300-1, 3301-1, 3301-1, 3306-1, and 3307-1 together and took comments at the same time on these items at its spring 2017 Annual Meeting because the Committee considered them related. The CWMA believes this group of items is sufficiently developed and recommended they be presented for Vote at the upcoming NCWM Annual Meeting.

The SWMA, at its 2016 Annual Meeting, batched Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 together and heard comments for all items at the same time. The only comments received were for Item 3300-1. See Item 3300-1 for details. The SWMA forwarded this item to NCWM and recommended Voting status.

NEWMA grouped Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 together and heard comments for all items at the same time. NEWMA forwarded the items in the group to the NCWM and recommended Voting status at both its fall 2016 Interim Meeting and spring 2017 Annual Meeting.

3301-2 W S.3.7. MANIFOLD HOSE FLUSH SYSTEM

(This item was Withdrawn.)

Source:
New York (2016)

Purpose:
Recognize the use of hose flush systems in the NIST Handbook 44, Vehicle Tank-Meter (VTM) code**.**

Item under Consideration:
Amend NIST Handbook 44, Vehicle Tank Meter Code as follows:

S.3.7. Manifold Hose Flush System. – A hose flush system to clear the hose of product may be installed in the manifold when multiple products are dispensed through a single meter and hose under the following conditions:

(a) the inlet valves for the system are conspicuously located above the bottom framework of the truck; and

(b) the inlet valves for the system are not connected to any hose or piping (dust covers are permitted) when not in use; and

(c) the discharge hose remains of the wet hose type; and

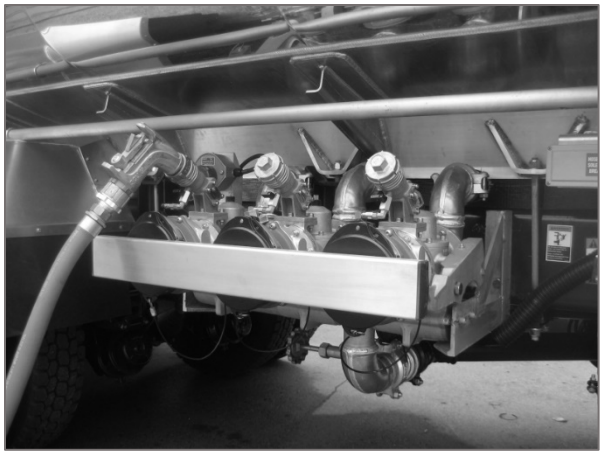
(d) the direction of flow for which the system may be set at any time is definitely and conspicuously indicated; and

(e) a recorded representation of each flush is maintained for inspection.

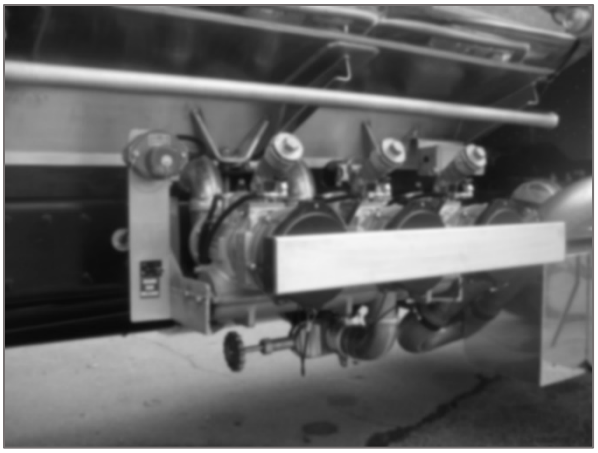
Background/Discussion:
Hose flush systems allow drivers to flush product where a truck is set-up to deliver multiple products through a single meter and hose. The system is particularly popular because it allows drivers to flush product without having to climb up on top of the truck, which is a common practice in the industry but one that can be dangerous. These systems are considered a significant safety advancement; however, without safeguards in place the systems could also be used to facilitate fraud.

These systems are being used country-wide, and there is no uniformity in what is and what is not acceptable by weights and measures jurisdictions. Some states have developed their own policies for acceptance, but this has led to problems when trucks have been moved from one state to another. Some states are considering prohibiting these systems, citing facilitation of fraud; however, they are also concerned that such prohibition may lead to drivers being unnecessarily injured or even killed. We want to do our job, but we also want drivers to be able to do their jobs in the safest way possible.

These systems make returning product after weights and measures testing very easy. These systems are also very good for preventing contamination of product.



Three-Compartment Manifold with Nozzle



Three-Compartment Manifold

2016 NCWM Interim Meeting:
The Committee heard comments on this item from Mr. Mike Sikula (New York), Mr. Hal Prince (Florida), Mr. Steve Giguere (Maine), Mr. John McGuire (New Jersey), Mr. Charlie Carroll (Massachusetts), Ms. Tina Butcher (NIST, OWM), Mr. Dmitri Karimov (Liquid Controls), and Mr. Dick Suiter (Richard Suiter Consulting). Mr. Sikula indicated some newer trucks were designed with manifold hose flush systems that need controls to prevent fraud; he also pointed out this is a nationwide issue, not just a New York issue.

Ms. Butcher mentioned a need to provide additional safeguards; mark the direction of flow on inlet and outlet valves; and add user requirements on when and how these systems should be used. Mr. Karimov advocated the addition of a second meter. Mr. Carroll said manifold flush systems should not be allowed.

There was general consensus in the comments heard that the hose flush back systems have arisen from a desire to minimize safety concerns with the delivery drivers having to climb up on top of trucks to flush hoses; however, these systems could enable fraud as fuel could be diverted after the meter and documentation of the flushing is typically not maintained. The Committee believes this item has merit, needs further development, and is interested in hearing from other states and manufacturers on this issue.

At the 2016 NCWM Annual Meeting, the Committee received an update on this item from its submitter, Mr. Mike Sikula (New York). Mr. Sikula reported manifold hose flush systems continue to be an issue in New York, and work on this item is ongoing.

NIST, OWM reiterated several comments and recommendations presented at the 2016 NCWM Interim Meeting. The following is a shortened summary of the comments and recommendations provided:

- There are undoubtedly safety and time advantages to being able to flush product from a hose using this system; however, there are also obvious concerns about the possibility of facilitation of fraud.
- It is presumably very easy to pump metered product back into the tank with this system, and this is much less obvious and less difficult than climbing to the top of the truck with a charged hose and returning it through the hatches. Particularly in an environment where customers are often not present during the delivery; this creates serious concerns about its potential misuse and the ease with which that misuse can occur.
- If manifold hose flush systems are permitted, it would be essential to have certain safeguards in place to help prevent misuse; yet still allow the operator to benefit from improved safety and ease of use offered by the system.
- The system does not appear to violate the diversion of product requirements outlined in VTM Code Paragraph S.3.1. Diversion of Measured Liquid since the manifold equipment is not part of the discharge line or piping connected to the metering system.

- The process of diverting already-measured product through the use of the system would not be obvious to an untrained observer and is much more easily accomplished than having to climb to the top of a truck and flushing product back into one of the storage compartments.

NIST, OWM also provided a list of key points, questions, and recommendations for an alternative version of the original proposal in written comments to the Committee. Additionally, OWM recommended the inclusion of a proposed new "User Requirement" to help ensure proper application and use of such flush systems. See the Committee's 2016 Final Report for details.

In consideration of the comments received, the Committee agreed to maintain the Developing status of the item to allow additional time for its further development

2017 NCWM Interim Meeting:
At the Committee's 2017 NCWM Interim Meeting open hearings, Ms. Tina Butcher) reported NIST, OWM believes additional work is needed to develop this proposal. Ms. Butcher reiterated many of the comments OWM provided on this item at the 2016 NCWM Interim Meeting, including the need to provide additional safeguards; mark direction of flow on inlet and outlet valves; and add user requirements on when and how these systems should be used. Ms. Butcher asked if there were any updates on this item.

NEWMA's Committee Chair, Ms. Jane Zulkiewicz (Barnstable, Massachusetts), reported Mr. Mike Sikula (New York), submitter of the item, was not present at the 2017 NCWM Interim Meeting. She stated that Mr. Sikula had requested, at the 2016 NEWMA Fall Interim Meeting, another year cycle to allow time for him to address the recommendations and concerns regarding safety, misuse, clear marking of valves, and safeguards for fraud provided to him by the NIST, OWM at the 2016 NCWM Annual Meeting.

In consideration of the submitter's request for additional time to work on the proposal and OWM's acknowledgement that additional development of the proposal is still needed, the Committee agreed to recommend this item be maintained as a Developing item.

During the Committee's 2017 NCWM Annual Meeting open hearings, Ms. Jane Zulkiewicz (Town of Barnstable, Massachusetts), speaking as the NEWMA's Committee Chair, announced that Mr. Mike Sikula (New York) wished to Withdraw this item. This had been indicated in an e-mail to Ms. Zulkiewicz following the 2017 NCWM Interim Meeting in San Antonio, Texas. Ms. Zulkiewicz reported Mr. Sikula indicated he sees similar issues regarding his proposal pertaining to a manifold hose flush system in the LPG Code, but he has not yet developed a viable solution. It was further reported he intends to submit a new proposal once progress has been made.

The Committee agreed to Withdraw this item at the request of the submitter.

Regional Association Comments and Recommendations (Fall 2016 Conferences):
The WWMA believes this item needs further development, including but not limited to what type of product(s) may be allowed or may not be allowed in such a system. An example of what type product(s) that should not be allowed in such a system would be ATF and motor oil.

The CWMA agrees with the NIST, OWM concern that these devices may facilitate fraud and further development is needed to address these concerns. CWMA recommended that this item remain in Developing status.

The SWMA received comment from Mr. Hal Prince (Florida) who believed this proposal was a good start but falls short. He feels stronger safeguards regarding fraud need to be in place before this item is ready for a vote and encourages the submitter to incorporate much stronger safeguards in the proposal to protect the consumer.

Ms. Butcher (NIST, OWM) recommended this item remain developmental and has provided comments to the submitter and further stated this item has merit but needs additional safeguards. The Committee heard several express concerns over consumer protection with this proposal and looks forward to those issues being addressed by the submitter. The SWMA recommended that the item remain in Developing status.

NEWMA received a request from the submitter to allow one more year to further develop this item. NEWMA recommended that this item remain in Developing status.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf.**

3301-3 V S.5.7. METER SIZE

(This item was Adopted.)

Source:
City of Madison, Wisconsin (2017)

Purpose:
Remove a marking requirement that is no longer necessary due to changes in the product depletion test tolerance**.**

Item under Consideration:
Amend NIST Handbook 44, Vehicle Tank Meter Code as follows:

~~S.5.7. Meter Size. – Except for milk meters, if the meter model identifier does not provide a link to the meter size (in terms of pipe diameter) on an NTEP Certificate of Conformance, the meter shall be marked to show meter size.~~

~~[Nonretroactive as of January 1, 2009]~~

~~(Added 2008)~~

Background/Discussion:
The meter size is no longer pertinent information to the inspector because of changes to the product depletion test tolerance.

This requirement was added because the product depletion test tolerance was based on the meter size and without a marking requirement it is often difficult to determine the meter size; the inspector could make a mistake and apply the incorrect tolerance. The product depletion test was changed as of 2013, and the tolerance is now based on the marked flow rate of the meter.

T.4. Product Depletion Test. – The difference between the test result for any normal test and the product depletion test shall not exceed 0.5 % of the volume delivered in one minute at the maximum flow rate marked on the meter for meters rated higher than 380 Lpm (100 gpm) or 0.6 % of the volume delivered in one minute at the maximum flow rate marked on the meter for meters rated 380 Lpm (100 gpm) or lower. Test drafts shall be of the same size and run at approximately the same flow rate.

Note: The result of the product depletion test may fall outside of the applicable test tolerance as specified in Table 1. Accuracy Classes and Tolerances for Vehicle-Tank Meters.

(Amended 2013)

The meter size is no longer necessary for the inspector to know and, therefore, shall not be required to be marked.

At the 2017 NCWM Interim Meeting S&T Committee open hearings, Mr. Dmitri Karimov (Liquid Controls), speaking on behalf of the MMA, reported the MMA supports deletion of paragraph S.5.7. Mrs. Tina Butcher (NIST, OWM) stated since the product depletion test has changed and is currently based on the maximum flow rate marked on the device, paragraph S.5.7. should be deleted.

The Committee did not receive any comments opposing the item and considering the comments heard in support, the Committee agreed to present the item for Vote at the upcoming 2017 NCWM Annual Meeting.

At the Committee's 2017 NCWM Annual Meeting open hearings, Ms. Tina Butcher (NIST, OWM) acknowledged it would be appropriate to remove paragraph S.5.7. Meter Size from the Vehicle-Tank Meters Code. She stated the paragraph was added to the code at a time when the product depletion test tolerances were based on meter size. Product depletion test tolerances are no longer based on meter size. There may be other benefits to marking meter size on the meter. For example, at the 2016 NTEP Measuring Sector meeting, a comment was made that meter size markings may assist officials in determining if a particular meter is covered by an NTEP CC. Additionally, some small volume prover test procedures limit the number of passes per run based on meter size. Thus, a similar requirement may be beneficial in other metering codes.

Mr. Dmitri Karimov (Liquid Controls), speaking on behalf of the MMA, supported the proposal.

Hearing no comments in opposition to the proposal and in consideration of the comments heard in support of it, the Committee agreed to place the item on the Voting Consent (VC) calendar.

Regional Association Comments and Recommendations:
This item was not submitted to the WWMA for consideration at its 2016 Annual Meeting.

The CWMA agrees with the submitter that this specification is no longer relevant and should be removed from NIST Handbook 44 because the product depletion tolerance for these devices is no longer based on meter size. CWMA forwarded the item to the NCWM and recommended Voting status at both its fall 2016 Interim Meeting and spring 2017 Annual Meeting.

This item was not submitted to the SWMA for consideration at its 2016 Annual Meeting.

This item was not submitted to NEWMA for consideration at its fall 2016 Interim Meeting. NEWMA did consider the item during its spring 2017 Annual Meeting and reported it believed the item is fully developed and recommended it be forwarded to the NCWM as a Voting item.

3301-4 W N.4.X. AUTOMATIC STOP MECHANISM, T.X. AUTOMATIC STOP MECHANISM AND UR.2.6. AUTOMATIC STOP MECHANISM

(This item was Withdrawn.)

Source:
City of Madison, Wisconsin (2017)

Purpose:
Incorporate the automatic stop mechanism test requirement in NIST Handbook 112, EPO 23 Vehicle-Tank Meters, Power Operated into NIST Handbook 44 so that it is enforceable**.**

Item under Consideration:
Amend NIST Handbook 44 Vehicle Tank Meter Code as follows:

N.4.X. Automatic Stop Mechanism. – The automatic stop mechanism shall stop the flow within one-half the minimum interval indicated.

T.X. Automatic Stop Mechanism. – The automatic stop mechanism shall stop the flow within one-half the minimum interval indicated.

UR.2.6. Automatic Stop Mechanism. – The automatic stop mechanism shall stop the flow within one-half the minimum interval indicated.

Background/Discussion:
Examination Procedure Outline (EPO) 23 states the automatic stop mechanism should stop the flow within one-half the minimum interval indicated. This requirement of the automatic stop mechanism is specific to VTMs and has a precise tolerance not addressed in NIST Handbook 44, Section 3.31. or G-UR.4.1. If it is to be enforced by weights and measures personnel, the automatic stop requirement should be stated in NIST Handbook 44.

2017 NCWM Interim Meeting:
At the 2017 NCWM Interim Meeting S&T Committee open hearings, several industry representatives and an NIST, OWM representative voiced opposition to the item. Mr. Dmitri Karimov (Liquid Controls), speaking on behalf of the MMA, commented that the auto-stop mechanism is a convenience and the MMA opposes the item. Ms. Tina Butcher (NIST, OWM) stated that the one-half minimum division tolerance specified NIST Publication 112, EPO 23 is from an unknown source and it was included in EPO 23 to provide guidance on a non-metrological function to inspectors. Mr. Michael Keilty (Endress & Hauser Flowtec AG USA) commented that the automatic-stop mechanism is *not* an NTEP-evaluated item.

In consideration of the comments received and at the recommendation of item's submitter, the Committee agreed to Withdraw this item.

Regional Association Comments and Recommendations (Fall 2016 Conferences):
The CWMA agrees the Automatic Stop Mechanism tests specified in EPO 23 should be incorporated into NIST Handbook 44. CWMA forwarded this item to the NCWM and recommended Voting status.

3302 LPG AND ANHYDROUS AMMONIA LIQUID-MEASURING DEVICES

3302-1 D N.3. TEST DRAFTS.

(The status of this item was changed from Voting to Developing.)

Note: This agenda item previously appeared on the Committee's agenda as Item 332-2 in 2015 and Item 332-5 in 2016.

Source:
Endress + Hauser Flowtec AG USA (2015)

Purpose:
Allow transfer standard meters to be used to test and place into service dispensers and delivery system flow meters.

Item under Consideration:
Amend NIST Handbook 44, LPG and Anhydrous Ammonia Liquid-Measuring Devices as follows:

N.3. Test Drafts.

N.3.1. Minimum Test. – Test drafts should be equal to at least the amount delivered by the device in one minute at its normal discharge rate.
(Amended 1982 **and 2017**)

N.3.2. Transfer Standard Test. – The minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.

Background/Discussion:
The Committee initially considered a proposal to modify paragraph N.3. Test Drafts and to add a new paragraph N.3.2. Transfer Standard Test as shown below. Note that, in the fall of 2016, Mr. Keilty provided an update to this proposal as shown in the Item Under Consideration above.

N.3. Test Drafts.

N.3.1. Minimum Test. – Test drafts should be equal to at least the amount delivered by the device in one minute at its normal discharge rate.
(Amended 1982)

N.3.2. Transfer Standard Test. – When comparing a meter with a calibrated transfer standard, the test draft shall be equal to at least the amount delivered by the device in two minutes at its maximum discharge rate.

The submitter noted the use of transfer standards (or "master meters" as some people refer to them) is recognized in Sections 3.34. Cryogenic Liquid-Measuring Devices Code, 3.38. Carbon Dioxide Liquid-Measuring Devices Code and 3.39. Hydrogen Gas-Measuring Devices – Tentative Code. Field evaluation of LPG meters, CNG dispensers, and LNG dispensers is very difficult using volumetric and gravimetric field standards and methods. The tolerances for these applications are such that using transfer meter standards are more efficient and safer. With CNG, LNG, and LPG applications, the transfer standard meters are placed in-line with the delivery system as it is used to fill tanks and vehicles. The use of transfer standards eliminates return to storage issues. The use of transfer standard meters is easier and faster compared to the use of traditional field standards. The cost of using transfer standards and transporting them is much less than the cost of traditional field provers and standards. Recognition in NIST Handbook 44 will enable states to allow transfer standard meters to place systems into service and for field enforcement. The amended language is made to clarify the minimum test quantity for using transfer standard meters accommodating both large quantity and low quantity delivery systems. Volumetric field provers and gravimetric field proving are susceptible to environmental influences. The states commonly use meters as transfer standards to test rack meters. In some applications, transfer standard meters are not more accurate than the meters used in the dispenser. For this reason, longer test drafts and possibly more tests need to be run.

The State of California is purported to have conducted a short study of master meters in the past. The conclusion did not lead to wide adoption of the practice. However, the State of California uses a mass flow meter as a master meter for carbon dioxide flowmeter enforcement.

Section 3.37. Mass Flow Meters user requirement UR.3.8. Return of Product to Storage, Retail Compressed Natural Gas Dispensers requires the natural gas, which is delivered into the test container, to be returned to storage. This is difficult and most often not complied with when the test vessel contents are released to atmosphere.

The submitter recommends that NIST update EPO 28 for CNG dispensers and EPO 26 for LPG Liquid Measuring Systems to include transfer standard meter tests. NIST Handbook 105-4 should also be revised to specifically address the transfer standard meter and the requirements for use.

The S&T Committee might also consider amending Sections 3.30. Liquid-Measuring Devices Code and 3.31. Vehicle-Tank Meters Code to allow transfer standard meters.

2015 Interim and Annual Meetings:
The Committee heard comments both in support of and in opposition to the proposal outlined in this item and a corresponding item in the Mass Flow Meters Code. Mr. Mike Keilty (Endress + Hauser Flowtec AG USA), submitter of these two items, outlined the benefits of using a master meter as a standard in testing application such as CNG, LNG, and LPG. The Committee heard comments in opposition to the proposal from Mr. Henry Oppermann (Weights and Measures Consulting, LLC), speaking on behalf of himself, as well as Seraphin Test Measure, Co. Mr. Oppermann noted there are significant differences between a transfer standard and a field standard. Ms. Tina Butcher (NIST, OWM) acknowledged the advantages to identifying and developing alternate test methods such as this, but noted that simply adding the proposed language doesn't address the multiple other elements, which needed to be in place, to ensure traceability. OWM provided a list of those elements along with other suggestions. OWM noted the USNWG on Alternative Test Methods might be a better venue to develop the elements to support the use of these devices. This was echoed by Mr. Dmitri Karimov (Liquid Control, LLC) who also commented that the regulatory authority must assess the suitability of a given standard. The Committee also heard from Ms. Kristin Macey (California) who commented that if the proposal were adopted, it would allow use of a transfer standard and California

would not be able to fully support it, citing results of comparison testing conducted by California in which the master meter performed worst of the three methods examined. Mr. Keilty, in response to Ms. Butcher and Mr. Oppermann's comments, stated he agreed completely and noted by adding the paragraph to these two codes is a step towards allowing the use of transfer standards. It's understood there are many things that need to be in place in order for it to be considered suitable for use in testing. The Committee also heard other comments from regulators and industry supporting the continued development of this issue. The Committee agreed the item has merit, but it needs further development and suggested the submitter work with NIST, OWM by providing data for the USNWG to consider.

See the Committee's 2015 Final Report for details.

2016 NCWM Interim and Annual Meetings:
The Committee again heard comments both in support of and in opposition to this item and the corresponding item in the Mass Flow Meters Code. Mr. Michael Keilty (Endress + Hauser Flowtec), the submitter, stated he supported this item as a Voting item as did Mr. Alan Walker (Florida). Others expressed support of the item, but noted the need for additional development. The Committee heard again from Ms. Tina Butcher and Mr. Henry Oppermann, who reiterated their 2015 detailed comments regarding the tasks needing to be completed before considering changes to NIST Handbook 44. Both echoed the need to collect data to properly evaluate whether or not a master meter could be considered a suitable standard.

During its Interim Meeting work session, the Committee acknowledged comments suggesting the need for additional test data. It was also acknowledged that there was a lot of support for the proposal. Those supporting the proposal had indicated using a transfer standard is much easier and faster than testing gravimetrically and eliminates the need to discharge product from a prover into the atmosphere, which is viewed by many as a safety concern. Given the addition of the proposed language would not dictate the method of testing and the decision on whether or not to use a particular method of testing would remain with each jurisdiction, the Committee agreed to present both items for Vote at the Annual Meeting.

At the 2016 Annual Meeting, the Committee received numerous comments from industry and regulators alike, predominantly in support of the proposals. These comments cited benefits such as safety, faster and more efficient testing, and lack of problems with using master meters. Mr. Marc Buttler (Emerson Process Management – Micro Motion) also expressed supports of the items, but suggested replacing the words "maximum discharge rate" with "maximum test rate" in proposed paragraph N.3.2.; the submitter agreed with the suggestion.

The Committee also heard comments in opposition to the item and comments emphasizing the need for further development and data. A new comment offered by Ms. Butcher (NIST, OWM) noted the proposed new paragraph N.3.1. would create a conflict with the minimum test procedures outlined in the NIST EPO for CNG dispensers since tests conducted at the MMQ and at some other quantities are frequently completed in less than one minute. There was also some debate regarding the application of the Fundamental Considerations regarding the allocation of error and uncertainty associated with a given test method, and Mr. Henry Oppermann clarified the proper application of these criteria. Mr. Oppermann noted transfer standards, in some cases, are no more accurate than the meter being tested and the proposals lack a specification associated with the performance of the standard. He recommended the items be changed to Informational or Developmental.

During the Committee's work session, members of the Committee agreed that the comments received during the open hearings were mostly in support of the two proposals. The Committee discussed the proposed changes to the text, including the errors in the transcription of the text in the Item Under Consideration. The Committee discussed the potential impact on testing CNG dispensers, acknowledging that the proposed requirement cannot be met by someone wanting to apply the procedures in the NIST EPO (which were developed through a WG comprised of industry and regulatory officials). Some Committee members familiar with CNG testing concurred a test run typically takes less than one minute to complete. The Committee was concerned with the potential conflict and questioned whether the submitter had fully considered the impact of the proposed language. These discussions led the Committee to decide to change the status of the item from Voting to Developmental and return them to the submitter for further development.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf.**

2017 NCWM Interim Meeting:
Just prior to the 2017 NCWM Interim Meeting, the Committee agreed to amend the proposal in agenda Item 3302-1 to that shown in Item under Consideration at the request of Mr. Michael Keilty (Endress & Hauser Flowtec AG USA), submitter of the item. The Committee Chairman, Dr. Matthew Curran (Florida), announced during open hearings of the Committee at the 2017 NCWM Interim Meeting that the proposal had been changed and the revised version had been posted on NCWM's website.

During the 2017 NCWM Interim Meeting, the Committee grouped agenda Items 3302-1 and 3307-2 together and took comments on these items simultaneously because the Committee considered these items related.

Mr. Michael Keilty (Endress & Hauser Flowtec AG USA), submitter of the item, stated this was a Voting item at the 2016 NCWM Annual Meeting during which it was downgraded to a Developing status. He further offered the opinion that there was not a good mechanism for relaying back to the submitter what an item needs in the way of development. Having now submitted the item with amended language, he said that he would like to see this item put to a vote.

Ms. Tina Butcher (NIST, OWM) spoke of the need for standards used in testing to comply with the tolerances for standards specified in NIST Handbook 44, Appendix A. Fundamental Considerations …, which she noted requires the combined error and uncertainty of any standard used without correction to be less than one-third the applicable device tolerance. She also made evident the potential for more than one type of standard to be used in testing, noting the tolerances specified the Carbon Dioxide Liquid-Measuring Devices Code of Handbook 44 increase for different test methods. She stated the proposal seemed to address only one particular type of transfer standard (i.e., a master meter) and, as a result, the proposal could have a very limiting effect on the types of transfer standards that can be used. She also questioned the use of the term "transfer standard" and suggested the term, "field standard" may be a more appropriate term. As a final comment, she reiterated a previous OWM comment that more data is needed of comparisons to known standards.

Mr. Bruce Swiecicki (National Propane Gas Association) reported the National Propane Gas Association supported the item and noted its potential for efficiencies and safety benefits.

Mr. Constantine Cotsoradis (Flint Hills Resources) asked for this item be moved forward, citing the need for it due to there being systems already in use for this purpose.

Mr. Hal Prince (Florida) asked for the item be moved forward.

Mr. Ross Andersen (New York, retired) gave an example of alternative test methods being used for like applications, such as what the ASTM does. He stated different test methods will have different results and the variables of those methods need to be evaluated. He commented that the proposal is currently evaluating only one variable.

In consideration of the comments heard on these two items, the Committee agreed to present them for Vote at the 2017 NCWM Annual Meeting.

2017 NCWM Annual Meeting:
At the 2017 Annual Meeting, the Committee grouped this item with agenda Item 3307-2 and took comments on the two items at the same time. Several industry and regulatory officials voiced support to presenting the two items for Vote. Some of those speaking in support of the items acknowledged a lot of additional work still needed to be completed to confirm the adequacy of alternative test measures, such as a master meter, for use as a standard in testing commercial devices. The Committee was urged by some, however, to present the items for Vote, noting some states are already using alternative standards for testing and the additional work needed to confirm their adequacy can be completed post adoption of the proposals.

There were several who spoke in favor of maintaining the Developing status of the items. Mr. Steve Harrington (Oregon), for example, reported the State of Oregon is pursuing the use of a mass flow meter standard for use in testing LPG meters. He noted additional work is needed to develop procedures that will confirm the adequacy of the mass flow meter (standard) for use in testing LPG meters used in commercial applications. He recommended maintaining the Developing status of the items.

Ms. Tina Butcher (NIST, OWM) reported OWM believes the proposed changes are premature. More work is needed and OWM recommends maintaining the items as Developing. Ms. Butcher provided an update on some ongoing work relating to alternative test methods and the current proposals under consideration as follows:

- The NTEP Measuring Sector is developing guidelines for type-evaluation laboratories when conducting type evaluation using alternative types of standards.
- NIST, OWM has established a USNWG to examine alternative test methods.
    - The USNWG subgroup has been working to establish uncertainties for select test methods and examining data from some field tests.
    - The USNWG has developed guidelines for collecting measurement data.
    - The guidelines can be used by equipment manufacturers and/or weights and measures jurisdictions to collect data to examine different test methods and types of test standards.
    - Guidelines include tasks such as:
        - Developing a test protocol for collecting data and for identifying testing factors that may contribute the largest uncertainties in testing;
        - Following guidelines for data collection;
        - Collecting sufficient data under a similar variety of user conditions;
        - Identifying the major factors that could affect test results and contribute the largest uncertainties in testing;
        - Ensuring that NIST Handbook 44 and EPOs are updated and available for its use;
        - Making all results and assessments accessible to states and other enforcement agencies; and
        - Publishing and/or updating a NIST 105 Series Handbook and calibration procedures, if needed.
- OWM is in the process of developing a proposal to address the use of the term “transfer standard” throughout NIST Handbook 44. According to NIST Handbook 130 (“Uniform Laws and Regulations in the Areas of Legal Metrology and Engine Fuel Quality”); the International Vocabulary of Metrology; and references in Handbook 44 (“Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices”), Fundamental Considerations, the reference in the current proposals should be “field standard.” OWM plans to submit the proposal for consideration during the 2018 NCWM cycle.

Ms. Butcher also noted OWM has a significant concern with the proposal in agenda Item 3307-2 because proposed new paragraph N.3.1. conflicts with the minimum test of a CNG RMFD being performed today in accordance with the NIST EPO. A test conducted at the MMQ typically takes far less than a minute to complete. Additionally, the test drafts performed at one-third, two-thirds, and three-thirds test tank capacity often are completed in less than a minute’s time.

Ms. Butcher also reiterated many of the points OWM had provided in previous NCWM Meetings relating to these two proposals. The following is a short summary of these points:

- The development of alternative methods of testing commercial metering systems is an important issue. Many applications, in which using currently recognized test methods, may be not be feasible because of product characteristics, safety, cost, access to equipment, and other factors.

- Modifying NIST Handbook 44 as proposed doesn't ensure approval of any proposed test method. The decision on whether or not to accept a particular test method rests with the regulatory authority.
- Many things must be considered when selecting and determining the suitability of field standards to provide traceable measurements. These are sometimes referred to as the "essential elements of traceability." The following are some examples:
    - accuracy of a particular test standard relative to the applicable tolerance;
    - demonstrated reliability of the device over time;
    - device repeatability;
    - how well it duplicates actual use;
    - existence of documentary standards for the test equipment;
    - availability of equipment/facilities within a state lab to test the equipment; and
    - whether training has been provided for the lab staff, field officials, and users of the equipment.
- NIST Handbook 44, Appendix A. Fundamental Considerations, Section 3.2. Tolerances for Standards, specify that when a standard is used without correction, its combined error and uncertainty must be less than one-third of the applicable tolerance.
- The current proposal seems to simply borrow from other codes without technical rationale. There is a potential for more than one type of alternative test method. The current proposal may unintentionally limit other types.
- Even within the category of "master meters," different requirements may be needed for different master meter technologies in order to comply with this requirement.
- Should consideration be given to providing a larger tolerance when conducting tests using a particular test method as is done in the carbon dioxide and hydrogen codes? Testing would need to be conducted to demonstrate the magnitude of the additional tolerance.
- Weights and measures needs a system that results in:
    - manufacturers knowing the requirements for the design of the standard;
    - systematic and appropriate collection of measurement data on proposed standards;
    - states (regulatory authorities) having access to the measurement data; and
    - side-by-side testing to compare results with existing test methods.
- Additional data and analysis is needed prior to recommending specific language for adoption in NIST Handbook 44.

Mr. Henry Oppermann, (Weights and Measures Consulting, LLC) speaking on his own behalf as well as consultant for Seraphin Test Measure, Co., stated there is no clear understanding of the terms "field standard" and "transfer standard." Any standard proposed for use in testing must meet the tolerances for standards specified in the Fundamental Considerations (Appendix A) of NIST Handbook 44, and there must be proof that the standard is able to comply with the tolerance over a range of field conditions. He raised the question, "without data to support the accuracy of a standard, how do you know it is accurate enough to use in testing a commercial device?" Mr. Oppermann expressed the need for the development of a test method (or procedures) that can be used to identify meters, performs well enough, and can be used as a standard in testing. Mr. Robert Murnane (Seraphin Test Measure, Co.) stated that he echoed Mr. Oppermann's comments. He acknowledged the existence of the USNWG, which NIST had created for the purpose of identifying the variables and parameters over which a proposed alternate standard must be tested and evaluated to ensure the methodologies and standards facilitate measurements with metrological traceability. He also noted jurisdictions could already use alternative standards if controls were in place to validate their traceability. Mr. Oppermann and Mr. Murnane both forwarded written comments to the Committee in advance of the meeting opposing the adoption of these two items and recommending their status be changed from Voting to Developing.

Mr. Michael Keilty (Endress + Hauser Flowtec AG USA) stated he would entertain a change to the terminology (transfer standard) in his proposals. He reported some jurisdictions will not allow the use of a transfer standard unless it is mentioned in NIST Handbook 44. He agreed with Mr. Murnane and Ms. Butcher that procedures would still need to be in place to ensure the adequacy of the standard for use in testing a commercial device. He recommended the Committee present the two items for Vote.

Based on the concerns raised by numerous members during the open hearings and recommendations from all four regional associations, the Committee felt the two items in the group had merit, but more work is necessary to move them forward. The Committee agreed to downgrade them to a Developing status.

Regional Association Comments and Recommendations:
The WWMA reported at its 2016 Annual Meeting, it believes this item should remain Developing until such time data is supplied to verify the test equipment can meet accuracy considerations as a standard.

At its 2016 Interim Meeting, the CWMA reported it recognizes the need for transfer standards, but until requirements are in place regarding their use, the CWMA recommends this item be Withdrawn. At its 2017 Annual Meeting, the CWMA reported it supports the use of alternative test methods but believes the procedures must be in place to ensure the standards meet the fundamental considerations for field standards. The CWMA recommended the item be moved to Developing status until the procedures are in place.

The SWMA batched Items 3302-1 and 3307-1 together at its 2017 Annual Meeting and heard comments on both items at the same time. Mr. Hal Prince (Florida) stated he supports these items and would like to see them move forward as Voting items. Mr. Henry Oppermann (Seraphin) stated he was opposed to the adoption of these items, and they should be Withdrawn. He further stated they are not legally acceptable standards and referred to his written submission in opposition to these items. Mr. Oppermann further stated the transfer standards must meet the one-third requirement, and there has not been any data provided showing they meet the one-third requirement. Ms. Tina Butcher (OWM) stated NIST submitted several comments in opposition of this item as written. She said the use isn't merely recognized by putting it in print and these devices need traceability. Further, Ms. Butcher stated the proposal appears to be lifting language from other codes and specifically asked where the two minutes came from. She concluded by stating NIST doesn't oppose the use of master meters, but a lot more work needs to be done before they can be used. Mr. Tim Chesser (Arkansas) stated he was in full support of using master meters but can't defend their use. He added that the operating conditions need to identify products and limits. The SWMA recommends this item remain in Developing status, but urges the submitter and those opposed to it to reach a resolution as the Committee believes the item has merit and could be beneficial in the field.

NEWMA recommended, at its 2016 Interim Meeting, that this item remain in a Developing status for another year. At its 2017 Annual Meeting, NEWMA grouped items 3302-1 and 3307-2 together and reported it believes these items should be further developed to include definitions of terms (transfer standards).

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf.**

3302-2 D N.4.1.2. REPEATABILITY TESTS AND N.4.2.4. REPEATABILITY TESTS FOR TYPE EVALUATION

Source:
Ross Andersen, Retired (2017)

Purpose:
Address differences between NIST Handbook44 and NCWM Publication 14 practices for LPG Liquid Meter testing.

Item under Consideration:
Amend NIST Handbook 44, Liquid Measuring Devices Code as follows:

N.4.1.2. Repeatability Tests. – Tests for repeatability should include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors such as temperature, pressure, and flow rate are reduced to the extent that they will not affect the results obtained. **Repeatability tests shall be based on the uncompensated volume (e.g., with the temperature compensator deactivated). Both field tests and type evaluation tests shall be run at flow rates consistent with normal tests as specified in N.4.1.**

(Amended 20XX)

Add a new Paragraph N.4.2.4. as follows:

N.4.2.4. Repeatability Tests for Type Evaluation. – Tests for repeatability should include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors such as temperature, pressure, and flow rate are reduced to the extent that they will not affect the results obtained. Repeatability tests shall be based on the uncompensated volume (e.g., with the temperature compensator deactivated). Type evaluation tests shall be run at flow rates consistent with special tests as specified in N.4.2., N.4.2.1., N.4.2.2., or N.4.2.3. as appropriate.

(Added 20XX)

Background/Discussion:
This proposal is aimed to correct a number of areas of confusion. The inclusion of repeatability in the N.4.1. series indicates that repeatability is to be run at normal flow rates. The submitter believes there is some confusion as to whether this was the actual intent and notes running the tests only at normal flow rates is consistently how the test was performed in the field. The proposed amendment to N.4.1.2. clarifies this explicitly for field tests and type evaluation tests.

The new paragraph regarding type evaluation is proposed because NTEP has, for a long time, required repeatability on tests over the entire range of flow rates conducted under controlled conditions during type evaluation testing. This means these tests are conducted anywhere between rated maximum and minimum flow rates. The proposed addition would formalize and legitimize what has been done for a long time.

Another question that has arisen is whether gross or net results could be used in repeatability tests. Obviously, you can't compare net to gross, but you can compare three consecutive gross results or three consecutive net results. As the practice in NIST Handbook 44 is to test one variable at a time to the extent possible, the proposed revision would clarify that repeatability is assessed on gross meter performance only. This can be accomplished by deactivating the ATC and conducting the repeatability tests or just using gross values where both gross and net are available from the same test draft.

At the Committee's 2017 Interim Meeting open hearings, the Committee heard support for the item from Mr. Dmitri Karimov (Liquid Controls) on behalf of the MMA.

Ms. Tina Butcher (NIST, OWM) clarified that, although it is common for repeatability to be conducted at the normal flow rate, there is nothing precluding an inspector from running these tests at any valid flow rate. The meter should be expected to be repeatable at any flow rate throughout the approved range. OWM concurs with the submitter that the specific tolerances for "repeatability" found in the specific codes are located under the heading of "normal tests." There was also some discussion as to whether or not repeatability should only be applicable to gross or uncompensated meter readings. Some felt the same requirements should also be applicable when testing a meter in net or compensated mode. OWM suggested this may have unintended consequences. These may include errors or stability issues in the temperature compensation being interpreted as apparent repeatability issues.

Mr. Constantine Cotsoradis (Flint Hills Resources) also questioned whether or not repeatability requirements may be applied to the compensated, net registrations.

Mr. Michael Keilty (Endress & Hauser Flowtec AG) commented that the proposal should be further evaluated by the NTEP laboratories.

Mr. Karimov reminded the group that any changes to the requirements must consider all meter technologies and not just positive displacement (PD) meters.

Ultimately, the Committee agreed more work was needed to develop the item and assigned it a "Developing" status. During its open hearings at the 2017 NCWM Annual Meeting, the Committee received comments from the submitter of this item, Mr. Ross Andersen (New York, retired), supporting further development of this item. Mr. Andersen noted he submitted this item because he wanted to make it clear in NIST Handbook 44 that for field evaluation, repeatability tests are only to be conducted at normal flow rates (i.e., at flow rates consistent with paragraph N.4.1. Normal Tests). NIST Handbook 44 also needs to clarify whether repeatability tests are to be conducted using temperature compensation or without temperature compensation. He further noted that NTEP evaluates these meters across all flow rates, and he would work with the MMA and the Measuring Sector to further develop this item.

In written comments submitted to the Committee, NIST, OWM concurred with the need to make modifications to the measuring codes to clarify the application of repeatability criteria. NIST, OWM believes it is not clear whether the original intent was to limit the application of the repeatability tolerances in the specific codes to only certain types of tests. During discussion at the MMA meeting, it was noted the 2001 Measuring Sector discussion included no reference to limiting repeatability tests to only normal tests, which causes question as to whether or not the location in the code is appropriate. Prior to the addition of repeatability tolerances in the measuring codes, only G-S.5.4. applied. When considering the addition of the repeatability requirements to the specific measuring codes, the weights and measures community felt strongly that a measuring device should be able to repeat its indications within a much smaller limit. Field officials should be able to verify a device is capable of repeating its indications at other flow rates and use conditions. Repeatability testing at other than normal flow rates should not be limited to type evaluation.

