Comments on Block 2 items for 2020 and Items SCL-20-10 and SCL-20.11
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January 21, 2020

1. Comments on Block 2 items:

A. After listening to the Cannabis Work Group at the 2019 Annual Meetings, I had an "aha" moment where I clearly saw the problems addressed in Block 2. Generating the fixes was simply a matter of looking back at R76 to see what got lost in translation. I prepared two YouTube video presentations to help explain the Block 2 items. The first video is titled "What is the Verification Scale Division, e."

You can view the video at: https://youtu.be/J2Ihh5IyX74

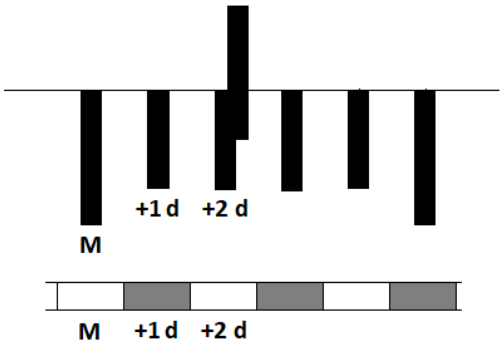
The first part of this video explains that our long-held idea that e was part of the instrument display is problematic and is essentially a shortcut. The problem with shortcuts is that they fail to work outside of a set framework. That framework is that e must have the same value as d. If e = 10d, people tried to ignore d and "verify e." The first problem is that we don't verify e or d, we verify the instrument indication, which is made up of all the divisions between zero and the current indication. Second, you find that the digit to the left of the differentiated d is not normally rounded. That's because the break point for this "e" at zero occurs at -9.5 d and + 9.5 d. This makes the zero 1.9 e wide. This fails to conform with S.1.1.1.(a) which requires the zero to be +/- 0.5 division. It also means the center of every e away from zero is offset by that extra 4.5 d (0.45 e).

Another indication of the problem with our understanding of e is revealed when considering the ungraduated instrument, i.e. the equal-arm balance. We immediately see that this instrument has no d's, but it does have e's! R76 handles this very adeptly, but HB44 has large problems. First, HB44 requires the marking of d, without exception. An equal-arm balance has no d's to mark. In R76, where e is the primary classification marking, the equal-arm balance is marked, as all other instruments, with class, Max, Min, and e. If the equal-arm balance has no divisions, then e cannot be part of the instrument scale. The correct explanation is that e is defining the division of the "true value" scale, hence the name "verification" scale division. The point is that e is a tool in verification. It is not the object of verification, i.e. not the "verified" scale division.

The second part of this video addresses digital rounding, see proposed addition of N.1.12. (Note OWM staff pointed out this is a typo and should be N.1.13. since N.1.12. is already used. In discussing Block 2 with NIST OWM staff, they expressed confusion on this issue. They helped me see that I omitted an important definition in my proposal. I propose to correct that omission by offering the R76 definition from T.5.4.3. as follows:

Rounding error of digital indication. – The difference between the indication and the result the instrument would give with analog indication.

Without the requirement to eliminate digital rounding error we create an inequality between analog and digital instruments. In the top part of the figure, we are looking at an analog indication where the tolerance is 2 d. We consider this instrument out-of-tolerance since the index (coming down from the top) unambiguously indicates greater than +2 d error. However, the corresponding digital indication (bottom part) will not be out-of-tolerance until the error exceeds 2.5 d and shows M+3d indication.



Note that the analog indication has some ambiguity resulting from the width of the graduations and the index. This natural ambiguity is parallel to the R76 requirement to eliminate (reduce) the rounding error to at least 0.2 e. In the figure, that is about where the index is drawn, to about +2.2d.

I suggest we have two choices regarding digital rounding error.
Option 1: to require elimination of digital rounding error as R76 does it and as proposed in Block 2, or
Option 2: to apply tolerances to analog indications only after the reading has been rounded to the closest graduation.

Applying Option 2 to the graphic, results in this instrument passing since the rounded value is +2d and is therefore in tolerance. This would provide equity between analog and digital indications without eliminating rounding error. There are problems though, since this is not what we understand the tolerance values to mean, and NTEP has exclusively used Option 1 for all evaluations ever conducted. I stress that this is an all or nothing choice. You can't have it both ways and fulfill basic tenets of HB44. Either the half-d rounding error on all instruments is part of the tolerance or it is not!