During the Committee's work session, the NIST Technical Advisor further noted that, initially, OWM had questioned whether the 40 percent of the absolute value of maintenance tolerance was too stringent to apply to the results of "Special Tests." However, during the MMA meeting at the 2017 Annual Meeting, it was noted that "Special Tests" are granted a larger tolerance. Thus, applying the "40 percent" value to the maintenance tolerances applied to special tests would result in applying a larger repeatability tolerance to those tests. Additionally, there was no mention of restricting the tolerances to only normal tests in either the S&T Committee or Measuring Sector reports when the tolerances were initially added. Consequently, testing at multiple flow rates seems appropriate and the code needs to be changed to clarify the intent.

Based on the comments heard and its work session discussions, the Committee agreed to recommend this item be further Developed.

Regional Association Comments and Recommendations:
At its 2016 Interim Meeting, the CWMA reported it believes this item needs further clarification. CWMA did not forward this item to NCWM and recommended that it be Withdrawn. At its 2017 Annual Meeting, the CWMA reported it believes the item has merit and recommended it move forward as a Developing item.

The SWMA, at its 2016 Interim Meeting, heard comment from Mr. Henry Oppermann (Weights and Measures Consulting) that he doesn't understand why there should be a difference in repeatability between compensated and uncompensated tests. He further stated the repeatability should be the same for both tests. The SWMA did not forward this item to NCWM and recommended that it be Withdrawn as it is already specified in NCWM Publication 14.

NEWMA forwarded this item to NCWM and recommended it be a Developing item at both its 2016 Interim and 2017 Annual Meetings. At the 2017 Annual Meeting, NEWMA reported the submitter was still developing the item and accepting feedback.

3302-3 V N.4.2.3. FOR WHOLESALE DEVICES

(This item was Adopted.)

Source:
NIST Office of Weights and Measures (2016)

Purpose:

- To specify the purpose of special tests conducted on Wholesale LPG and Anhydrous Ammonia Liquid-Measuring Devices;
- To specify the special tests are to be conducted at or slightly above the designated flow rates in the referenced paragraph; and
- To specify the special tests are not to be conducted below the device's marked minimum discharge rate.

Item under Consideration:
Amend NIST Handbook 44, Liquefied Petroleum Gas and Anhydrous Liquid-Measuring Devices Code as follows:

N.4.2.3. ~~For~~Wholesale Devices. – **"Special" tests on ~~A~~ a** wholesale device shall **include a test at or slightly above the minimum discharge rate marked on the device.** ~~**be so tested at a minimum discharge rate of:**~~

~~(**a) 40 L (10 gal) per minute for a device with a rated maximum discharge less than 180 L (50 gal) per minute.**~~

~~**(b) 20 % of the marked maximum discharge rate for a device with a rated maximum discharge of 180 L (50 gal) per minute or more, or**~~

~~**(c) the minimum discharge rate marked on the device, whichever is least.**~~

In no case shall the test be performed at a flow rate less than the minimum discharge rate marked on the device.

(Amended 1987 **and 20XX**)

Background/Discussion:
In 2014, the Liquid-Measuring Devices (LMD) Code of NIST Handbook 44 was modified to clarify testing requirements for special tests of wholesale LMDs and to help to ensure that those tests were not conducted at flow rates less than the minimum flow rates marked by the manufacturers of the metering systems. The proposed changes outlined above would align the special test requirements for LPG and Anhydrous Ammonia Liquid-Measuring Devices with those adopted in 2014 in the LMD Code and provide consistency in testing procedures across measuring codes.

During training seminars for weights and measures officials and service personnel, NIST, OWM and other trainers instruct students to conduct special tests slightly above the marked minimum flow rate. While an official or service agent is not precluded from setting the flow rate exactly at the marked minimum flow rate, special care must be taken to ensure that the flow rate does not drop below the marked minimum during the test. This can sometimes be difficult in field environments. Flow rates can vary slightly during a test draft due to factors such as changes in system pressure and the number of other devices in use within the system. If the inspector or service agent sets the flow rate exactly at the marked minimum flow rate, such variations can result in the flow rate dropping below the marked minimum flow rate for portions of the test. This could potentially result in an unfair test to the metering system. Additionally, it is sometimes difficult to control the flow rate during the entire test or to even set the flow rate at "exactly" the marked minimum rate. The proposed language would provide flexibility to the inspector or service agent to conduct a special test "at" or "near" the marked minimum and still consider such a test to be valid.

This proposal would provide consistency with 2015 NIST Handbook 44, Section 3.30. Liquid-Measuring Devices Code, Special Tests, paragraph N.4.2.4. Special Tests, Wholesale Devices.

See the Committee's 2016 Annual Report to review previous language and positions to amend NIST Handbook 44 LPG and Anhydrous Ammonia Liquid Measuring Devices Code Paragraph N.4.2.3.

In December 2016, the MMA submitted an amended version of paragraph N.4.2.3. For Wholesale Devices to the Committee to replace the original proposal submitted by NIST. The MMA, in written comments provided to the Committee, noted all LPG devices must have a minimum discharge rate marked on the device. Options (a) and (b) of paragraph N.4.2.3. would never apply because the requirement is to always choose the least of Options (a), (b), or (c), but never to go below the minimum marked flow rate. Since Option (c) is the minimum discharge rate marked on the device, it is the only possible choice. If Options (a) and/or (b) are greater than (c), then they would not be the least of the three. If they are less than (c), they cannot be applied because to do so would be to drop below the minimum marked rate. Therefore, MMA saw an opportunity to shorten the paragraph in a way that would have no change on the final meaning or outcome.

During the Committee's open hearings at the 2017 NCWM Interim Meeting, Mr. Dmitri Karimov (Liquid Controls), speaking on behalf of the MMA, reported the MMA supported the amended version it had submitted to the Committee.

Ms. Tina Butcher (NIST, OWM) commented that OWM agreed with the MMA's assessment of this paragraph and believes the proposed changes to shorten the paragraph are appropriate.

In consideration of the comments received in support of the revised version of the proposal submitted by the MMA, the Committee agreed to replace the original proposal with the one revised by the MMA as shown in "Item under Consideration" and present the item for Vote at the upcoming NCWM Annual Meeting.

During the 2017 NCWM Annual Meeting, the Committee received numerous comments in support of this item (i.e., the amended version of paragraph S.4.2.3., which was submitted by the MMA in December 2016) and no comments in opposition to it.

Ms. Butcher reiterated many of the same points offered by OWM during previous open hearings of the Committee from past NCWM Interim and Annual Meetings to include:

- OWM submitted the proposal to align the requirements in paragraph N.4.2.3. with the changes made to corresponding requirements in the LMD Code in 2015. That code was modified to make it more "real world" with respect to how special tests are conducted on wholesale devices.
- The LMD code paragraph was modified to specify that the special test include a test "at or slightly above" the slower of two rates specified in the paragraph but never shall the test be conducted at a flow rate less than the minimum flow rate marked on the device.
- It is very difficult for field officials to control the flow of product during testing to a constant flow. This proposed change to the LPG and Anhydrous Liquid Measuring Code takes into account the difficulty encountered by field officials to be able to control the flow of product when performing special tests, and makes clear that at no time during the test shall the flow be less than the minimum flow rate marked on the device being tested.
- It has been suggested by a few people that more clarity is needed to better define what is meant by "slightly" in the proposed changes to the paragraph. This terminology is already used in the LMD Code. OWM concurs that improvements could be made, but suggests this be considered as a future change. MC has set a flow rate limit of no more than 10 percent of the marked minimum flow rate for these tests.

Mr. Dmitri Karimov (Liquid Controls, LLC), speaking on behalf of the MMA, voiced support for the proposal, including use of the term "slightly." A few others (i.e., officials and industry representatives) also voiced support for the proposal with an added suggestion that consideration possibly be given to better define the term "slightly" at some future date.

Hearing only comments in support of the proposal, with no immediate changes proposed by those providing comment, the Committee agreed to present the item for Vote as shown in the Item under Consideration.

Regional Association Comments and Recommendations:
The WWMA reported, at its 2016 Annual Meeting, this item should be given Informational status since the MMA is currently working on changes to this item.

The CWMA reported, at both its fall 2016 Interim Meeting and spring 2017 Annual Meeting, this item is fully developed and recommended a Voting status.

At its 2016 Annual Meeting, the SWMA received comment from Ms. Butcher who reported that last year NIST submitted changes as a "housekeeping" measure to align with similar changes to other codes. The Committee believes this item is fully developed and recommended Voting status.

NEWMA reported at both its fall 2016 Interim Meeting and spring 2017 Annual Meeting that the Committee believes this item is fully developed and recommended Voting status.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf.**

3305 MILK METERS

3305-1 V S.2.1. VAPOR ELIMINATION (SEE RELATED ITEMS 3300-1, 3301-1, 3306-1 AND 3307-1)

(This item was Adopted.)

Source:
Liquid Controls and NIST, OWM (2017)

Purpose:
Align other measuring device codes with the changes adopted in 2016 under S&T LPG and NH_3 Code Item 332-3 (S.2.1. Vapor Elimination).

Item under Consideration:
Amend NIST Handbook 44, Milk Meters Code as follows:

S.2. Design of Measuring Elements.

S.2.1. Air/Vapor Elimination. – A ~~**metering**~~ **measuring** system shall be equipped with an effective **air/**vapor eliminator or other ~~**effective means**~~ automatic **means** ~~**in operation**~~ to prevent the passage of **air/**vapor ~~**and air**~~ through the meter. Vent lines from the air~~ **or**~~/vapor eliminator shall be made of ~~**metal tubing or some other suitably rigid material**~~ **appropriate non-collapsible material.**

(Amended 2017)

Background/Discussion:
The proposed changes would ensure consistency across the various measuring device codes in NIST Handbook 44. This would help ensure more uniform interpretation of the requirements and facilitate application by officials and industry.

The proposed changes will align other codes with the following changes made to the LPG code at the 2016 NCWM Annual Meeting.

S.2.1. Vapor Elimination.

(a) A device shall be equipped with an effective **automatic** ~~**vapor eliminator or other effective**~~ means to prevent the passage of vapor through the meter.

(b) Vent lines from the vapor eliminator shall be made of appropriate non-collapsible material.

(Amended 20XX)

The proposed changes make the requirement less design-specific and more focused on ensuring the means for eliminating air or vapor are effective, including the vent lines not be susceptible to restriction. The proposed changes also clarify that the provision for vapor elimination must be automatic in nature to be considered effective.

NIST, OWM in its analysis of the 2016 S&T agenda item referenced above suggested a similar change be proposed, where necessary, to corresponding requirements in other measuring codes and encouraged the Committee to consider including such an item on its agenda in the 2016-2017 NCWM cycle.

Note that the Mass Flow Meters Code states "means to prevent the measurement of vapor and air" while other codes state "means to prevent the passage of vapor and air through the meter," but such distinction is probably justified. Consequently, no modifications are proposed to align this language with other codes.

During the 2017 NCWM Interim and Annual Meetings, the Committee grouped agenda Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 together and took comments on these items simultaneously because it considered these items related.

See agenda Item 3300-1 for a summary of the comments received and the resulting actions taken by the Committee on these items.

Regional Association Comments and Recommendations:
The WWMA considered Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 at the same time at its 2016 Annual Meeting. NIST, OWM will update language adopted at the 2016 NCWM Annual Meeting to these additional devices. The WWMA considered these items developed and forwarded them to NCWM, recommending Voting status.

The CWMA reported at its fall 2016 Interim Meeting that it recognized the value of aligning the measuring device codes and forwarded this item to the NCWM, recommending Voting status. The CWMA grouped Items 3300-1, 3301-1, 3301-1, 3306-1, and 3307-1 together and took comments at the same time on these items at its spring 2017 Annual Meeting because it considered them related. The CWMA reported it believes this group of items is sufficiently developed and recommended they be presented for Vote at the upcoming NCWM Annual Meeting.

The SWMA, at its 2016 Annual Meeting, batched Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 together and heard comments for all items at the same time. The only comments received were for Item 3300-1. See this item for details. The SWMA forwarded this item to NCWM and recommended Voting status.

NEWMA grouped Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 together and heard comments for all items at the same time. NEWMA forwarded the items in the group to the NCWM and recommended Voting status at both its fall 2016 Interim Meeting and spring 2017 Annual Meeting.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf.**

3306 WATER METERS

3306-1 V S.2.2.1. AIR ELIMINATION (SEE RELATED ITEMS 3300-1, 3301-1, 3305-1 AND 3307-1)

(This item was Adopted.)

Source:
Liquid Controls and NIST, OWM (2017)

Purpose:
Align other measuring device codes with the changes adopted in 2016 under S&T LPG and NH_3 Code Item 332-3 (S.2.1. Vapor Elimination).

Item under Consideration:
Amend NIST Handbook 44, Water Meters Code as follows:

S.2.2. Batching ~~Meters~~Measuring Systems Only.

S.2.2.1. Air/Vapor Elimination, Batching Measuring Systems. – Batching **~~meters~~measuring systems** shall be equipped with an effective air/**vapor** eliminator **or other automatic means to prevent the passage of air/vapor through the meter. Vent lines from the air/vapor eliminator shall be made of appropriate non-collapsible material.**

(Amended 2017)

Background/Discussion:
The proposed changes would ensure consistency across the various measuring device codes in NIST Handbook 44. This would help ensure more uniform interpretation of the requirements and facilitate application by officials and industry.

The proposed changes will align other codes with the following changes that were made to the LPG code at the 2016 NCWM Annual Meeting.

S.2.1. Vapor Elimination.

(a) A device shall be equipped with an effective **automatic** **~~vapor eliminator or other effective~~** means to prevent the passage of vapor through the meter.

(b) Vent lines from the vapor eliminator shall be made of appropriate non-collapsible material.

(Amended 20XX)

The proposed changes make the requirement less design-specific and more focused on ensuring that the means for eliminating air or vapor are effective, including the vent lines not be susceptible to restriction. The proposed changes also clarify the provision for vapor elimination must be automatic in nature in order to be considered effective.

NIST, OWM in its analysis of the 2016 S&T agenda item referenced above suggested a similar change be proposed, where necessary, to corresponding requirements in other measuring codes and encouraged the Committee to consider including such an item on its agenda in the 2016 - 2017 NCWM cycle.

Note the Mass Flow Meters Code states “means to prevent the measurement of vapor and air” while other codes state “means to prevent the passage of vapor and air through the meter,” but such distinction is probably justified. Consequently, no modifications are proposed to align this language with other codes.

During the 2017 NCWM Interim and Annual Meetings, the Committee grouped agenda Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 together and took comments on these items simultaneously because it considered these items related. See agenda Item 3300-1 for a summary of the comments received and the resulting actions taken by the Committee on these items.

Regional Association Comments and Recommendations:
The WWMA considered Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 at the same time at its 2016 Annual Meeting. NIST, OWM will update language adopted at the 2016 NCWM Annual Meeting to these additional devices. The WWMA considered these items developed and forwarded them to NCWM, recommending Voting status.

The CWMA reported at its fall 2016 Interim Meeting that it recognized the value of aligning the measuring device codes and forwarded this item to the NCWM, recommending Voting status. The CWMA grouped Items 3300-1, 3301-1, 3301-1, 3306-1, and 3307-1 together and took comments at the same time on these items at its spring 2017 Annual Meeting because it considered them related. The CWMA reported it believes this group of items is sufficiently developed and recommended they be presented for vote at the upcoming NCWM Annual Meeting.

The SWMA, at its 2016 Annual Meeting, batched Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 together and heard comments for all items at the same time. The only comments received were for Item 3300-1. See this item for details. The SWMA forwarded this item to NCWM and recommended Voting status.

NEWMA grouped Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 together and heard comments for all items at the same time. NEWMA forwarded the items in the group to the NCWM and recommended Voting status at both its fall 2016 Interim Meeting and spring 2017 Annual Meeting.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf.**

3307 MASS FLOW METERS

3307-1 V S.3.3. VAPOR ELIMINATION (SEE RELATED ITEMS 3300-1, 3301-1, 3305-1 AND 3306-1)

(This item was Adopted.)

Source:
Liquid Controls and NIST, OWM (2017)

Purpose:
Align other measuring device codes with the changes adopted in 2016 under S&T LPG and NH_3 Code Item 332-3 (S.2.1. Vapor Elimination).

Item under Consideration:
Amend NIST Handbook 44, Mass Flow Meters Code as follows:

S.3.3. Air/Vapor Elimination. – A ~~**liquid-measuring instrument or**~~ measuring system shall be equipped with an effective **air/**vapor ~~**or air**~~ eliminator or other ~~**effective**~~ **automatic** means~~**, automatic in operation,**~~ to prevent the measurement of **air/**vapor. Vent lines from the air/~~**or**~~ vapor eliminator shall be made of ~~**metal tubing or some other suitable rigid**~~ **appropriate non-collapsible** material.

(Amended 1999 **and 2017**)

S.3.3.1. Air/Vapor Elimination on Loading Rack Liquid ~~Metering~~ Measuring Systems.

(a) A loading rack ~~**liquid metering**~~ **measuring** system shall be equipped with a**n effective air/**vapor ~~**or air**~~ eliminator or other automatic means to prevent the passage of **air/**vapor ~~**and air**~~ through the meter unless the system is designed or operationally controlled by a **means** ~~**method, approved by the weights and measures jurisdiction having statutory authority over the device,**~~ such that neither air nor vapor can enter the system.

(b) Vent lines from the air~~**/ or**~~ vapor eliminator ~~**(if present)**~~ shall be made of ~~**metal tubing or other rigid**~~ **appropriate non-collapsible** material.

(Added 1995) **(Amended 2017)**

Background/Discussion:

The proposed changes would ensure consistency across the various measuring device codes in NIST Handbook 44. This would help ensure more uniform interpretation of the requirements and facilitate application by officials and industry.

The proposed changes will align other codes with the following changes that were made to the LPG code at the 2016 NCWM Annual Meeting.

S.2.1. Vapor Elimination.

(a) A device shall be equipped with an effective **automatic** ~~**vapor eliminator or other effective**~~ means to prevent the passage of vapor through the meter.

(b) Vent lines from the vapor eliminator shall be made of appropriate non-collapsible material.

(Amended 20XX)

The proposed changes make the requirement less design-specific and more focused on ensuring the means for eliminating air or vapor are effective, including the vent lines are not susceptible to restriction. The proposed changes also clarify that the provision for vapor elimination must be automatic in nature to be considered effective.

NIST, OWM in its analysis of the 2016 S&T agenda item referenced above suggested a similar change be proposed, where necessary, to corresponding requirements in other measuring codes and encouraged the Committee to consider including such an item on its agenda in the 2016-2017 NCWM cycle.

Note the Mass Flow Meters Code states “means to prevent the measurement of vapor and air” while other codes state “means to prevent the passage of vapor and air through the meter,” but such distinction is probably justified. Consequently, no modifications are proposed to align this language with other codes.

During the 2017 NCWM Interim and Annual Meetings, the Committee grouped agenda Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 together and took comments on these items simultaneously because it considered these items related. See agenda Item 3300-1 for a summary of the comments received and the resulting actions taken by the Committee on these items.

At the 2017 NCWM Annual Meeting, the MMA voiced support for the group of items but suggested retaining the word “measurement” in the first sentence of paragraph S.3.3. of agenda Item 3307-1 rather than replacing it with the word “passage” as proposed. The MMA noted it is not necessary to prevent air/vapor from passing through a mass flow meter to achieve accurate measurement. It is only necessary to require there be means to prevent the measurement of the air/vapor. Ms. Butcher and others supported the MMA’s suggestion.

Hearing only comments in support of these items, the Committee agreed to the change proposed by the MMA to agenda Item 3307-1 as shown in Item Under Consideration for this item and present the items for Vote.

Regional Association Comments and Recommendations:
The WWMA considered Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 at the same time at its 2016 Annual Meeting. NIST, OWM will update language adopted at the 2016 NCWM Annual Meeting to these additional devices. The WWMA considered these items developed and forwarded them to NCWM; recommending Voting status.

The CWMA reported at its fall 2016 Interim Meeting it recognized the value of aligning the measuring device codes and forwarded this item to the NCWM; recommending Voting status. At the spring 2017 Annual Meeting, the CWMA grouped Items 3300-1, 3301-1, 3301-1, 3306-1, and 3307-1 together and took all comments on these related items at the same time. The CWMA believes this group of items is sufficiently developed and recommended they be presented for Vote at the upcoming NCWM Annual Meeting.

The SWMA, at its 2016 Annual Meeting, batched Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 together and heard comments for all items at the same time. The only comments received were for Item 3300-1. See this item for details. The SWMA forwarded this item to NCWM and recommended Voting status.

NEWMA grouped Items 3300-1, 3301-1, 3305-1, 3306-1, and 3307-1 together and heard comments for all items at the same time. NEWMA forwarded the items in the group to the NCWM and recommended Voting status at both its fall 2016 Interim Meeting and spring 2017 Annual Meeting.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf**.

3307-2 D N.3. TEST DRAFTS

(The status of this item was changed from Voting to Developing.)

Note: This agenda item previously appeared on the Committee's agenda as agenda Item 337-3 in 2015 and 2016.

Source:
Endress + Hauser Flowtec AG USA (2015)

Purpose:
Allow transfer standard meters to be used to test and place into service dispensers and delivery system flow meters.

Item under Consideration:
Amend NIST Handbook 44, Mass Flow Meters Code as follows:

N.3. Test Drafts.

N.3.1. Minimum Test. – The minimum test shall be one test draft at the maximum flow rate of the installation and one test draft at the minimum flow rate. More tests may be performed at these or other flow rates. (See T.3. Repeatability.)

(Amended 1982)

N.3.2. Transfer Standard Test. – The minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.

Background/Discussion:
In the fall of 2016, Mr. Keilty provided an update to the Item under Consideration. That update appears in the agenda. The previous proposed Item under Consideration was as follows:

N.3. Test Drafts.

N.3.1. Minimum Test. – Test drafts should be equal to at least the amount delivered by the device in one minute at its normal discharge rate.

(Amended 1982)

N.3.2. Transfer Standard Test. – When comparing a meter with a calibrated transfer standard, the test draft shall be equal to at least the amount delivered by the device in 2 minutes at its maximum discharge rate.

The use of transfer standards is recognized in Sections 3.34. Cryogenic Liquid-Measuring Devices Code and 3.38. Carbon Dioxide Liquid-Measuring Devices Code and 3.39. Hydrogen Gas-Measuring Devices – Tentative Code. Field evaluation of LPG meters and CNG dispensers and LNG dispensers is very difficult using volumetric and gravimetric field standards and methods. The tolerances for these applications are such that using transfer meter standards are more efficient and safer. With CNG and LNG and LPG applications, the transfer standard meters are placed in-line with the delivery system as it is used to fill tanks and vehicles. The use of transfer standards eliminates return to storage issues. The use of transfer standard meters is easier and faster compared to the use of traditional field standards. The cost of using transfer standards and transporting them is much less than the cost of traditional field provers and standards. Recognition in NIST Handbook 44 will enable states to allow transfer standard meters to place systems into service and for field enforcement. The amended language is made to clarify the minimum test quantity for using transfer standard meters accommodating both large quantity and low quantity delivery systems. Volumetric field provers and gravimetric field proving are susceptible to environmental influences. The states commonly use meters as transfer standards to test rack meters. In some applications, transfer standard meters are not more accurate than the meters used in the dispenser. For this reason, longer test drafts and possibly more tests need to be run.

The State of California is purported to have conducted a short study of master meters in the past. The conclusion did not lead to wide adoption of the practice. However, the State of California uses a mass flow meter as a master meter for carbon dioxide flowmeter enforcement.

Section 3.37. Mass Flow Meters user requirement UR.3.8. Return of Product to Storage, Retail Compressed Natural Gas Dispensers requires that the natural gas which is delivered into the test container must be returned to storage. This is difficult and most often not complied with when the test vessel contents are released to atmosphere.

The submitter recommends that NIST update EPO 28 for CNG dispensers and EPO 26 for LPG Liquid Measuring Systems to include transfer standard meter tests. NIST Handbook 105-4, "Specifications and Tolerances for Reference Standards and Field Standard Weights and Measure: Specifications and Tolerances for Liquefied Petroleum Gas and Anhydrous Ammonia Liquid Volumetric Provers," should also be revised to specifically address the transfer standard meter and the requirements for use.

The S&T Committee might also consider amending Sections 3.30. Liquid-Measuring Devices Code and 3.31. Vehicle-Tank Meters Code to allow transfer standard meters.

2015 Interim and Annual Meetings:
The Committee heard comments both in support of and in opposition to the proposal outlined in this item and a corresponding item in the LPG and Anhydrous Ammonia Liquid-Measuring Devices Code. Mr. Mike Keilty (Endress + Hauser Flowtec AG USA), submitter of these two items outlined the benefits of using a master meter as a standard in testing application such as CNG, LNG, and LPG. The Committee heard comments in opposition to the proposal from Mr. Henry Oppermann (Weights and Measures Consulting, LLC and speaking on behalf of Seraphin Test Measure, Co.) noted there are significant differences between a transfer standard and a field standard. Ms. Tina Butcher (NIST, OWM) acknowledged the advantages to identifying and developing alternate test methods such as this, but noted that simply adding the proposed language doesn't address the multiple other elements needing to be in place to ensure traceability; OWM provided a list of those elements along with other suggestions. NIST, OWM noted the USNWG on Alternative Test Methods might be a better venue to develop the elements to support the use of these devices. This was echoed by Mr. Dmitri Karimov (Liquid Control, LLC) who also commented that the regulatory authority must assess the suitability of a given standard. The Committee also heard from Ms. Kristin Macey

(California) who commented if the proposal were adopted, it would allow use of a transfer standard and California would not be able to fully support it, citing results of comparison testing conducted by California in which the master meter performed the worst of the three methods examined. Mr. Keilty, in response to Ms. Butcher and Mr. Oppermann's comments, stated he agreed completely and noted adding the paragraph to these two codes is a step towards allowing the use of transfer standards. It's understood there are many things that need to be in place to consider them suitable for use in testing. The Committee also heard other comments from regulators and industry supporting the continued development of this issue. The Committee agreed the item has merit, but needs further development and suggested the submitter work with OWM by providing data for the USNWG to consider.

See the Committee's 2015 Final Report for details.

2016 NCWM Interim and Annual Meetings:
The Committee again heard comments both in support of and in opposition to this item and the corresponding item in the LPG and Anhydrous Ammonia Liquid-Measuring Devices Code. Mr. Michael Keilty (Endress + Hauser Flowtec), the submitter, stated he supported this item as a Voting item as did Alan Walker (Florida). Others expressed support of the item, but noted the need for additional development. The Committee heard again from Ms. Butcher and Mr. Henry Oppermann, who reiterated their 2015 detailed comments regarding the tasks that need to be completed before considering changes to NIST Handbook 44. Both echoed the need to collect data to properly evaluate whether or not a master meter could be considered a suitable standard.

During its Interim Meeting work session, the Committee acknowledged comments suggesting the need for additional test data. It was also acknowledged there was a lot of support for the proposal. Those supporting the proposal had indicated that using a transfer standard is much easier and faster than testing gravimetrically and eliminates the need to discharge product from a prover into the atmosphere, which is viewed by many as a safety concern. Given the addition of the proposed language would not dictate the method of testing and the decision on whether or not to use a particular method of testing would remain with each jurisdiction, the Committee agreed to present both items for Vote at the Annual Meeting.

At the 2016 Annual Meeting, the Committee received numerous comments from industry and regulators alike, predominantly in support of the proposals. These comments cited benefits such as safety; faster and more efficient testing; and lack of problems with using master meters. Mr. Marc Buttler (Emerson Process Management – Micro Motion) also expressed supports of the items, but suggested replacing the words "maximum discharge rate" with "maximum test rate" in proposed paragraph N.3.2.; the submitter agreed with the suggestion.

The Committee also heard comments in opposition to the item and comments emphasizing the need for further development and data. A new comment offered by Ms. Butcher noted the proposed new paragraph N.3.1. would create a conflict with the minimum test procedures outlined in the NIST EPO for CNG dispensers since tests conducted at the MMQ and at some other quantities are frequently completed in less than one minute. There was some debate regarding the application of the Fundamental Considerations regarding the allocation of error and uncertainty associated with a given test method, and Mr. Henry Oppermann clarified the proper application of these criteria. Mr. Oppermann noted the transfer standards, in some cases, are no more accurate than the meter being tested and the proposals lack a specification associated with the performance of the standard. He recommended the items be changed to Informational or Developmental.

During the Committee's work session, members of the Committee agreed the comments received during the open hearings were mostly in support of the two proposals. The Committee discussed the proposed changes to the text, including the errors in the transcription of the text in the Item Under Consideration. The Committee discussed the potential impact on testing CNG dispensers, acknowledging the proposed requirement cannot be met by someone wanting to apply the procedures in the NIST EPO (which were developed through a WG comprised of industry and regulatory officials). Some Committee members familiar with CNG testing concurred that a test run typically takes less than one minute to complete. The Committee was concerned with the potential conflict and questioned whether the submitter had fully considered the impact of the proposed language. These discussions led the Committee to decide to change the status of the item from Voting to Developmental and return them to the submitter for further development.

2017 NCWM Interim and Annual Meetings:
During the 2017 NCWM Interim and Annual Meetings, the Committee grouped agenda Item 3302-1 and 3307-2 together and took comments on these items simultaneously because it considered these items related. See agenda Item 3302-1 for a summary of the comments received and the resulting actions taken by the Committee on these items at those meetings.

Regional Association Comments and Recommendations:
The WWMA reported at its 2016 Annual Meeting that it believes this type of device will not allow the time consideration as found in paragraph N.3.1., also this section should be bold and underlined as it is entirely new. The submitter also needs to supply test data to verify the test equipment can meet accuracy considerations as a standard. The WWMA recommends this item remain in a Developing status.

At its 2016 Interim Meeting, the CWMA reported it recognizes the need for transfer standards, but until requirements are in place regarding their use, the CWMA recommends this item be Withdrawn. At its 2017 Annual Meeting, the CWMA reported it supports the use of alternative test methods but believes the procedures must be in place to ensure the standards meet the fundamental considerations for field standards. The CWMA recommended the item be moved to Developing status until the procedures are in place

The SWMA batched Items 3302-1 and 3307-1 together at its 2016 Annual Meeting and heard comments on both items at the same time. Mr. Hal Prince (Florida) stated he supports these items and would like to see them move forward as Voting items. Mr. Henry Oppermann (Seraphin) stated he was opposed to the adoption of these items, and they should be Withdrawn. He further stated they are not legally acceptable standards and referred to his written submission in opposition to these items. Mr. Oppermann further stated transfer standards must meet the one-third requirement, and there has not been any data provided showing they meet this requirement. Ms. Butcher stated NIST submitted many comments in opposition of this item as written. She stated the use isn't merely recognized by putting it in print, and these devices need traceability. Further, Ms. Butcher stated the proposal appears to be lifting language from other codes and specifically asked where the two minutes came from. She concluded by stating NIST doesn't oppose the use of master meters, but a lot more work needs to be done before they can be used. Mr. Tim Chesser (Arkansas) stated he was in full support of using master meters but can't defend their use. He added the operating conditions need to identify products and limits. The SWMA recommend this item remain in Developing status, but urges the submitter and those opposed to it to reach a resolution as the Committee believes the item has merit and could be beneficial in the field.

NEWMA recommended, at its 2016 Interim Meeting, this item remain in a Developing status for another year. At its 2017 Annual Meeting, NEWMA grouped Items 3302-1 and 3307-2 together and reported it believes these items should be further developed to include definitions of terms (transfer standards).

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf**.

3504 TAXIMETERS

3504-1 V A.2. EXCEPTIONS. (SEE RELATED ITEM 3600-6)

(This item was Adopted.)

Source:
USNWG on Taximeters (2017)

Purpose:
Clarify that the Taximeters Code does not apply to Transportation Network Measuring Systems, which would fall under a new tentative code developed specifically for those systems.

Item under Consideration:
Amend NIST Handbook 44, Taximeters Code as follows:

A.2. Exceptions. – This code does not apply to;

(a) Odometers on vehicles that are rented on a distance basis (for which see Section 5.53. Code for Odometers)**;**

(b) Devices that only display a flat rate or negotiated rate**.; or**

(c) Transportation Network Measurement Systems (for which see Section 5.XX Transportation Network Measurement Systems).

(Amended 1977 **and 20XX**)

Background/Discussion:
Proposed Change (1):

The appearance of new types of transportation-for-hire services that use location services (such as GPS) and software applications as an interface for the user and provider of the service has created a need for regulatory standards that could be applied to these types of systems. These systems, being referred to as Transportation Network Measurement Systems (TNMS) do not use a conventional "taximeter" or other dedicated hardware device(s) that conform to the more traditional design of taximeters; however, they provide a similar transportation-for-hire service. Regulatory officials have met with little or no success in attempts to apply existing standards (including those in Section 5.54. Taximeters Code) to TNMS due to differences in the design of these systems and other, existing types of transportation-for-hire services. The hardware components used in TNMS are devices (cellular telephones, computers, and tablets) are typically owned/possessed by the drivers and passengers using the systems and are not designed, sold, issued, or otherwise provided by the Transportation Network Companies. Since there is an absence of dedicated physical hardware used in these systems and because the primary components that are integral to the TNMS consist of various software programs, many members of the weights and measures community and transportation industry have concluded that a new code, separate from the existing Taximeters Code, is needed.

TNMS have established a large customer base in the transportation-for-hire marketplace, and these systems are used extensively in the United States as well as internationally. There is a preponderance of public and political support to recognize and accept TNMS as fair-market competition to traditional taxi services. To this point, reasonable and appropriate standards that can be applied for the evaluation of TNMS as commercial systems must be developed and implemented. Primary goals of the implementation of a TNMS code (as well as corresponding changes to the Taximeters code) are to ensure a level playing field within this industry, ensure fair and equitable transactions, ensure transparency for consumers, and to facilitate value comparisons.

The USNWG on Taximeters has worked on updating the NIST Handbook 44, Taximeters Code as well as the development of appropriate requirements for transportation systems using location services and software applications since the later portion of 2012. More recently, Transportation Network Companies (TNCs) that are the providers of TNMS have joined this effort and added their input into the standards development process. Because there are instances where taximeters are now being designed to operate using similar features and functionality as TNMS, the USNWG on Taximeters has also developed corresponding changes to the NIST Handbook 44, Taximeters Code in an effort to provide a regulatory parity between these transportation-for-hire industry competitors. Those proposed changes to the Taximeters Code will be submitted under a separate item, which already appears on the Committee's agenda (Item 3504-1 on the Committee's 2017 draft agenda) as a "carryover" item.

Proposed Change (2):

Anticipating that the proposal to add a new Transportation Network Measurement Systems Code into NIST Handbook 44 will be adopted, there will be a corresponding need to clarify the existing Handbook 44, 5.54. Taximeters Code will not be applicable to these types of systems. The addition of an exemption under paragraph A.2. in the current Taximeters Code for TNMS will make this clear. While this amendment to provide an exemption for TNMS in the current Taximeters Code is to be proposed also under a different agenda item (Item 3504-1, as

described above), it is essential that this proposed change be a part of the TNMS item as well. This will help avoid any conflict and confusion regarding the application of the proposed tentative code should a decision be made to reject or delay Item 3504-1.

Some in the weights and measures community and the transportation-for-hire industry have opposed the development of a new separate NIST Handbook 44 Code for TNMS, stating since those systems perform the same function as a taximeter, TNMS should be assessed based on requirements already existing in the Handbook 44, Taximeters Code. Additional arguments cite the lack of regulatory standards for TNMS are pointing out the loss of revenue of the traditional-type taxi services due to the increase of competition from TNMS operating in the same jurisdiction. The loss of business being reported by some in the taxi industry has also reportedly resulted in a severe decrease of the value of "medallions" (roughly equivalent to a permit to operate a taxicab) in many areas where medallions are purchased by taxi companies as a prerequisite to operate in those jurisdictions.

Because the design and functions of these systems are considerably different from those used in today's taximeters, there are differences between the proposed new NIST Handbook 44, TNMS Code and requirements that are already in (or are proposed to be added to) the existing Handbook 44 Taximeters Code. Some may view the differences between these standards as being unfair and as providing advantages to one over the other; however, the changes being proposed under Item 3504-1 should bring the two codes into closer alignment. Additionally, this does not preclude the possibility of a future proposal to merge the two codes as technology evolves.

At the 2017 NCWM Interim Meeting, the Committee agreed to group agenda Items 3504-1 and 3600-6 together and take comments on these items simultaneously because it considered these items related.

The Committee received numerous comments from participants of the USNWG on Taximeters and others, including industry representatives and regulatory officials alike, indicating the two items were fully developed and recommending they be presented for Vote at the upcoming NCWM Annual Meeting.

Mr. John Barton (NIST, OWM and Technical Advisor to the USNWG on Taximeters) commented that he agreed with the WWMA's changes to paragraph A.2 of the Taximeters Code, which provide for an exception of that code applying to TNMS. He noted OWM recognizes the importance and the urgent need for regulatory standards applicable to TMNS since these types of transportation services have been in use for some time and existing Handbook 44, requirements do not sufficiently address this type of system. He also acknowledged the efforts of the USNWG on Taximeters for the development of this proposal to meet the needs of this industry and the officials responsible for their regulation.

The new draft TNMS code is proposed as a tentative NIST Handbook 44 code and is not intended for enforcement use at this time. He further stated OWM acknowledges the challenges in the development of regulatory standards for these systems based on their extensive use of software and location services such as GPS and cellular networks. Because there is no precedent for these types of transportation systems, OWM believes it is important to introduce regulatory standards for TNMS on a "trial" basis. This will allow for the identification of any necessary modifications to the tentative code prior to being used as an enforcement tool.

The Committee also received comments from Mr. Stan Toy (Santa Clara County Weights and Measures, California) requesting amendments to the following draft tentative code paragraphs:

- **S.1.1. General Indicating Elements and N.1. Distance Tests.** – *Summary of the comments provided:* The model, age, and condition of a cell phone, which serves as primary indicator in a TNMS, can affect its performance capabilities. I would suggest amending the note in proposed paragraph N.1. by specifying 100 percent of the devices used in a TNMS be tested or at least a sample of them that are in use.

- **N.1.2.2. Additional Tests.** – *Summary of the comments provided:* Why do so many tests need to be completed before taking action? There are no other devices that we test where this is required. Officials should be permitted to take a device out of service with one test that fails to comply. How many failures does it take before officials can reject: 2 out of the 4; 3 out of the 4, etc. Each test must be done on a

road and takes about 30 - 45 minutes to complete. How are officials to schedule a work day given how much time it might take to test a particular device that fails one or more tests? I recommend changing the word "shall" to "may" in this paragraph.

- **N.1.3.2. Roads.** – *Summary of the comments provided:* The paragraph requires tests to be conducted on public roads that are in good repair. What is "good repair?" Another concern is requiring the tests to be conducted on public roads. Mapping systems are based on public roads. In rural areas, Uber claims their system can calculate charges on driveways of customers. These are not public roads.

- **S.3.2. Significant Trip Data Loss.** – *Summary of the comments provided:* The paragraph needs to include limits on how frequently this can occur; for example, 10 percent of the time; 90 percent of the time, etc. A loss signal allows a different rate structure to be charged.

Mr. Barton, in response to Mr. Toy's concerns, noted the draft code, if adopted, would be added to NIST Handbook 44 as a tentative code, during which time, it could be determined whether changes to any of the paragraphs were needed before the status was changed to a permanent code. Regarding verifying repeatability of these devices, the WG considered this issue extensively and concluded there is no need to test each and every driver's cell phone.

Mr. Bob O'Leary (Uber Technologies, Inc.) stated he supported Item 3600-6 as a tentative code and said he would like to address some of Mr. Toy's concerns. He reported the WG had extensively debated the issues being raised. With respect to suggesting all devices be tested, a TNMS uses data from all phones to determine which road segment a driver drove on. Plug in any IOS or Android phone and get good results. There is no evidence to support the regulatory burden of requiring all devices to be tested. Regarding the need to test on public roads, it is important the tests be conducted on public roads. The system can't function when off public roads. Mr. O'Leary also stated there is a misconception that Uber is unregulated, when, in fact, most states do regulate Uber.

In consideration of the comments received, the Committee agreed to present both items in the group for Vote at the upcoming NCWM Annual Meeting.

At the 2017 NCWM Annual Meeting, the Committee agreed to group agenda Items 3504-1 and 3600-6 together and take comments on these items simultaneously because it considered these items related.

The Committee received numerous comments from participants of the USNWG on Taximeters and others, including industry representatives and regulatory officials alike.

Mr. John Barton (NIST, OWM and Technical Advisor to the USNWG on Taximeters) reiterated comments from the 2017 NCWM Interim Meeting and noted the USNWG acknowledged the comments made about the use of the term "transfer standard" from Items 3302-1 and 3307-2. He noted the workgroup would not object to the removal of the definition in the tentative code if it helped the item move forward. Mr. Barton also stated that all tests for these devices must be made on public roads and supported striking, "which are in good repair" from paragraph N.1.3.2. of the tentative (TNMS) code and its corresponding paragraph in the Taximeters Code (N.1.3.2.1.). Mr. Barton, speaking on behalf of NIST, OWM reiterated comments from the Interim Meeting about Item 3600-6, and stated since there are currently no regulatory standards in place, it would be appropriate to allow this tentative code to be adopted. He further stated OWM recognized the concerns with the use of the term "transfer standard," and its use in this tentative code may need to be revisited; however, that should not prevent the proposed tentative code from moving forward.

Mr. James Cassidy (City of Cambridge, Massachusetts) spoke as a member of the USNWG and stated he supported the work of the USNWG and supported this tentative code moving forward.

The Committee also received comments from Mr. Stan Toy (Santa Clara County Weights and Measures, California) who reiterated the amendments he suggested at the 2017 NCWM Interim Meeting. Mr. Toy stated that he could not support adoption of this tentative code if these changes were not incorporated.

Mr. Bob O'Leary (Uber) stated he was also a member of the workgroup and supported adoption of Item 3600-6. He further stated that he supported removal of the term "transfer standard" and supported other amendments proposed by

NIST, OWM. Mr. O'Leary also stated the workgroup discussed extensively the comments and concerns raised by Mr. Toy, but the WG did not move those suggestions forward.

Mr. Jeff Brandt (Lyft) noted that he too was a member of the USNWG and supported adoption of Item 3600-6. He also echoed the comments made by Mr. O'Leary.

Ms. Kristin Macey (California) echoed the comments made by Mr. Barton and Mr. O'Leary. She noted California has been the jurisdiction working with industry and highlighted they have been pursing type evaluation at the state level. Ms. Macey further stated she agreed with the proposed changes to remove the term "transfer standard" from the tentative code. Ms. Macey concluded she would work to provide test data in the future to move this from a tentative code to a permanent code.

Mr. Henry Oppermann (Weights and Measures Consulting) stated he did not have a problem with the tentative code as proposed, but did agree with the suggestions to remove the term "transfer standard" from the tentative code.

Ms. Fran Elston-Houston (Ohio) added that in Ohio their legislature removed from the weights and measures jurisdiction the authority to regulate these types of devices and if this tentative code was not adopted this same scenario could happen in other states.

Mr. Marco Mares (San Diego County, California) spoke in support of the tentative code and echoed Ms. Kristin Macey's comments.

Mr. Keith Walsh (New York City Taxi Commission) added his support of this tentative code.

Mr. Mike Sikula (New York) provided written comments in support of the tentative code.

Based upon the comments received in support of amending the draft tentative (TNMS) code by deleting the definition of "transfer standard" from that code and amending paragraph N.1.3.2. by deleting the words "which are in good repair," the Committee agreed to these changes. The Committee also agreed to present the two items in this group for Vote. The changes to the draft tentative code agreed to by the Committee are reflected in the Item Under Consideration for agenda Item 3600-6.

Regional Association Comments and Recommendations:
The WWMA noted during its 2016 Annual Meeting the original proposal did not reflect an amendment to A.2. Exceptions, which was adopted at the 2016 NCWM Annual Meeting. The Item under Consideration now reflects the updated paragraph. The WWMA considered this item with Item 3600-6 and forwarded these items to the NCWM, recommending them as Voting items. The WWMA further recommended that both items be voted upon in a single Vote of NCWM.

The CWMA supports the USNWG and believes this item is fully developed. The CWMA recommended this item be a Voting item at both its fall 2016 Interim Meeting and spring 2017 Annual Meeting.

The SWMA batched Items 3504-1 and 3600-6 together at its 2016 Annual Meeting and heard comments for both items at the same time. Mr. Bob O'Leary (Uber) stated the USNWG had developed a new code over the last year. He further stated that the USNWG has come to consensus with this draft code and believes it is ready for a Vote. Mr. O'Leary concluded by stating he is looking forward to its adoption in July. Mr. James Cassidy (Cambridge, Massachusetts) spoke in support of these items and noted the code is a tentative code, which needs to be adopted. Ms. Kristin Macey (California) noted that both she and Mr. Cassidy were a part of this process within the WG and stated the code has been vetted at all levels of government, in particular those who conduct taximeter testing. She further noted this new technology is a system and not a device. Ms. Macey concluded by stating this new type of system must be tested using transfer standards. The SWMA believes this item is fully developed and forwarded it to NCWM, recommending Voting status.

At its fall 2016 Interim Meeting, NEWMA reported it believes the item is ready for adoption and forwarded it to the NCWM, recommending Voting status. At its spring 2016 Annual Meeting NEWMA recommended removing the proposed definition of a transfer standard and that the item then be forwarded to the NCWM as a Voting item.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf**.

3504-2 V USNWG ON TAXIMETERS – TAXIMETER CODE REVISIONS AND GLOBAL POSITIONING SYSTEM-BASED SYSTEMS FOR TIME AND DISTANCE MEASUREMENT

Note: This item was originally titled "Item 360-5, S.5. Provision for Security Seals" in the Committee's 2013 Interim Agenda. At the 2013 NCWM Interim Meeting, the Committee combined that item with "Item 354-1, Global Positioning Systems for Taximeters" and "Item 360-6, Global Positioning Systems for Taximeters" to create this new, consolidated item to address the development of recommendations on multiple topics related to taximeters and GPS-based time and distance measuring systems.

(This item was adopted.)

Source:
NIST USNWG on Taximeters

Purpose:
Revise the Taximeters Code to be applicable and appropriate for current technology and eliminate disparities between this code and the newly proposed Transportation Network Measuring Systems (TNMS) Code.

Item under Consideration:
Amend NIST Handbook 44, Taximeters Code as follows:

Section 5.54. Taximeters

A. Application

A.1. General. – This code applies to taximeters; that is, to devices that automatically calculates at a predetermined rate or rates and indicate the charge for hire of a vehicle.

A.2. Exceptions. – This code does not apply to:

(a) Odometers on vehicles that are rented on a distance basis (for which see Section 5.53. Code for Odometers).

(b) Devices that only display a flat rate or negotiated rate.

(c) Transportation Network Measurement Systems (for which see Section 5.XX. Transportation Network Measurement Systems).

(Amended 1977**, ~~and~~** 2016**, and 20XX**)

A.3. Additional Code Requirements. – In addition to the requirements of this code, Taximeters shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Design of Indicating and Recording Elements.

S.1.1. General. – A taximeter shall be equipped with a primary indicating element.
(Amended 1988 and 2015)

S.1.1.1. Recording Elements. *– A receipt providing information as required in S.1.9. Recorded Representations shall be available from a taximeter or taximeter system through an integral or separate recording element for all transactions conducted.*
[Nonretroactive January 1, 2016]
(Added 2015)

S.1.2. Advancement of Indicating Elements. – Except when a taximeter is being cleared, the primary indicating and recording elements shall be susceptible of advancement only by the movement of the vehicle or by the time mechanism.

At the conclusion of a transaction (e.g., following the totalizing of all accrued charges and having a customer receipt made available), no other advancement of fare, extras or other charges shall occur until the taximeter has been cleared.
[Nonretroactive as of January 1, 2017]

Where permitted, a flat rate or negotiated rate shall be displayed in the "fare" indicating mechanism, provided that once a flat rate or negotiated rate is entered the fare may no longer be advanced by movement of the vehicle or the time mechanism.
(Amended 1988 and 2016)

S.1.2.1. Time Mechanism. – Means shall be provided on all taximeters designed to calculate fares based on a combination of time elapsed and distance traveled, to enable the vehicle operator to render the time mechanism either operative or inoperative with respect to the fare-indicating mechanism.
(Added 20XX)

S.1.2.2. Distance Mechanism. – Means shall be provided on all taximeters designed to calculate fare based on a combination of time elapsed and/or distance traveled to enable the vehicle operator to render the distance mechanism either operative or inoperative with respect to the fare-indicating mechanism.
[Nonretroactive as of January 1, 20XX]
(Added 20XX)

S.1.3. Visibility of Indications.

S.1.3.1. Taximeter Indications. – The indications of fare, including extras, and the mode of operation, such as "time" or "hired," shall be constantly displayed whenever the meter is in operation. All indications of passenger interest shall be easily read from a distance of 1.2 m (4 ft) under any condition of normal operation. **This includes any necessary lighting, shading or other means necessary to make displayed indications clearly visible to operator and passenger.**
(Amended 1977, 1986, ~~and~~ 1988 **and 20XX**)

S.1.3.~~1~~2. Minimum Height of Figures, Words, and Symbols. – The minimum height of the figures used to indicate the fare shall be 10 mm and for extras, 8 mm. The minimum height of the figures, words, or symbols used for other indications, including those used to identify or define, shall be 3.5 mm.
(Added 1986)

~~***S.1.3.2. Lighting of Indications. Integral lighting shall be provided to illuminate the fare, extras, the rate or rate code, and the taximeter status (i.e., vacant, hired, and time off).***~~
~~***[Nonretroactive as of January 1, 1989]***~~

~~**(Added 1988) (Amended 1990)**~~

S.1.3.3. Passenger's Indications. *– A supplementary indicating element installed in a taxi to provide information regarding the taxi service to the passenger* ***(i.e., Passenger Information Monitor or PIM)****, shall clearly display the current total of all charges incurred for the transaction. The accruing total of all charges must remain clearly visible on the passenger's display (unless disabled by the passenger) at all times during the transaction.*
[Nonretroactive as of January 1, 2016]

(Added 2015) **(Amended 20XX)**

S.1.3.3.1. Additional Information. *– Additional information shall be displayed or made available through a passenger's indicating element (as described in S.1.3.3. Passenger's Indications) and shall be current and reflect any charges that have accrued. This additional information shall include:*

(a) an itemized account of all charges incurred including fare, extras, and other additional charges; and

(b) the rate(s) in use at which any fare is calculated.

Any additional information made available must not obscure the accruing total of charges for the taxi service. This additional information may be made accessible through clearly identified operational controls (e.g., keypad, button, menu, touch-screen).
[Nonretroactive as of January 1, 2016]

(Added 2015)

S.1.3.3.2. Fare and Extras Charges. *– The indication of fare and extras charges on a passenger's indicating element shall agree with similar indications displayed on all other indicating elements in the system.*
[Nonretroactive as of January 1, 2016]

(Added 2015)

S.1.4. Actuation of Fare-Indicating Mechanism. – When a taximeter designed to calculate fares upon the basis of a combination of distance traveled and time elapsed **but not both time and distance used concurrently to calculate fare,** is operative with respect to fare indication, the fare-indicating mechanism shall be actuated by the distance mechanism whenever the vehicle is in motion at such a speed that the rate of distance revenue equals or exceeds the time rate, and may be actuated by the time mechanism whenever the vehicle speed is less than this and when the vehicle is not in motion. ~~**Means shall be provided for the vehicle operator to render the time mechanism either operative or inoperative with respect to the fare-indicating mechanism.**~~

(Amended 1977 **and 20XX**)

S.1.5. Operating Condition.

S.1.5.1. General. – When a taximeter is cleared, the indication "Not Registering," "Vacant," or an equivalent expression shall be shown. Whenever a taximeter is set to register charges, it shall indicate "Registering," "Hired," or an equivalent expression and the rate at which it is set shall be automatically indicated (Rate 1 or Rate A, for example).

(Amended 1988)

S.1.5.2. Time not Recording. – When a taximeter is set for fare registration with the time mechanism inoperative, it shall indicate "Time Not Recording" or an equivalent expression.

(Amended 1988)

S.1.5.3. Distance not Recording. – When a taximeter is set for fare registration with the distance mechanism inoperative, it shall indicate "Distance Not Recording" or an equivalent expression. [Nonretroactive as of January 1, 20XX]

(Added 20XX)

S.1.6. Fare Identification. – Fare indications shall be identified by the word "Fare" or by an equivalent expression. Values shall be defined by suitable words or monetary signs.

S.1.7. Extras. – Extras shall be indicated as a separate item and shall not be included in the fare indication. They shall be identified by the word "Extras" or by an equivalent expression. Values shall be defined by suitable words or monetary signs. Means may be provided to totalize the fare and extras if the totalized amount returns to separate indications of fare and extras within 5 seconds or less.

(Amended 1988)

S.1.7.1. Nonuse of Extras. – If and when taximeter extras are prohibited by legal authority or are discontinued by a vehicle operator, the extras mechanisms shall be rendered inoperable or the extras indications shall be effectively obscured by permanent means.

S.1.8. Protection of Indications. – All indications of fare and extras shall be protected from unauthorized alteration or manipulation.

(Amended 2015)

***S.1.9. Recorded Representation.** – A printed **or electronic** receipt issued from a taximeter, whether through an integral or separate recording element, shall include as a minimum, the following information when processed through the taximeter system:*

(a) date;

*(b) unique vehicle identification number, such as the medallion number, taxi number, vehicle identification number (VIN), permit number, or other identifying information as specified by the statutory authority;**

*(c) start and end time of the trip;**

*(d) distance traveled, maximum increment of 0.1 km (0.1 mi);**

(e) fare in $;

*(f) each rate at which the fare was computed and the associated fare at that rate;**

*(g) additional charges (in $) where permitted such as extras, any surcharges, telecommunication charges, and taxes shall be identified and itemized;**

*(h) total charge for service in $ (inclusive of fare, extras, and all additional charges);**

*(i) trip number, if available;** **and***

*(j) telephone number (or other contract information) for customer assistance.;** **and***

(k) a statement of chargeable time and chargeable distance for taximeters that calculate fare using time and distance concurrently.***

Note: When processed through the taximeter or taximeter system, any adjustments (in $) to the total charge for service including discounts, credits, and tips shall also be included on the receipt.**
*[Nonretroactive as of January 1, 1989] *[Nonretroactive as of January 1, 2000]*
[Nonretroactive as of January 1, 2016]* ***[Nonretroactive as of January 1, 20XX]***
(Added 1988) (Amended 1999**,** ~~**and**~~ 2015**, and 20XX**)

S.1.9.1. Multiple Recorded Representations.

S.1.9.1.1. Duplicate Receipts. *– A recording element may produce a duplicate receipt for the previous transaction provided the information printed is identical to the original with the exception of time issued. The duplicate receipt shall include the words "duplicate" or "copy." The feature to print a duplicate receipt shall be deactivated at the time the meter is hired for the next fare.*
[Nonretroactive as of January 1, 2000]
(Added 1999)

S.1.10. Non-fare Information. *– The fare and extras displays may be used to display auxiliary information provided the meter is in the vacant condition and such information is only displayed for10 seconds, or less. If the information consists of a list of information, the list may be displayed one item after another, provided that each item is displayed for 10 seconds, or less.*
[Nonretroactive as of January 1, 2002]
(Added 2000)

S.2. Basis of Fare Calculations. – A taximeter shall calculate fares only upon the basis of:

(a) distance traveled;

(b) time elapsed; or

(c) a combination of distance traveled and time elapsed.

A taximeter may utilize more than one rate to calculate the fare during a trip. Any change in the applied rate must occur at the completion of the current interval.
(Amended 1977 and 2016)

S.2.1. Initial Time and Distance Intervals. – The time and distance intervals of a taximeter **that does not calculate fares based on distance travelled and time elapsed used concurrently** shall be directly proportional as expressed in the following formula:

$$\frac{Seconds\ of\ \ Initial\ Time\ Interval}{Seconds\ \ per\ \ Non-Initial\ Time\ Interval} = \frac{Distance\ of\ \ Initial\ Mileage\ Interval}{Distance\ \ per\ \ Non-Initial\ Mileage\ Interval}$$

(Added 1990) **(Amended 20XX)**

S.3. Design of Operating Control.

S.3.1. Positions of Control. – The several positions of the operating controls shall be clearly defined and shall be so constructed that accidental or inadvertent changing of the operating condition of the taximeter is improbable. Movement of the operating controls to an operating position immediately following movement to the cleared position shall be delayed enough to permit the taximeter to come to a complete rest in the cleared position.
(Amended 1988)

S.3.2. Control for Extras Mechanism. – The knob, handle, or other means provided to actuate the extras mechanism shall be inoperable whenever the taximeter is cleared.

S.4. Interference. – The design of a taximeter shall be such that **when a fare is calculated by using time and/or by using distance (but not used concurrently)** there will be no interference between the time and the distance portions of the mechanism device at any speed of operation.

(Amended 1977**, ~~and~~** 1988 **and 20XX**)

~~S.5. Provision for Security Seals. – Adequate provision shall be made to provide security for a taximeter. Security may be provided either by:~~

~~(a) Affixing security seals to the taximeter and to all other components required for service operation of a complete installation on a vehicle, so that no adjustments, alterations, or replacements affecting accuracy or indications of the device or the assembly can be made without mutilating the seal or seals; or~~

~~(b) Using a combination of security seals described in paragraph (a) and, in the case of a component that may be removed from a vehicle (e.g., slide mounting the taximeter), providing a physical or electronic link between components affecting accuracy or indications of the device to ensure that its performance is not affected and operation is permitted only with those components having the same unique properties.~~

~~The sealing means shall be such that it is not necessary to disassemble or remove any part of the device or of the vehicle to apply or inspect the seals.~~

~~(Amended 1988 and 2000)~~

S.5. Provisions for Security Sealing. – Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or physically applying security seals in such a manner that requires the security seal to be broken before an adjustment or interchange can be made of:

(a) any metrological parameter affecting the metrological integrity of the taximeter and associated equipment; or

(b) any metrological parameter controlled by software residing in the taximeter or an associated external computer network.

When applicable, the adjusting mechanism shall be readily accessible for purposes of affixing a security seal.

[Audit trails shall use the format set forth in Table S.5.]

(Added 20XX)

S.5.1. Taximeters Connected to Networked Systems. – Metrological features that are not located on the taximeter device installed in the vehicle (i.e., accessed through a computer network, server, or "cloud") shall be secured by means that will:

(a) protect the integrity of metrological data and algorithms used to compute fares from such data against unauthorized modification; and

(b) use software-based access controls or equivalent technological protections that limit access to metrological data and algorithms used to compute fares from such data only to authorized persons.

(Added 20XX)

S.5.2. Taximeters Calibrated to Specific Vehicles. – In the case of taximeters where the proper performance and calibration of the device has been verified when used in a specific vehicle and which may be removed from the vehicle (e.g., slide mounting the taximeter), means shall be provided through a physical seal or electronic link between components affecting accuracy or indications of the device to ensure

that its performance is not affected and operation is permitted only with those components having the same unique properties.

(Added 20XX)

Table S.5. Categories of Devices and Methods of Sealing	
Categories of Device	***Methods of Sealing***
Category 1: No remote configuration capability.	***Seal by physical seal or a combination of physical seals and for components that may be removed from the vehicle, a physical or electronic link as described in S.5.3. Taximeters Calibrated to Specific Vehicles***
Category 2: Remote access to adjustable parameters, but access is controlled by physical hardware. ***The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode. The device shall not operate as normal when in the configuration mode.***	***The hardware enabling access for remote access to calibration functions must be at the device and sealed using a physical seal and also include an event logger.*** ***An event logger must also be used to record changes to configuration parameters made through remote access.*** ***The event loggers must include event counters (minimum count of 1000 events), the parameter ID, the date and time of the change, and the new value of the parameter. A printed or electronic copy of the information must be available through the device. The event loggers shall have a capacity to retain records equal to 10 times the number of sealable parameters in the device, but not more than 1000 records are required.*** ***(Note: Does not require 1000 changes to be stored for each parameter.)***
Category 3: Remote access to adjustable parameters. ***Remote access to adjustable parameters may be unlimited or controlled through a software switch (e.g., password).*** ***The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode. The device shall not operate as normal when in the configuration mode.***	***An event logger must also be used to record changes to adjustable parameters that are made through remote access and which is accessible only by authorized persons (using an internet web browser or other such secure software.*** ***The event logger shall include event counters, the date and time of the change, the parameter ID and the new value of the parameter. A printed or electronic copy of the information must be available through the device. The event loggers shall have a capacity to retain records equal to 10 times the number of sealable parameters in the device, but not more than 1000 records are required.*** ***(Note: Does not require 1000 changes to be stored for each parameter.)*** ***The device shall become inoperable when access to the system's metrological parameters is made through unapproved or unauthorized means. The device shall remain inoperable until cleared by the official having statutory authority.***

[Nonretroactive as of January 1, 20XX]

S.6. Power Interruption, Electronic Taximeters.

(a) After a power interruption of 3 seconds or less, the fare and extras indications shall return to the previously displayed indications and may be susceptible to advancement without the taximeter being cleared.

(b) After a power interruption exceeding 3 seconds, the fare and extras indications shall return to the previously displayed indications and shall not be susceptible to advancement until the taximeter is cleared.

*After restoration of power following an interruption exceeding 3 seconds, the previously displayed fare shall be displayed for a maximum of 1 minute at which time the fare shall automatically clear and the taximeter shall return to the vacant condition.**
*[*Nonretroactive as of January 1, 2002]*
(Added 1988) (Amended 1989, 1990, and 2000)

S.7. Measurement Signal Loss. – In the event that the measurement signal is interrupted, the taximeter shall be capable of determining any information needed to complete a transaction in progress at the time of signal loss/interruption.

Note: If the meter ceases to increment fare based on distance, the taximeter may continue to increment fare based on elapsed time if the time mechanism is not affect by signal loss.

(Added 20XX)

S.7.1. Intermittent Trip Data Loss. – When the measurement signal is lost intermittently during a trip (e.g., traveling through a tunnel) but recovered prior to the end of the trip, the taximeter shall be capable of calculating an accurate fare in accordance with T.1. Tolerance Values.

(Added 20XX)

S.7.2. Significant Trip Data Loss. – When the signal is lost for a significant portion of the trip, the taximeter shall calculate the total charge utilizing recorded time and distance measurements and other charges (e.g., tolls and airport fees), and may also include other means in accordance with the terms of service (or other agreement) the passenger has agreed to.

Note: Significant trip data loss refers to instances when the measurement signal is lost to the extent that the taximeter cannot perform an accurate measurement or when the signal is not regained by the end of the trip.

(Added 20XX)

S.~~7~~8. Anti-Fraud Provisions, Electronic Taximeters. – An electronic taximeter may have provisions to detect and eliminate distance input that is inconsistent with **~~output of the vehicle's distance sensor~~the taximeters's source(s) of distance measurement data**. When a taximeter equipped with this feature detects input inconsistent with the distance **~~sensor~~measurement data source(s)**:

(a) The meter shall either filter out the inconsistent distance input signals or cease to increment fare based on distance until the distance input signal **~~returns to normal~~ is restored to normal operation**. If the meter ceases to increment fare based on distance, the taximeter may continue to increment fare based on elapsed time **where permitted by the statutory authority and if the time mechanism is not affected by inconsistent signals**;

(b) The taximeter shall povide a visible or audible signal that inconsistent input signals are being detected; and

(c) The taximeter shall record the occurrence in an event logger. The event logger shall include an event counter **~~(000 to 999)~~**, the date, and the time of at least the last 1000 occurrences.

(Added 2001) **(Amended 20XX)**

N. Notes

N.1. Distance Tests.

N.1.1. Test Methods. – To determine compliance with distance tolerances, a distance test of a taximeter shall be conducted utilizing one or more of the following test methods:

(a) **Road Test.** – A road test consists of driving the vehicle over a precisely measured road course.

(b) **Fifth-Wheel Test.** – A fifth-wheel test consists of driving the vehicle over any reasonable road course and determining the distance actually traveled through the use of a mechanism known as a "fifth wheel" that is attached to the vehicle and that independently measures and indicates the distance.

(c) **Simulated-Road Test.*** – A simulated road test consists of determining the distance traveled by use of a roller device, or by computation from rolling circumference and wheel-turn data.

***Simulated-road testing is not appropriate for taximeters using measurement data from sources other than signal(s) generated by rotation of the wheels of the vehicle.**

(Amended 1977 **and 20XX**)

N.1.2. Test Procedures. – The distance test of a taximeter, whether a road test, a simulated-road test, or a fifth-wheel test, shall include at least duplicate runs of sufficient length to cover at least the third money drop or 1 mi, whichever is greater, and shall be at a speed approximating the average speed traveled by the vehicle in normal service. In the case of metric-calibrated taximeters, the test should cover at least the third money drop or 2 km, whichever is greater.

(Amended 1977)

N.1.2.1. Taximeters Using Measurement Data Sources from Other Than Rotation of the Wheels. – Repeatability testing shall be conducted if during testing a taximeter registers a distance measurement that does not comply with the tolerance values in T.1.1. Distance Tests. A minimum of three additional tests shall be conducted at the same location and where all test variables are reduced to the greatest extent practicable to verify the sytems ability to repeat transaction indications. Repeatability testing performed in excess of these three additional tests is done at the discretion of the official with statutory authority.

Testing of taximeters with metrologically significant parameters that do not completely reside within the taximeter device shall include tests performed under variable conditions to verify that any non-compliant issue is generated from a network system rather than a single taximeter device. The variability tests shall include a minimum of three consecutive tests of varying lengths, locations, and/or environmental conditions.

(Added 20XX)

N.1.3. Test Conditions.

N.1.3.1. Measurement Data Based on the Rotation of the Vehicle's Wheels. – For taximeters that receive input of measurement data generated (directly or indirectly) from rotation of the vehicle's wheels, the test of the taximeter shall be performed under the following conditions.

(Added 20XX)

N.1.3.1.1. Vehicle Lading. – During the distance test of a taximeter, the vehicle shall carry two persons, or in the case of a simulated-road test, 70 kg or 150 lb of test weights may be substituted in lieu of the second person.

N.1.3.1.2. Tire Pressure. – At the completion of test run or runs, the tires of the vehicle under test shall be checked to determine that the tire pressure is that operating tire pressure posted in the vehicle. If not, the tire pressure should be adjusted to the posted tire pressure and further tests may be conducted to determine the operating characteristics of the taximeter.

(Amended 1977 **and 20XX**)

N.1.3.2. Taximeters Using Other Measurement Data Sources. - Except during type evaluation, all tests shall be performed under conditions that are considered usual and customary for the location(s) where the system is normally operated and as deemed necessary by the statutory authority.

(Added 20XX)

N.1.3.2.1. Roads. - All tests shall be conducted on public roads.

(Added 20XX)

N.1.3.2.2. Testing for Environmental Influences. – During type evaluation, the distance test may be performed on a route traveled by the vehicle that exposes the system to conditions possibly contributing to the loss of, or interference with the signal(s) providing measurement data. This may include:

(a) Objects that may obstruct or reflect signals such as tall buildings/structures, forestation, tunnels, etc.;

(b) Routes that do not follow a straight-line path;

(c) Significant changes in altitude; and

(d) Any other relevant environmental conditions.

(Added 20XX)

N.2. Time Test. – If a taximeter is equipped with a timing device through which charges are made for time intervals, the timer shall be tested at the initial interval, four separate subsequent intervals, and an average time test of at least four consecutive subsequent time intervals.

(Amended 1988)

N.3. Interference Test. – ~~**If a taximeter is equipped with a timing device through which charges are made for time intervals**~~**For taximeters that calculate fares based on time and/or distance but not simultaneously**, a test shall be conducted to determine whether there is interference between the time and distance elements. During the interference test, the vehicle's operating speed shall be 3 km/h or 4 km/h, or 2 mi/h or 3 mi/h faster**, and then 3 km/h or 4 km/h (2mi/h or 3 mi/h) slower** than the speed at which the basic distance rate equals the basic time rate. The basic rate per hour divided by the basic rate per mile is the speed (km/h or mi/h) at which the basic time rate and basic distance rate are equal.

Note: Performance of the interference test may not be considered appropriate as a field test while travelling in a vehicle equipped with a taximeter. This test may be performed during type evaluation under controlled conditions for practicality and for safety concerns.

(Amended 1988 **and 20XX**)

T. Tolerances

T.1. Tolerance Values.

T.1.1. On Distance Tests. – Maintenance and acceptance tolerances for taximeters shall be as follows:

(a) On Overregistration: 1 % of the interval under test.

(b) On Underregistration: 4 % of the interval under test, with an added tolerance of 30 m or 100 ft whenever the initial interval is included in the interval under test.

T.1.2. On Time Tests.

T.1.2.1. On Individual Time Intervals. – Maintenance and acceptance tolerances on individual time intervals shall be as follows:

(a) On Overregistration: 3 seconds per minute (5 %).

(b) On Underregistration: 9 seconds per minute (15 %) on the initial interval, and 6 seconds per minute (10 %) on subsequent intervals.

T.1.2.2. On Average Time Interval Computed After the Initial Interval. – Except for the initial interval, maintenance and acceptance tolerances on the average time interval shall be as follows:

(a) On Overregistration: 0.2 second per minute (0.33 %).

(b) On Underregistration: 3 seconds per minute (5 %).

(Amended 1991)

T.1.3. On Interference Tests. – For taximeters designed to calculate fares upon the basis of a combination of distance traveled and time elapsed, but not using both simultaneously.

(Added 1998) (Amended 20XX)

T.1.3.1. The **distance** registration of a taximeter in the "time on" position shall agree within 1 % of its ~~**performance**~~ **distance registration** in the "time off" position.

(Amended 20XX)

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

(Added 20XX)

UR. User Requirements

UR.1. Inflation of Vehicle Tires. – For taximeters that receive input of measurement data generated (directly or indirectly) from rotation of the vehicle's wheels, ~~T~~the operational tire pressure of passenger vehicles and truck tires shall be posted in the vehicle and shall be maintained at the posted pressure.

(Amended 1977 **and 20XX**)

UR.2. Position and Illumination of Taximeter. – A taximeter shall be so positioned and illuminated that its indications, operational markings, and controls of passenger interest can be conveniently read by a passenger seated

~~in the back seat of the vehicle~~ in a position of up to 1.2 meters (4 ft.) away from the taximeter under any condition of normal operation.

(Amended 1985**, ~~and~~** 1986 **and 20XX**)

UR.3. Statement of Rates. – The distance and time rates for which a taximeter is set, including the initial distance interval and the initial time interval, the local tax rate, and the schedule of extras when an extras indication is provided shall be conspicuously displayed inside the front and rear passenger compartments. The words "Rate," "Rates," or "Rates of Fare" shall precede the rate statement. The rate statement shall be fully informative, self-explanatory, and readily understandable by the ordinary passenger, and shall either be of a permanent character or be protected by glass or other suitable transparent material.

(Amended 1977, 1988, 1990, and 1999)

Appendix D

location services. – any of the various technologies used to determine the geographical location of a receiving unit in or physically attached to a vehicle. These technologies may include but are not limited to: Global Positioning Service; cellular networks; wi-fi networks. [5.54., 5.XX.]

Background/Discussion:

The Committee has received multiple proposals over the past several years related to updating the NIST Handbook 44, Taximeters Code to reflect current technology as well as a request to establish criteria for GPS-based time and distance measuring systems used in transportation and other applications. In April 2012, NIST, OWM established a U.S. National Working Group to work on these issues.

The USNWG on Taximeters has submitted a number of proposed changes to the NIST Handbook 44, Taximeters Code over the past two to three years. These initial changes were focused primarily on updating the code to account for the use of more advanced equipment (e.g., Passenger Information Monitors or PIMs, Mobile Data Terminals or MDTs, credit card readers, printers).

More recently, the WG's efforts were focused on the development of standards intended for "transportation network measurement systems" (TNMS) that calculate passenger fares based on time and distance derived from location services. A characteristic of TNMS that prompted the WG to develop separate requirements was the manner in which the consumer (rider) acquired this type of service and the means provided as an interface between rider, driver, and transportation network company. This interface is typically in the form of a software application program or "app." The recognition that the TNMS are almost entirely software-based was another factor that moved the USNWG to develop a separate set of requirements for these systems. The proposal for this new TNMS code has been submitted for consideration as a new item in the S&T Committee.

During the USNWG meeting discussions, the WG members recognized when developing new requirements for TNMS or modifying requirements for taximeters, there was a potential risk of creating unintended, unfair advantages for either type of device. Since these devices are used to calculate charges for the same type of service, the WG believed there should be a parallel set of requirements.

The USNWG members also recognized the traditional-type of taximeters were evolving in such a way that would incorporate some of the technologies used within TNMS and the differences between the two types of devices/system were becoming less clearly defined. This prompted the WG to develop the two separate codes in some ways where they will mirror each other in certain sections. The USNWG has now finalized a draft for proposed changes in the NIST Handbook 44, Taximeters Code which is being submitted for consideration as a Voting item.

During the 2017 NCWM Interim Meeting, the Committee received numerous comments in support of this item from industry representatives and regulatory officials alike recommending it be presented for Vote at the upcoming NCWM Annual Meeting.

Mr. John Barton (NIST, OWM and NIST Technical Advisor to the USNWG on Taximeters) stated this proposal is intended to address the use of evolving technologies in the taxi industry and these proposed changes were also developed to mitigate or eliminate any possible disparity between NIST Handbook 44 requirements applicable to taximeters and the new requirements being proposed in the Transportation Network Measurement Systems (TNMS) Code under S&T Item 3600-6. Mr. Barton noted NIST, OWM acknowledges the importance of establishing parallel standards that facilitate fair and equal regulation of devices and systems being used in the same or similar types of services, such as taximeters used by the traditional taxi industry and the use of TNMS by Transportation Network Companies (TNCs). OWM believes that if a new Handbook 44, TNMS Code is adopted (as is being proposed under Item 3600-6), the changes being recommended in the existing Handbook 44, Taximeters Code are necessary to maintain an equitable balance in the application of regulatory standards for both types of transportation services.

Mr. Barton noted many of the changes being proposed are intended to facilitate the use of location services (such as GPS) by taximeters to determine distance travelled. Other proposed changes would allow taximeters to calculate fare charges using time elapsed and distance travelled simultaneously. These features are characteristically found in TNMS and the changes, if adopted, would also allow this in taximeters and would permit taximeters to compete on a more equal basis. Other changes proposed in this item would account for the use of software applications or "apps" installed on passenger-owned devices as a convenience to customers of taxi services. Reportedly, some taxi services are already offering this type of feature, and OWM believes taxi services should be permitted to use the same type of technology being used by TNCs in their products.

Mr. Barton also stated OWM sees a benefit in the changes proposed that would allow taximeters to be sealed by other than physical means. Other commercial weighing and measuring devices have been permitted to use electronic forms of security seals and, recognizing the technological evolution of taximeters and their increasing use of software (as in all other types of devices), it is considered reasonable to permit this method of sealing in taximeters.

Many of the proposed changes will expressly permit taxis to expand their functionality by using non-traditional technologies. Some changes being proposed in the existing NIST Handbook 44, Taximeters Code are restrictive in nature and would require taximeters to comply with requirements that correspond to requirements found in the proposed new TNMS Code.

Mr. Barton also reported that OWM believes adding a definition in Handbook 44, Appendix D as proposed in this item would be of benefit and will provide a clear understanding for the use of the term "location services." It is recognized there are a number of systems and networks, which can be used in place of or in conjunction with GPS, to locate a geographical position of a for-hire vehicle. Simply using "GPS" to refer to any of services/systems that could be used to calculate distance travelled is overly simplistic and likely often incorrect. Since this term is being proposed to be included in both the amended Taximeters Code and the proposed new TNMS Code, it is considered a necessary change to NIST Handbook 44.

Mr. Stan Toy (Santa Clara County Weights and Measures, California) stated he had concerns similar to those made evident in comments he had provided regarding the draft tentative TNMS code proposed in agenda Item 3600-6 with some of the proposed requirements in the existing Taximeters Code. He reiterated concerns he had with:

- the number of tests required under proposed new paragraph N.1.2.1. Taximeters Using Measurement Data Sources Other Than Rotation of Wheels to be able to reject a device for failing performance requirements;
- having to conduct tests on "public roads" that are in "good repair" as specified in proposed new paragraph N.1.3.2.1. Roads; and
- neglecting to include limits on the frequency of signal loss in proposed new paragraph S.7.2. Significant Trip Data Loss.

Mr. Barton noted that significant trip data loss is invariably going to occur in places where the signal is lost, to which Mr. Toy responded he understands there will be instances where the signal is lost; his concern is how often it occurs.

In consideration of the comments received on this item, the Committee agreed to present if for Vote at the upcoming 2017 NCWM Annual Meeting.

At the 2017 NCWM Annual Meeting, the Committee received numerous comments in support of this item from industry representatives and regulatory officials alike recommending it to remain Voting.

Mr. John Barton (NIST, OWM) provided background information from the USNWG on taximeters and stated the workgroup supports this item. He further noted that, if it would move the item forward, the workgroup agreed to remove the term "transfer standard" from the definitions section and to remove the words, "which are in good repair" from paragraph N.1.3.2.1.

Mr. Henry Oppermann (Weights and Measures Consulting, LLC) noted the term "transfer standard" was used three times throughout the item but wasn't terribly concerned.

Ms. Kristin Macey stated California allows taxi companies to use any technology for the determination of time and distance, so long as the device is approved.

Mr. Stan Toy (Santa Clara County Weights and Measures, California) stated that he had concerns similar to those made evident in comments he had provided regarding the draft tentative TNMSs code proposed in agenda Item 3600-6. He then reiterated concerns he had expressed at the 2017 NCWM Interim Meeting.

Mr. Curt Floren (Los Angeles County, California) asked questions about the validity or necessity of three additional tests if the first one fails. Mr. Barton responded that the multiple tests would demonstrate repeatability. Mr. Floren then asked if we allow taxis to use similar technology, which code would they fall under? Mr. Barton noted there were no proposed changes to the general application and that the code applies to taximeters, which the USNWG felt was sufficient. Mr. Floren noted that he supported moving the tentative code for transportation network companies forward, but asked for everyone to take a look at paragraph S.5.1 and determine if that language could possibly create confusion regarding which code would apply.

Mr. Bob O'Leary (Uber) responded to Mr. Floren's questions noting the definitions attempt to differentiate from "taximeters" and "transportation network devices." He further noted taxis are based on a relationship with the driver (e.g., have to directly contact the driver), but with a transportation network company, the user has to download an app to use the service.

Mr. James Cassidy (City of Cambridge, Massachusetts) spoke in support of the item.

Mr. Mike Sikula (New York) provided written comments in support of this item.

The Committee, agreed to delete the words, "which are in good repair" from paragraph N.1.3.2.1. as suggested by the USNWG because it felt the determination of whether a road is in good repair would be too arbitrary. The Committee, however, did not believe deletion of the term "transfer standard" from the code, as was also suggested by the USNWG, was a necessary change and, therefore, elected not to delete it anywhere in which it appears in the code. Based on all the comments heard in support of this item, the Committee agreed to present the item for Vote as shown in Item Under Consideration.

Regional Association Comments and Recommendations:
The WWMA did not have the opportunity to review and comment on the updated language for this item at its 2016 Annual Meeting because the USNWG was still considering final language during the WWMA Conference.

The CWMA recommended at both its fall 2016 Interim Meeting and spring 2017 Annual Meeting that this item remain in Developing status. At its 2017 Annual Meeting, an additional recommendation was for this item to remain in a Developing status until such time that paragraph T.2. has been removed. Numerous issues must be resolved regarding the use of transfer standards. Among these issues, the criteria and procedures are needed to specify how the standard deviation of the transfer standard is to be determined.

The SWMA received no comments for this item during its 2016 Annual Meeting. The Committee believes this item is fully developed and recommended Voting status.

NEWMA reported at its fall 2016 Interim Meeting it supports the USNWG and recommended this item be a Voting item. At its spring 2017 Annual Meeting, NEWMA again recommended the item move forward as a Voting item, but without the proposed definition of a "transfer standard."

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf**.

3508 MULTIPLE DIMENSION MEASURING DEVICES

3508-1 V S.1.7. MINIMUM MEASUREMENT ~~LENGTHS~~ AND S.1.8. INDICATIONS BELOW MINIMUM AND ABOVE MAXIMUM

(This item was Adopted.)

Source:
Multiple Dimension Measuring Device (MDMD) WG (2017)

Purpose:
Clarification of the application of the minimum measurement and tare operation.

Item under Consideration:
Amend NIST Handbook 44, Multiple Dimension Measuring Devices Code as follows:

S.1.7. Minimum Measurement ~~Lengths~~. – Except for entries of tare, the minimum **measurement** ~~**length to be measured**~~ by a device is 12 **d** ~~**divisions**~~. The manufacturer may specify a longer minimum **measurement** ~~**length**~~. **For multi-interval devices, this applies only to the first measuring range (segment) of each measurement axis (length, width, and height).**

(Amended 2017)

S.1.8. Indications Below Minimum and Above Maximum. – When objects are smaller than the minimum dimensions identified in paragraph S.1.7. Minimum **Measurement** ~~**Lengths**~~ or larger than any of the maximum dimensions plus 9 d, and/or maximum volume marked on the device plus 9 d, or when a combination of dimensions**, including tare,** for the object being measured exceeds the measurement capability of the device, the indicating or recording element shall either:

(a) not indicate or record any usable values; or

(b) identify the indicated or recorded representation with an error indication.

(Amended 2004 **and 2017**)

Background/Discussion:
The MDMD WG believes that the expansion of S.1.7. to include multi-interval devices with the additional proposed changes provides a better explanation of how to apply the 12-d minimum measurement specification and the application of tare with respect to marked maximum dimension for the axes in which tare was applied.

This proposal also addresses the change in the use of the word "length" and recommends the use of the word "measurement." The WG feels that "measurement" is better suited for all axes.

These proposed changes better harmonize the device specifications with those of Measurement Canada.

2017 NCWM Interim Meeting
At the 2017 NCWM Interim Meeting, the Committee heard comments of support for this item as written from Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA; Ms. Fran Elson-Houston (Ohio Department of Agriculture); and Mr. Richard Suiter (Richard Suiter Consulting).

Mr. Richard Harshman (NIST, OWM) commented that OWM believes the proposed changes to both paragraphs in this proposal are appropriate. The 12-division minimum specified in paragraph S.1.7. is intended to apply not only to the length of an item being measured as is currently specified in the paragraph, but also the width and height of the item. Replacing the word "length" with "measurement" in these two paragraphs will make clear the application of the 12-division minimum measurement to each axis (L, W, and H).