Error weights have always been a means to resolve the issue of tolerance compliance, even though it is not supported by the code. If the inspector does not eliminate rounding error, the tolerance is increased by 0.5 d. A proper understanding of high-resolution instruments also allows us to reduce digital rounding when e – 5 d or e = 10 d. I heard comments that it would be a burden to field officials to have to always use error weights. My proposal does not require the inspector to eliminate rounding error in all tests, just those where the inspector chooses. Since our tests are pass-fail, the elimination only need be done in a case near the tolerance limit. Since we typically fail from 5 to 10% of instruments tested, the number of cases where rounding error has to be eliminated will be small.

B. The second YouTube video is titled: "Additional Thoughts Re: What is the Verification Scale Division, e?"

You can view the video at: https://youtu.be/bM9sYdkUnGs

The first part of this video explains the negative consequences of thinking of e as part of the instrument indication. I show how the current interpretation of Table 6. Tolerances cannot be deduced from the text. I show that we are presently enforcing R76 and not what is written in HB44! In addition, I show that Table 8. Minimum Load, and even Table 3. Parameters for Accuracy Classes are confusing because the differences between e and d are blurred in HB44. I show that R76 is not blurred, since e and d are independent of each other and are regulated differently.

In the second part of the video, I explore Table 8. and the general subject of minimum load by comparing R76 and HB44. I make an important connection between Table 8 and Table 3 showing that the two tables need to parallel each other (but presently don't in HB44). I show the resulting minimum loads where e = d (where the shortcut works) are identical. However, when e ≠ d, and the shortcut falls apart, we find HB44 differs significantly from R76 in three out of the three possible cases.

I would like the items in this Block to move forward this year but recognize the challenge in communication. I welcome the formation of a work group to address these items and would like to contribute. That work group should not only address the specific proposals in the Block but undertake the challenge of revising how we train officials to understand the Scales Code to avoid the confusion that largely prompted the cannabis work group.

2. Comments on SCL-20-10 and SCL-20-11: The use of high-resolution instruments in commerce is not just a Scales Code issue. We need to look for parallels in other codes and see that HB44 has a principled approach. I prepared a third video doing that.

You can view the video at: https://youtu.be/FTqEwS-jt00

The commercial marketplace has a place for instruments with varying levels of resolution. Once we disconnect e and d, we can see that d in many applications is not the same as e. There are low-resolution instruments (d > e). normal-resolution instruments (d ~ e), and high-resolution instruments (d < e). Using examples of instruments used in commerce I show that there are valid reasons to use high-resolution instruments in commerce.

Specific to SCL-20.10, I support the move to repeal S.1.2.2.2. and S.1.2.2.3. I think the reasons to allow these instruments in commerce are set clearly out in the third video. High-resolution instruments in Class I or II applications, with the proposed change, would only affect jeweler's and cannabis applications. I see no benefit to using high-resolution for prescription applications.

Specific to SCL-20.11, I have commented that this paragraph should be a user requirement rather than a specification. In the proposal, I see no justification to limit the use of high-resolution instruments of Class I or II to only jeweler's scales. Why would it be OK to sell gold chains at $30/gram on a e = 0.1 g and d = 0.01 g, yet not appropriate for cannabis or other similarly priced commodities? I favor the NY proposal of eliminating the paragraph entirely.

Further, I note that high-resolution instruments had been available and legal from 1986 to 2018 when the current S.1.2.2.2. took effect. Where was the problem in that time period? High-resolution instruments are a bit more expensive than an e = d model, but you increase the weighing range by a factor of 10 as a reward and get smaller pricing increments. Users are not going to choose the higher priced instrument unless they see a benefit.

The confusion surrounding high-resolution instruments, in my opinion, never affected buyers or sellers. I have yet to hear a concrete reason why the differentiated digit somehow makes the instrument unsuitable for commerce. The confusion was solely on the part of the W&M officials. It is my hope that the information provided in my three videos will help officials better understand the code and help them realize jeweler's and cannabis applications are very appropriate for these instruments.