In consideration of the comments received in support of this item, the Committee agreed to recommend the item for a Vote.

At the 2017 NCWM Annual Meeting, the Committee received comments from several interested parties.

Mrs. Tina Butcher (NIST, OWM) clarified that, for multi-interval devices, the minimum measurement (12 d) requirements for each of the measured axis are only applicable to the first measuring range (segment). She further suggested that replacing the word "length" with "measurement" clarifies that the requirements are applicable to each of the measured axis (length, width, and height).

The Committee again heard comments of support for this item as written from Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA; and Ms. Fran Elson-Houston (Ohio Department of Agriculture). Mr. Robert Kennington (Quantronix, Inc.), who is the chair of the MDMD WG, also expressed support for the changes as drafted.

In consideration of the comments heard in support of the item, the Committee agreed to present the item for Vote.

Regional Association Comments and Recommendations:
The WWMA considered this item to be fully developed at its 2016 Annual Meeting and forwarded it to the NCWM, recommending it as a Voting item.

The CWMA believes this item is fully developed and recommended that it be a Voting item at both its fall 2016 Interim Meeting and spring 2017 Annual Meeting.

The SWMA received no comments on this item at its 2016 Annual Meeting. The Committee believes this item is fully developed and recommended Voting status.

NEWMA forwarded this item to the NCWM and recommended Voting status at both its fall 2016 Interim Meeting and spring 2017 Annual Meeting.

3508-2 W T.3. TOLERANCE VALUES (SEE ALSO ITEMS 3200-7, 3201-1, 3204-1, 3205-2, 3509-1 AND 3600-4)

(This item was Withdrawn.)

Source:
Ross Andersen, Retired (2017)

Purpose:
Provide language in this code that is consistent with the General Code.

Item under Consideration:
Amend NIST Handbook 44, Multiple Dimension Measuring Devices (MDMD) Code as follows**:**

T.3. Tolerance Values. – **The tolerances hereinafter prescribed shall be applied equally to errors of underregistration and errors of overregistration**. The maintenance and acceptance tolerance values shall be ~~±~~1 division.

[Note the ± is stricken near the end of the second sentence.]

Background/Discussion:
This item was submitted as one of a group of items that includes agenda Items 3200-7, 3201-1, 3204-1, 3205-2, 3508-2, 3509-1, and 3600-4. The Background/Discussion information is the same for these items and included in agenda Item 3200-7 of this report. At the 2017 NCWM Interim Meeting, the Committee agreed to Withdraw these items in consideration of the comments received during that meeting.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf**.

3509 ELECTRONIC LIVESTOCK, MEAT, AND POULTRY EVALUATION SYSTEMS

3509-1 W T.1. TOLERANCES ON INDIVIDUAL MEASUREMENTS (SEE RELATED ITEMS 3200-7, 3201-1, 3204-1, 3205-2, 3508-2 AND 3600-4)

(This item was Withdrawn.)

Source:
Ross Andersen, Retired (2017)

Purpose:
Provide language in this code that is consistent with the General Code.

Item under Consideration:
Amend NIST Handbook 44, Electronic Livestock, Meat, and Poultry Evaluation Systems Code as follows**:**

T.1. Tolerances on Individual Measurements. – **The tolerances hereinafter prescribed shall be applied equally to errors of underregistration and errors of overregistration.** Maintenance and acceptance tolerances on an individual measurement shall be as shown in Table T.1. Tolerances.

Background/Discussion:
This item was submitted as one of a group of items that includes agenda Items 3200-7, 3201-1, 3204-1, 3205-2, 3508-2, 3509-1, and 3600-4. The Background/Discussion information is the same for these items and included in agenda Item 3200-7 of this report. At the 2017 NCWM Interim Meeting, the Committee agreed to Withdraw these items in consideration of the comments received during that meeting.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf**.

3600 OTHER ITEMS

3600-1 D ELECTRIC WATTHOUR METERS CODE UNDER DEVELOPMENT

Source:
NIST, OWM (2016)

Purpose:

- Make the weights and measures community aware of work being done within the U.S. National Work Group (USNWG) on Electric Vehicle Fueling and Submetering to develop proposed requirements for electric watthour meters used in submeter applications in residences and businesses;
- Encourage participation in this work by interested regulatory officials, manufacturers, and users of electric submeters.
- Allow an opportunity for the USNWG to provide regular updates to the S&T Committee and the weights and measures community on the progress of this work;
- Allow the USWNG to vet specific proposals as input is needed.

Item under Consideration:
There is presently no specific item for consideration. This Developing Item is included on the Committee's agenda (and a corresponding item is proposed for inclusion on the L&R Committee agenda) to keep the weights and measures community apprised of USNWG current projects, including the following:

- The USNWG continues to develop recommended test procedures for inclusion in a new EPO 30 for Electric Vehicle Refueling Equipment along with proposed requirements for field test standards.
- The USWNG is continuing work to develop a proposed code for electricity-measuring devices used in sub-metering electricity at residential and business locations. This does not include metering systems under the jurisdiction of public utilities. The USNWG hopes to have a draft code for consideration by the community in the 2016-2107 NCWM cycle.

The USNWG will provide regular updates on the progress of this work and welcomes input from the community.

For additional information, contact USNWG Chairman Tina Butcher at tbutcher@nist.gov or (301) 975-2196 or Technical Advisor, Juana Williams at juana.williams@nist.gov or (301) 975-3989.

Background/Discussion:
In 2012, NIST, OWM formed the USNWG on Electric Vehicle Fueling and Submetering to develop proposed requirements for commercial electricity-measuring devices (including those used in sub-metering electricity at residential and business locations and those used to measure and sell electricity dispensed as a vehicle fuel) and to ensure the prescribed methodologies and standards facilitate measurements that are traceable to the International System of Units (SI).

In 2013, the NCWM adopted changes recommended by the USNWG to the NIST Handbook 130 requirements for the Method of Sale of Commodities to specify the method of sale for electric vehicle refueling. At the 2015 NCWM Annual Meeting, the NCWM adopted NIST Handbook 44, Section 3.40 Electric Vehicle Refueling Systems developed by the USNWG.

The creation of Developing Items on both the L&R and S&T Committee agendas will provide for a venue to allow the USNWG to update the weights and measures community on continued work to develop test procedures and test equipment standards. This item will also provide a forum for reporting on work to develop proposed method of sale requirements for electric watthour meters and a tentative device code for electric watthour meters in residential and business locations and serve as a placeholder for eventual submission of these proposals for consideration by NCWM.

The Committee received an update on this item from Ms. Tina Butcher (NIST, OWM), Chairman of the USNWG on Electric Refueling and Submetering at both the 2016 NCWM Interim and Annual Meetings. See the Committee's 2016 Final Report for details of those updates.

During the 2017 NCWM Interim Meeting, Ms. Tina Butcher, Chairman of the USNWG on Electric Vehicle Refueling and Submetering, provided an update on the progress of the USNWG. She noted that, when the USNWG was initially created, it was charged with addressing *all* electric submeters, including commercial electric vehicle refueling systems as well as commercial utility-type electric watthour meters under the purview of weights and measures jurisdictions (rather than public utility commissions or similar entities). Shortly after beginning its work, the USNWG agreed to focus its initial efforts on developing proposed requirements, test procedures, and field standard criteria for commercial electric vehicle refueling metering systems. In July 2015, after several years of intensive work by the USNWG, a tentative code for electric vehicle refueling systems was presented to and adopted by the NCWM.

In December 2015, the USNWG discussed plans to resume work on electric watthour meter requirements, including the development of a proposed NIST Handbook 44 code. A draft code derived from one initially circulated in 2014 was re-distributed to the USNWG in December 2015, with a deadline for comments in February 2016. This deadline was ultimately extended to March 2016 at the request of some WG members. The USNWG recently agreed upon revisions to its charter, which includes dividing the larger USNWG into two parts: one to address Electric Vehicle Refueling Equipment and the other to address Electric Watthour Metering Systems. NIST, OWM continues to analyze and compile comments received on the draft code.

Work continues on test equipment standards and test procedures for Electric Vehicle Refueling Equipment, under a subcommittee, Chaired by Mr. Ted Bohn, (Argonne National Laboratory), within the original USNWG. The USNWG's next step is to reconvene the USNWG and begin review of the comments on the draft watthour meters code. The Technical Advisor to the USNWG, Ms. Juana Williams, will be polling members on dates for 1) a short, web-based conference to review the overall plan for drafting requirements and procedures for watthour meters; and 2) an in-person meeting to begin reviewing and discussing comments received on the draft NIST Handbook 44 watthour meters code and agreeing upon needed changes. NIST, OWM appreciates the diligent work of the USNWG members in collaborating on the development of these much-needed standards.

Those interested in the work can contact Ms. Tina Butcher, Chairman, at tbucher@nist.gov or Ms. Juana Williams, Technical Advisor, at jwilliams@nist.gov.

At the 2017 NCWM Annual Meeting, the Committee received an update on this item from Ms. Tina Butcher (NIST, OWM and Chairman of the USNWG on Electric Vehicle Refueling and Submetering) very similar to the one she provided during the 2017 NCWM Interim Meeting. In addition to explaining the charge of the USNWG on Electric Vehicle Refueling and Submetering and providing an historical account of its significant accomplishments and its current focus, she also announced that the first face-to-face meeting of the Watthour Type Electric Meter (WHE) Subgroup will be held September 12 - 14, 2017, in Sacramento, California, and the work continues on test equipment standards and test procedures for Electric Vehicle Refueling Systems.

The Committee agreed to maintain its developing status on this item based on the update provided and the ongoing work of the USNWG.

Regional Association Comments and Recommendations:
The WWMA believes this item should remain a Developing item as the USNWG continues its work.

The CWMA supports the continued development of this item and recommends it remain in a Developing status.

The SWMA received a request from Ms. Tina Butcher (NIST, OWM) that the item remain Developing and provided a history of the USNWG. The SWMA looks forward to the progress of the USNWG and recommended the item remain in Developing status.

NEWMA supports the continued development of this item.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf**.

3600-2 D APPENDIX A FUNDAMENTAL CONSIDERATIONS: SECTION 4.4. GENERAL CONSIDERATIONS (SEE RELATED ITEMS 3100-1 AND 3200-5)

Source:
Ross Andersen, Retired (2017)

Purpose:
Address the application of the code requirements across multiple devices.

Item under Consideration:
Amend NIST Handbook 44, Appendix A. Fundamental Considerations as follows:

> **4.4. General Considerations.** – The simpler the commercial device, the fewer are the specification requirements affecting it, and the more easily and quickly can adequate inspection be made. As mechanical complexity increases, however, inspection becomes increasingly important and more time consuming, because the opportunities for the existence of faulty conditions are multiplied. It is on the relatively complex device, too, that the official must be on the alert to discover any modification that may have been made by an operator that might adversely affect the proper functioning of the device. **Code requirements in the Handbook are applied only to a single device or system, unless specifically stated in the code. An electronic sum of measured values from multiple devices is not subject to code requirements, except that it be mathematically correct (i.e., add up to the proper sum) – See General Code G-S.5.2.2.(e).**
>
> It is essential for the officials to familiarize themselves with the design and operating characteristics of the devices that he inspects and tests. Such knowledge can be obtained from the catalogs and advertising literature of device manufacturers, from trained service persons and plant engineers, from observation of the operations performed by service persons when reconditioning equipment in the field, and from a study of the devices themselves.
>
> Inspection should include any auxiliary equipment and general conditions external to the device that may affect its performance characteristics. To prolong the life of the equipment and forestall rejection, inspection should also include observation of the general maintenance of the device and of the proper functioning of all required elements. The official should look for worn or weakened mechanical parts, leaks in volumetric equipment, or elements in need of cleaning.

Background/Discussion:
The submitter modified the proposal after the 2016 WWMA meeting. The Item under Consideration now represents the revised version. The original was presented at WWMA was as follows:

> **4.4. General Considerations.** – **Code requirements are applied only to a single device or system, unless specifically stated in the code. The official may encounter equipment where the digital indications from more than one device are electronically summed. This may be done in multiple ways. Each device may have its own indicating element and the sum is indicated on a separate, associated indicator which is interfaced directly with each device (i.e., a computer or console via cable or even Bluetooth wireless communication). The indicating elements of the individual devices may be enclosed in a single housing, with separate indicators for each device and a separate indicator for the electronic sum. An electronic sum of measured values from multiple devices is not subject to code requirements, except that it be mathematically correct (i.e., add up to the proper sum) – See General Code G-S.5.2.2.(e).**

The submitter provided the following comments:

> The simpler the commercial device, the fewer are the specification requirements affecting it, and the more easily and quickly can adequate inspection be made. As mechanical complexity increases, however, inspection becomes increasingly important and more time consuming, because the opportunities for the existence of faulty conditions are multiplied. It is on the relatively complex device, too, that the official must be on the alert to discover any modification that may have been made by an operator that might adversely affect the proper functioning of the device.
>
> It is essential for the officials to familiarize themselves with the design and operating characteristics of the devices that they inspect and test. Such knowledge can be obtained from the catalogs and advertising literature of device manufacturers, from trained service persons and plant engineers, from observation of the operations performed by service persons when reconditioning equipment in the field, and from a study of the devices themselves.
>
> Inspection should include any auxiliary equipment and general conditions external to the device that may affect its performance characteristics. In order to prolong the life of the equipment and forestall rejection, inspection should also include observation of the general maintenance of the device and of the proper functioning of all required elements. The official should look for worn or weakened mechanical parts, leaks in volumetric equipment, or elements in need of cleaning.
>
> Some are now coming to understand that the NCWM made a mistake in 1990 in interpreting how we apply the code requirements to the three-platform, three-indicator truck scale with a fourth summed indication. In any suggestion that a Code should be changed or reinterpreted, there is an unstated requirement that there must be some conflict that needs resolution. Often the difficult part is in just identifying the conflict or in finding the right question to expose the conflict to others and, in doing so, possibly point to the resolution. Some might think there is no conflict and there is no issue, but I must disagree.
>
> What stands out on this issue to me is the huge divide between the public sector and private sector on this issue. It was black and white in 1989, good guys vs the bad guys. The public sector, me included, saw the issue one way, while the scale industry almost unilaterally saw it differently. As I think back over my career, I find it hard to find many issues where consensus between the two sides eluded the NCWM as it did for this issue. In my experience, the scale industry works toward consensus as earnestly as the public sector. If there is no consensus here, this should bother us all and encourage us to try to understand why.
>
> If we ask the question on our current issue, as Henry Oppermann has, it goes like this: How do we apply the Scales Code requirements to a three-platform scale with three independent weight indications and a fourth indication of the sum of the three independent platforms? His answer follows his logic of the "duck test." Quoting him, "if a scale looks like truck scale, operates like a truck scale, and weighs trucks, then it is a truck scale."
>
> It is important to note that a parallel issue was on the 2016 S&T agenda dealing with the v_{min} requirement for these three-platform scales with three independent indicators. However, in dealing with this small part of the larger issue, the Committee has chosen to ignore the larger issue for now. In my testimony at the 2016 Interim Meeting, I pointed out that the v_{min} change would result in a mixed state of being. Part of our interpretation for v_{min} would treat the three scales as three, but treat them as one for all other requirements. Does this make sense?
>
> I see an immediate problem here, as Henry's quote is based on thinking from 1989; and I'll suggest much earlier, pre-1986 to be exact. We can see this in Tables 7b. and 7a. in the Scales Code. These tables deal with selection requirements for unmarked scales and marked scales. Table 7b. reflects that pre-1986 thought process where the application of the unmarked device determined what technical and performance requirements would apply. This is the model implied in Henry's comment

and in the thought process we see from the S&T Committee as it wrestled with this issue in 1990. Quoting from page 157 of the 1990 S&T Final Report: "The classification of a scale or weighing system into an accuracy class should be based upon its application and method of use, not on the design of the device." In the same paragraph the report also notes, "The significance of this interpretation is that not only must each independent weighing device meet the requirements of Handbook 44, but the entire weighing system must meet all requirements that would apply if the device were a single scale" (emphasis added). This was voted on and approved by the public-sector voters of the NCWM with strong opposition from the (non-voting) scale industry.

Looking at that last statement in the S&T report today, does it even make sense? Table 7a. made a radical departure from the pre-1986 way of thinking. Under the "New" Scales Code which took effect January 1, 1986, the technical and performance requirements were determined by the class designation that was chosen and marked on the device by the manufacturer. In the wording of the table, it is a typical application of the class. Thus, the requirements apply based on the class designation as marked by the manufacturer and the device is adapted to the application. To me this contradicts the S&T conclusions in 1990.

I'm suggesting that a "duck test" is not valid for marked devices. For example, there is no single set of requirements for a marked truck scale. By this, I mean one can use a class III or a class IIIL scale to weigh trucks and the requirements are, therefore, very different. This was impossible to imagine prior to 1986 under the "Old" Scales Code. It is the manufacturer, in the design and production phases, who determines and marks the class. It is the marked class that determines which technical requirements will be applied to the device, and this is done before it leaves the plant. The code recognizes that the manufacturer has no means to limit the application once the purchaser buys the device. \Whether a device is suitable is a separate question and has a separate requirement; that is, General Code Paragraph G-UR.1. Selection Requirements.

I believe the "duck test" is not valid for the entire Handbook. For me, the critical issue we have to address is how to apply code requirements in general. The simple, direct answer is: we apply code requirements to a device. That is how the requirements are written; in the singular. Why is this singularity important? The answer lies in unstated, general principles in Handbook 44 which we can elicit by asking, "How do we measure quantities of things in commerce, generally?" By generally, I mean across all codes. My answer is that the codes clearly allow multiple solutions to that question. I'll state this more specifically:

A commodity exchanged in commerce may be measured:

D. as a single draft measured using a single measuring instrument;

E. as the sum of measurements of sub-parts of the whole using multiple drafts on a single measuring instrument; or

F. as the sum of measurements of sub-parts of the whole using multiple drafts of multiple measuring instruments.

It must be noted that the instrument used in any of the options A through C, must be suitable for service when measuring the whole or the sub-part in conformance with G-UR.1. For the purposes of this discussion we will stipulate that all measuring instruments involved are suitable for service, whether measuring the whole or the sub-part. For example, all weighments are stipulated to be greater than the recommended minimum load in Table 8 or liquid quantities in conformance with G-UR.1.3.

A couple of examples might help. I don't think I need to illustrate option A, as it is the most common solution. Option B can be seen with an Automatic Bulk Weighing system which operates by summing multiple drafts weighed on the same scale to provide a total weight of the whole

commodity. But I could also do option B using VTM's. I could make multiple deliveries from a single VTM unit to fill a large customer order; that is, larger than the tank capacity of the single VTM. Alternatively, I could fill that order using drafts from multiple VTM units, option C.

Our assumption in accepting each of these options is that the sum of measurements from multiple compliant instruments is *de facto* compliant. In fact, the reason that we use multiple drafts in the first place is that the total will probably exceed our ability to verify the quantity of the whole, even if we wanted to! Going back to our examples, how could we verify, after the fact, that the 1 000 tons of grain loaded on a barge from an ABWS system with a 50 000 lb capacity scale is accurate? That's at least 40 drafts.

What becomes very clear to me in the general case is that the technical and performance requirements are applied to the individual device without regard to the summed total. It seems this summed total has always been the crux of the issue. Does this summed indication now link the three independent platforms with their independent indication in a way that makes them one device for legal purposes? This is what the S&T Committee decided in 1990. Some would continue to say "yes" and some would say "no." However, there is the law to consider. By law, I mean the general rules of construction of legal requirements. In construction, we must not be arbitrary and capricious. I believe those that say the three scales are one scale are being arbitrary and capricious.

To see how this is so, consider what UR.3.3. Single-Draft Weighing means. Below is the current NIST Handbook 44 text.

UR.3.3. Single-Draft Vehicle Weighing. – A vehicle or a coupled-vehicle combination shall be commercially weighed on a vehicle scale only as a single draft. That is, the total weight of such a vehicle or combination shall not be determined by adding together the results obtained by separately and not simultaneously weighing each end of such vehicle or individual elements of such coupled combination. However, the weight of:

(a) a coupled combination may be determined by uncoupling the various elements (tractor, semitrailer, trailer), weighing each unit separately as a single draft, and adding together the results; or

(b) a vehicle or coupled-vehicle combination may be determined by adding together the weights obtained while all individual elements are resting simultaneously on more than one scale platform.

The first sentence makes it clear that this is not a general provision as it limits the scope of the requirement to "a vehicle or a coupled-vehicle combination." It now goes on to say that any entity fitting one of those two descriptions shall be weighed as a single draft. Note that this is "option A" from the general case above. The paragraph goes on to provide more explanation of what "single-draft" means.

Then we come to a "However," indicating there are viable alternatives to the single-draft requirement. Alternative (a) allows the coupled combination to be divided into sub-parts that are weighed separately and the weight of the coupled combination is found by summing the individual weights of the sub-parts. Alternative (b) says that a vehicle or a coupled combination may be suspended simultaneously on more than one scale and the weight is found by summing the indications of the multiple scales.

On first glance, we might think that alternative (a) is option B from the general case, and alternative (b) is option C. However, closer reading will show that is not the case. Look carefully at the wording of alternatives (a) and (b). You cannot equate (a) with option B since (a) does not limit you to a

single scale. You might assume that the multiple parts would be weighed on the same scale, but the code does not stipulate that. To do that, the code would have to add the words, "on the same scale;" that is, weighing each unit separately on the same scale and adding together the results." What I'm pointing out is that (a) as it is now written allows either general option B or C. By this I am considering the case where there are multiple scales available at the site. Each of those scales might have a capacity and division size of 200,000 × 20 lb. For example, think about one of those three component trucks (tractor, trailer, and pup). Alternative (a) allows you to uncouple and weigh the three sub-parts on three scales, two scales, or one scale in full compliance with the code.

Now it becomes clear that UR.3.3. is addressing the real issue with weighing large vehicles and coupled-vehicle combinations, and that is shifting loads and coupler interactions. In alternative (a) you eliminate both interferences by isolating each part on its own scale. In alternative (b) by supporting the vehicle or combination on multiple scales, any shift in the load or coupler interaction cancels out. If load shift or coupler interference reduces the weight on one platform, it increases it on another. Of critical importance, the three-platform scale that is the focus of this discussion, is an application of (b) where the load is supported simultaneously on more than one platform and the individual indications of the three scales are summed to get a total. There is no other way to describe what is happening since the total indication is, in fact, a sum of the weights from the three separate platforms. Also of critical importance, there should be no expectation whatsoever that the sum valued obtained in alternative (a) will be identical to alternative (b).

However, getting back to the question about three scales or one, it should now be clear that the Handbook clearly allows summed indications from multiple devices using options B or C. If the S&T statement is correct, then the code requirements must be applied across two scales or three scales in the example of multiple scales at a site. Thus, the three, one hundred-ton scales have a combined 30,000 divisions according to that interpretation. This would virtually preclude having multiple scales at the same site as they might be used to weight a single coupled-vehicle combination in pieces. Even going to 50 lb divisions still puts them out of compliance. Also, you have to consider the shift test requirements, which now require agreement of sections across all three scales!

Finally, we have to consider other cases of three independent scale platforms configured to weigh trucks. In case one, each platform has a stand-alone independent indicator and the three indications are manually summed by the operator. In case two, each platform has an individual indicator but all three indicators are housed in a single enclosure. Again, the summing is done manually by the operator. In both of these cases, the three independent instruments remain independent under the 1990 decision. This is what I mean by arbitrary and capricious.

Now suppose I can weigh a coupled-vehicle combination on three platforms with three separate indicators and manually add the indications to obtain a total weight for the combination. As I understand the 1990 decision, those three scales do not have to meet requirements like the number of scale divisions extended across all three scales. That extension only applies if there is a single weight display for the three scale indications and a fourth electronic indication for the sum. The results obtained are absolutely identical in function (adding manually on paper or having the system add them up) yet you are applying different requirements to the three scales depending on whether you are doing it manually or electronically. Isn't that being blatantly arbitrary and capricious?

Move over to the VTM example, and the three VTM units used to fill that order, must those three meters be treated as one meter, think about repeatability tests. It doesn't make sense for scales, nor does it make sense for any of the other codes. Thus, I argue that options B and C allow the summing of multiple devices without forcing them to be considered one instrument for applying code requirements. I believe the handbook needs to say that explicitly to avoid confusion.

I offer one additional item of support. I found reference that this issue has been raised internationally. Sections of the 2009 WELMEC Guide to Non-Automatic Weighing Instruments addresses this issue quite clearly (see pertinent sections on the final pages of this document). Point 3.1.16. in the Guide

addresses the same issues as UR.3.3. where multiple platforms are used. The applications coincide with those I expressed in this discussion paper. Also, I believe point 3.1.54. addresses the use of multiple axle-load scales to weigh a vehicle. It also supports the conclusion that the individual axle-load scales do not become a single instrument for compliance purposes. In extension, if 3.1.54. does not apply MPE (tolerances) to the summed indication, it also does not extend other technical requirements such as v_{min} [which the NCWM has addressed], n_{max}, shift test, etc.

The Fundamental Considerations change is necessary to spell out clearly that code requirements do not extend across multiple devices unless specifically stated. A good example is the application of the code to wheel-load weighers designated as and used in pairs. For those scales designated as pairs, many authorities apply the tolerances only to the combined indication of the pair. None of the other requirements applicable to the wheel-load weigher are affected by this exception. For example, the combined number of divisions for the pair is not limited to 1200 as in Table 3. Other requirements like identification markings, rules for indicators, zero-load adjustments, etc., remain applicable only to the individual wheel-load weigher and not to the pair.

The addition to G-S.5.2.2. is necessary since you can't write requirements into the Fundamental Considerations. That section is there to help understand how to apply what is written in the codes. You must have a specification that the electronic sum be mathematically correct to reference if there is non-compliance. That is, readings from three scales of 107, 206, and 98 must result in an electronic sum of 411.

Note 4 in Table 3 has to be changed, since the last two sentences address these instances of multiple independent scales and reflect the 1990 decision. The removal of the last sentence removes the summed indicator from consideration under the classification system as discussed above, since the summed indication is not a directly measured quantity and is not subject to class requirements. The summed indication is also not subject to requirements for n_{max}, tolerances, etc. When this last sentence is removed, it makes the next to last sentence unnecessary for each independent scale is already covered under the general provisions of the Table.

There is a small side issue regarding multiple devices using option C where the division size is not the same for all the devices. The general principle (i.e., summing the indications from compliant devices is a valid way to measure a commodity) does not necessarily require that division sizes of the individual devices be identical. Note that you might want to apply UR.1.3. to printed records from the three scales. However, the proposed new Fundamental Considerations paragraph exempts the summed indication since code requirements do not apply to the summed indication except the mathematical correctness. Also, the summed indication is a sum, not a representation of a scale division. It is just a sum of the values obtained from the individual compliant devices. The individual weights are also required to be shown on any record of the transaction. While the different division sizes may offend our sensibilities a little bit, on what objective basis can we say it violates the general principle; that is, the sum of multiple compliant measurements is also *de facto* compliant. It is this compilation of original sources for the sum and the sum that provides the transparency for the transaction. Note the WELMEC reference indicates this is the position taken by many internationally.

I can think of another possible situation in the case of multiple ABWS systems. Suppose you are loading to a single barge from two sources where the two ABWS scales have different division sizes. The scale controller interfaced to the two scales now can print each of the weighments from each of the two scales and a single total for the entire transaction. The sum need only be mathematically correct since it is a mathematical sum of independent, compliant weighments.

3.1.2 Calculated weight (Meeting 10, Decision 10)

Where the indication represents an actual determination of the weight then the indication must respect the error allowance and be presented in the correct format.

When gross, net and tare are printed together, weight may be calculated from two actual determinations of weight. In the case of a multi-interval instrument it would be allowed to print a calculated value with the least significant digit which need not be rounded to the relevant scale interval.

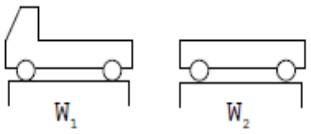
Any printout of the calculated weight values should be identified as calculated weight values.

(See also Sections 3.1.16 and 3.1.54)

3.1.16 Combined and multi-plate weighbridges (Meeting 14, Point 4, Meeting 15, Point 2 and Meeting 18, Point 9)

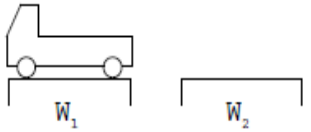
This concerns weight obtained by using adjacent weighbridges. Acceptable solutions, with examples, are shown below:

Two weighbridges, each with its own indicator:

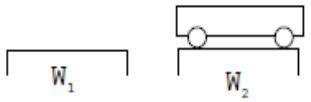


W_1 = 30 t x 10 kg
W_2 = 30 t x 10 kg
(Two indicators; simultaneous indication necessary)
Calculated weight 60 t x 10 kg
(mpe does not apply to calculated weight)

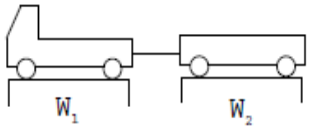
Multi-plate weighbridge with one indicator:



W_1 = 30 t x 10 kg



W_2 = 30 t x 10 kg



W_{1+2} = 60 t x 20 kg

W_{1+2} is a weighing range (Compatibility of modules and mpe must be satisfied for it)

(See also Sections 3.1.2 and 3.1.54)

3.1.54 Vehicle weighing by summation of individual wheel load NAWIs ("axle weighers") (Meeting 25, Point 9)

If the total weight of a vehicle is calculated automatically by summing the individual weight values produced by individual wheel load NAWIs ("axle weighers"), the system is not to be regarded as being one single NAWI. The mpe does not apply to calculated weight.

(See also Sections 3.1.2 and 3.1.6)

3.1.6 Load cells

(Note that throughout this guide, "load cells" refers to analogue load cells rather than digital load cells unless stated otherwise.)

At the 2017 NCWM Interim Meeting, the Committee grouped agenda Items 3100-1, 3200-5 and 3600-2 together and took comments on these items simultaneously because it considered them related. See agenda Item 3100-1 for a summary of the comments received and the resulting actions taken by the Committee on these items at the 2017 NCWM Interim Meeting.

At the 2017 NCWM Annual meeting, the Committee grouped agenda Items 3100-1, 3200-5, and 3600-2 together because it considered them related. Mr. Ross Andersen (New York, retired) spoke on the updates to this group of items as the submitter. See agenda Item 3100-1 for a summary of the updated information provided by him. The Committee agreed to carryover this group of items on its agenda as Developing items to allow Mr. Andersen the opportunity to further develop and garner support for his proposals.

Regional Association Comments and Recommendations:
At its 2016 Annual Meeting, the WWMA only heard comments from the NIST, OWM. There was a concern this would increase the tolerance applied to this type of device and may also cause conflicting tolerances. The WWMA heard new Items 3100-1 and 3600-2 together. The WWMA forwarded this item to NCWM, recommending a Developing status.

At its 2016 Interim Meeting, the CWMA reported it believes that without the addition of G-S.5.2.2.(e) this change is not relevant. CWMA did not forward this item to NCWM and recommended that it be Withdrawn. At its 2017 Annual Meeting, the CWMA reported it agrees with concerns raised by the SMA and believes this item needs more development.

At its 2016 Annual Meeting, the SWMA batched Items 3100-1, 3200-5, and 3600-2 together and heard comments for all at the same time. Mr. Henry Oppermann (Weights and Measures Consulting) disagrees with these items and opposes them. He recommends Withdrawing all three items in this batch. Mr. Oppermann contends they violate the principles of NIST Handbook 44. He further contends this should be on performance and not design. Mr. Oppermann concluded by stating the submitter misinterpreted the WELMEC guidelines and multiplatform truck scales used together must function as a single scale. The Committee did not forward these items to NCWM and recommends they be Withdrawn because the proposed language is unnecessary.

At its 2016 Interim Meeting, NEWMA reported it believes this item has merit; but would like an example of how this applies to independent/multiple devices. At its 2017 Annual Meeting, NEWMA reported the item was not ready for vote with impending changes agreed by the item's submitter. NEWMA forwarded the item to NCWM and recommended Developing status at both meetings.

3600-3 W APPENDIX D – DEFINITIONS: BATCHING SYSTEM

(This item was Withdrawn.)

Source:
Richard Suiter Consulting (2016)

Purpose:
Add a definition to NIST Handbook 44, Appendix D to differentiate batching systems from other types of weighing and measuring systems.

Item under Consideration:
Amend NIST Handbook 44, Appendix D, Definitions as follows:

batching system. – One in which materials are measured in pre-determined quantities by weight and/or liquid measure. [2.20]

Background/Discussion:
At the 2016 Annual Meeting, the Committee changed the status of this item from "Voting" to "Informational" at the request of the submitter.

Even though there are numerous batching systems in the market place and several batching systems (both manual and automated) have an NTEP CC there is no definition in NIST Handbook 44 to differentiate these systems from other types of weighing and measuring systems. Weights and measures officials seeing a system for the first time, particularly if automated, may have difficulty in determining what section of Handbook 44 to apply. This definition will assist those officials in making that determination. The SMA Handbook of Terms and Definitions Fourth Edition 1981 includes a definition for batching systems; however, for some reason that definition has never been added to Handbook 44. The definition for batching scales has also never been added, even though Paragraph S.1.2. Value of Scale Division Units, makes an exception for "batching scales and weighing systems."

2016 NCWM Interim Meeting
At the 2016 NCWM Interim Meeting, the Committee agreed to group Items 320-1 and 360-3 together and receive comments simultaneously on these two items. See Item 320-1 for a summary of the comments received and Committee considerations regarding these two items.

The Committee agreed to amend the proposed definition of "batching system" by deleting the word "raw" as was done by the WWMA S&T Committee at its 2015 Annual Meeting and as was also proposed by the SMA. The Committee further agreed to present the item for vote as shown in "Item Under Consideration" at the upcoming 2016 NCWM Annual Meeting.

2016 NCWM Annual Meeting:
At the 2016 NCWM Annual Meeting, Ms. Tina Butcher (NIST, OWM) indicated the purpose of Appendix D of NIST Handbook 44 is to define terms that are used in one or more of the codes in the handbook and to specify how they are intended to apply in those codes. The term "batching system" does not appear in the Scales Code of Handbook 44 and, therefore, it would be inappropriate to include a definition in Handbook 44 with a reference to that code.

Ms. Butcher stated the term "batching scale" does appear in NIST Handbook 44; however, there is no definition in Handbook 44 for the term. The following definition appears in a 1975 edition of a publication titled, "Terms and Definitions for the Weighing Industry" once made available by the SMA:

> **BATCHING SCALE,** N. Any scale which, by design or construction, lends itself readily to use in proportioning admixtures by weight.

OWM does not consider a "batching scale" and "batching system" the same device, given the differences in the two definitions provided. That is, the definition of the term "batching scale," from the SMA publication differs from the definition of the term "batching system" presented in the proposal.

Ms. Butcher also indicated that NIST, OWM does not understand the purpose of the proposal; that is, what the submitter is trying to achieve by proposing a new definition be added. If adding a definition and referencing it to the Scales Code is to recognize the existence of some automated batching systems in which the scales used in those systems return to zero-load balance after each draft load is discharged from the weighing/load-receiving element when being used in automatic operation, the Scales Code already addresses the operation of those scales. She noted OWM had already acknowledged in earlier comments the existence of some automated weighing systems that, by virtue of their design, fail to meet the definition of an ABWS and, therefore, the application of the ABWS Code; yet, these systems retain a "heel" following the discharge of the product comprised in each draft. The heel is part of the load that has failed to discharge during the discharge cycle of the previous weighment. To determine accurately, the amount of product discharged in each draft, these systems must take into account the weight of each remaining heel and subtract it from the weight indicated for its corresponding load. OWM believes the reason Kansas has submitted a proposal to update the ABWS Code (S&T agenda Item 322-2) is to address these systems. Adding a new definition and referencing it to the Scales Code might tend to confuse some into believing such systems don't necessarily have to start each draft load from a zero-load balance condition or take into account the weight of each remaining heel, which would be a false conclusion.

Ms. Butcher recommended, if the submitter of this proposal believes a gap exists in the Scales Code and the gap is the application of the code to some of the weighing equipment used in a particular type of batching operation, then a proposal, which identifies that equipment, along with corresponding proposed requirements to be applied, should be drafted and submitted for consideration. It would be inappropriate to consider the addition of a new definition into NIST Handbook 44 until a proposal supporting the inclusion of the term into the code has been submitted to the S&T Committee and adopted.

Mr. Richard Suiter (Richard Suiter Consulting, LLC) commented that the term "automated batching systems" appeared in an earlier "companion" proposal to amend the Scales Code of NIST Handbook 44, but the earlier proposal had been Withdrawn by the Committee at the 2016 NCWM Interim Meeting. It was his intent in offering the two proposals, to try and differentiate between the scales used in an automated batching system from those used in other weighing applications. He pointed out that the terms "batching scales" and "weighing systems" appear in Scales Code Paragraph S.1.2., and he believes the definition being proposed would fit these terms. He indicated there was a need for Handbook 44 to define "batching scale" and "batching systems" and asked the Committee to consider agreeing to an Informational status on the item to allow for its further development.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported the SMA opposes the item because there are no current specifications and tolerances defined to support the definition.

Mr. Henry Oppermann, (W&M Consulting, LLC) reported he had submitted written comments to the Committee in opposition to the item. He stated the proposed definition is incorrect and inappropriate based on the written comments provided.

In consideration of 1) the comments received on this item, and 2) the submitter's request to the Committee to assign an Informational status to the item to allow time for him to develop a new Scales Code proposal intended to address scales used in batching systems, the Committee agreed to maintain the item with an Informational status on its agenda.

2017 NCWM Interim Meeting:
During the 2017 NCWM Interim Meeting, the Committee grouped agenda Items 3200-1 and 3600-3 together and took comments on these items simultaneously because it considered these items related. See agenda Item 3200-1 for a summary of the comments received by the Committee on these items at the 2017 NCWM Interim Meeting. The Committee agreed to Withdraw this item (i.e., agenda Item 3600-3) at the recommendation of the submitter during this meeting.

Regional Association Comments and Recommendations (Fall 2016 Conferences):
The WWMA heard Items 3200-1 and 3600-3 together. The WWMA did not believe the language submitted agrees with the submitter's goal and believes further development is needed by the source. WWMA forwarded this item to the NCWM and recommended Developing status.

The CWMA S&T believes this item is fully developed and recommended a Voting status.

The SWMA batched Items 3200-1 and 3600-3 together and heard comments on all items at the same time. Mr. Henry Oppermann (Weights and Measures Consulting) stated he was opposed to these items because they'll make it more difficult for the weights and measures official because the definition is not specific enough. These scales are "automatic bulk weighting systems" and this proposal was designed to exempt some scales from the Automatic Bulk Weighing Systems (ABWS) Code. It was also stated that, "many are already in the marketplace, some of which have an NTEP certificate," but the submitter doesn't want to bring them into compliance with the automatic bulk weighing system code. Further, Mr. Oppermann stated this device has an unsealed parameter allowing the user to program a tolerance on the return to zero, which should not be allowed. The SWMA forwarded the item to NCWM and recommended Developing status. The SWMA asks the submitter to address why this is not covered in the ABWS code and present the overall picture of the item's necessity.

The NEWMA S&T Committee requested clarification from Mr. Suiter (Richard Suiter Consulting) on the language for the Scales Code. The NEWMA S&T Committee believes the language is pertinent to defining a batching scale. NEWMA recommended that this be a Voting item.

3600-4 W APPENDIX D DEFINITIONS: OVERREGISTRATION AND UNDER-REGISTRATION (SEE RELATED ITEMS 3200-7, 3201-1, 3204-1, 3205-2, 3508-2 AND 3509-1)

(This item was Withdrawn.)

Source:
Ross Andersen, Retired (2017)

Purpose:
Provide language that is consistent with the General Code.

Item under Consideration:
Amend NIST Handbook 44, Appendix D as follows**:**

> **overregistration and underregistration. –** When an instrument or device is of such a character that it indicates or records values as a result of its operation, its error is said to be in the direction of overregistration or underregistration, depending upon whether the indications are, respectively, greater or less than they should be. Examples of devices having errors of "overregistration" are: a fabric-measuring device that indicates more than the **verified** ~~**true**~~ length of material passed through it; and a liquid-measuring device that indicates more than the **verified** ~~**true**~~ amount of the liquid delivered by the device. Examples of devices having errors of "underregistration" are: a meter that indicates less than the **verified** ~~**true**~~ amount of product that it delivers; and a weighing scale that indicates or records less than the **verified** ~~**true**~~ weight of the applied load. [1.10]

Background/Discussion:
This item was submitted as one of a group of items that includes agenda Items 3200-7, 3201-1, 3204-1, 3205-2, 3508-2, 3509-1, and 3600-4. The Background/Discussion information is the same for these items and included in agenda Item 3200-7 of this report. At the 2017 NCWM Interim Meeting, the Committee agreed to Withdraw these items in consideration of the comments received during that meeting.

3600-5 D APPENDIX D – DEFINITIONS: REMOTE CONFIGURATION CAPABILITY

Source:
NIST office of Weights and Measures (2013)

Purpose:
Expand the scope of definition to cover instances where the "other device," as noted in the current definition, may be necessary to the operation of the weighing or measuring device or which may be considered a permanent part of that device.

Item Under Consideration:
Modify the General Code by adding the following paragraph to address security for systems adjusted using removable media:

G-S.8.2. Devices and Systems Adjusted Using Removable Digital Storage Device. – For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, such as a secure digital (SD) card, USB flash drive, etc., security shall be provided for those parameters using an event logger in the device. The event logger shall include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter. A printed copy of the information must be available on demand through the device or through another on-site device. In addition to providing a printed copy of the information, the information may be made available electronically. The event logger shall have a capacity to retain records equal to 10 times the number of sealable parameters in the device, but not more than 1000 records are required. (Note: Does not require 1000 changes to be stored for each parameter.)

(Added 20XX)

In addition to adding new paragraph G-S.8.2., exempt current sealing requirements from applying to devices and systems adjusted using a removable digital storage device by amending the sealing requirements in the following NIST Handbook 44 code Sections: 2.20., 2.21., 2.22., 2.24., 3.30., 3.31., 3.32., 3.33., 3.34., 3.35., 3.36., 3.37., 3.38., 3.39., 3.40., 5.55., 5.56.(a), and 5.58. This exemption is needed because the General Code paragraph being proposed will address the sealing of all device types and systems that can be adjusted using a removable digital storage device. The following additional changes are proposed to provide the exemption noted:

2.20. Scales Code

S.1.11. Provision for Sealing.

S.1.11.1. Devices and Systems Adjusted Using a Removable Digital Storage Device. – For devices and systems in which the calibration or configuration parameters, as defined in Appendix D, can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2.

S.1.11.2. All Other Devices. – ***Except on Class I scales and devices specified in S.1.11.1. the following provisions for sealing applies:***

(a) Provision shall be made for applying a security seal in a manner that requires the security seal to be broken before an adjustment can be made to any component affecting the performance of an electronic device.
[Nonretroactive as of January 1, 1979]

(b) A device shall be designed with provision(s) for applying a security seal that must be broken, or for using other approved means of providing security (e.g., data change audit trail available at the time of inspection), before any change that detrimentally affects the metrological integrity of the device can be made to any electronic mechanism.
[Nonretroactive as of January 1, 1990]

(c) Audit trails shall use the format set forth in Table S.1.11. [Nonretroactive as of January 1, 1995]

A device may be fitted with an automatic or a semi-automatic calibration mechanism. This mechanism shall be incorporated inside the device. After sealing, neither the mechanism nor the calibration process shall facilitate fraud.

(Amended 1989, 1991, ~~and~~ 1993**,** and **20XX**)

2.21. Belt-Conveyor Scale Systems Code

S.5. Provision for Sealing. – For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. ***For all other devices, the following provisions for sealing apply:***

A device shall be designed using the format set forth in Table S.5. with provision(s) for applying a security seal that must be broken, or for using other approved means of providing security (e.g., data change audit trail available at the time of inspection), before any change that affects the metrological integrity of the device can be made to any electronic mechanism.
[Nonretroactive as of January 1, 1999]

(Added 1998) **(Amended 20XX)**

2.22. Automatic Bulk Weighing Systems

S.1.6. Provision for Sealing Adjustable Components on Electronic Devices. – For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. For parameters adjusted using other means, p~~P~~rovision shall be made for applying a security seal in a manner that requires the security seal to be broken before an adjustment can be made to any component affecting the performance of the device.

(Amended 20XX)

2.24. Automatic Weighing Systems

S.1.3. Provision for Sealing.

(a) **Automatic Weighing Systems, Except Automatic Checkweighers. – For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2.**

For parameters adjusted using other means, a ~~A~~ device shall be designed with provision(s) as specified in Table S.1.3. Categories of Device and Methods of Sealing for applying a security seal that must be broken, or for using other approved means of providing security (e.g., data change audit trail available at the time of inspection), before any change that detrimentally affects the metrological integrity of the device can be made to any electronic mechanism.

(b) **For Automatic Checkweighers. –** Security seals are not required in applications where it would prohibit an authorized user from having access to the calibration functions of a device.

(Amended 20XX)

3.30. Liquid Measuring Devices

S.2.2. Provision for Sealing. – For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for

those parameters as specified in G-S.8.2. For parameters adjusted using other means, the following applies:

Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or for physically applying a security seal in such a manner that requires the security seal to be broken before an adjustment or interchange can be made of:

(a) any measuring or indicating element;

(b) any adjustable element for controlling delivery rate when such rate tends to affect the accuracy of deliveries; and

(c) any metrological parameter that will affect the metrological integrity of the device or system.

When applicable, the adjusting mechanism shall be readily accessible for purposes of affixing a security seal. *[Audit trails shall use the format set forth in Table S.2.2.] * [*Nonretroactive and Enforceable as of January 1, 1995]*

(Amended 1991, 1993, 1995, ~~and~~ 2006**, and 20XX**)

3.31. Vehicle-Tank Meters

S.2.2. Provision for Sealing. – For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. For parameters adjusted using other means, the following applies:

Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or for physically applying a security seal in such a manner that requires the security seal to be broken before a change or an adjustment or interchange may be made of:

(a) any measuring or indicating element;

(b) any adjustable element for controlling delivery rate when such rate tends to affect the accuracy of deliveries; and

(c) any metrological parameter that will affect the metrological integrity of the device or system.

When applicable, the adjusting mechanism shall be readily accessible for purposes of affixing a security seal. *[Audit trails shall use the format set forth in Table S.2.2. Categories of Device and Methods Sealing.]* [*Nonretroactive as of January 1, 1995]*

(Amended 2006 **and 20XX**)

3.32. LPG and Anhydrous Ammonia Liquid-Measuring Devices

S.2.2. Provision for Sealing. – For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for

those parameters as specified in G-S.8.2. For parameters adjusted using other means, the following applies:

Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or for physically applying a security seal in such a manner that requires the security seal to be broken before an adjustment or interchange may be made of:

(a) any measuring or indicating element;

(b) any adjustable element for controlling delivery rate, when such rate tends to affect the accuracy of deliveries; and

(c) any metrological parameter that will affect the metrological integrity of the device or system.

When applicable, the adjusting mechanism shall be readily accessible for purposes of affixing a security seal.

[Audit trails shall use the format set forth in Table S.2.2. Categories of Device and Methods of Sealing.] [*Nonretroactive as of January 1, 1995]*

(Amended 2006 **and 20XX**)

3.33. Hydrocarbon Gas Vapor-Measuring Devices

S.2.2. Provision for Sealing. – For devices or systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. For parameters adjusted using other means, the following applies:

Adequate provision shall be made for applying security seals in such a manner that no adjustment or interchange may be made of any measurement element.

(Amended 20XX)

3.34. Cryogenic Liquid-Measuring Devices

S.2.5. Provision for Sealing. – For devices or systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. For parameters adjusted using other means, the following applies:

Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or for physically applying a security seal in such a manner that requires the security seal to be broken before an adjustment or interchange may be made of:

(a) any measuring or indicating element;

(b) any adjustable element for controlling delivery rate when such rate tends to affect the accuracy of deliveries;

(c) any automatic temperature or density compensating system; and

(d) any metrological parameter that will affect the metrological integrity of the device or system.

When applicable, any adjusting mechanism shall be readily accessible for purposes of affixing a security seal.

[Audit trails shall use the format set forth in Table S.2.5. Categories of Device and Methods of Sealing]*
[*Nonretroactive as of January 1, 1995]

(Amended 2006 **and 20XX**)

3.35. Milk Meters

S.2.3. Provision for Sealing. – For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. For parameters adjusted using other means, the following applies:

Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or for physically applying a security seal in such a manner that requires the security seal to be broken before an adjustment or interchange may be made of any:

(a) measuring element or indicating element;

(b) adjustable element for controlling delivery rate, when such rate tends to affect the accuracy of deliveries; and

(c) metrological parameter that will affect the metrological integrity of the device or system.

When applicable, the adjusting mechanism shall be readily accessible for purposes of affixing a security seal.

[Audit trails shall use the format set forth in Table S.2.3. Categories of Device and Methods of Sealing]
*[*Nonretroactive as of January 1, 1995]*

(Amended 2006 **and 20XX**)

3.36. Water Meters

S.2.1. Provision for Sealing. – For devices or systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. For parameters adjusted using other means, the following applies:

Adequate provision shall be made for applying security seals in such a manner that no adjustment or interchange may be made of:

(a) any measurement elements; and

(b) any adjustable element for controlling delivery rate when such rate tends to affect the accuracy of deliveries.

The adjusting mechanism shall be readily accessible for purposes of affixing a security seal.

(Amended 20XX)

3.37. Mass Flow Meters

S.3.5. Provision for Sealing. – For devices or systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for

those parameters as specified in G-S.8.2. For parameters adjusted using other means, the following applies:

Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or physically applying security seals in such a manner that no adjustment or interchange may be made of:

(a) any measuring or indicating element;

(b) any adjustable element for controlling delivery rate when such rate tends to affect the accuracy of deliveries;

(c) the zero-adjustment mechanism; and

(d) any metrological parameter that will affect the metrological integrity of the device or system.

When applicable, the adjusting mechanism shall be readily accessible for purposes of affixing a security seal.
*[Audit trails shall use the format set forth in Table S.3.5. Categories of Device and Methods of Sealing]**
*[*Nonretroactive as of January 1, 1995]*

(Amended 1992, 1995, 2006**,** and **20XX**)

3.38. Carbon Dioxide Liquid-Measuring Devices

S.2.5. Provision for Sealing. – **For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. For parameters adjusted using other means, the following applies:**

Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or for physically applying a security seal in such a manner that requires the security seal to be broken before an adjustment or interchange may be made of:

(a) any measuring or indicating element;

(b) any adjustable element for controlling delivery rate when such rate tends to affect the accuracy of deliveries;

(c) any automatic temperature or density compensating system; and

(d) any metrological parameter that will affect the metrological integrity of the device or system.

When applicable any adjusting mechanism shall be readily accessible for purposes of affixing a security seal.
*[Audit trails shall use the format set forth in Table S.2.5. Provision for Sealing]**
*[*Nonretroactive as of January 1, 1995]*

(Amended 2006 **and 20XX**)

3.39. Hydrogen Gas-Measuring Devices – Tentative Code

S.3.3. Provision for Sealing. – **For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for**

those parameters as specified in G-S.8.2. For parameters adjusted using other means, the following applies:

Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or physically applying security seals in such a manner that no adjustment may be made of:

(a) each individual measurement element;

(b) any adjustable element for controlling delivery rate when such rate tends to affect the accuracy of deliveries;

(c) the zero-adjustment mechanism; and

(d) any metrological parameter that detrimentally affects the metrological integrity of the device or system.

When applicable, the adjusting mechanism shall be readily accessible for purposes of affixing a security seal. Audit trails shall use the format set forth in Table S.3.3. Categories of Device and Methods of Sealing.

(Amended 20XX)

3.40. Electric Vehicle Fueling Systems – Tentative Code

S.3.3. Provision for Sealing. – For devices or systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. For parameters adjusted using other means, the following applies:

Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or physically applying security seals in such a manner that no adjustment may be made of:

(a) each individual measurement element;

(b) any adjustable element for controlling voltage or current when such control tends to affect the accuracy of deliveries;

(c) any adjustment mechanism that corrects or compensates for energy loss between the system and vehicle connection; and

(d) any metrological parameter that detrimentally affects the metrological integrity of the EVSE or system.

When applicable, the adjusting mechanism shall be readily accessible for purposes of affixing a security seal. Audit trails shall use the format set forth in Table S.3.3. Categories of Device and Methods of Sealing.

(Amended 20XX)

5.55. Timing Devices

S.4. Provisions for Sealing. – For devices or systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. For parameters adjusted using other means, ~~A~~adequate provisions shall be made to provide security for the timing element.

(Added 2015) **(Amended 20XX)**

5.56.(a) Grain Moisture Meters

S.2.5. Provision for Sealing. – **For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. For parameters adjusted using other means, the following applies:**

~~P~~rovision shall be made for applying a security seal in a manner that requires the security seal to be broken, or for using other approved means of providing security (e.g., audit trail available at the time of inspection as defined in Table S.2.5. Categories of Device and Methods of Sealing) before any change that affects the metrological integrity of the device can be made to any mechanism.

(Amended 20XX)

5.58. Multiple Dimension Measuring Devices

S.1.11. Provision for Sealing. – For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. For parameters adjusted using other means, the following applies:

(a) **~~A~~ The** device **or system** shall be designed with provision(s) for applying a security seal that must be broken, or for using other approved means of providing security (e.g., data change audit trail available at the time of inspection), before any change that detrimentally affects the metrological integrity **~~of the device~~** can be made to any measuring element.

(b) Audit trails shall use the format set forth in Table S.1.11. Categories of Devices and Methods of Sealing for Multiple Dimension Measuring Systems.

(Amended 20XX)

Background/Discussion:
The Committee initially considered a proposal from the NTEP Grain Analyzer Sector to modify the definition for "remote configuration capability" as follows:

remote configuration capability. – The ability to adjust a weighing or measuring device or change its sealable parameters from or through some other device that **~~is not~~ may or may not** itself **be** necessary to the operation of the weighing or measuring device or **~~is not~~ may or may not be** a permanent part of that device. [2.20, 2.21, 2.24, 3.30, 3.37, 5.56(a)]

(Added 1993) **(Amended 20XX)**

The proposal was intended to address the use of removable digital storage devices in grain moisture meters (GGMs). Removable digital storage devices can be used in GMMs as either data transfer devices that are not necessary to the operation of the GMM or as data storage devices which are necessary to the operation of the GMM. If removable data storage devices are necessary to the operation of the device, they are not covered by the current definition of remote configuration capability in NIST Handbook 44.

A USB flash drive is most likely to be used as a data transfer device. In a typical data transfer application considered by the Grain Sector, the USB flash drive is first connected to a computer with access to the GMM manufacturer's web site to download the latest grain calibrations and then stored in the USB flash drive. The USB flash drive is removed from the computer and plugged into a USB port on the GMM. The GMM is put into remote configuration mode to copy the new grain calibration data into the GMM's internal memory. When the GMM has been returned to normal operating (measuring) mode, the USB flash drive can be removed from the GMM.

Although a Secure Digital (SD) memory card could be used as a data transfer device it is more likely to be used as a data storage device. In a typical "data storage device" application, the SD memory card stores the grain calibrations

used on the GMM. The SD memory card must be plugged into an SD memory card connector on a GMM circuit card for the GMM to operate in measuring mode. To install new grain calibrations, the GMM must be turned "off" or put into a mode in which the SD memory card can be safely removed. The SD memory card can either be replaced with an SD memory card that has been programmed with the new grain calibrations or the original SD memory card can be re-programmed with the new grain calibrations in much the same way as described in the preceding paragraph to copy new grain calibrations into a USB flash drive. In either case, the SD memory card containing the new calibrations must be installed in the GMM for the GMM to operate in measuring mode. In that regard, the SD memory card (although removable) can be considered a permanent part of the GMM in that the GMM cannot operate without it.

Note: In the above example SD memory card could be any removable flash memory card such as the Secure Digital Standard-Capacity, the Secure Digital High-Capacity, the Secure Digital Extended-Capacity, and the Secure Digital Input/Output, which combines input/output functions with data storage. These come in three form factors: the original size, the mini size, and the micro size. A Memory Stick is a removable flash memory card format, launched by Sony in 1998, and is also used in general to describe the whole family of Memory Sticks. In addition to the original Memory Stick, this family includes the Memory Stick PRO, the Memory Stick Duo, the Memory Stick PRO Duo, the Memory Stick Micro, and the Memory Stick PRO-HG.

The Committee heard opposition to the proposed changes to the definition, though many comments indicated support for changes to adequately address security for weighing and measuring systems adjusted using removable media. Over the course of several years, multiple proposals were presented and the Grain Analyzer Sector decided to address its concerns through implementation of other requirements specific to grain analyzers. Acknowledging the need to modify sealing requirements to better address systems adjusted using removable media, OWM requested the Committee assign responsibility for this item to NIST, OWM.

At the 2015 and 2016 Interim and Annual Meetings, NIST, OWM provided updates to the Committee on its progress developing this item. Ms. Tina Butcher (NIST, OWM) noted that, after analyzing the issue, OWM was concerned that proposing modifications to the existing sealing requirements might have unintended consequences for some equipment not adjusted using this type of media. Since modifications using removable media that would remain in the device during normal use had not been envisioned when the audit trail criteria were originally developed, NIST, OWM believes it might be best to create sealing requirements that apply more specifically to this technology. At the 2015 Annual Meeting, Ms. Butcher reported members of its LMDP developed a draft General Code paragraph they believe will address the sealing of devices using this technology to make adjustments. The LMDP requested this draft paragraph be included in this item to begin generating feedback to assist in further development of this item and shared the proposed approach with the Committee and NTEP Sectors.

Ms. Butcher also noted the LMDP plans to propose modifications to a number of the individual device codes in NIST Handbook 44 to reference the new General Code sealing requirement and shared an example of such proposed changes in the Scales Code.

See the Committee's 2013 - 2016 Final Reports for additional background information and to review the different proposals considered by the Committee to address security of equipment; the metrological parameters of which can be changed by use of some form of removable digital storage device.

In January 2017, just prior to the 2017 NCWM Interim, NIST, OWM contacted the Committee to make it aware that OWM had prepared additional proposed changes that finalized the proposal. OWM asked the Committee to replace the Grain Analyzer Sector's original proposal with OWM's complete proposal (including the proposed General Code paragraph and proposed changes to specific codes), which was agreed.

At the 2017 NCWM Interim Meeting, OWM requested this item be maintained on the Committee's 2017 agenda as either a "Developing" or "Informational" item to allow for study and comment on the proposed changes between then and the fall 2017 regional weights and measures association meetings. At this point, after considering and incorporating any changes to the proposal, OWM plans to recommend the Committee consider recommending the proposal for adoption by the NCWM in 2018.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported that the SMA is opposed to this item as it currently appears on the Committee's Interim Meeting agenda. Members of the SMA haven't had the opportunity to review OWM's most recent changes, and he was, therefore, unable to render an opinion on the changes.

The Committee agreed to replace the Grain Analyzer Sector's original proposal with OWM's complete proposal as shown in "Item under Consideration" in 2016 NCWM Publication 16 and assign the item a "Developing" status as recommended by NIST, OWM.

At the 2017 NCWM Annual Meeting, the Committee received an update on this item from Ms. Butcher. Ms. Butcher briefly summarized the background of this item as outlined in this item and reiterated that this method of making adjustments was not envisioned when the existing criteria for audit trails and electronic sealing were developed in the early 1990s. NIST, OWM was concerned that attempting to modify the existing criteria for electronic sealing might inadvertently affect existing equipment, which the current requirements adequately address and create overly complex requirements. OWM has developed a new proposal to address devices which are adjusted via means of removable media such as the SD card and has provided the Committee with a copy. The new proposal recommends the addition of a new General Code requirement and recommends revisions to sealing requirements in individual, specific codes to reference the new General Code requirement. OWM circulated an initial draft to the NTEP Sectors and the community and incorporated the feedback it received.

The SMA opposed the item as written because of the inclusion of the term, "configuration" in proposed paragraph S.1.11.1. of the Scales Code portion of the proposal. The SMA noted that the industry-accepted definition of "configuration" includes items that should not be considered sealable. Consequently, the SMA recommended removing the text "configuration or" from paragraph S.1.11.1. as it appears in Item Under Consideration of the Committee's 2017 Interim Report for this item. OWM understands SMA's concern with respect to paragraph S.1.11.1. of the proposal and, in an attempt to address the concern, requests the Committee replace this particular paragraph in the Item Under Consideration of the Committee's 2017 Interim Report with the following:

> **S.1.11.1. Devices and Systems Adjusted Using a Removable Digital Storage Device. – For devices and systems in which the calibration or configuration parameters, as defined in Appendix D, can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2.**

Assuming SMA and others concur with this change, NIST, OWM considers this item fully developed and asks the Committee and regional associations to consider assigning it a Voting status for the 2018 NCWM cycle. As the submitter of this item, OWM also asks the Committee to include the corresponding proposed changes to all the codes with the proposal in the "Carryover Items" to be considered by the regional associations.

Based on the comments and request received by NIST, OWM on this item, the Committee agreed to replace the text for paragraph S.1.11.1. shown in the Committee's 2017 Interim Report with that shown above and to include the additional language in its Carryover Item. These changes are reflected in the Item Under Consideration above.

Regional Association Comments and Recommendations:
The only comment received at WWMA's 2016 Annual Meeting, was to keep this item Developing. WWMA agreed with this recommendation.

The CWMA, at its fall 2016 Interim Meeting reported that it believes this item has merit and supports its further development. At the CWMA's spring 2017 Annual Meeting, the SMA reported it was opposed to this item as written because the industry-accepted definition of "configuration" includes items that should not be considered sealable parameters. The SMA recommended removing the text "configuration or" from paragraph S.1.11.1. During the Committee's work session, Mr. Rick Harshman (NIST, OWM) proposed the following change to paragraph S.1.11.1. of the proposal in an attempt to resolve the concerns of the SMA:

> **S.1.11.1. Devices and Systems Adjusted Using a Removable Digital Storage Device. – For devices and systems in which the calibration or configuration parameters (that is, any of those typically required by**

weights and measured to be sealed) can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2.

An SMA member, present at the CWMA meeting commented that the changes proposed by Mr. Harshman seemed a satisfactory solution, but he could not speak for the entire SMA membership. Without being able to confirm the changes proposed by Mr. Harshman will be accepted, the CWMA recommended this to be a Developing item.

The SWMA, at its 2016 Annual Meeting, received comment from Ms. Tina Butcher (NIST, OWM) that this item was originally put forward by the Grain Sector, but NIST recognized there are other devises that could be affected by this language. She stated OWM didn't want to change existing requirements, but wished to put forth new language from what the Grain Sector had proposed. Ms. Butcher asked for this item to remain Developing until at least January. She concluded by stating if no new language had been recommended by then the item should be Withdrawn. Mr. Lou Straub (Scale Manufacturers Association) spoke in opposition of the item as printed in the agenda, but noted that the SMA would revisit any new proposed language and may change their position depending on what changes come forward. The SWMA looks forward to the continued development of this item and acknowledges the comments that the item should be Withdrawn if new language has not been proposed by January 2017.

NEWMA recommended this be a Developing item on the NCWM agenda at both its fall 2016 Interim Meeting and spring 2017 Annual Meeting. NEWMA agreed, at its fall 2017 Annual Meeting, with a recommendation made by the SMA to remove the text "configuration or" from paragraph S.1.11.1. of the proposal.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf**.

3600-6 V 5.XX. TRANSPORTATION NETWORK MEASUREMENT SYSTEMS – TENTATIVE CODE AND APPENDIX D DEFINITIONS (SEE RELATED ITEM 3504-1)

(This item was Adopted.)

Source:
USNWG on Taximeters (2017)

Purpose:
Add a new tentative code for transportation-for-hire measurement systems being referred to as "Transportation Network Measurement Systems" to NIST Handbook 44.

Item Under Consideration:
Amend NIST Handbook 44 by adding a new code and definitions to Appendix D as follows:

5.XX. Transportation Network Measurement Systems – Tentative Code

This tentative code has only a trial or experimental status and is not intended to be enforced. The requirements are designed for study prior to the development and adoption of a final code. Officials wanting to conduct an official examination of a device or system are advised to see paragraph G-A.3. Special and Unclassified Equipment.

(Tentative Code Added 20XX)

A. Application

A.1. General. – This code applies to a transportation network measurement system used in connection with a digital network that determines the actual time elapsed and/or distance travelled during a network-arranged ride to calculate a fare for transportation services.

Note: The fare is calculated by software services residing on the transportation network company servers using data transmitted by the indicating elements present in the vehicle, which are running software applications or services supplied by the transportation network company. The measurement data is generated from sources not physically connected to the vehicle (e.g., a navigation satellite system such as GPS and/or other location services).

A.2. Exceptions. – This code does not apply to:

(a) any system that charges a flat rate or fixed charge, and/or does not use a measurement of actual time elapsed or distance travelled to calculate a fare for transportation services;

(b) odometers on vehicles that are rented or hired on a distance basis (for which see Section 5.53. Odometers);

(c) taximeters (for which see Section 5.54. Taximeters); or

(d) any system where the fare is calculated by equipment located in the vehicle.

A.3. Additional Code Requirements. – In addition to the requirements of this code, transportation network measurement systems shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Design of Indicating and Recording Elements. – Indicating and recording elements shall provide indications and recorded representations that are clear, definite, accurate, and easily read under any conditions of normal operation of the device(s).

All indicating and recording elements used in a transportation network measurement system shall operate correctly while using the online-enabled technology application service provided by the transportation network company.

S.1.1. General Indicating Elements. – A transportation network measurement system shall include, as a minimum:

(a) an indicating element used by a transportation network company driver that displays information and facilitates the measurements during a network-arranged ride to calculate a fare for transportation services; and

(b) an indicating element used by a transportation network company rider that displays information that allows the rider to review the current rate(s) for the transportation service and request a ride.

S.1.2. General Recording Elements. – A transportation network measurement system shall be capable of:

(a) recording all information necessary to generate a receipt specified in S.1.10. Receipt; and

(b) providing information to transportation network company drivers, including but not limited to a summary of rides given as specified in S.1.11. Driver's Summary; and

(c) providing a copy of all metrological data required by law to be provided to a weights and measures jurisdiction with statutory authority.

S.1.3. Identification. – All transportation network measurement system indicating elements shall display for the purposes of identification the following information:

(a) the name, initials, or trademark of the transportation network measurement system manufacturer, distributor, or developer; and

(b) the current version or revision identifier of the software application service provided by the transportation network company running on the indicating elements identified in S.1.1. General Indicating Elements.

(1) The version or revision identifier shall be prefaced by words or an abbreviation that clearly identifies the number as the required version or revision.

(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.).

S.1.4. Location of Identification Information. – The information required by S.1.3. Identification shall be accessible through an easily recognized menu and, if necessary, a submenu or other appropriate means. Examples of menu and submenu identification include, but are not limited to, "Help," "About," "System Identification," "Weights and Measures Identification," or "Identification."

S.1.5. Display of Rates and Additional Charges. – The transportation network measurement system shall be designed to make available to transportation network company riders the rate(s) for transportation services before the beginning of a network-arranged ride. The system shall also be capable of providing an explanation of the basis for calculating a fare including, if applicable, the base fare, rates for time and distance, and the amount of a booking fee, platform fee, or other similar service fee, before a rider submits the request for a network-arranged ride.

S.1.6. Fare Estimates. – The transportation network measurement system shall be capable of displaying a fare estimate to the transportation network company rider before a request for a network-arranged ride is made.

S.1.7. Actuation of Measurement System. – Following the initiation of a network-arranged ride by the transportation network company driver, and prior to the conclusion of that network-arranged ride, the transportation network measurement system shall only indicate and/or record measurements resulting from the movement of the vehicle or by the time mechanism.

S.1.8. Fare Adjustment. – A transportation network measurement system shall be designed with:

(a) a "time off" mechanism and a "distance off" mechanism provided for the transportation network system driver to render the measurement of time and distance either operative or inoperative during the ride; or

(b) the capability to make post-transaction fare adjustments to reduce the amount of the fare, provided that the system creates a record of all location and time data from the time the ride request was accepted by the transportation network company driver.

[Nonretroactive as of January 1, 20XX]

S.1.9. Fare Identification and Other Charges.

S.1.9.1. Fare Identification. – Fare indications shall be identified by the word "Fare" or by an equivalent expression when displayed on the transportation network company system receipt required by S.1.10. Values shall be defined by suitable words or monetary signs.

S.1.9.2. Other Charges. – Other charges shall be indicated as separate line items when displayed on the receipt required by S.1.10. Receipt. Other charges shall be identified using an appropriate descriptive term, including but not limited to "Booking Fee," "Tolls," "Airport Pickup/Dropoff Surcharge" or an equivalent expression. Values shall be defined by suitable words or monetary signs.

S.1.10. Receipt. – A transportation network measurement system shall issue a printed or electronic receipt to a transportation network company rider. This receipt shall include as a minimum the following:

(a) date of the start of the trip;

(b) unique identifying information sufficient for the transportation network company to identify the transaction, or other identifying information as specified by the statutory authority;

(c) start and end time of trip, total time of trip (maximum increment of one second), and if applicable, the total elapsed time during any time-off period;

(d) distance traveled, maximum increment of 0.01 km or 0.01 mi;

(e) the associated fare in $;

(f) other charges where permitted shall be identified and itemized;

(g) total charge in $;

(h) the start and end addresses or locations of the trip;

(i) a map showing the route taken; and

(j) a means to obtain transportation network company rider assistance.

S.1.11. Driver's Summary. – A transportation network measurement system shall be capable of providing a summary of the driver's activity regarding network-arranged rides. The summary shall include, but not be limited to, the following information about each ride:

(a) date and time for start of trip;

(b) unique identifying information sufficient for the transportation network company to identify the transaction, or other identifying information as specified by the statutory authority;

(c) total time of trip, maximum increment of one second;

(d) distance traveled, maximum increment of 0.01 km or 0.01 mi;

(e) the total fare received;

(f) other charges where permitted; and

(g) a means to obtain transportation network company driver assistance.

S.2. Provision for Sealing.

S.2.1. System Security. – Adequate provision shall be made to provide security for a transportation network measurement system. The system shall be designed to:

(a) protect the integrity of metrological data and algorithms used to compute fares from such data against unauthorized modification using industry-standard technological protection mechanisms such as data encryption; and

(b) use software-based access controls or equivalent technological protections that limit access to metrological data and algorithms used to compute fares from such data only to authorized persons.

S.2.2. System Audit. – The transportation network measurement system shall be designed in a manner that permits officials having statutory authority to verify compliance with this transportation network measurement system code.

S.2.3. Change Tracking. – Changes made by the manufacturer, distributor, or developer of a transportation network measurement system to any algorithms or code which have a metrological effect shall be logged and recorded. The period covered by this change record is not required to exceed one year.

S.3. Provision for Trip Data Loss. – In the event that a portion of the trip data is lost due to power or signal interruption by the transportation network company driver's indicating element, the transportation network measurement system shall be capable of determining the information needed to complete any transaction in progress at the time of the power or signal loss.

S.3.1. Intermittent Trip Data Loss. – When the location services signal is lost intermittently during a prearranged ride (e.g., traveling through a tunnel) but recovered prior to the end of the ride, the transportation network measurement system shall be capable of calculating an accurate fare in accordance with T.1. Tolerance Values.

S.3.2. Significant Trip Data Loss. – When the location services signal is lost for a significant portion of the network-arranged ride, the transportation network measurement system shall provide for alternative fare structures.

Note: Significant trip data loss refers to instances when the location services signal is lost to the extent that the transportation network measurement system is not capable of calculating an accurate fare in accordance with T.1. Tolerance Values using actual time and actual distance, or when the signal is not regained by the end of the ride.

S.3.3. Alternative Fare Structures. – In the event the transportation network measuring system is not using actual time and actual distance for a particular trip (e.g., zone-based fares, signal loss), that portion of the fare not based on actual time and actual distance is not subject to this code. Charges not based on actual time and actual distance measurements may be based on the terms of service.

N. Notes

N.1. Distance Tests.

N.1.1. Test Methods. – To determine compliance with distance tolerances, distance test(s) of a transportation network measurement system shall be conducted. The distance test(s) shall consist of a road test unless safety or other practical concerns prohibit road testing. A transfer standard test may be performed in the absence of a road test. At least one test shall be of a length sufficient to exceed the minimum fare.

N.1.1.1. Road Test. – The test consists of operating the conveyance over a precisely measured course calibrated to a traceable linear measure of at least one mile in length

N.1.1.2. Transfer Standard Test. – The test consists of operating the conveyance over an unmeasured course while using a calibrated transfer standard, such as a fifth-wheel, to measure the distance travelled.

Note: Field examinations of transportation network measurement systems need not include testing of all individual devices that are used as driver/passenger indicating elements in connection with the service provided. It is considered sufficient that a representative sample of various indicating elements be incorporated in testing to verify proper operation of the system.

N.1.2. Test Procedures.

N.1.2.1. Test Length. – All tests must be at least one mile in length. If a measured course or testing equipment is not readily available that will enable a test of a length sufficient to exceed the minimum fare, after completing the testing specified in N.1.1. Test Methods, an additional unmeasured test may be conducted. The purpose of this additional unmeasured test is to verify compliance with S.1.10. Receipt.

N.1.2.2. Additional Tests. – If during testing a transportation network measurement system produces a measurement that does not comply with the tolerance values in T.1.1. Distance Tests, a minimum of three additional tests shall be conducted at the same location where all test variables are reduced to the greatest extent practicable to verify the system's ability to repeat transaction indications. Repeatability testing performed in excess of these three additional tests is done at the discretion of the official with statutory authority.

To verify system-wide noncompliance, tests for variability shall be conducted, including a minimum of three consecutive tests of varying lengths, locations, and/or environmental conditions.

N.1.3. Test Conditions.

N.1.3.1. General. – Except during type evaluation, all tests shall be performed under the conditions that are considered usual and customary within the location(s) where the system is normally operated as deemed necessary by the statutory authority.

N.1.3.2. Roads. – All tests shall be conducted on public roads.

N.1.3.3. Testing for Environmental Influences. – During type evaluation, the distance test may include a route traveled by the vehicle that will expose the system to conditions that could contribute to the loss of, or interference with the location service's signal. This may include:

- **(a) Objects that may obstruct or reflect signals such as tall buildings/structures, forestation, tunnels, etc.;**
- **(b) Routes that do not follow a straight-line path;**
- **(c) Significant changes in altitude;**
- **(d) Any other relevant environmental conditions**

N.2. Time Test. – A transportation network measurement system which determines time elapsed shall be tested for compliance with the tolerances values specified in T.1.2. Time Tests, using a certified, traceable standard.

T. Tolerances

T.1. Tolerance Values. – The tolerances will be as specified in T.1.1. Distance Tests and T.1.2. Time Tests. (The following proposed tolerance values will be confirmed based on performance data evaluated by the U.S. National Work Group before the transportation network measurement systems code becomes a Permanent Code.)

T.1.1. Distance Tests. – Maintenance and acceptance tolerances shall be as follows:

(a) On Overregistration: 2.5 %

(b) On Underregistration: 2.5 %

T.1.2. Time Tests. – Maintenance and acceptance tolerances shall be as follows:

(a) On Overregistration: 5 seconds or 0.5 %, whichever is greater

(b) On Underregistration: 5 seconds or 0.5 %, whichever is greater

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

UR. User Requirements

UR.1. System Indications. – The indicating elements identified in S.1.1. General Indicating Elements shall display indications and information in a manner such that they can be conveniently read by the user of the device, computer, website, or online-enabled technology application service.

UR.1.1. Statement of Rates. – The transportation network company rider shall be able to view the basis for calculating the fare including, if applicable, the base fare, rates for time and distance, and the amount of a booking fee, platform fee, or other similar service fee.

UR.2. Change Tracking. – Upon request by an official having statutory authority, the transportation network company shall provide an explanation of changes that are logged pursuant to S.2.3. Change Tracking requirement during the time period covered by the request. Any such request shall be answered within two business days, unless extended by the official having statutory authority. Records provided pursuant to S.2.3. Change Tracking shall be treated as confidential and proprietary to the extent permitted by any applicable law.

UR.3. System Installation and Operation. – The transportation network company driver shall use the indicating elements identified in S.1.1. (a) General Indicating Elements in accordance with the requirements of the manufacturer, distributor, or developer.

UR.4. Fare Estimates. – Estimates for fare charges shall be provided by the transportation network measurement system when requested by the transportation network company rider and following the input of a final destination for the trip being requested. The recipient of the fare estimate shall be able to access information about the fare estimate, including key variables that may lead to discrepancies between actual fare charged and the fare estimate provided as required by law.

UR.5. Determination of Total Charges When Location Service Data is Lost. – The transportation network company shall disclose the manner in which total charges are determined when there is significant data loss from location services to the transportation network company rider and driver after the conclusion of the trip.

Appendix D

digital network. – An online-enabled technology application service, website, or system offered or used by a transportation network company that enables a transportation network company rider to arrange a network-arranged ride with a transportation network company driver. [5.XX]

network-arranged ride. – The provision of transportation by a transportation network company driver to a transportation network company rider, or other persons selected by the transportation network company rider, arranged through a digital network. [5.XX]

transportation network measurement system. – The information technology infrastructure and services offered or used by a transportation network company that receives data collected through a digital network and calculates a fare for a network-arranged ride. [5.XX]

transportation network company. – An entity that uses a digital network to connect transportation network company riders with transportation network company drivers who provide network-arranged rides, and offers or provides a transportation network measurement system, subject to an agreement or terms of service between the transportation network company and transportation network company rider or driver. [5.XX]

transportation network company driver. – An individual authorized by the transportation network company to access the digital network and receive connections to transportation network company riders for the purpose of providing network-arranged rides. [5.XX]

transportation network company rider. – An individual who has obtained an account with a transportation network company and uses the transportation network company's digital network to connect with a transportation network company driver who can offer or provide a network-arranged ride to the transportation network company rider or other persons selected by the transportation network company rider. [5.XX]

Background/Discussion:

The rationale, background, etc., for this item is the same as that provided under agenda Item 3504-1 and the Committee grouped the two items together at the 2017 NCWM Interim and Annual Meetings. See the Background/Discussion portion of agenda Item 3504-1 for details.

At the 2017 NCWM Interim Meeting, the Committee agreed to group agenda Items 3504-1 and 3600-6 together and take comments on these items simultaneously because it considered these items related. See agenda Item 3504-1 for a summary of the comments received and the resulting actions taken by the Committee on these items at the 2017 NCWM Interim Meeting.

At the 2017 NCWM Annual Meeting, the Committee agreed to group agenda Items 3504-1 and 3600-6 together and take comments on these items simultaneously because it considered these items related. See agenda Item 3504-1 for a summary of the comments received by the Committee on these items at the 2017 NCWM Annual Meeting.

Based upon the comments received in support of amending the draft tentative (TNMS) code by deleting the definition of "transfer standard" from that code and amending paragraph N.1.3.2. by deleting the words "which are in good repair," the Committee agreed to these changes. The Committee also agreed to present the two items in this group for Vote. The changes to the draft tentative code agreed to by the Committee are reflected in the Item Under Consideration for this item.

Regional Association Comments and Recommendations:

The WWMA received many comments in favor of this item from both industry and regulators at its 2016 Annual Meeting. They also received a few concerns on language and made minor changes to N.1.2.2. and N.1.3.2. as shown below. Since this item will need to coincide with Item 3504-1 (updated version) if adopted, the WWMA recommends

that they be Voted upon together by NCWM. WWMA forwarded the item to NCWM and recommended that it be a Voting item with the following changes:

N.1.2. Test Procedures.

N.1.2.1. Test Length. – All tests must be at least one mile in length. If a measured course or testing equipment is not readily available that will enable a test of a length sufficient to exceed the minimum fare, after completing the testing specified in N.1.1. Test Methods, an additional unmeasured test may be conducted. The purpose of this additional unmeasured test is to verify compliance with S.1.10. Receipt.

N.1.2.2. Additional Tests. – If during testing a transportation network measurement system produces a measurement that does not comply with the tolerance values in T.1.1. Distance Tests, a minimum of three additional tests ~~**shall**~~ **may** be conducted at the same location where all test variables are reduced to the greatest extent practicable to verify the system's ability to repeat transaction indications. Repeatability testing performed in excess of these three additional tests is done at the discretion of the official with statutory authority.

To verify system-wide noncompliance, tests for variability shall be conducted, including a minimum of three consecutive tests of varying lengths, locations, and/or environmental conditions.

N.1.3. Test Conditions.

N.1.3.1. General. – Except during type evaluation, all tests shall be performed under the conditions that are considered usual and customary within the location(s) where the system is normally operated as deemed necessary by the statutory authority.

N.1.3.2. Roads. – All tests shall be conducted on public roads~~**. which are in good repair**~~**.**

N.1.3.3. Testing for Environmental Influences. – During type evaluation, the distance test may include a route traveled by the vehicle that will expose the system to conditions that could contribute to the loss of, or interference with the location service's signal. This may include:

(a) Objects that may obstruct or reflect signals such as tall buildings/structures, forestation, tunnels, etc.;

(b) Routes that do not follow a straight-line path;

(c) Significant changes in altitude;

(d) Any other relevant environmental conditions.

The CWMA reported at its fall 2016 Interim Meeting it supports the work of the USNWG on Taximeters and believes this item is fully developed and should be included in NIST Handbook 44 as a tentative code. CWMA forwarded the item to NCWM and recommended Voting status. At its spring 2017 Annual Meeting, NEWMA reported numerous issues must be resolved regarding the use of transfer standards. Among these issues, criteria and procedures are needed to specify how the standard deviation of the transfer standard is to be determined. If these issues are resolved or if the use of transfer standards is removed from this item, the CWMA would support it as a Voting item. As proposed the CWMA supports the continued development of this code.

The SWMA batched Items 354-1 and 3600-6 together and heard comments for both items at the same time at its 2016 Annual Meeting. Mr. Bob O'Leary (Uber) stated that the USNWG had developed a new code over the last year. He further stated that the USNWG has come to consensus with this draft code and believed it is ready for a Vote. Mr. O'Leary concluded by stating he is looking forward to its adoption in July. Mr. James Cassidy (Cambridge, Massachusetts) spoke in support of these items and noted that the code is a tentative code, which needs to be adopted. Ms. Kristin Macey (California) noted that both Mr. Cassidy and she were a part of this process within the USNWG

and stated that the code has been vetted at all levels of government, in particular those that conduct taximeter testing. She further noted this new technology is a system and not a device. Ms. Macey concluded by stating that this new type of system must be tested using transfer standards. The SWMA believes this item is fully developed and forwarded it to NCWM, recommending Voting status.

NEWMA expressed appreciation for the hard work and many meetings of the USNWG on Taximeters. NEWMA forwarded the item to the NCWM and recommended Voting status at both its fall 2016 Interim Meeting (with no changes) and spring 2017 Annual Meeting (after agreeing to delete the definition of "transfer standard" from the proposal).

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 101st National Conference on Weights and Measures" (SP1212, 2016) at: **nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1212.pdf**.

Dr. Matthew Curran, Florida | Committee Chair
Ms. Jane Zulkiewicz, Town of Barnstable, Massachusetts | Member
Mr. Ivan Hankins, Iowa | Member
Ms. Rachelle Miller, Wisconsin | Member
Mr. Josh Nelson, Oregon | Member
Mr. Luciano Burtini, Measurement Canada | Canadian Technical Advisor
Mr. Rick Harshman, NIST, OWM | NIST Technical Advisor
Mr. Darrell Flocken, NCWM | NTEP Technical Advisor

Specifications and Tolerances Committee

Appendix A

Item 3205-1: NIST Handbook 44 – Scales Code, WIM Task Group's Current Proposed Changes

(Attachment to agenda Item 3205-1)

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Section 2.20. Scales

A. Application

A.1. General. – This code applies to all types of weighing devices other than automatic bulk-weighing systems, belt-conveyor scales, and automatic weighing systems. The code comprises requirements that generally apply to all weighing devices, and specific requirements that are applicable only to certain types of weighing devices.

(Amended 1972 and 1983)

A.2. Wheel-Load Weighers, Portable Axle-Load Weighers, and Axle-Load Scales. – The requirements for wheel-load weighers, portable axle-load weighers, and axle-load scales apply only to such scales in official use for the enforcement of traffic and highway laws or for the collection of statistical information by government agencies.

(Amended 20XX)

A.3. Additional Code Requirements. – In addition to the requirements of this code, devices covered by the Scales code shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Design of Indicating and Recording Elements and of Recorded Representations.

S.1.1. Zero Indication.

(a) On a scale equipped with indicating or recording elements, provision shall be made to either indicate or record a zero-balance condition.

(b) On an automatic-indicating scale or balance indicator, provision shall be made to indicate or record an out-of-balance condition on both sides of zero.

(c) A zero-balance condition may be indicated by other than a continuous digital zero indication, provided that an effective automatic means is provided to inhibit a weighing operation or to return to a continuous digital indication when the scale is in an out-of-balance condition.

(Added 1987) (Amended 1993)

(Amended 1987)

S.1.1.1. Digital Indicating Elements.

(a) A digital zero indication shall represent a balance condition that is within ± ½ the value of the scale division.

(b) A digital indicating device shall either automatically maintain a "center-of-zero" condition to ± ¼ scale division or less, or have an auxiliary or supplemental "center-of-zero" indicator that defines a zero-balance condition to ± ¼ of a scale division or less. A "center-of-zero" indication may operate when zero is indicated for gross and/or net mode(s).
[Nonretroactive as of January 1, 1993]

(c) Weigh-in-Motion Vehicle Scales Zero or Ready Indication.

(1) Provision shall be made to indicate or record either a zero or ready condition.

(2) <u>A zero or ready condition may be indicated by other than a continuous digital zero indication, provided that an effective automatic means is provided to inhibit a measuring operation when the device is in an out-of-zero or non-ready condition.</u>

(Amended 1992**<u>,</u>** ~~**and**~~ 2008**<u>, and 20XX</u>**)

S.1.1.2. No-Load Reference Value. – On a single draft manually operated receiving hopper scale installed below grade, used to receive grain, and utilizing a no-load reference value provision shall be made to indicate and record the no-load reference value prior to the gross load value.

(Added 1983)

S.1.2. Value of Scale Division Units. *– Except for batching scales and weighing systems used exclusively for weighing in predetermined amounts, the value of a scale division "d" expressed in a unit of weight shall be equal to:*

(a) 1, 2, or 5; or

(b) a decimal multiple or submultiple of 1, 2, or 5; or
Examples: scale divisions may be 10, 20, 50, 100; or 0.01, 0.02, 0.05; or 0.1, 0.2, 0.5, etc.

(c) a binary submultiple of a specific unit of weight.

Examples: scale divisions may be ½, ¼, 1/8, 1/16, etc.
[Nonretroactive as of January 1, 1986]

S.1.2.1.<u>1</u> Digital Indicating Scales, Units*. – Except for postal scales, a digital-indicating scale shall indicate weight values using only a single unit of measure. Weight values shall be presented in a decimal format with the value of the scale division expressed as 1, 2, or 5, or a decimal multiple or submultiple of 1, 2, or 5.*

The requirement that the value of the scale division be expressed only as 1, 2, or 5, or a decimal multiple or submultiple of only 1, 2, or 5 does not apply to net weight indications and recorded representations that are calculated from gross and tare weight indications where the scale division of the gross weight is different from the scale division of the tare weight(s) on multi-interval or multiple range scales. For example, a multiple range or multi-interval scale may indicate and record tare weights in a lower weighing range (WR) or weighing segment (WS), gross weights in the higher weighing range or weighing segment, and net weights as follows:

55 kg	*Gross Weight*	*(WR2 d = 5 kg)*	*10.05 lb*	*Gross Weight*	*(WS2 d = 0.05 lb)*
<u>– 4 kg</u>	*Tare Weight*	*(WR1 d = 2 kg)*	*<u>– 0.06 lb</u>*	*Tare Weight*	*(WS1 d = 0.02 lb)*
= 51kg	*Net Weight*	*(Mathematically Correct)*	*= 9.99 lb*	*Net Weight*	*(Mathematically Correct)*

[Nonretroactive as of January 1, 1989]

(Added 1987) (Amended 2008)

S.1.2.2. Verification Scale Interval.

S.1.2.2.1. Class I and II Scales and Dynamic Monorail Scales. – If $e \neq d$, the verification scale interval "e" shall be determined by the expression:

$$d < e \leq 10\ d$$

If the displayed division (d) is less than the verification division (e), then the verification division shall be less than or equal to 10 times the displayed division.

The value of e must satisfy the relationship, $e = 10^k$ of the unit of measure, where k is a positive or negative whole number or zero. This requirement does not apply to a Class I device with d < 1 mg where e = 1 mg. If e ≠ d, the value of "d" shall be a decimal submultiple of "e," and the ratio shall not be more than 10:1. If e ≠ d, and both "e" and "d" are continuously displayed during normal operation, then "d" shall be differentiated from "e" by size, shape, color, etc. throughout the range of weights displayed as "d."

(Added 1999)

S.1.2.2.2. Class III and IIII Scales. – The value of "e" is specified by the manufacturer as marked on the device. Except for dynamic monorail scales, "e" must be less than or equal to "d."

(Added 1999)

S.1.2.3. Prescription Scale with a Counting Feature. – A Class I or Class II prescription scale with an operational counting feature shall not calculate a piece weight or total count unless the sample used to determine the individual piece weight meets the following conditions:

(a) minimum individual piece weight is greater than or equal to 3 e; and

(b) minimum sample piece count is greater than or equal to 10 pieces.

(Added 2003)

S.1.3. Graduations.

S.1.3.1. Length. – Graduations shall be so varied in length that they may be conveniently read.

S.1.3.2. Width. – In any series of graduations, the width of a graduation shall in no case be greater than the width of the clear space between graduations. The width of main graduations shall be not more than 50 % greater than the width of subordinate graduations. Graduations shall be not less than 0.2 mm (0.008 in) wide.

S.1.3.3. Clear Space Between Graduations. – The clear space between graduations shall be not less than 0.5 mm (0.02 in) for graduations representing money-values, and not less than 0.75 mm (0.03 in) for other graduations. If the graduations are not parallel, the measurement shall be made:

(a) along the line of relative movement between the graduations at the end of the indicator; or

(b) if the indicator is continuous, at the point of widest separation of the graduations.

S.1.4. Indicators.

S.1.4.1. Symmetry. – The index of an indicator shall be of the same shape as the graduations, at least throughout that portion of its length associated with the graduations.

S.1.4.2. Length. – The index of an indicator shall reach to the finest graduations with which it is used, unless the indicator and the graduations are in the same plane, in which case, the distance between the end of the indicator and the ends of the graduations, measured along the line of the graduations, shall be not more than 1.0 mm (0.04 in).

S.1.4.3. Width. – The width of the index of an indicator in relation to the series of graduations with which it is used shall be not greater than:

(a) the width of the narrowest graduation;
[Nonretroactive as of January 1, 2002]

(b) the width of the clear space between weight graduations; and

(c) three-fourths of the width of the clear space between money-value graduations.

When the index of an indicator extends along the entire length of a graduation, that portion of the index of the indicator that may be brought into coincidence with the graduation shall be of the same width throughout the length of the index that coincides with the graduation.

S.1.4.4. Clearance. – The clearance between the index of an indicator and the graduations shall in no case be more than 1.5 mm (0.06 in).

S.1.4.5. Parallax. – Parallax effects shall be reduced to the practicable minimum.

S.1.5. Weighbeams.

S.1.5.1. Normal Balance Position. – The normal balance position of the weighbeam of a beam scale shall be horizontal.

S.1.5.2. Travel. – The weighbeam of a beam scale shall have equal travel above and below the horizontal. The total travel of the weighbeam of a beam scale in a trig loop or between other limiting stops near the weighbeam tip shall be not less than the minimum travel shown in Tables 1M and 1. When such limiting stops are not provided, the total travel at the weighbeam tip shall be not less than 8 % of the distance from the weighbeam fulcrum to the weighbeam tip.

Table 1M.
Minimum Travel of Weighbeam of Beam Scale Between Limiting Stops

Distance from Weighbeam Fulcrum to Limiting Stops (centimeters)	Minimum Travel Between Limiting Stops (millimeter)
30 or less	10
30+ to 50, inclusive	13
50+ to 100, inclusive	18
Over 100	23

Table 1.
Minimum Travel of Weighbeam of Beam Scale Between Limiting Stops

Distance from Weighbeam Fulcrum to Limiting Stops (inches)	Minimum Travel Between Limiting Stops (inch)
12 or less	0.4
12+ to 20, inclusive	0.5
20+ to 40, inclusive	0.7
Over 40	0.9

S.1.5.3. Subdivision. – A subdivided weighbeam bar shall be subdivided by scale division graduations, notches, or a combination of both. Graduations on a particular bar shall be of uniform width and perpendicular to the top edge of the bar. Notches on a particular bar shall be uniform in shape and dimensions and perpendicular to the face of the bar. When a combination of graduations and notches is employed, the graduations shall be positioned in relation to the notches to indicate notch values clearly and accurately.

S.1.5.4. Readability. – A subdivided weighbeam bar shall be so subdivided and marked, and a weighbeam poise shall be so constructed, that the weight corresponding to any normal poise position can easily and accurately be read directly from the beam, whether or not provision is made for the optional recording of representations of weight.

S.1.5.5. Capacity. – On an automatic-indicating scale having a nominal capacity of 15 kg (30 lb) or less and used for direct sales to retail customers:

(a) the capacity of any weighbeam bar shall be a multiple of the reading-face capacity;

(b) each bar shall be subdivided throughout or shall be subdivided into notched intervals, each equal to the reading-face capacity; and

(c) the value of any turnover poise shall be equal to the reading-face capacity.

S.1.5.6. Poise Stop. – Except on a steelyard with no zero graduation, a shoulder or stop shall be provided on each weighbeam bar to prevent a poise from traveling and remaining back of the zero graduation.

S.1.6. Poises.

S.1.6.1. General. – No part of a poise shall be readily detachable. A locking screw shall be perpendicular to the longitudinal axis of the weighbeam and shall not be removable. Except on a steelyard with no zero graduation, the poise shall not be readily removable from a weighbeam. The knife-edge of a hanging poise shall be hard and sharp and so constructed as to allow the poise to swing freely on the bearing surfaces in the weighbeam notches.

S.1.6.2. Adjusting Material. – The adjusting material in a poise shall be securely enclosed and firmly fixed in position; if softer than brass, it shall not be in contact with the weighbeam.

S.1.6.3. Pawl. – A poise, other than a hanging poise, on a notched weighbeam bar shall have a pawl that will seat the poise in a definite and correct position in any notch, wherever in the notch the pawl is placed, and hold it there firmly and without appreciable movement. The dimension of the tip of the pawl that is transverse to the longitudinal axis of the weighbeam shall be at least equal to the corresponding dimension of the notches.

S.1.6.4. Reading Edge or Indicator. – The reading edge or indicator of a poise shall be sharply defined, and a reading edge shall be parallel to the graduations on the weighbeam.

S.1.7. Capacity Indication, Weight Ranges, and Unit Weights.

(a) **Gross Capacity.** – An indicating or recording element shall not display nor record any values when the gross load (not counting the initial dead load that has been canceled by an initial zero-setting mechanism) is in excess of 105 % of scale capacity.

(b) ***Capacity Indication.*** *– Electronic computing scales (excluding postal scales and weight classifiers) shall neither display nor record a gross or net weight in excess of scale capacity plus 9 d.*
[Nonretroactive as of January 1, 1993]

The total value of weight ranges and of unit weights in effect or in place at any time shall automatically be accounted for on the reading face and on any recorded representation.

This requirement does not apply to: (1) single-revolution dial scales, (2) multi-revolution dial scales not equipped with unit weights, (3) scales equipped with two or more weighbeams, nor (4) devices that indicate mathematically derived totalized values.

(Amended 1990, 1992, and 1995)

S.1.8. Computing Scales.

S.1.8.1. Money-Value Graduations, Metric Unit Prices. – The value of the graduated intervals representing money-values on a computing scale with analog indications shall not exceed:

(a) 1 cent at all unit prices of 55 cents per kilogram and less;

(b) 2 cents at unit prices of 56 cents per kilogram through $2.75 per kilogram (special graduations defining 5-cent intervals may be employed but not in the spaces between regular graduations);

(c) 5 cents at unit prices of $2.76 per kilogram through $7.50 per kilogram; or

(d) 10 cents at unit prices above $7.50 per kilogram.

Value figures and graduations shall not be duplicated in any column or row on the graduated chart. (Also see S.1.8.2. Money-Value Computation.)

S.1.8.2. Money-Value Graduations, U.S. Customary Unit Prices. – The value of the graduated intervals representing money-values on a computing scale with analog indications shall not exceed:

(a) 1 cent at all unit prices of 25 cents per pound and less;

(b) 2 cents at unit prices of 26 cents per pound through $1.25 per pound (special graduations defining 5-cent intervals may be employed but not in the spaces between regular graduations);

(c) 5 cents at unit prices of $1.26 per pound through $3.40 per pound; or

(d) 10 cents at unit prices above $3.40 per pound.

Value figures and graduations shall not be duplicated in any column or row on the graduated chart. (Also see S.1.8.2. Money-Value Computation.)

S.1.8.3. Money-Value Computation. – A computing scale with analog quantity indications used in retail trade may compute and present digital money-values to the nearest quantity graduation when the value of the minimum graduated interval is 0.005 kg (0.01 lb) or less. (Also see Sec. 1.10. General Code G-S.5.5. Money-Values, Mathematical Agreement.)

S.1.8.4. Customer's Indications. – Weight indications shall be shown on the customer's side of computing scales when these are used for direct sales to retail customers. Computing scales equipped on the operator's side with digital indications, such as the net weight, unit price, or total price, shall be similarly equipped on the customer's side. Unit price displays visible to the customer shall be in terms of single whole units of weight and not in common or decimal fractions of the unit. Scales indicating in metric units may indicate price per 100 g.
(Amended 1985 and 1995)

S.1.8.4.1. *Scales that will function as either a normal round off scale or as a weight classifier shall be provided with a sealable means for selecting the mode of operation and shall have a clear indication (annunciator), adjacent to the weight display on both the operator's and customer's side whenever the scale is operating as a weight classifier.*
[Nonretroactive as of January 1, 2001]
(Added 1999)

S.1.8.5. Recorded Representations, Point-of-Sale Systems. – The sales information recorded by cash registers when interfaced with a weighing element shall contain the following information for items weighed at the checkout stand:

(a) the net weight;[1]

[1] For devices interfaced with scales indicating in metric units, the unit price may be expressed in price per 100 grams. Weight values shall be identified by kilograms, kg, grams, g, ounces, oz, pounds, or lb. *The "#" symbol is not acceptable. [Nonretroactive as of January 1, 2006]*
(Amended 1995 and 2005)

(b) the unit price;[1]

(c) the total price; and

(d) the product class or, in a system equipped with price look-up capability, the product name or code number.

S.1.8.6. Values to be Recorded, Weigh-In-Motion Vehicle Scales. – At a minimum, the following values shall be printed and/or stored electronically for each vehicle weighment:

(a) lane identification (required if more than one lane at the site has the ability to weigh a vehicle in motion);

(b) weight and sequence of each axle;

(c) total vehicle weight;

(d) time and date.

(Added 20XX)

S.1.9. Prepackaging Scales.

S.1.9.1. Value of the Scale Division. – On a prepackaging scale, the value of the intervals representing weight values shall be uniform throughout the entire reading face. The recorded weight values shall be identical with those on the indicator.

S.1.9.2. Label Printer. – A prepackaging scale or a device that produces a printed ticket to be used as the label for a package shall print all values digitally and of such size, style of type, and color as to be clear and conspicuous on the label.

S.1.10. Adjustable Components. – An adjustable component such as a pendulum, spring, or potentiometer shall be held securely in adjustment and, except for a zero-load balance mechanism, shall be located within the housing of the element.

(Added 1986)

S.1.11. Provision for Sealing.

(a) Except on Class I scales, provision shall be made for applying a security seal in a manner that requires the security seal to be broken before an adjustment can be made to any component affecting the performance of an electronic device.
[Nonretroactive as of January 1, 1979]

(b) Except on Class I scales, a device shall be designed with provision(s) for applying a security seal that must be broken, or for using other approved means of providing security (e.g., data change audit trail available at the time of inspection), before any change that detrimentally affects the metrological integrity of the device can be made to any electronic mechanism.
[Nonretroactive as of January 1, 1990]

(c) Except on Class I scales, audit trails shall use the format set forth in Table S.1.11. Categories of Device and Methods of Sealing.
[Nonretroactive as of January 1, 1995]

A device may be fitted with an automatic or a semi-automatic calibration mechanism. This mechanism shall be incorporated inside the device. After sealing, neither the mechanism nor the calibration process shall facilitate fraud.

(Amended 1989, 1991, and 1993)

Table S.1.11. Categories of Device and Methods of Sealing	
Categories of Device	***Methods of Sealing***
Category 1: *No remote configuration capability.*	*Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.*
Category 2: *Remote configuration capability, but access is controlled by physical hardware.* *The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode.*	*The hardware enabling access for remote communication must be at the device and sealed using a physical seal or two event counters: one for calibration parameters and one for configuration parameters.*
Category 3: *Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).*	*An event logger is required in the device; it must include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter. A printed copy of the information must be available through the device or through another on-site device. The event logger shall have a capacity to retain records equal to 10 times the number of sealable parameters in the device, but not more than 1000 records are required. (**Note:** Does not require 1000 changes to be stored for each parameter.)*

[Nonretroactive as of January 1, 1995]

(Table added 1993)

S.1.12. Manual Weight Entries. *– A device when being used for direct sale shall accept an entry of a manual gross or net weight value only when the scale gross or net* weight indication is at zero. Recorded manual weight entries, except those on labels generated for packages of standard weights, shall identify the weight value as a manual weight entry by one of the following terms: "Manual Weight," "Manual Wt," or "MAN WT." The use of a symbol to identify multiple manual weight entries on a single document is permitted, provided that the symbol is defined on the same page on which the manual weight entries appear and the definition of the symbol is automatically printed by the recording element as part of the document.*
*[Nonretroactive as of January 1, 1993] [*Nonretroactive as of January 1, 2005]*

(Added 1992) (Amended 2004)

S.1.13. Vehicle On-Board Weighing Systems: Vehicle in Motion. – When the vehicle is in motion, a vehicle on-board weighing system shall either:

(a) be accurate; or

(b) inhibit the weighing operation.

(Added 1993)

S.1.14. <u>Weigh-In-Motion Vehicle Scale: Operational Limitation. – A weigh-in-motion vehicle scale shall not provide a weight indication or recorded representation if any operational limitation is exceeded.</u>

<u>(Added 20XX)</u>

S.2. Design of Balance, Tare, Level, Damping, and Arresting Mechanisms.

S.2.1. Zero-Load Adjustment.

S.2.1.1. General. – A scale shall be equipped with means by which the zero-load balance may be adjusted. Any loose material used for this purpose shall be enclosed so that it cannot shift in position and alter the balance condition of the scale.

Except for an initial zero-setting mechanism, an automatic zero adjustment outside the limits specified in S.2.1.3. Scales Equipped with an Automatic Zero-Tracking Mechanism is prohibited.

(Amended 2010)

S.2.1.2. Scales used in Direct Sales. – A manual zero-setting mechanism (except on a digital scale with an analog zero-adjustment mechanism with a range of not greater than one scale division) shall be operable or accessible only by a tool outside of and entirely separate from this mechanism, or it shall be enclosed in a cabinet. Except on Class I or II scales, a balance ball shall either meet this requirement or not itself be rotatable.

A semiautomatic zero-setting mechanism shall be operable or accessible only by a tool outside of and separate from this mechanism or it shall be enclosed in a cabinet, or it shall be operable only when the indication is stable within plus or minus:

(a) 3.0 scale divisions for scales of more than 2000 kg (5000 lb) capacity in service prior to January 1, 1981, and for all axle load, railway track, **weigh-in-motion vehicle systems**, and vehicle scales; or

(b) 1.0 scale division for all other scales.

(Amended 20XX)

S.2.1.3. Scales Equipped with an Automatic Zero-Tracking Mechanism.

S.2.1.3.1. Automatic Zero-Tracking Mechanism for Scales Manufactured Between January 1, 1981, and January 1, 2007. – The maximum load that can be "rezeroed," when either placed on or removed from the platform all at once under normal operating conditions, shall be for:

(a) bench, counter, and livestock scales: 0.6 scale division;

(b) vehicle, **weigh-in-motion vehicle systems**, axle load, and railway track scales: 3.0 scale divisions; and

(c) all other scales: 1.0 scale division.

(Amended 2005 **and 20XX**)

S.2.1.3.2. Automatic Zero-Tracking Mechanism for Scales Manufactured on or after January 1, 2007. – The maximum load that can be "rezeroed," when either placed on or removed from the platform all at once under normal operating conditions, shall be:

(a) for vehicle, **weigh-in-motion vehicle systems**, axle load, and railway track scales: 3.0 scale divisions; and

(b) for all other scales: 0.5 scale division.

(Added 2005) **(Amended 20XX)**

S.2.1.3.3. Means to Disable Automatic Zero-Tracking Mechanism on Class III L Devices. – *Class III L devices equipped with an automatic zero-tracking mechanism shall be designed with a sealable means that would allow zero tracking to be disabled during the inspection and test of the device. [Nonretroactive as of January 1, 2001]*

(Added 1999) (Amended 2005)

S.2.1.4. Monorail Scales. – On a static monorail scale equipped with digital indications, means shall be provided for setting the zero-load balance to within 0.02 % of scale capacity. On a dynamic monorail weighing system, means shall be provided to automatically maintain these conditions.

(Amended 1999)

S.2.1.5. Initial Zero-Setting Mechanism. – Scales of accuracy Classes I, II, and III may be equipped with an initial zero-setting device.

(a) For weighing, load-receiving, and indicating elements in the same housing or covered on the same CC, an initial zero-setting mechanism shall not zero a load in excess of 20 % of the maximum capacity of the scale unless tests show that the scale meets all applicable tolerances for any amount of initial load compensated by this device within the specified range.

(b) For indicating elements not permanently attached to weighing and load-receiving elements covered on a separate CC, the maximum initial zero-setting mechanism range of electronic indicators shall not exceed 20 % of the configured capacity. [Nonretroactive as of January 1, 2009]

(Added 2008)

(Added 1990) (Amended 2008)

S.2.1.6. Combined Zero-Tare ("0/T") Key. – Scales not intended to be used in direct sales applications may be equipped with a combined zero and tare function key, provided that the device is clearly marked as to how the key functions. The device must also be clearly marked on or adjacent to the weight display with the statement "Not for Direct Sales."

(Added 1998)

S.2.2. Balance Indicator. – On a balance indicator consisting of two indicating edges, lines, or points, the ends of the indicators shall be sharply defined. When the scale is in balance, the ends shall be separated by not more than 1.0 mm (0.04 in).

S.2.2.1. Dairy-Product Test, Grain-Test, Prescription, and Class I and II Scales. – Except on digital indicating devices, a dairy-product test, grain-test, prescription, or Class I or II scale shall be equipped with a balance indicator. If an indicator and a graduated scale are not in the same plane, the clearance between the indicator and the graduations shall be not more than 1.0 mm (0.04 in).

S.2.2.2. Equal-Arm Scale. – *An equal-arm scale shall be equipped with a balance indicator. If the indicator and balance graduation are not in the same plane, the clearance between the indicator and the balance graduation shall be not more than 1.0 mm (0.04 in). [Nonretroactive as of January 1, 1989]*

(Added 1988)

S.2.3. Tare. – *On any scale (except a monorail scale equipped with digital indications and multi-interval scales or multiple range scales when the value of tare is determined in a lower weighing range or weighing segment), the value of the tare division shall be equal to the value of the scale division.** The tare mechanism shall operate only in a backward direction (that is, in a direction of underregistration) with respect to the zero-load balance

condition of the scale. *A device designed to automatically clear any tare value shall also be designed to prevent the automatic clearing of tare until a complete transaction has been indicated. **
*[*Nonretroactive as of January 1, 1983]*

(Amended 1985 and 2008)

*Note: On a computing scale, this requires the input of a unit price, the display of the unit price, and a computed positive total price at a readable equilibrium. Other devices require a complete weighing operation, including tare, net, and gross weight determination**
*[*Nonretroactive as of January 1, 1983]*

S.2.3.1. Monorail Scales Equipped with Digital Indications. – On a static monorail weighing system equipped with digital indications, means shall be provided for setting any tare value of less than 5 % of the scale capacity to within 0.02 % of scale capacity. On a dynamic monorail weighing system, means shall be provided to automatically maintain this condition.

(Amended 1999)

S.2.4. Level-Indicating Means. – Except for portable wheel-load weighers and portable axle load scales, a portable scale shall be equipped with level-indicating means if its weighing performance is changed by an amount greater than the appropriate acceptance tolerance when it is tilted up to and including 5 % rise over run in any direction from a level position and rebalanced. The level-indicating means shall be readable without removing any scale parts requiring a tool.

[This requirement is nonretroactive as of January 1, 1986, for prescription jewelers', and dairy-product test scales and scales marked Class I and II.]

Note: Portable wheel-load weighers and portable axle-load scales shall be accurate when tilted up to and including 5 % rise over run in any direction from a level position and rebalanced.

(Amended 1991 and 2008)

S.2.4.1. Vehicle On-Board Weighing Systems. – A vehicle on-board weighing system shall operate within tolerance when the weighing system is tilted up to and including 5 % rise over run in any direction from a level position and rebalanced. If the accuracy of the system is affected by out-of-level conditions normal to the use of the device, the system shall be equipped with an out-of-level sensor that inhibits the weighing operation when the system is out of level to the extent that the accuracy limits are exceeded.

(Added 1992) (Amended 2008)

S.2.5. Damping Means. – An automatic-indicating scale and a balance indicator shall be equipped with effective means to damp oscillations and to bring the indicating elements quickly to rest.

S.2.5.1. Digital Indicating Elements. – **Except for weigh-in-motion vehicle systems being operated in a dynamic mode** Digital indicating elements equipped with recording elements shall be equipped with effective means to permit the recording of weight values only when the indication is stable within plus or minus:

(a) 3.0 scale divisions for scales of more than 2000 kg (5000 lb) capacity in service prior to January 1, 1981, hopper (other than grain hopper) scales with a capacity exceeding 22 000 kg (50 000 lb), and for all vehicle, axle load, livestock, and railway track scales; and

(b) 1.0 scale division for all other scales.

The values recorded shall be within applicable tolerances.

(Amended 1995 **and 20XX**)

S.2.5.2. Jewelers', Prescription, and Class I, and Class II Scales. – A jewelers', prescription, Class I, or Class II scales shall be equipped with appropriate means for arresting the oscillation of the mechanism.

S.2.5.3. Class I and Class II Prescription Scales with a Counting Feature. – A Class I or Class II prescription scale shall indicate to the operator when the piece weight computation is complete by a stable display of the quantity placed on the load-receiving element.

(Added 2003)

S.3. Design of Load-Receiving Elements.

S.3.1. Travel of Pans of Equal-Arm Scale. – The travel between limiting stops of the pans of a nonautomatic-indicating equal-arm scale not equipped with a balance indicator shall be not less than the minimum travel shown in Table 2M. and Table 2.

Table 2M.
Minimum Travel of Pans of
Nonautomatic Indicating Equal-Arm Scale
without Balance Indicator

Nominal Capacity (kilograms)	Minimum Travel of Pans (millimeters)
2 or less	9
2+ to 5, inclusive	13
5+ to 12, inclusive	19
Over 12	25

Table 2.
Minimum Travel of Pans of
Nonautomatic Indicating Equal-Arm Scale
without Balance Indicator

Nominal Capacity (pounds)	Minimum Travel of Pans (inch)
4 or less	0.35
4+ to 12, inclusive	0.5
12+ to 26, inclusive	0.75
Over 26	1.0

S.3.2. Drainage. – A load-receiving element intended to receive wet commodities shall be so constructed as to drain effectively.

S.3.3. Scoop Counterbalance. – A scoop on a scale used for direct sales to retail customers shall not be counterbalanced by a removable weight. A permanently attached scoop-counterbalance shall indicate clearly on both the operator's and customer's sides of the scale whether it is positioned for the scoop to be on or off the scale.

S.4. Design of Weighing Elements.

S.4.1. Antifriction Means. – Frictional effects shall be reduced to a minimum by suitable antifriction elements. Opposing surfaces and points shall be properly shaped, finished, and hardened. A platform scale having a frame around the platform shall be equipped with means to prevent interference between platform and frame.

S.4.2. Adjustable Components. – An adjustable component such as a nose-iron or potentiometer shall be held securely in adjustment. The position of a nose-iron on a scale of more than 1000 kg (2000 lb) capacity, as determined by the factory adjustment, shall be accurately, clearly, and permanently defined.

(Amended 1986)

S.4.3. Multiple Load-Receiving Elements. – Except for mechanical bench and counter scales, a scale with a single indicating or recording element, or a combination indicating-recording element, that is coupled to two or more load-receiving elements with independent weighing systems, shall be provided with means to prohibit the activation of any load-receiving element (or elements) not in use, and shall be provided with automatic means to indicate clearly and definitely which load-receiving element (or elements) is in use.

S.5. Design of Weighing Devices, Accuracy Class.

S.5.1. Designation of Accuracy Class. *– Weighing devices are divided into accuracy classes and shall be designated as I, II, III, III L, or IIII.*
[Nonretroactive as of January 1, 1986]

S.5.2. Parameters for Accuracy Class. *– The accuracy class of a weighing device is designated by the manufacturer and shall comply with parameters shown in Table 3.*
[Nonretroactive as of January 1, 1986]

S.5.3. Multi-Interval and Multiple Range Scales, Division Value. – On a multi-interval scale and multiple range scale, the value of "e" shall be equal to the value of "d."[2]
(Added 1986) (Amended 1995)

S.5.4. Relationship of Minimum Load Cell Verification Interval Value to the Scale Division. *– The relationship of the value for the minimum load cell verification scale interval, v_{min}, to the scale division, d, for a specific scale using National Type Evaluation Program (NTEP) certified load cells shall comply with the following formulae where N is the number of load cells in a single independent[1] weighing/load-receiving element (such as hopper, railroad track, or vehicle scale weighing/load-receiving elements):*

(a) $v_{\min} \leq \frac{d^*}{\sqrt{N}}$ *for scales without lever systems; and*

(b) $v_{\min} \leq \frac{d^*}{\sqrt{N} \times (scale\,multiple)}$ *for scales with lever systems.*

[1]"Independent" means with a weighing/load-receiving element not attached to adjacent elements and with its own A/D conversion circuitry and displayed weight.

*[*When the value of the scale division, d, is different from the verification scale division, e, for the scale, the value of e must be used in the formulae above.]*

This requirement does not apply to complete weighing/load-receiving elements or scales, which satisfy all the following criteria:

- *the complete weighing/load-receiving element or scale has been evaluated for compliance with T.N.8.1. Temperature under the NTEP;*
- *the complete weighing/load-receiving element or scale has received an NTEP Certificate of Conformance; and*
- *the complete weighing/load-receiving element or scale is equipped with an automatic zero-tracking mechanism which cannot be made inoperative in the normal weighing mode. (A test mode which permits the disabling of the automatic zero-tracking mechanism is permissible, provided the scale cannot function normally while in this mode.*

[Nonretroactive as of January 1, 1994]
(Added 1993) (Amended 1996 and 2016)

[2] Footnote 1 to Table 3 Parameters for Accuracy Classes.

Table 3.
Parameters for Accuracy Classes

Class	*Value of the Verification Scale Division (d or e[1])*	*Number of Scale[4] Divisions (n)*	
		Minimum	*Maximum*
SI Units			
I	*equal to or greater than 1 mg*	*50 000*	--
II	*1 to 50 mg, inclusive*	*100*	*100 000*
	equal to or greater than 100 mg	*5 000*	*100 000*
III[2,5]	*0.1 to 2 g, inclusive*	*100*	*10 000*
	equal to or greater than 5 g	*500*	*10 000*
III L[3]	*equal to or greater than 2 kg*	*2 000*	*10 000*
IIII	*equal to or greater than 5 g*	*100*	*1 200*
U.S. Customary Units			
III[5]	*0.0002 lb to 0.005 lb, inclusive*	*100*	*10 000*
	0.005 oz to 0.125 oz, inclusive	*100*	*10 000*
	equal to or greater than 0.01 lb	*500*	*10 000*
	equal to or greater than 0.25 oz	*500*	*10 000*
III L[3]	*equal to or greater than 5 lb*	*2 000*	*10 000*
IIII	*greater than 0.01 lb*	*100*	*1 200*
	greater than 0.25 oz	*100*	*1 200*

[1] For Class I and II devices equipped with auxiliary reading means (i.e., a rider, a vernier, or a least significant decimal differentiated by size, shape, or color), the value of the verification scale division "e" is the value of the scale division immediately preceding the auxiliary means.

[2] A Class III scale marked "For prescription weighing only" may have a verification scale division (e) not less than 0.01 g.

(Added 1986) (Amended 2003)

[3] The value of a scale division for crane and hopper (other than grain hopper) scales shall be not less than 0.2 kg (0.5 lb). The minimum number of scale divisions shall be not less than 1000.

[4] On a multiple range or multi-interval scale, the number of divisions for each range independently shall not exceed the maximum specified for the accuracy class. The number of scale divisions, n, for each weighing range is determined by dividing the scale capacity for each range by the verification scale division, e, for each range. On a scale system with multiple load-receiving elements and multiple indications, each element considered shall not independently exceed the maximum specified for the accuracy class. If the system has a summing indicator, the n_{max} for the summed indication shall not exceed the maximum specified for the accuracy class.

(Added 1997)

[5] The minimum number of scale divisions for a Class III Hopper Scale used for weighing grain shall be 2000.)

[*Nonretroactive as of January 1, 1986*]

(Amended 1986, 1987, 1997, 1998, 1999, 2003, and 2004)

S.6. Marking Requirements. – (Also see G-S.1. Identification, G-S.4. Interchange or Reversal of Parts, G-S.6. Marking Operational Controls, Indications, and Features, G-S.7. Lettering, G-UR.2.1.1. Visibility of Identification, and UR.3.4.1. Use in Pairs.)

S.6.1. Nominal Capacity; Vehicle and Axle-Load Scales. *– For all vehicle and axle-load scales, the marked nominal capacity shall not exceed the concentrated load capacity (CLC) times the quantity of the number of sections in the scale minus 0.5.*

As a formula, this is stated as: $\text{nominal capacity} \leq CLC \times (N - 0.5)$
where N = the number of sections in the scale.
[Nonretroactive as of January 1, 1989]

Note: When the device is used in a combination railway track and vehicle weighing application, the above formula shall apply only to the vehicle scale application.

(Added 1988) (Amended 1999 and 2002)

S.6.2. Location of Marking Information. – Scales that are not permanently attached to an indicating element, and for which the load-receiving element is the only part of the weighing/load-receiving element visible after installation, may have the marking information required in Section 1.10. General Code, G-S.1. Identification and Section 2.20. Scales Code, S.6. Marking Requirements located in an area that is accessible only through the use of a tool; provided that the information is easily accessible (e.g., the information may appear on the junction box under an access plate). The identification information for these scales shall be located on the weighbridge (load-receiving element) near the point where the signal leaves the weighing element or beneath the nearest access cover.

(Added 1989)

S.6.3. Scales, Main Elements, and Components of Scales or Weighing Systems. – Scales, main elements of scales when not contained in a single enclosure for the entire scale, load cells for which Certificates of Conformance (CC) have been issued under the National Type Evaluation Program (NTEP), and other equipment necessary to a weighing system, but having no metrological effect on the weighing system, shall be marked as specified in Table S.6.3.a. Marking Requirements and explained in the accompanying notes in Table S.6.3.b. Notes for Table S.6.3.a.

(Added 1990)

Table S.6.3.a.
Marking Requirements

To Be Marked With ⇓	Weighing Equipment				
	Weighing, Load-Receiving, and Indicating Element in Same Housing or Covered on the Same CC[1]	**Indicating Element not Permanently Attached to Weighing and Load-Receiving Element or Covered by a Separate CC**	**Weighing and Load-Receiving Element Not Permanently Attached to Indicating Element or Covered by a Separate CC**	**Load Cell with CC (11)**	**Other Equipment or Device (10)**
Manufacturer's ID (1)	X	X	X	X	X
Model Designation and Prefix (1)	X	X	X	X	X
Serial Number and Prefix (2)	X	X	X	X	X (16)
Certificate of Conformance Number (CC) (23)	X	X	X	X	X (23)
Accuracy Class (17)	X	X (8)	X (19)	X	
Nominal Capacity (3)(18)(20)	X	X	X		
Value of Scale Division, "d" (3)	X	X			
Value of "e" (4)	X	X			
Temperature Limits (5)	X	X	X	X	
Concentrated Load Capacity (CLC) (12)(20)(22)		X	X (9)		
Special Application (13)	X	X	X		
Maximum Number of Scale Divisions (n_{max}) (6)		X (8)	X (19)	X	
Minimum Verification Scale Division (e_{min})			X (19)		
"S" or "M" (7)				X	
Direction of Loading (15)				X	
Minimum Dead Load				X	
Maximum Capacity				X	
Safe Load Limit				X	
Load Cell Verification Interval (v_{min}) (21)				X	
Section Capacity and Prefix (14)(20)(22)(24)		X	X		

Table S.6.3.a.
Marking Requirements

Note: For applicable notes, Table S.6.3.b.
[1] Weighing/load-receiving elements and indicators which are in the same housing or which are permanently attached will generally appear on the same CC. If not in the same housing, elements shall be hard-wired together or sealed with a physical seal or an electronic link. This requirement does not apply to peripheral equipment that has no input or effect on device calibrations or configurations.
(Added 2001)

(Added 1990) (Amended 1992, 1999, 2000, 2001, 2002, ~~and~~ 2004**, and 20XX**)

Table S.6.3.b.
Notes for Table S.6.3.a. Marking Requirements

1. Manufacturer's identification and model designation and *model designation prefix.** *[*Nonretroactive as of January 1, 2003*]
(Also see G-S.1. Identification.) *[Prefix lettering may be initial capitals, all capitals or all lower case]*
(Amended 2000)

2. *Serial number [Nonretroactive as of January 1, 1968] and prefix [Nonretroactive as of January 1, 1986].* (Also see G-S.1. Identification.)

3. The device shall be marked with the nominal capacity. *The nominal capacity shall be shown together with the value of the scale division (e.g., 15 × 0.005 kg, 30 × 0.01 lb, or capacity = 15 kg, d = 0.005 kg) in a clear and conspicuous manner and be readily apparent when viewing the reading face of the scale indicator unless already apparent by the design of the device. Each scale division value or weight unit shall be marked on multiple range or multi-interval scales.*
[Nonretroactive as of January 1, 1983]
(Amended 2005)

4. *Required only if different from "d."*
[Nonretroactive as of January 1, 1986]

5. *Required only on Class III, III L, and IIII devices if the temperature range on the NTEP CC is narrower than and within − 10 °C to 40 °C (14 °F to 104 °F). [Nonretroactive as of January 1, 1986]*
(Amended 1999)

6. *This value may be stated on load cells in units of 1000; e.g., n: 10 is 10 000 divisions.*
[Nonretroactive as of January 1, 1988]

7. *Denotes compliance for single or multiple load cell applications. It is acceptable to use a load cell with the "S" or Single Cell designation in multiple load cell applications as long as all other parameters meet applicable requirements. A load cell with the "M" or Multiple Cell designation can be used only in multiple load cell applications.*
[Nonretroactive as of January 1, 1988]
(Amended 1999)

8. *An indicating element not permanently attached to a weighing element shall be clearly and permanently marked with the accuracy Class of I, II, III, III L, or IIII, as appropriate, and the maximum number of scale divisions, n_{max}, for which the indicator complies with the applicable requirement. Indicating elements that qualify for use in both Class III and III L applications may be marked III/III L and shall be marked with the maximum number of scale divisions for which the device complies with the applicable requirements for each accuracy class.*
[Nonretroactive as of January 1, 1988]

Table S.6.3.b.
Notes for Table S.6.3.a. Marking Requirements

9. *For vehicle and axle-load scales only. The CLC shall be added to the load-receiving element of any such scale not previously marked at the time of modification.*
[Nonretroactive as of January 1, 1989]
(Amended 2002)

10. Necessary to the weighing system but having no metrological effect, e.g., auxiliary remote display, keyboard, etc.

11. *The markings may be either on the load cell or in an accompanying document; except that, if an accompanying document is provided, the serial number shall appear both on the load cell and in the document. [Nonretroactive as of January 1, 1988] The manufacturer's name or trademark, the model designation, and identifying symbols for the model and serial numbers as required by paragraph G-S.1. Identification shall also be marked both on the load cell and in any accompanying document.*
[Nonretroactive as of January 1, 1991]

12. Required on the indicating element *and the load-receiving element* of vehicle and axle-load scales. *Such marking shall be identified as "concentrated load capacity" or by the abbreviation "CLC." **
*[*Nonretroactive as of January 1, 1989]*
(Amended 2002)

13. *A scale designed for a special application rather than general use shall be conspicuously marked with suitable words, visible to the operator and to the customer, restricting its use to that application, e.g., postal scale, prepack scale, weight classifier, etc.** When a scale is installed with an operational counting feature, the scale shall be marked on both the operator and customer sides with the statement "The counting feature is not legal for trade," except when a Class I or Class II prescription scale complies with all Handbook 44 requirements applicable to counting features.
*[*Nonretroactive as of 1986]*
(Amended 1994 and 2003)

14. Required on *livestock** and railway track scales. When marked on vehicle and axle-load scales manufactured before January 1, 1989, it may be used as the CLC. For livestock scales manufactured between January 1, 1989, and January 1, 2003, required markings may be either CLC or section capacity.
*[*Nonretroactive as of January 1, 2003]*
(Amended 2002)

15. *Required if the direction of loading the load cell is not obvious.*
[Nonretroactive as of January 1, 1988]

16. *Serial number [Nonretroactive as of January 1, 1968] and prefix [Nonretroactive as of January 1, 1986].* (Also see G-S.1. Identification.) Modules without "intelligence" on a modular system (e.g., printer, keyboard module, cash drawer, and secondary display in a point-of-sale system) are not required to have serial numbers.

17. *The accuracy class of a device shall be marked on the device with the appropriate designation as I, II, III, III L, or IIII.*
[Nonretroactive as of January 1, 1986]

18. The nominal capacity shall be conspicuously marked as follows:
(a) on any scale equipped with unit weights or weight ranges;
(b) on any scale with which counterpoise or equal-arm weights are intended to be used;
(c) on any automatic-indicating or recording scale so constructed that the capacity of the indicating or recording element, or elements, is not immediately apparent;
(d) on any scale with a nominal capacity less than the sum of the reading elements; and
*(e) on the load-receiving element (weighbridge) of vehicle, axle-load, and livestock scales.**

Table S.6.3.b.
Notes for Table S.6.3.a. Marking Requirements

*[*Nonretroactive as of January 1, 1989]*

(Amended 1992)

19. *For weighing and load-receiving elements not permanently attached to indicating element or covered by a separate CC.*
[Nonretroactive as of January 1, 1988]

(Amended 1992)

20. *Combination vehicle/railway track scales must be marked with both the nominal capacity and CLC for vehicle weighing and the nominal capacity and section capacity for railway weighing. All other requirements relating to these markings will apply.*
[Nonretroactive as of January 1, 2000]

(Added 1999)

21. *The value of the load cell verification interval (v_{min}) must be stated in mass units. In addition to this information, a device may be marked with supplemental representations of v_{min}.*
[Nonretroactive as of January 1, 2001]

(Added 1999)

22. *Combination vehicle/livestock scales must be marked with both the CLC for vehicle weighing and the section capacity for livestock weighing. All other requirements relative to these markings will apply.*
[Nonretroactive as of January 1, 2003]

(Added 2002) (Amended 2003)

***Note**: The marked section capacity for livestock weighing may be less than the marked CLC for vehicle weighing.*

(Amended 2003)

23. *Required only if a CC has been issued for the device or equipment.*
[Nonretroactive as of January 1, 2003]

(G-S.1. Identification (e) Added 2001)

24. *The section capacity shall be prefaced by the words "Section Capacity" or an abbreviation of that term. Abbreviations shall be "Sec Cap" or "Sec C." All capital letters and periods may be used.*
[Nonretroactive as of January 1, 2005]

(Added 2004)

S.6.4. Railway Track Scales. – A railway track scale shall be marked with the maximum capacity of each section of the load-receiving element of the scale. Such marking shall be accurately and conspicuously presented on, or adjacent to, the identification or nomenclature plate that is attached to the indicating element of the scale. The nominal capacity marking shall satisfy the following:

(a) For scales manufactured from January 1, 2002, through December 31, 2013:

(1) the nominal capacity of a scale with more than two sections shall not exceed twice its rated section capacity; and

(2) the nominal capacity of a two-section scale shall not exceed its rated section capacity.

(b) For scales manufactured on or after January 1, 2014, the nominal scale capacity shall not exceed the lesser of:

(1) the sum of the Weigh Module Capacities as shown in Table S.6.4.M. and Table S.6.4.; or

(2) the Rated Section Capacity (RSC) multiplied by the Number of Sections (Ns) minus the Number of Dead Spaces (Nd) minus 0.5. As a formula this is stated as:

$$RSC \times (Ns - Nd - 0.5);$$ or

(3) 290 300 kg (640 000 lb).

(Amended 1988, 2001, 2002, and 2013)

Table S.6.4.M. Railway Track Scale – Weigh Module Capacity	
Weigh Module Length (meters)	**Weigh Module Capacity (kilograms)**
< 1.5	36 300
1.5 to < 3.0	72 600
3.0 to < 4.5	108 900
4.5 to < 7.0	45 100
7.0 to < 9.0	168 700
9.0 to < 10.5	192 300
10.5 to < 12.0	234 100
12.0 to < 17.0	257 600
Note: The capacity of a particular module is based on its length as shown above. To determine the "sum of the weigh module capacities" referenced in paragraph S.6.4.(b)(1): (1) determine the length of each individual weigh module in the scale; (2) find its corresponding "weigh module capacity" in the table above; and (3) add all of the individual weigh module capacities."	

(Table Added 2013)

Table S.6.4. Railway Track Scale – Weigh Module Capacity	
Weigh Module Length (feet)	**Weigh Module Capacity (pounds)**
< 5	80 000
5 to < 10	160 000
10 to < 15	240 000
15 to < 23	320 000
23 to < 29	372 000
29 to < 35	424 000
35 to < 40	516 000
40 to < 56	568 000
Note: The capacity of a particular module is based on its length as shown above. To determine the "sum of the weigh module capacities" referenced in paragraph S.6.4.(b)(1): (1) determine the length of each individual weigh module in the scale; (2) find its corresponding "weigh module capacity" in the table above; and (3) add all of the individual weigh module capacities."	

(Table Added 2013)

S.6.5. Livestock Scales. – A livestock scale manufactured prior to January 1, 1989, or after January 1, 2003, shall be marked with the maximum capacity of each section of the load-receiving element of the scale. Livestock scales manufactured between January 1, 1989, and January 1, 2003, shall be marked with either the Concentrated Load Capacity (CLC) or the Section Capacity. Such marking shall be accurately and conspicuously presented on, or adjacent to the identification or nomenclature plate that is attached to the indicating element of the scale. *The nominal capacity of a scale with more than two sections shall not exceed twice its rated section capacity. The nominal capacity of a two-section scale shall not exceed its rated section capacity.**
*[*Nonretroactive as of January 1, 2003]*
(Added 2002)

Also see Note 14 in Table S.6.3.b. Notes for Table S.6.3.a.

S.6.6. Counting Feature, Minimum Individual Piece Weight, and Minimum Sample Piece Count. – A Class I or Class II prescription scale with an operational counting feature shall be marked with the minimum individual piece weight and minimum number of pieces used in the sample to establish an individual piece weight.
(Added 2003)

N. Notes

N.1. Test Procedures.

N.1.1. Increasing-Load Test. – The increasing-load test shall be conducted on all scales with the test loads approximately centered on the load-receiving element of the scale, except on a scale having a nominal capacity greater than the total available known test load. When the total test load is less than the nominal capacity, the test load is used to greatest advantage by concentrating it, within prescribed load limits, over the main load supports of the scale.

N.1.2. Decreasing-Load Test (Automatic Indicating Scales). – The decreasing-load test shall be conducted with the test load approximately centered on the load-receiving element of the scale.

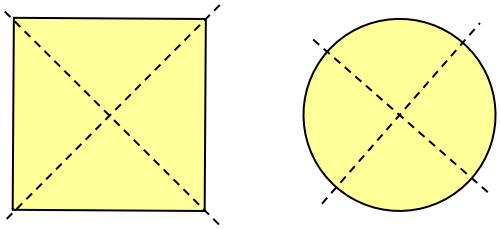
N.1.2.1. Scales Marked I, II, III, or IIII. – Except for portable wheel load weighers, decreasing-load tests shall be conducted on scales marked I, II, III or IIII and with "n" equal to or greater than 1000 with test loads equal to the maximum test load at each tolerance value. For example, on a Class III scale, at test loads equal to 4000 d, 2000 d, and 500 d; for scales with n less than 1000, the test load shall be equal to one-half of the maximum load applied in the increasing-load test. (Also see Table 6. Maintenance Tolerances.)
(Amended 1998)

N.1.2.2. All Other Scales. – On all other scales, except for portable wheel load weighers, the decreasing-load test shall be conducted with a test load equal to one-half of the maximum load applied in the increasing-load test.
(Amended 1998)

N.1.3. Shift Test.

N.1.3.1. Dairy-Product Test Scales. – A shift test shall be conducted with a test load of 18 g successively positioned at all points on which a weight might reasonably be placed in the course of normal use of the scale.

N.1.3.2. Equal-Arm Scales. – A shift test shall be conducted with a half-capacity test load centered successively at four points positioned equidistance between the center and the front, left, back, and right edges of each pan as shown in the diagrams below. An equal test load shall be centered on the other pan.



N.1.3.3. Vehicle Scales, Axle-Load Scales, and Livestock Scales.

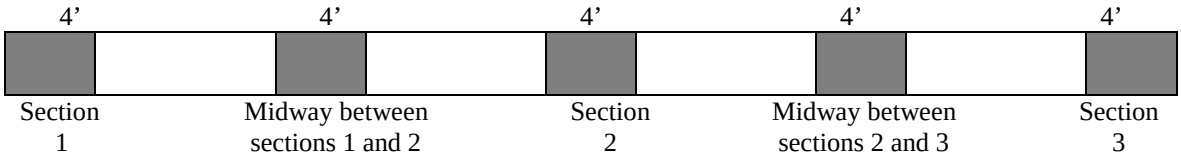
N.1.3.3.1. Vehicle Scales, Axle-Load Scales, and Combination Vehicle/Livestock Scales.

(a) **Minimum Shift Test.** – At least one shift test shall be conducted with a minimum test load of 12.5 % of scale capacity, which may be performed anywhere on the load-receiving element using the prescribed test patterns and maximum test loads specified below. (Combination Vehicle/Livestock Scales shall also be tested consistent with N.1.3.3.2. Prescribed Test Pattern and Test Loads for Livestock Scales with More Than Two Sections and Combination Vehicle/Livestock Scales.)

(Amended 1991, 2000, and 2003)

(b) **Prescribed Test Pattern and Loading for Vehicle Scales, Axle-Load Scales, and Combination Vehicle/Livestock Scales.** – The normal prescribed test pattern shall be an area of 1.2 m (4 ft) in length and 3.0 m (10 ft) in width or the width of the scale platform, whichever is less. Multiple test patterns may be utilized when loaded in accordance with paragraph (c), (d), or (e) as applicable. An example of a possible test pattern is shown in the diagram below.

(Amended 1997, 2001, and 2003)



(c) **Loading Precautions for Vehicle Scales, Axle-Load Scales, and Combination Vehicle/Livestock Scales.** – When loading the scale for testing, one side of the test pattern shall be loaded to no more than half of the concentrated load capacity or test load before loading the other side. The area covered by the test load may be less than 1.2 m (4 ft) × 3.0 m (10 ft) or the width of the scale platform, whichever is less; for test patterns less than 1.2 m (4 ft) in length the maximum loading shall meet the formula: [(wheel base of test cart or length of test load divided by 48 in) × 0.9 × CLC]. The maximum test load applied to each test pattern shall not exceed the concentrated load capacity of the scale. When the test pattern exceeds 1.2 m (4 ft), the maximum test load applied shall not exceed the concentrated load capacity times the largest “r” factor in Table UR.3.2.1. Span Maximum Load for the length of the area covered by the test load. For load-receiving elements installed prior to January 1, 1989, the rated section capacity may be substituted for concentrated load capacity to determine maximum loading. An example of a possible test pattern is shown above.

(Amended 1997 and 2003)

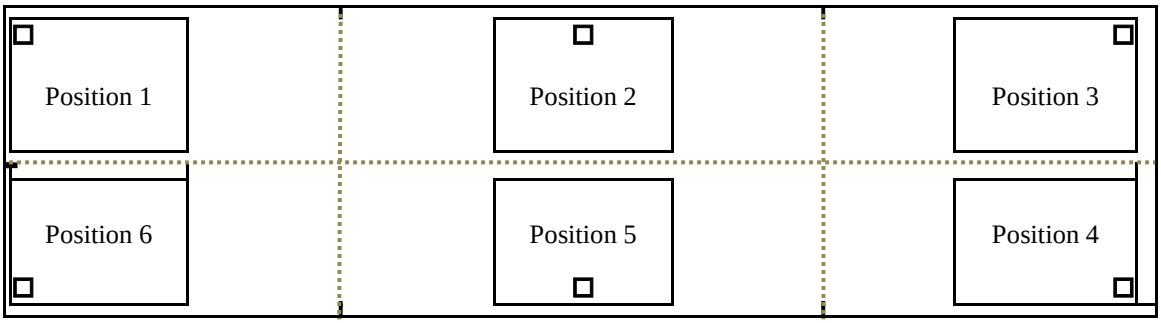
(d) **Multiple Pattern Loading.** – To test to the nominal capacity, multiple patterns may be simultaneously loaded in a manner consistent with the method of use.

(e) **Other Designs.** – Special design scales and those that are wider than 3.7 m (12 ft) shall be tested in a manner consistent with the method of use but following the principles described above.

(Amended 1988, 1991, 1997, 2000, 2001, and 2003)

(Amended 2003)

N.1.3.3.2. Prescribed Test Pattern and Test Loads for Livestock Scales with More Than Two Sections and Combination Vehicle/Livestock Scales. – A minimum test load of 5 000 kg (10 000 lb) or one-half of the rated section capacity, whichever is less, shall be placed, as nearly as possible, successively over each main load support as shown in the diagram below. For livestock scales manufactured between January 1, 1989, and January 1, 2003, the required loading shall be no greater than one-half CLC.



□ = Load Bearing Point

(Added 2003) (Amended 2016)

N.1.3.3.3. Prescribed Test Patterns and Test Loads for Two-Section Livestock Scales. – A shift test shall be conducted using the following prescribed test loads and test patterns: 1) When a single field standard weight is used, the prescribed test load shall be applied centrally in the prescribed test pattern; or 2) When multiple field standard weights are used as the prescribed test load, the load shall be applied in a consistent pattern in the shift test positions throughout the test and applied in a manner that does not concentrate the load in a test pattern that is less than when the same load is a single field standard weights on the load-receiving element.

The shift test load shall not exceed one-half the rated section capacity or one-half the rated concentrated load capacity whichever is applicable, using either:

(a) A one-half nominal capacity test load centered as nearly as possible, successively at the center of each quarter of the load-receiving element as shown in N.1.3.7. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers Figure 1; or

(b) A one-quarter nominal capacity test load centered as nearly as possible, successively over each main load support as shown in N.1.3.7. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers Figure 2.

(Added 2007) (Amended 2016)

N.1.3.4. Railway Track Scales Weighing Individual Cars in Single Drafts. – A shift test shall be conducted with at least two different test loads, if available, distributed over, to the right and left of, each pair of main levers or other weighing elements supporting each section of the scale.

N.1.3.5. Monorail Scales, Static Test. – A shift test shall be conducted with a test load equal to the largest load that can be anticipated to be weighed in a given installation, but never less than one-half scale capacity. The load shall be placed successively on the right end, the left end, and the center of the live rail.

(Added 1985)

N.1.3.5.1. Dynamic Monorail Weighing Systems. – Dynamic tests with livestock carcasses or portions of carcasses shall be conducted during normal plant production. No less than 20 test loads using carcasses or portions of carcasses of the type normally weighed shall be used in the dynamic test. If the plant conveyor chain does not space or prevent the carcasses or portions of carcasses from touching one another, dynamic tests shall not be conducted until this condition has been corrected.

All carcasses or portions of carcasses shall be individually weighed statically on either the same scale being tested dynamically or another monorail scale with the same or smaller divisions and in close proximity. (The scale selected for static weighing of the carcasses or portions of carcasses shall first be tested statically with certified test weights that have been properly protected from the harsh environment of the packing plant to ensure they maintain accuracy.)

If the scale being tested is used for weighing freshly slaughtered animals (often referred to as a "hot scale"), care must be taken to get a static weighment as quickly as possible before or following the dynamic weighment to avoid loss due to shrink. If multiple dynamic tests are conducted using the same carcasses or portions of carcasses, static weights shall be obtained before and after multiple dynamic tests. If the carcass or portion of a carcass changes weight between static tests, the amount of weight change shall be taken into account, or the carcass or portion of a carcass shall be disregarded for tolerance purposes.

Note: For a dynamic monorail test, the reference scale shall comply with the principles in the Fundamental Considerations paragraph 3.2. Tolerances for Standards.

(Added 1996) (Amended 1999 and 2007)

N.1.3.6. Vehicle On-Board Weighing Systems. – The shift test for a vehicle on-board weighing system shall be conducted in a manner consistent with its normal use. For systems that weigh as part of the lifting cycle, the center of gravity of the load may be shifted in the vertical direction as well as from side to side. In other cases, the center of gravity may be moved to the extremes of the load-receiving element using loads of a magnitude that reflect normal use (i.e., the load for the shift test may exceed one-half scale capacity), and may, in some cases, be equal to the capacity of the scale. The shift test may be conducted when the weighing system is out of level to the extent that the weighing system remains operational.

(Added 1992)

N.1.3.7. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers. – A shift test shall be conducted using the following prescribed test loads and test patterns. A single field standard weight used as the prescribed test load shall be applied centrally in the prescribed test pattern. When multiple field standard weights are used as the prescribed test load, the load shall be applied in a consistent pattern in the shift test positions throughout the test and applied in a manner that does not concentrate the load in a test pattern that is less than when that same load is a single field standard weight on the load-receiving element.

(a) For scales with a nominal capacity of 500 kg (1000 lb) or less, a shift test shall be conducted using a one-third nominal capacity test load (defined as test weights in amounts of at least 30 % of scale capacity, but not to exceed 35 % of scale capacity) centered as nearly as possible at the center of each quadrant of the load-receiving element using the prescribed test pattern as shown in Figure 1.

(b) For scales with a nominal capacity greater than 500 kg (1000 lb), a shift test may be conducted by either using a one-third nominal capacity test load (defined as test weights in amounts of at least 30 % of scale capacity, but not to exceed 35 % of scale capacity) centered as nearly as possible at the center of each quadrant of the load-receiving element using the prescribed test pattern as shown

in Figure 1, or by using a one-quarter nominal capacity test load centered as nearly as possible, successively, over each corner of the load-receiving element using the prescribed test pattern as shown in Figure 2.

Figure 1

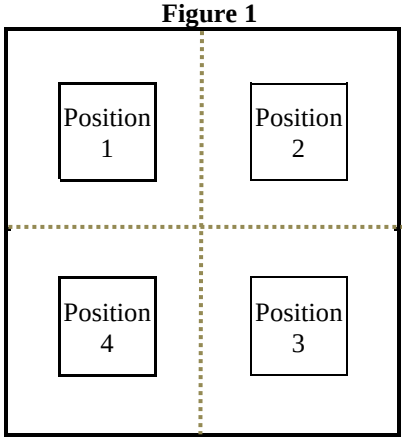
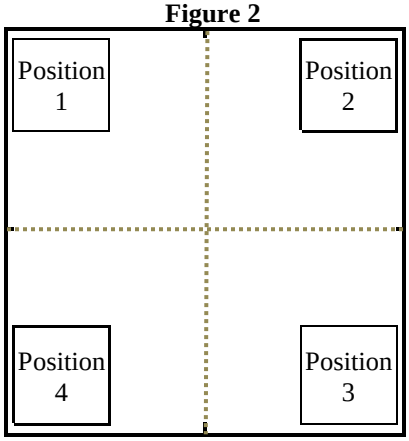


Figure 2



(Added 2003)

(Amended 1987, 2003, and 2007)

N.1.4. Sensitivity Test. – A sensitivity test shall be conducted on nonautomatic-indicating (weighbeam) scales only, with the weighing device in equilibrium at zero-load and at maximum test load. The test shall be conducted by increasing or decreasing the test load in an amount equal to the applicable value specified in T.2. Sensitivity Requirement (SR) or T.N.6. Sensitivity.

N.1.5. Discrimination Test. *– A discrimination test shall be conducted on all automatic indicating scales with the weighing device in equilibrium at or near zero load and at or near maximum test load, and under controlled conditions in which environmental factors are reduced to the extent that they will not affect the results obtained. For scales equipped with an Automatic Zero-Tracking Mechanism (AZT), the discrimination test may be conducted at a range outside of the AZT range.*
[Nonretroactive as of January 1, 1986]

(Added 1985) (Amended 2004)

N.1.5.1. Digital Device. – On a digital device, this test is conducted from just below the lower edge of the zone of uncertainty for increasing load tests, or from just above the upper edge of the zone of uncertainty for decreasing-load tests.

N.1.6. RFI Susceptibility Tests, Field Evaluation. – An RFI test shall be conducted at a given installation when the presence of RFI has been verified and characterized if those conditions are considered "usual and customary."

(Added 1986)

N.1.7. Ratio Test. – A ratio test shall be conducted on all scales employing counterpoise weights and on nonautomatic-indicating equal-arm scales.

N.1.8. Material Tests. – A material test shall be conducted on all customer-operated bulk weighing systems for recycled materials using bulk material for which the device is used. Insert into the device, in a normal manner, several accurately pre-weighed samples (free of foreign material) in varying amounts approximating average drafts.

N.1.9. Zero-Load Balance Change. – A zero-load balance change test shall be conducted on all scales after the removal of any test load. The zero-load balance should not change by more than the minimum tolerance applicable. (Also see G-UR.4.2. Abnormal Performance.)

N.1.10. Counting Feature Test. – A test of the counting function shall be conducted on all Class I and Class II prescription scales having an active counting feature used in "legal for trade" applications. The test should verify that the scale will not accept a sample with less than either the minimum sample piece count or the minimum sample weight of 30 e. Counting feature accuracy should be verified at a minimum of two test loads. Verification of the count calculations shall be based upon the weight indication of the test load.

Note:
(1) The minimum sample weight is equal to the marked minimum individual piece weight times the marked minimum sample piece count.

(2) Test load as used in this section refers to actual calibration test weights selected from an appropriate test weight class.

(Added 2003)

N.1.11. Substitution Test. – In the substitution test procedure, material or objects are substituted for known test weights, or a combination of known test weights and previously quantified material or objects, using the scale under test as a comparator. Additional test weights or other known test loads may be added to the known test load to evaluate higher weight ranges on the scale.

(Added 2003)

N.1.12. Strain-Load Test. – In the strain-load test procedure, an unknown quantity of material or objects are used to establish a reference load or tare to which test weights or substitution test loads are added.

(Added 2003)

N.2. Verification (Testing) Standards. – Field standard weights used in verifying weighing devices shall comply with requirements of NIST Handbook 105-Series standards (or other suitable and designated standards) or the tolerances expressed in Fundamental Considerations, paragraph 3.2. (i.e., one-third of the smallest tolerance applied).

(Amended 1986)

N.3. Minimum Test Weights and Test Loads. – The minimum test weights and test loads for in-service tests (except railway track scales) are shown in Table 4. (Also see Footnote 2 in Table 4. Minimum Test Weights and Test Loads.)

(Added 1984) (Amended 1988)

N.3.1. Minimum Test-Weight Load and Tests for Railway Track Scales.

(Amended 1990 and 2012)

N.3.1.1. Initial and Subsequent Tests. – The test-weight load shall be not less than 35 000 kg (80 000 lb). A strain-load test conducted up to the used capacity of the weighing system is recommended.

(Added 1990) (Amended 2012)

N.3.1.2. Interim Test. – An Interim Test may be used to return a railway track scale into temporary service following repairs that could affect the accuracy of the weighing system providing all of the following conditions are met:

(a) a test weight load of not less than 13 500 kg (30 000 lb) shall be used;

(b) a shift (section) test shall be conducted using a test-weight load of not less than 13 500 kg (30 000 lb);

(c) a strain-load test shall be conducted up to at least 25 % of scale capacity;

(d) all test results shall be within applicable tolerances; and

(e) the official with statutory authority shall be immediately notified when scales are repaired and placed in temporary service with an Interim Test. The length of temporary service following repair is at the discretion of the official with statutory authority.

(Added 1990) (Amended 2012)

N.3.1.3. Enforcement Action for Inaccuracy. – To take enforcement action on a scale that is found to be inaccurate, a minimum test load of 13 500 kg (30 000 lb) must be used.

(Added 1990)

Table 4.
Minimum Test Weights and Test Loads[1]

Devices in Metric Units				Devices in U.S. Customary Units		
Device Capacity (kg)	**Minimums (in terms of device capacity)**			**Device Capacity (lb)**	**Minimums (in terms of device capacity)**	
	Test Weights (greater of)	**Test Loads[2]**			**Test Weights (greater of)**	**Test Loads[2]**
0 to 150 kg	100 %			0 to 300 lb	100 %	
151 to 1 500 kg	25 % or 150 kg	75 %		301 to 3 000 lb	25 % or 300 lb	75 %
1 501 to 20 000 kg	12.5 % or 500 kg	50 %		3001 to 40 000 lb	12.5 % or 1 000 lb	50 %
20 001 kg+	12.5 % or 5 000 kg	25 %[3]		40 001 lb+	12.5 % or 10 000 lb	25 %[3]

Where practicable:

- Test weights to dial face capacity, 1000 d, or test load to used capacity, if greater than minimums specified.
- During initial verification, a scale should be tested to capacity.

[1] If the amount of test weight in Table 4 combined with the load on the scale would result in an unsafe condition, then the appropriate load will be determined by the official with statutory authority.

[2] The term "test load" means the sum of the combination of field standard test weights and any other applied load used in the conduct of a test using substitution test methods. Not more than three substitutions shall be used during substitution testing, after which the tolerances for strain load tests shall be applied to each set of test loads.

[3] The scale shall be tested from zero to at least 12.5 % of scale capacity using known test weights and then to at least 25 % of scale capacity using either a substitution or strain load test that utilizes known test weights of at least 12.5 % of scale capacity. Whenever practical, a strain load test should be conducted to the used capacity of the scale. When a strain load test is conducted, the tolerances apply only to the test weights or substitution test loads.

(Amended 1988, 1989, 1994, and 2003)

Note: GIPSA requires devices subject to their inspection to be tested to at least "used capacity," which is calculated based on the platform area of the scale and a weight factor assigned to the species of animal weighed on the scale. "Used capacity" is calculated using the formula:

Used Scale Capacity = Scale Platform Area × Species Weight Factor

Where species weight factor = 540 kg/m^2 (110 lb/ft^2) for cattle, 340 kg/m^2 (70 lb/ft^2) for calves and hogs, and 240 kg/m^2 (50 lb/ft^2) for sheep and lambs.

N.3.2. Field Standard Weight Carts. – Field Standard Weight Carts that comply with the tolerances expressed in Fundamental Considerations, paragraph 3.2. (i.e., one-third of the smallest tolerance applied) may be included as part of the minimum required test load (Also see Table 4. Minimum Test Weights and Test Loads.) for shift tests and other test procedures.

(Added 2004)

N.4. Coupled-in-Motion Railroad Weighing Systems. [3]

N.4.1. Weighing Systems Used to Weigh Trains of Less Than Ten Cars. – These weighing systems shall be tested using a consecutive-car test train consisting of the number of cars weighed in the normal operation run over the weighing system a minimum of five times in each mode of operation following the final calibration.

(Added 1990) (Amended 1992)

N.4.2. Weighing Systems Placed in Service Prior to January 1, 1991, and Used to Weigh Trains of Ten or More Cars. – The minimum test train shall be a consecutive-car test train of no less than ten cars run over the scale a minimum of five times in each mode of operation following final calibration.

(Added 1990) (Amended 1992)

N.4.3. Weighing Systems Placed in Service on or After January 1, 1991, and Used to Weigh Trains of Ten or More Cars.

(a) These weighing systems shall be tested using a consecutive-car test train of no less than ten cars run over

(b) if the official with statutory authority determines it necessary, the As-Used Test Procedures outlined in N.4.3.1. shall be used.

(Added 1990) (Amended 1992)

N.4.3.1. As-Used Test Procedures – A weighing system shall be tested in a manner that represents the normal method of operation and length(s) of trains normally weighed. The weighing systems may be tested using either a:

(a) consecutive-car test train of a length typical of train(s) normally weighed; or

(b) distributed-car test train of a length typical of train(s) normally weighed.

However, a consecutive-car test train of a shorter length may be used, provided that initial verification test results for the shorter consecutive-car test train agree with the test results for the distributed-car or full-length consecutive-car test train as specified in N.4.3.1.1. Initial Verification.

The official with statutory authority shall be responsible for determining the minimum test train length to be used on subsequent tests.

(Added 1990) (Amended 1992)

N.4.3.1.1. Initial Verification. – Initial verification tests should be performed on any new weighing system and whenever either the track structure or the operating procedure changes. If a consecutive-car test train of length shorter than trains normally weighed is to be used for subsequent verification, the shorter consecutive-car test train results shall be compared either to a distributed-car or to a consecutive-car test train of length(s) typical of train(s) normally weighed.

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[3] A test weight car that is representative of one of the types of cars typically weighed on the scale under test may be used wherever reference weight cars are specified.

(Added 1991)

The difference between the total train weight of the train(s) representing the normal method of operation and the weight of the shorter consecutive-car test train shall not exceed 0.15 %. If the difference in test results exceeds 0.15 %, the length of the shorter consecutive-car test train shall be increased until agreement within 0.15 % is achieved. Any adjustments to the weighing system based upon the use of a shorter consecutive-car test train shall be offset to correct the bias that was observed between the full-length train test and the shorter consecutive-car test train.

(Added 1990) (Amended 1992 and 1993)

N.4.3.1.2. Subsequent Verification. – The test train may consist of either a consecutive-car test train with a length not less than that used in initial verification, or a distributed-car test train representing the number of cars used in the normal operation.

(Added 1990)

N.4.3.1.3. Distributed-Car Test Trains.

(a) The length of the train shall be typical of trains that are normally weighed.

(b) The reference weight cars shall be split into three groups, each group consisting of ten cars or 10 % of the train length, whichever is less.

(Amended 1991)

(c) The test groups shall be placed near the front, around the middle, and near the end of the train.

(d) Following the final adjustment, the distributed-car test train shall be run over the scale at least three times or shall produce 50 weight values, whichever is greater.

(e) The weighing system shall be tested in each mode of operation.

(Added 1990) (Amended 1992)

N.4.3.1.4. Consecutive-Car Test Trains.

(a) A consecutive-car test train shall consist of at least ten cars.

(b) If the consecutive-car test train consists of between ten and twenty cars, inclusive, it shall be run over the scale a minimum of five times in each mode of operation following the final calibration.

(c) If the consecutive-car test train consists of more than twenty cars, it shall be run over the scale a minimum of three times in each mode of operation.

(Added 1990) (Amended 1992)

N.5. Uncoupled-in-Motion Railroad Weighing System. – An uncoupled-in-motion scale shall be tested statically before being tested in motion by passing railroad reference weight cars over the scale. When an uncoupled-in-motion railroad weighing system is tested, the car speed and the direction of travel shall be the same as when the scale is in normal use. The minimum in-motion test shall be three reference weight cars passed over the scale three times. The cars shall be selected to cover the range of weights that are normally weighed on the system and to reflect the types of cars normally weighed.

(Added 1993)

N.6. Nominal Capacity of Prescription Scales. – The nominal capacity of a prescription scale shall be assumed to be one-half apothecary ounce, unless otherwise marked. (Applicable only to scales not marked with an accuracy class.)

N.7. Weigh-in-Motion Vehicle Scale.

N.7.1. Static Testing. – A Weigh-in-Motion Vehicle Scale shall be tested statically, whenever possible, using field standard weights/test loads in accordance with Table 4, uniformly distributed on the scale platform. Additionally, for scale platforms with a length of less than 4 ft a test load not greater than one half of section capacity shall be positioned between the centerline and left and right side respectively. Scale platforms with a length of 4 ft or greater shall be tested in accordance with N.1.3.3.1. Class III L acceptance and maintenance tolerance as shown in Table 6. shall apply.

N.7.2. Dynamic Testing. – The Dynamic test for a Weigh-in-Motion-Vehicle Scale shall simulate the normal intended use as closely as possible (i.e., test as used). The minimum test shall consist of a vehicle(s), loaded with known field standards, dynamically weighed three consecutive times. The known field standards should then be unloaded and three additional dynamic weighments of the empty vehicle(s) should be recorded. Additionally, for scale platform widths greater than 11 ft, at least one of the loaded vehicle runs and empty vehicle runs shall be made near the left edge and right edge of the scale platform respectively. Class III L maintenance tolerance as shown in Table 6 shall apply to the known field test standards load minus the calculated value (loaded weight − unloaded weight = calculated value) the Table 6 tolerance values shall be based on the value of the known test load.

(Added 20XX)

T. Tolerances Applicable to Devices not Marked I, II, III, III L, or IIII

T.1. Tolerance Values.

T.1.1. General. – The tolerances applicable to devices not marked with an accuracy class shall have the tolerances applied as specified in Table T.1.1. Tolerances for Unmarked Scales.

(Amended 1990)

T.1.2. Postal and Parcel Post Scales. – The tolerances for postal and parcel post scales are given in Table T.1.1. Tolerances for Unmarked Scales and Table 5. Maintenance and Acceptance Tolerances for Unmarked Postal and Parcel Post Scales.

(Amended 1990)

Table T.1.1. Tolerances for Unmarked Scales

Type of Device	Subcategory	Minimum Tolerance	Acceptance Tolerance	Maintenance Tolerance	Decreasing-Load Multiplier[1]	Other Applicable Requirements
Vehicle, axle-load, livestock, railway track (weighing statically), crane, and hopper (other than grain hopper)		Class III L, T.N.3.1 (Table 6) and T.N.3.2.			1.0	T.N.2., T.N.3., T.N.4.1., T.N.4.2., T.N.4.3., T.N.4.4., T.N.5., T.N.7.2., *T.N.8.1.4.*[4], T.N.9.
Grain test scales	n ≤ 10 000 n > 10 000	Class III, T.N.3.1. (Table 6) and T.N.3.2. Class II, T.N.3.1. (Table 6) and T.N.3.2.			1.0	*T.N.8.1.4.*[4], T.N.9.
Railway track scales weighing in motion		T.N.3.6. except that for T.N.3.6.2. (a), no single error shall exceed four times the maintenance tolerance.			1.0	*T.N.8.1.4.*[4], T.N.9.
Monorail scales, in-motion		T.N.3.8.			1.0	*T.N.8.1.4.*[4], T.N.9.
Customer-operated bulk-weighing systems for recycled materials		± 5 % of applied material test load. Average error on 10 or more test loads ≤ 2.5 %.			1.0	*T.N.8.1.4.*[4], T.N.9.
Wheel-load weighers and portable axle-load scales	Tested individually or in pairs[2]	0.5 d or 50 lb, whichever is greater	1 % of test load	2 % of test load	1.5[3]	*T.N.8.1.4.*[4], T.N.9.
Prescription scales		0.1 grain (6 mg)	0.1 % of test load	0.1 % of test load	1.5	*T.N.8.1.4.*[4], T.N.9.
Jewelers' scales	Graduated	0.5 d	0.05 % of test load	0.05 % of test load	1.5	*T.N.8.1.4.*[4], T.N.9.
	Ungraduated	Sensitivity or smallest weight, whichever is less				
Dairy-product test scale	Loads < 18 g 18 g load	0.2 grain 0.2 grain	0.2 grain 0.3 grain	0.2 grain 0.5 grain	1.5	*T.N.8.1.4.*[4], T.N.9.
Postal and parcel post scales designed/used to weigh loads < 2 lb	Loads < 2 lb	15 grain, 1 g, 1/32 oz, 0.03 oz, or 0.002 lb	15 grain, 1 g, 1/32 oz, 0.03 oz, or 0.002 lb	15 grain, 1 g, 1/32 oz, 0.03 oz, or 0.002 lb	1.5	*T.N.8.1.4.*[4], T.N.9.
	Loads ≤ 2 lb	Table 5	Table 5	Table 5		
Other postal and parcel post scales		Table 5	Table 5	Table 5	1.5	*T.N.8.1.4.*[4], T.N.9.
All other scales (including grain hopper)	n > 5000	0.5 d or 0.05 % of scale capacity, whichever is less	0.05 % of test load	0.1 % of test load	1.5	T.N.2.5., T.N.4.1., T.N.4.2., T.N.4.3., T.N.5., T.N.7.2., *T.N.8.1.4.*[4], T.N.9.
	n ≤ 5000	Class III, T.N.3.1., Table 6 and T.N.3.2.			1.0	T.N.2., T.N.3., T.N.4.1., T.N.4.2., T.N.4.3., T.N.5., T.N.7.2., *T.N.8.1.4.*[4], T.N.9.

[1] The decreasing load test applies only to automatic indicating scales.
[2] If marked and tested as a pair, the tolerance shall be applied to the sum of the indication.
[3] The decreasing load test does not apply to portable wheel load weighers.
[4] *T.N.8.1.4. Operating Temperature. is nonretroactive and effective for unmarked devices manufactured as of January 1, 1981.*

(Table Added 1990; Amended 1992, 1993, and 2012)

Table 5.
Maintenance and Acceptance Tolerances for Unmarked
Postal and Parcel Post Scales

Scale Capacity (lb)	Test Loads (lb)	Maintenance Tolerance (±) (oz)	Maintenance Tolerance (±) (lb)	Acceptance Tolerance (±) (oz)	Acceptance Tolerance (±) (lb)
0 to 4, inclusive*	0 to 1, inclusive	1/32	0.002	1/32	0.002
	over 1	1/8	0.008	1/16	0.004
over 4*	0 to 7, inclusive	3/16	0.012	3/16	0.012
	7+ to 24, inclusive	3/8	0.024	3/16	0.012
	24+ to 30, inclusive	½	0.030	¼	0.015
	over 30	0.1 % of Test Load		0.05 % of Test Load	

*Also see Table T.1.1. Tolerances for Unmarked Scales for scales designed and/or used to weigh loads less than 2 lb.

T.2. Sensitivity Requirement (SR).

T.2.1. Application. – The sensitivity requirement (SR) is applicable to all nonautomatic-indicating scales not marked I, II, III, III L, or IIII, and is the same whether acceptance or maintenance tolerances apply.

T.2.2. General. – Except for scales specified in paragraphs T.2.3. Prescription Scales through T.2.8. Railway Track Scales: 2 d, 0.2 % of the scale capacity, or 40 lb, whichever is least.

T.2.3. Prescription Scales. 6 mg (0.1 grain).

T.2.4. Jewelers' Scales.

T.2.4.1. With One-Half Ounce Capacity or Less. – 6 mg (0.1 grain).

T.2.4.2. With More Than One-Half Ounce Capacity. – 1 d or 0.05 % of the scale capacity, whichever is less.

T.2.5. Dairy-Product Test Scales.

T.2.5.1. Used in Determining Butterfat Content. – 32 mg (0.5 grain).

T.2.5.2. Used in Determining Moisture Content. – 19 mg (0.3 grain).

T.2.6. Grain Test Scales. – The sensitivity shall be as stated in T.N.6. Sensitivity.
(Amended 1987)

T.2.7. Vehicle, Axle-Load, Livestock, and Animal Scales.

T.2.7.1. Equipped with Balance Indicators. – 1 d.

T.2.7.2. Not Equipped with Balance Indicators. – 2 d or 0.2 % of the scale capacity, whichever is less.

T.2.8. Railway Track Scales. – 3 d or 100 lb, whichever is less.

T.3. Sensitivity Requirement, Equilibrium Change Required.

The minimum change in equilibrium with test loads equal to the values specified in T.2. Sensitivity Requirements (SR) shall be as follows:

(a) **Scale with a Trig Loop but without a Balance Indicator. –** The position of rest of the weighbeam shall change from the center of the trig loop to the top or bottom, as the case may be.

(b) **Scale with a Single Balance Indicator and Having a Nominal Capacity of Less Than 250 kg (500 lb). –** The position of rest of the indicator shall change 1.0 mm (0.04 in) or one division on the graduated scale, whichever is greater.

(c) **Scale with a Single Balance Indicator and Having a Nominal Capacity of 250 kg (500 lb) or Greater. –** The position of rest of the indicator shall change 6.4 mm (0.25 in) or one division on the graduated scale or the width of the central target area, whichever is greater. However, the indicator on a batching scale shall change 3.2 mm (0.125 in) or one division on the graduated scale, whichever is greater.

(d) **Scale with Two Opposite-Moving Balance Indicators. –** The position of rest of the two indicators moving in opposite directions shall change 1.0 mm (0.04 in) with respect to each other.

(e) **Scale with Neither a Trig Loop nor a Balance Indicator. –** The position of rest of the weighbeam or lever system shall change from the horizontal, or midway between limiting stops, to either limit of motion.

T.N. Tolerances Applicable to Devices Marked I, II, III, III L, and IIII.

T.N.1. Principles.

T.N.1.1. Design. – The tolerance for a weighing device is a performance requirement independent of the design principle used.

T.N.1.2. Accuracy Classes. – Weighing devices are divided into accuracy classes according to the number of scale divisions (n) and the value of the scale division (d).

T.N.1.3. Scale Division. – The tolerance for a weighing device is related to the value of the scale division (d) or the value of the verification scale division (e) and is generally expressed in terms of d or e.

T.N.2. Tolerance Application.

T.N.2.1. General. – The tolerance values are positive (+) and negative (−) with the weighing device adjusted to zero at no load. When tare is in use, the tolerance values are applied from the tare zero reference (zero net weight indication); the tolerance values apply to the net weight indication for any possible tare load using certified test loads.

(Amended 2008)

T.N.2.2. Type Evaluation Examinations. – For type evaluation examinations, the tolerance values apply to increasing and decreasing load tests within the temperature, power supply, and barometric pressure limits specified in T.N.8.

T.N.2.3. Subsequent Verification Examinations. – For subsequent verification examinations, the tolerance values apply regardless of the influence factors in effect at the time of the conduct of the examination. (Also see G-N.2. Testing with Nonassociated Equipment.)

T.N.2.4. Multi-Interval and Multiple Range (Variable Division-Value) Scales. – For multi-interval and multiple range scales, the tolerance values are based on the value of the scale division of the range in use.

T.N.2.5. Ratio Tests. – For ratio tests, the tolerance values are 0.75 of the applicable tolerances.

T.N.3. Tolerance Values.

T.N.3.1. Maintenance Tolerance Values. – The maintenance tolerance values are as specified in Table 6. Maintenance Tolerances.

T.N.3.2. Acceptance Tolerance Values. – The acceptance tolerance values shall be one-half the maintenance tolerance values.

T.N.3.3. Wheel-Load Weighers and Portable Axle-Load Weighers of Class IIII. – The tolerance values are two times the values specified in T.N.3.1. Maintenance Tolerance Values and T.N.3.2. Acceptance Tolerance Values.

(Amended 1986)

T.N.3.4. Crane and Hopper (Other than Grain Hopper) Scales. – The maintenance and acceptance tolerances shall be as specified in T.N.3.1. Maintenance Tolerance Values and T.N.3.2. Acceptance Tolerance Values for Class III L, except that the tolerance for crane and construction materials hopper scales shall not be less than 1 d or 0.1 % of the scale capacity, whichever is less.

(Amended 1986)

Table 6.
Maintenance Tolerances
(All values in this table are in scale divisions)

Tolerance in Scale Divisions									
	1		**2**		**3**		**5**		
Class	**Test Load**								
I	0 -	50 000	50 001 -	200 000	200 001 +				
II	0 -	5 000	5 001 -	20 000	20 001 +				
III	0 –	500	501 -	2 000	2 001 -	4 000	4 001 +		
IIII	0 -	50	51 -	200	201 -	400	401 +		
III L	0 -	500	501 -	1 000	(Add 1 d for each additional 500 d or fraction thereof)				

T.N.3.5. Separate Main Elements: Load Transmitting Element, Indicating Element, Etc. – If a main element separate from a complete weighing device is submitted for laboratory type evaluation, the tolerance for the main element is 0.7 that for the complete weighing device. This fraction includes the tolerance attributable to the testing devices used.

(Amended 2015)

T.N.3.6. Coupled-In-Motion Railroad Weighing Systems. – The maintenance and acceptance tolerance values for the group of weight values appropriate to the application must satisfy the following conditions:

(Amended 1990 and 1992)

T.N.3.6.1. – For any group of weight values, the difference in the sum of the individual in-motion car weights of the group as compared to the sum of the individual static weights shall not exceed 0.2 %.

(Amended 1990)

T.N.3.6.2. – If a weighing system is used to weigh trains of five or more cars, and if the individual car weights are used, any single weight value within the group must meet the following criteria:

(a) no single error may exceed three times the static maintenance tolerance;

(b) not more than 5 % of the errors may exceed two times the static maintenance tolerance; and

(c) not more than 35 % of the errors may exceed the static maintenance tolerance.

(Amended 1990 and 1992)

T.N.3.6.3. – For any group of weight values wherein the sole purpose is to determine the sum of the group, T.N.3.6.1. alone applies.

(Amended 1990)

T.N.3.6.4. – For a weighing system used to weigh trains of less than five cars, no single car weight within the group may exceed the static maintenance tolerance.

(Amended 1990 and 1992)

T.N.3.7. Uncoupled-in-Motion Railroad Weighing Systems. – The maintenance and acceptance tolerance values for any single weighment within a group of non-interactive (i.e., uncoupled) loads, the weighment error shall not exceed the static maintenance tolerance.

(Amended 1992)

T.N.3.8. Dynamic Monorail Weighing System. – Acceptance tolerance shall be the same as the maintenance tolerance shown in Table 6. Maintenance Tolerances. On a dynamic test of twenty or more individual test loads, 10 % of the individual test loads may be in error, each not to exceed two times the tolerance. The error on the total of the individual test loads shall not exceed ± 0.2 %. (Also see Note in N.1.3.5.1. Dynamic Monorail Weighing Systems.) *For equipment undergoing type evaluation, a tolerance equal to one-half the maintenance tolerance values shown in Table 6. Maintenance Tolerances shall apply.*
[Nonretroactive January 1, 2002]

(Added 1986) (Amended 1999 and 2001)

T.N.3.9. Materials Test on Customer-Operated Bulk Weighing Systems for Recycled Materials. – The maintenance and acceptance tolerance shall be ± 5 % of the applied materials test load except that the average error on ten or more test materials test loads shall not exceed ± 2.5 %.

(Added 1986)

T.N.3.10. Prescription Scales with a Counting Feature. – In addition to Table 6. Maintenance Tolerances (for weight), the indicated piece count value computed by a Class I or Class II prescription scale counting feature shall comply with the tolerances in Table T.N.3.10. Maintenance and Acceptance Tolerances in Excess and in Deficiency for Count.

Table T.N.3.10.
Maintenance and Acceptance Tolerances
in Excess and in Deficiency for Count

Indication of Count	Tolerance (piece count)
0 to 100	0
101 to 200	1
201 or more	0.5 %

(Added 2003)

T.N.3.11. Tolerances for Substitution Test. – Tolerances are applied to the scale based on the substitution test load.

(Added 2003)

T.N.3.12. Tolerances for Strain-Load Test. – Tolerances apply only to the test weights or substitution test loads.

(Added 2003)

T.N.3.XX. Tolerances for Weigh in Motion Vehicle Scales.

T.N.3.XX.1. Static Weighing. – Acceptance tolerance shall be one-half maintenance tolerance.

T.N.3.XX.2. Dynamic Weighing. – Acceptance tolerance shall be the same as the maintenance tolerance shown in Table 6. Maintenance Tolerances.

(Added 20XX)

T.N.4. Agreement of Indications.

T.N.4.1. Multiple Indicating/Recording Elements. – In the case of a scale or weighing system equipped with more than one indicating element or indicating element and recording element combination, where the indicators or indicator/recorder combination are intended to be used independently of one another, tolerances shall be applied independently to each indicator or indicator/recorder combination.

(Amended 1986)

T.N.4.2. Single Indicating/Recording Element. – In the case of a scale or weighing system with a single indicating element or an indicating/recording element combination, and equipped with component parts such as unit weights, weighbeam and weights, or multiple weighbeams that can be used in combination to indicate a weight, the difference in the weight value indications of any load shall not be greater than the absolute value of the applicable tolerance for that load, and shall be within tolerance limits.

(Amended 1986)

T.N.4.3. Single Indicating Element/Multiple Indications. – In the case of an analog indicating element equipped with two or more indicating means within the same element, the difference in the weight indications for any load other than zero shall not be greater than one-half the value of the scale division (d) and be within tolerance limits.

(Amended 1986)

T.N.4.4. Shift or Section Tests. – The range of the results obtained during the conduct of a shift test or a section test shall not exceed the absolute value of the maintenance tolerance applicable and each test result shall be within applicable tolerances.

(Added 1986)

T.N.4.5. Time Dependence. – A time dependence test shall be conducted during type evaluation and may be conducted during field verification, provided test conditions remain constant.

(Amended 1989 and 2005)

T.N.4.5.1. Time Dependence: Class II, III, and IIII Non-Automatic Weighing Instruments. – A non-automatic weighing instrument of Classes II, III, and IIII shall meet the following requirements at constant test conditions. During type evaluation, this test shall be conducted at 20 °C ± 2 °C (68 °F ± 4 °F):

(a) When any load is kept on an instrument, the difference between the indication obtained immediately after placing the load and the indication observed during the following 30 minutes shall not exceed

0.5 e. However, the difference between the indication obtained at 15 minutes and the indication obtained at 30 minutes shall not exceed 0.2 e.

(b) If the conditions in (a) are not met, the difference between the indication obtained immediately after placing the load on the instrument and the indication observed during the following four hours shall not exceed the absolute value of the maximum permissible error at the load applied.

(Added 2005) (Amended 2006 and 2010)

T.N.4.5.2. Time Dependence: Class III L Non-Automatic Weighing Instruments. – A non-automatic weighing instrument of Class III L shall meet the following requirements:

(a) When any load is kept on an instrument, the difference between the indication obtained immediately after placing the load and the indication observed during the following 30 minutes shall not exceed 1.5 e. However, the difference between the indication obtained at 15 minutes and the indication obtained at 30 minutes shall not exceed 0.6 e.

(b) If the conditions in (a) are not met, the difference between the indication obtained immediately after placing the load on the instrument and the indication observed during the following four hours shall not exceed the absolute value of the maximum permissible error at the load applied.

(Added 2005) (Amended 2010)

T.N.4.5.3. Zero Load Return: Non-automatic Weighing Instruments. – A non-automatic weighing instrument shall meet the following requirements at constant test conditions. During type evaluation, this test shall be conducted at 20 °C ± 2 °C (68 °F ± 4 °F). The deviation on returning to zero as soon as the indication has stabilized, after the removal of any load which has remained on the instrument for 30 minutes shall not exceed:

(a) 0.5 e for Class II and IIII devices,

(b) 0.5 e for Class III devices with 4000 or fewer divisions,

(c) 0.83 e for Class III devices with more than 4000 divisions, or

(d) one-half of the absolute value of the applicable tolerance for the applied load for Class III L devices.

For a multi-interval instrument, the deviation shall not exceed 0.83 e_1 (where e_1 is the interval of the first weighing segment of the scale).

On a multiple range instrument, the deviation on returning to zero from Max_i (load in the applicable weighing range) shall not exceed 0.83 e_i (interval of the weighing range). Furthermore, after returning to zero from any load greater than Max_1 (capacity of the first weighing range) and immediately after switching to the lowest weighing range, the indication near zero shall not vary by more than e_1 (interval of the first weighing range) during the following five minutes.

(Added 2010)

T.N.4.6. Time Dependence (Creep) for Load Cells during Type Evaluation. – A load cell (force transducer) marked with an accuracy class shall meet the following requirements at constant test conditions:

(a) **Permissible Variations of Readings**. – With a constant maximum load for the measuring range (D_{max}) between 90 % and 100 % of maximum capacity (E_{max}), applied to the load cell, the difference between the initial reading and any reading obtained during the next 30 minutes shall not exceed the absolute value of the maximum permissible error (mpe) for the applied load. Also see Table T.N.4.6. Maximum Permissible Error (mpe) for Load Cells During Type Evaluation.) The difference between the reading obtained at 20 minutes and the reading obtained at 30 minutes shall not exceed 0.15 times the absolute

value of the mpe. (Also see Table T.N.4.6. Maximum Permissible Error (mpe) for Load Cells During Type Evaluation)

(b) **Apportionment Factors.** – The mpe for creep shall be determined from Table T.N.4.6. Maximum Permissible Error (mpe) for Load Cells During Type Evaluation using the following apportionment factors (pLC):

p_{LC} = 0.7 for load cells marked with S (single load cell applications),
p_{LC} = 1.0 for load cells marked with M (multiple load cell applications), and
p_{LC} = 0.5 for Class III L load cells marked with S or M.

(Added 2005, Amended 2006)

Table T.N.4.6.
Maximum Permissible Error (mpe)* for Load Cells During Type Evaluation

mpe in Load Cell Verifications Divisions (v) = p_{LC} × Basic Tolerance in v			
Class	**p_{LC} × 0.5 v**	**p_{LC} × 1.0 v**	**p_{LC} × 1.5 v**
I	0 - 50 000 v	50 001 v - 200 000 v	200 001 v +
II	0 - 5 000 v	5 001 v - 20 000 v	20 001 v +
III	0 - 500 v	501 v - 2 000 v	2 001 v +
IIII	0 - 50 v	51 v - 200 v	201 v +
III L	0 - 00 v	501 v - 1 000 v	(Add 0.5 v to the basic tolerance for each additional 500 v or fraction thereof up to a maximum load of 10 000 v)

v represents the load cell verification interval
p_{LC} represents the apportionment factors applied to the basic tolerance
p_{LC} = 0.7 for load cells marked with S (single load cell applications)
p_{LC} = 1.0 for load cells marked with M (multiple load cell applications)
p_{LC} = 0.5 for Class III L load cells marked with S or M
*mpe = p_{LC} × Basic Tolerance in load cell verifications divisions (v)

(Table Added 2005) (Amended 2006)

T.N.4.7. Creep Recovery for Load Cells During Type Evaluation. – The difference between the initial reading of the minimum load of the measuring range (D_{min}) and the reading after returning to minimum load subsequent to the maximum load (D_{max}) having been applied for 30 minutes shall not exceed:

(a) 0.5 times the value of the load cell verification interval (0.5 v) for Class II and IIII load cells;

(b) 0.5 times the value of the load cell verification interval (0.5 v) for Class III load cells with 4000 or fewer divisions;

(c) 0.83 times the value of the load cell verification interval (0.83 v) for Class III load cells with more than 4000 divisions; or

(d) 2.5 times the value of the load cell verification interval (2.5 v) for Class III L load cells.

(Added 2006) (Amended 2009 and 2011)

T.N.5. Repeatability. – The results obtained from several weighings of the same load under reasonably static test conditions shall agree within the absolute value of the maintenance tolerance for that load, and shall be within applicable tolerances.

T.N.6. Sensitivity. – This section is applicable to all nonautomatic-indicating scales marked I, II, III, III L, or IIII.

T.N.6.1. Test Load.

(a) The test load for sensitivity for nonautomatic-indicating vehicle, axle-load, livestock, and animal scales shall be 1 d for scales equipped with balance indicator, and 2 d or 0.2 % of the scale capacity, whichever is less, for scales not equipped with balance indicators.

(b) For all other nonautomatic-indicating scales, the test load for sensitivity shall be 1 d at zero and 2 d at maximum test load.

T.N.6.2. Minimum Change of Indications. – The addition or removal of the test load for sensitivity shall cause a minimum permanent change as follows:

(a) for a scale with trig loop but without a balance indicator, the position of the weighbeam shall change from the center to the outer limit of the trig loop;

(b) for a scale with balance indicator, the position of the indicator shall change one division on the graduated scale, the width of the central target area, or the applicable value as shown below, whichever is greater:

Scale of Class I or II: 1 mm (0.04 in),
Scale of Class III or IIII with a maximum capacity of 30 kg (70 lb) or less: 2 mm (0.08 in),
Scale of Class III, III L, or IIII with a maximum capacity of more than 30 kg (70 lb): 5 mm (0.20 in);

(c) for a scale without a trig loop or balance indicator, the position of rest of the weighbeam or lever system shall change from the horizontal or midway between limiting stops to either limit of motion.

(Amended 1987)

T.N.7. Discrimination.

T.N.7.1. Analog Automatic Indicating (i.e., Weighing Device with Dial, Drum, Fan, etc.). – A test load equivalent to 1.4 d shall cause a change in the indication of at least 1.0 d. (Also see N.1.5. Discrimination Test.)

T.N.7.2. Digital Automatic Indicating. – A test load equivalent to 1.4 d shall cause a change in the indicated or recorded value of at least 2.0 d. This requires the zone of uncertainty to be not greater than three-tenths of the value of the scale division. (Also see N.1.5.1. Digital Device.)

T.N.8. Influence Factors. – The following factors are applicable to tests conducted under controlled conditions only, provided that:

(a) types of devices approved prior to January 1, 1986, and manufactured prior to January 1, 1988, need not meet the requirements of this section;

(b) new types of devices submitted for approval after January 1, 1986, shall comply with the requirements of this section; and

(c) all devices manufactured after January 1, 1988, shall comply with the requirements of this section.

(Amended 1985)

T.N.8.1. Temperature. – Devices shall satisfy the tolerance requirements under the following temperature conditions:

T.N.8.1.1. If not specified in the operating instructions for Class I or II scales, or if not marked on the device for Class III, III L, or IIII scales, the temperature limits shall be: − 10 °C to 40 °C (14 °F to 104 °F).

T.N.8.1.2. If temperature limits are specified for the device, the range shall be at least that specified in Table T.N.8.1.2. Temperature Range by Class.

Table T.N.8.1.2.
Temperature Range by Class

Class	Temperature Range
I	5 ºC (9 °F)
II	15 ºC (27 °F)
III, III L, and IIII	30 ºC (54 °F)

T.N.8.1.3. Temperature Effect on Zero-Load Balance. – The zero-load indication shall not vary by more than:

(a) three divisions per 5 °C (9 °F) change in temperature for Class III L devices; or

(b) one division per 5 °C (9 °F) change in temperature for all other devices.

(Amended 1990)

T.N.8.1.4. Operating Temperature. – Except for Class I and II devices, an indicating or recording element shall not display nor record any usable values until the operating temperature necessary for accurate weighing and a stable zero balance condition have been attained.

T.N.8.2. Barometric Pressure. – Except for Class I scales, the zero indication shall not vary by more than one scale division for a change in barometric pressure of 1 kPa over the total barometric pressure range of 95 kPa to 105 kPa (28 in to 31 in of Hg).

T.N.8.3. Electric Power Supply.

T.N.8.3.1. Power Supply, Voltage and Frequency.

(a) Weighing devices that operate using alternating current must perform within the conditions defined in paragraphs T.N.3. Tolerance Values through T.N.7. Discrimination, inclusive, when tested over the range of − 15 % to + 10 % of the marked nominal line voltage(s) at 60 Hz, or the voltage range marked by the manufacturer, at 60 Hz.

(Amended 2003)

(b) Battery operated instruments shall not indicate nor record values outside the applicable tolerance limits when battery power output is excessive or deficient.

T.N.8.3.2. Power Interruption. – A power interruption shall not cause an indicating or recording element to display or record any values outside the applicable tolerance limits.

T.N.9. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility. – The difference between the weight indication due to the disturbance and the weight indication without the disturbance shall not exceed one scale division (d); or the equipment shall:

(a) blank the indication; or

(b) provide an error message; or

(c) the indication shall be so completely unstable that it cannot be interpreted, or transmitted into memory or to a recording element, as a correct measurement value.

The tolerance in T.N.9. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility is to be applied independently of other tolerances. For example, if indications are at allowable basic tolerance error limits when the disturbance occurs, then it is acceptable for the indication to exceed the applicable basic tolerances during the disturbance.

(Amended 1997)

UR. User Requirements

UR.1. Selection Requirements. – Equipment shall be suitable for the service in which it is used with respect to elements of its design, including but not limited to, its capacity, number of scale divisions, value of the scale division or verification scale division, minimum capacity, and computing capability.[4]

UR.1.1. General.

(a) For devices marked with a class designation, the typical class or type of device for particular weighing applications is shown in Table 7a. Typical Class or Type of Device for Weighing Applications.

(b) For devices not marked with a class designation, Table 7b. Applicable to Devices not Marked with a Class Designation applies.

Table 7a.
Typical Class or Type of Device for Weighing Applications

Class	Weighing Application or Scale Type
I	Precision laboratory weighing
II	Laboratory weighing, precious metals and gem weighing, grain test scales
III	All commercial weighing not otherwise specified, grain test scales, retail precious metals and semi-precious gem weighing, grain-hopper scales, animal scales, postal scales, vehicle on-board weighing systems with a capacity less than or equal to 30 000 lb, and scales used to determine laundry charges

[4] Purchasers and users of scales such as railway track, hopper, and vehicle scales should be aware of possible additional requirements for the design and installation of such devices.

(Footnote Added 1995)

Table 7a. Typical Class or Type of Device for Weighing Applications	
III L	Vehicle scales, ***weigh in motion vehicle scales,*** vehicle on-board weighing systems with a capacity greater than 30 000 lb, axle-load scales, livestock scales, railway track scales, crane scales, and hopper (other than grain hopper) scales
IIII	Wheel-load weighers and portable axle-load weighers used for highway weight enforcement
Note: A scale with a higher accuracy class than that specified as "typical" may be used.	

(Amended 1985, 1986, 1987, 1988, 1992, 1995, ~~and~~ 2012***, and 201X***)

Table 7b. Applicable to Devices Not Marked with a Class Designation	
Scale Type or Design	**Maximum Value of d**
Retail Food Scales, 50 lb capacity and less	1 oz
Animal Scales	1 lb
Grain Hopper Scales Capacity up to and including 50 000 lb Capacity over 50 000 lb	 10 lb (not greater than 0.05 % of capacity) 20 lb
Crane Scales	not greater than 0.2 % of capacity
Vehicle and Axle-Load Scales Used in Combination Capacity up to and including 200 000 lb Capacity over 200 000 lb	 20 lb 50 lb
Railway Track Scales With weighbeam Automatic indicating	 20 lb 100 lb
Scales with capacities greater than 500 lb except otherwise specified	0.1 % capacity (but not greater than 50 lb)
Wheel-Load Weighers	0.25 % capacity (but not greater than 50 lb)
Note: For scales not specified in this table, G-UR.1.1. and UR.1. apply.	

(Added 1985) (Amended 1989)

UR.1.2. Grain Hopper Scales. – Hopper scales manufactured as of January 1, 1986, that are used to weigh grain shall be Class III and have a minimum of 2000 scale divisions.

(Amended 2012)

UR.1.3. Value of the Indicated and Recorded Scale Division. *– The value of the scale division as recorded shall be the same as the division value indicated.*
[Nonretroactive as of January 1, 1986]

(Added 1985) (Amended 1999)

UR.1.3.1. Exceptions. – The provisions of UR.1.3. Value of the Indicated and Recorded Scale Division shall not apply to:

(a) Class I scales, or

(b) Dynamic monorail weighing systems when the value of d is less than the value of e.

(Added 1999)

UR.1.4. Grain-Test Scales: Value of the Scale Divisions. – The scale division for grain-test scales shall not exceed 0.2 g for loads through 500 g, and shall not exceed 1 g for loads above 500 g through 1000 g.

(Added 1992)

UR.1.5. Recording Element, Class III L Railway Track Scales. *– Class III L Railway Track Scales must be equipped with a recording element.*
[Nonretroactive as of January 1, 1996]

(Added 1995)

UR.1.6. Recording Element, Class III L Weigh In Motion Vehicle Scales. – Class III L Weigh In Motion Vehicle Scales must be equipped with a recording element.

(Added 20XX)

UR.2. Installation Requirements.

UR.2.1. Supports. – A scale that is portable and that is being used on a counter, table, or the floor shall be so positioned that it is firmly and securely supported.

UR.2.2. Suspension of Hanging Scale. – A hanging scale shall be freely suspended from a fixed support when in use.

UR.2.3. Protection from Environmental Factors. – The indicating elements, the lever system or load cells, and the load-receiving element of a permanently installed scale, and the indicating elements of a scale not intended to be permanently installed, shall be adequately protected from environmental factors such as wind, weather, and RFI that may adversely affect the operation or performance of the device.

UR.2.4. Foundation, Supports, and Clearance. – The foundation and supports of any scale installed in a fixed location shall be such as to provide strength, rigidity, and permanence of all components, and clearance shall be provided around all live parts to the extent that no contacts may result when the load-receiving element is empty, nor throughout the weighing range of the scale. An in-motion railway track scale is not required to provide clearance using rail gaps to separate the live rail portion of the weighing/load-receiving element from that which is not live if the scale is designed to be installed and operated using continuous rail. *On vehicle and livestock scales, the clearance between the load-receiving elements and the coping at the bottom edge of the platform shall be greater than at the top edge of the platform.**
*[*Nonretroactive as of January 1, 1973]*

(Amended 1985)

UR.2.5. Access to Weighing Elements. – Adequate provision shall be made for ready access to the pit of a vehicle, livestock, animal, axle-load, or railway track scale for the purpose of inspection and maintenance. Any of these scales without a pit shall be installed with adequate means for inspection and maintenance of the weighing elements.

(Amended 1985)

UR.2.6. Approaches.

UR.2.6.1. Vehicle Scales. *– On the entrance and exit end(s) of a vehicle scale, there shall be a straight approach as follows:*

(a) the width at least the width of the platform,

(b) the length at least one-half the length of the platform but not required to be more than 12 m (40 ft), and

(c) not less than 3 m (10 ft) of any approach adjacent to the platform shall be in the same plane as the platform. Any slope in the remaining portion of the approach shall ensure (1) ease of vehicle access, (2) ease for testing purposes, and (3) drainage away from the scale.

In addition to (a), (b), and (c), scales installed in any one location for a period of six months or more shall have not less than 3 m (10 ft) of any approach adjacent to the platform constructed of concrete or similar durable material to ensure that this portion remains smooth and level and in the same plane as the platform; however, grating of sufficient strength to withstand all loads equal to the concentrated load capacity of the scale may be installed in this portion.
[Nonretroactive as of January 1, 1976]

(Amended 1977, 1983, 1993, 2006, and 2010)

UR.2.6.2. Axle-Load Scales. – At each end of an axle-load scale there shall be a straight ~~paved~~ approach in the same plane as the platform. The approaches shall be the same width as the platform and of sufficient length to insure the level positioning of vehicles during weight determinations.

UR.2.6.3. Weigh in Motion Vehicle Scales. – At each end of a Weigh in Motion Vehicle Scale there shall be a straight approach in the same plane as the platform. The approaches shall be the same width as the platform and of sufficient length to insure the level positioning of vehicles during weight determinations. Both approaches shall be made of concrete or similar durable material (e.g., steel).
[Nonretroactive January X, XXXX]

(Added 201X)

UR.2.7. Stock Racks. – A livestock or animal scale shall be equipped with a suitable stock rack, with gates as required, which shall be securely mounted on the scale platform. Adequate clearances shall be maintained around the outside of the rack.

UR.2.8. Hoists. – On vehicle scales equipped with means for raising the load-receiving element from the weighing element for vehicle unloading, means shall be provided so that it is readily apparent to the scale operator when the load-receiving element is in its designed weighing position.

UR.2.9. Provision for Testing Dynamic Monorail Weighing Systems. *– Provisions shall be made at the time of installation of a dynamic monorail weighing systems for testing in accordance with N.1.3.5.1. Dynamic Monorail Weighing Systems (a rail around or other means for returning the test carcasses to the scale being tested).*
[Nonretroactive as of January 1, 1998]

(Added 1997) (Amended 1999)

UR.3. Use Requirements.

UR.3.1. Recommended Minimum Load. – A recommended minimum load is specified in Table 8 since the use of a device to weigh light loads is likely to result in relatively large errors.

Table 8.
Recommended Minimum Load

Class	Value of Scale Division (d or e*)	Recommended Minimum Load (d or e*)
I	equal to or greater than 0.001 g	100
II	0.001 g to 0.05 g, inclusive	20
	equal to or greater than 0.1 g	50
III	All**	20
III L	All	50
IIII	All	10

*For Class I and II devices equipped with auxiliary reading means (i.e., a rider, a vernier, or a least significant decimal differentiated by size, shape or color), the value of the verification scale division "e" is the value of the scale division immediately preceding the auxiliary means. For Class III and IIII devices the value of "e" is specified by the manufacturer as marked on the device; "e" must be less than or equal to "d."

**A minimum load of 10 d is recommended for a weight classifier marked in accordance with a statement identifying its use for special applications.

(Amended 1990)

UR.3.1.1. Minimum Load, Grain Dockage Determination. – When determining the quantity of foreign material (dockage) in grain, the weight of the sample shall be equal to or greater than 500 scale divisions.
(Added 1985)

UR.3.2. Maximum Load. – A scale shall not be used to weigh a load of more than the nominal capacity of the scale.

UR.3.2.1. Maximum Loading for Vehicle Scales. – A vehicle scale shall not be used to weigh loads exceeding the maximum load capacity of its span as specified in Table UR.3.2.1. Span Maximum Load.
(Added 1996)

Note: UR.3.2.1. is not applicable to Weigh In Motion Vehicle Scales.

(Added 20XX)

Table UR.3.2.1.
Span Maximum Load

Distance in Feet Between the Extremes of any Two or More Consecutive Axles	Ratio of CLC to Maximum Load ("r" factor) Carried on Any Group of Two or More Consecutive Axles.							
	2 axles	3 axles	4 axles	5 axles	6 axles	7 axles	8 axles	9 axles
4[1]	1.000							
5[1]	1.000							
6[1]	1.000							
7[1]	1.000							
8 and less[1]	1.000	1.000						
More than 8[1]	1.118	1.235						
9	1.147	1.257						
10	1.176	1.279						
11	1.206	1.301						
12	1.235	1.324	1.471	1.632				
13	1.265	1.346	1.490	1.651				
14	1.294	1.368	1.510	1.669				
15	1.324	1.390	1.529	1.688	1.853			
16	1.353	1.412	1.549	1.706	1.871			
17	1.382	1.434	1.569	1.724	1.888			
18	1.412	1.456	1.588	1.743	1.906			
19	1.441	1.478	1.608	1.761	1.924			
20	1.471	1.500	1.627	1.779	1.941			
21	1.500	1.522	1.647	1.798	1.959			
22	1.529	1.544	1.667	1.816	1.976			
23	1.559	1.566	1.686	1.835	1.994			
24	1.588	1.588	1.706	1.853	2.012	2.176		
25	1.618	1.610	1.725	1.871	2.029	2.194		
26		1.632	1.745	1.890	2.047	2.211		
27		1.654	1.765	1.908	2.065	2.228		
28		1.676	1.784	1.926	2.082	2.245	2.412	
29		1.699	1.804	1.945	2.100	2.262	2.429	
30		1.721	1.824	1.963	2.118	2.279	2.445	
31		1.743	1.843	1.982	2.135	2.297	2.462	
32		1.765	1.863	2.000	2.153	2.314	2.479	2.647
33			1.882	2.018	2.171	2.331	2.496	2.664
34			1.902	2.037	2.188	2.348	2.513	2.680
35			1.922	2.055	2.206	2.365	2.529	2.697
36			2.000[2]	2.074	2.224	2.382	2.546	2.713
37			2.000[2]	2.092	2.241	2.400	2.563	2.730
38			2.000[2]	2.110	2.259	2.417	2.580	2.746
39			2.000	2.129	2.276	2.434	2.597	2.763
40			2.020	2.147	2.294	2.451	2.613	2.779
41			2.039	2.165	2.312	2.468	2.630	2.796
42			2.059	2.184	2.329	2.485	2.647	2.813
43			2.078	2.202	2.347	2.502	2.664	2.829
44			2.098	2.221	2.365	2.520	2.681	2.846

INSTRUCTIONS:

1. Determine the scale's CLC.

2. Count the number of axles on the vehicle in a given span and determine the distance in feet between the first and last axle in the span.

3. Multiply the CLC by the corresponding multiplier in the table.*

4. The resulting number is the scale's maximum concentrated load for a single span based on the vehicle configuration.

* note and formula on next page.

Table UR.3.2.1.
Span Maximum Load

Distance in Feet Between the Extremes of any Two or More Consecutive Axles	Ratio of CLC to Maximum Load ("r" factor) Carried on Any Group of Two or More Consecutive Axles.							
	2 axles	3 axles	4 axles	5 axles	6 axles	7 axles	8 axles	9 axles
45			2.118	2.239	2.382	2.537	2.697	2.862
46			2.137	2.257	2.400	2.554	2.714	2.879
47			2.157	2.276	2.418	2.571	2.731	2.895
48			2.176	2.294	2.435	2.588	2.748	2.912
49			2.196	2.313	2.453	2.605	2.765	2.928
50			2.216	2.331	2.471	2.623	2.782	2.945
51			2.235	2.349	2.488	2.640	2.798	2.961
52			2.255	2.368	2.506	2.657	2.815	2.978
53			2.275	2.386	2.524	2.674	2.832	2.994
54			2.294	2.404	2.541	2.691	2.849	3.011
55			2.314	2.423	2.559	2.708	2.866	3.028
56			2.333	2.441	2.576	2.725	2.882	3.044
57			2.353[3]	2.460	2.594	2.742	2.899	3.061
58				2.478	2.612	2.760	2.916	3.077
59				2.496	2.629	2.777	2.933	3.094
60				2.515	2.647	2.794	2.950	3.110

***Note:** This table was developed based upon the following formula. Values may be rounded in some cases for ease of use.

$$W = r \times 500\left[\left(\frac{LN}{N-1}\right) + 12N + 36\right]$$

[1] Tandem Axle Weight.
[2] Exception – These values in the third column correspond to the maximum loads in which the inner bridge dimensions of 36, 37, and 38 ft are considered to be equivalent to 39 ft. This allows a weight of 68 000 lb on axles 2 through 5.
[3] Corresponds to the Interstate Gross Weight Limit.

UR.3.3. Single-Draft Vehicle Weighing. – A vehicle or a coupled-vehicle combination shall be commercially weighed on a vehicle scale only as a single draft. That is, the total weight of such a vehicle or combination shall not be determined by adding together the results obtained by separately and not simultaneously weighing each end of such vehicle or individual elements of such coupled combination. However, the weight of:

(a) a coupled combination may be determined by uncoupling the various elements (tractor, semitrailer, trailer), weighing each unit separately as a single draft, and adding together the results; or

(b) a vehicle or coupled-vehicle combination may be determined by adding together the weights obtained while all individual elements are resting simultaneously on more than one scale platform.

Note: This paragraph does not apply to ***weigh-in-motion vehicle scales,*** highway-law-enforcement scales and scales used for the collection of statistical data.

(Added 1992) **(Amended 20XX)**

UR.3.4. Wheel-Load Weighing.

UR.3.4.1. Use in Pairs. – When wheel-load weighers or portable axle-load weighers are to be regularly used in pairs, both weighers of each such pair shall be appropriately marked to identify them as weighers intended to be used in combination.

UR.3.4.2. Level Condition. – A vehicle of which either an axle-load determination or a gross-load determination is being made utilizing wheel-load weighers or portable axle-load weighers, shall be in a reasonably level position at the time of such determination.

UR.3.5. Special Designs. – A scale designed and marked for a special application (such as a prepackaging scale or prescription scale with a counting feature) shall not be used for other than its intended purpose.[5]

(Amended 2003)

UR.3.6. Wet Commodities. – Wet commodities not in watertight containers shall be weighed only on a scale having a pan or platform that will drain properly.

(Amended 1988)

UR.3.7. Minimum Load on a Vehicle Scale *or Weigh in Motion Vehicle Scale*. – A vehicle scale ***or weigh in motion vehicle scale*** shall not be used to weigh net loads smaller than:

(a) 10 d when weighing scrap material for recycling or weighing refuse materials at landfills and transfer stations; and

(b) 50 d for all other weighing.

As used in this paragraph, scrap materials for recycling shall be limited to ferrous metals, paper (including cardboard), textiles, plastic, and glass.

(Amended 1988, 1992, ~~and~~ 2006**, and 20XX**)

UR.3.8. Minimum Load for Weighing Livestock. – A scale with scale divisions greater than 2 kg (5 lb) shall not be used for weighing net loads smaller than 500 d.

(Amended 1989)

UR.3.9. Use of Manual Weight Entries. – Manual gross or net weight entries are permitted for use in the following applications only when:

(a) a point-of-sale system interfaced with a scale is giving credit for a weighed item;

(b) an item is pre-weighed on a legal for trade scale and marked with the correct net weight;

(c) a device or system is generating labels for standard weight packages;

(d) postal scales or weight classifiers are generating manifests for packages to be picked up at a later time; or

(e) livestock and vehicle scale ***or weigh-in-motion vehicle scale*** systems ***that*** generate weight tickets to correct erroneous tickets.

(Added 1992) (Amended 2000 and 2004) **(Amended 20XX)**

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[5] Prepackaging scales and prescription scales with a counting feature (and other commercial devices) used for putting up packages in advance of sale are acceptable for use in commerce only if all appropriate provisions of NIST Handbook 44 are met. Users of such devices must be alert to the legal requirements relating to the declaration of quantity on a package. Such requirements are to the effect that, on the average, the contents of the individual packages of a particular commodity comprising a lot, shipment, or delivery must contain at least the quantity declared on the label. The fact that a prepackaging scale may overregister, but within established tolerances, and is approved for commercial service is not a legal justification for packages to contain, on the average, less than the labeled quantity.

(Amended 2003)

UR.3.10. Dynamic Monorail Weighing Systems. – When the value of d is different from the value of e, the commercial transaction must be based on e.

(Added 1999)

UR.3.11. Minimum Count. – A prescription scale with an operational counting feature shall not be used to count a quantity of less than 30 pieces weighing a minimum of 90 e.

(Added 2003)

Note: The minimum count as defined in this paragraph refers to the use of the device in the filling of prescriptions and is different from the minimum sample piece count as defined in S.1.2.3. and as required to be marked on the scale by S.6.6.

(Note Added 2004)

UR.3.12. Correct Stored Piece Weight. – For prescription scales with a counting feature, the user is responsible for maintaining the correct stored piece weight. This is especially critical when a medicine has been reformulated or comes from different lots.

(Added 2003)

UR.4. Maintenance Requirements.

UR.4.1. Balance Condition. – The zero-load adjustment of a scale shall be maintained so that, with no load on the load-receiving element and with all load-counterbalancing elements of the scale (such as poises, drop weights, or counterbalance weights) set to zero, the scale shall indicate or record a zero balance condition**.**. A scale not equipped to indicate or record a zero-load balance shall be maintained in balance under any no-load condition.

UR.4.2. Level Condition. – If a scale is equipped with a level-condition indicator, the scale shall be maintained in level.

UR.4.3. Scale Modification. – The dimensions (e.g., length, width, thickness, etc.) of the load receiving element of a scale shall not be changed beyond the manufacturer's specifications, nor shall the capacity of a scale be increased beyond its design capacity by replacing or modifying the original primary indicating or recording element with one of a higher capacity, except when the modification has been approved by a competent engineering authority, preferably that of the engineering department of the manufacturer of the scale, and by the weights and measures authority having jurisdiction over the scale.

(Amended 1996)

UR.5. Coupled-in-Motion Railroad Weighing Systems. – A coupled-in-motion weighing system placed in service on or after January 1, 1991, should be tested in the manner in which it is operated, with the locomotive either pushing or pulling the cars at the designed speed and in the proper direction. The cars used in the test train should represent the range of gross weights that will be used during the normal operation of the weighing system. Except as provided in N.4.2. Weighing Systems Placed in Service Prior to January 1, 1991, and Used to Weigh Trains of Ten or More Cars and N.4.3.(a) Weighing Systems Placed in Service on or After January 1, 1991, and Used to Weigh Trains of Ten or More Cars, normal operating procedures should be simulated as nearly as practical. Approach conditions for a train length in each direction of the scale site are more critical for a weighing system used for individual car weights than for a unit-train-weights-only facility, and should be considered prior to installation.

(Added 1990) (Amended 1992)

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