January 6, 2018

Comments on Block 3 Items SCL-3 and OTH-1

Submitted by Henry Oppermann
Weights and Measures Consulting

Position: I am opposed to these proposals. The proposals should be **withdrawn**, because:

- They undermine the foundation of accuracy classes; and
- They would result in larger and more frequent measurement errors in the weighing of trucks.

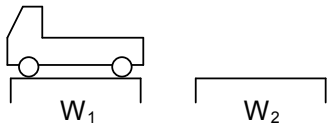
Discussion:

Conflict with Accuracy Classes

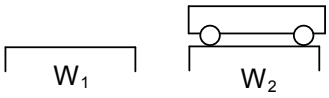
Accuracy classes for scales were established in OIML R76 and adopted into Handbook 44 to establish relationships between accuracy classes, the number of divisions within each accuracy class, and the sizes of scale divisions within each accuracy class. Briefly stated, (a) the higher the accuracy class, the greater the accuracy of the scale; (b) the more divisions a scale has for a given accuracy class, the more accurate the scale has to be (Class III L is the exception to this rule); and (c) with a given accuracy class, the scale with a smaller scale division is more accurate than scales of the same accuracy class with the same number of divisions, but with larger scale divisions.

A basic principle of weights and measures regulation is that scales used in commercial transactions must be accurate within acceptable limits. To address this concept, the Scales Code establishes the minimum levels of accuracy for scales that are used for different commercial transactions. For vehicle scales, the scales must be at least Class III L. The submitter claims that the three-platform weighing system is not a scale, which is incorrect. The weighing system weighs highway vehicles (trucks), which falls within the Handbook 44 definition of a vehicle scale. The definition of a vehicle scale depends upon what a scale or weighing system does (i.e., it weighs trucks). The definition does not depend upon how the scale is designed (i.e., one platform or three platforms or whether the total weight is from a single weight display or summed from three separate weight displays). If the exemptions are adopted, the summed weight indication would typically exceed the number of scale divisions permitted for a Class III L scale. Hence, the three-platform weighing system would not fit within the accuracy class categories. **OIML does not allow this.** See the diagram below.

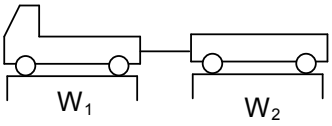
Multi-plate weighbridge with one indicator:



W1 = 30 t x 10 kg



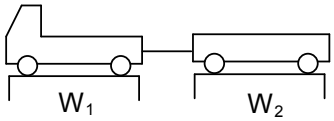
W2 = 30 t x 10 kg



W1+2 = 60 t x 20 kg

W1+2 is a weighing range (Compatibility of modules and mpe must be satisfied for it)

The configuration of two weighbridges, each with its own indicator, is not considered to be acceptable when used in the following manner:



(See also Sections 3.1.2 and 3.1.533)

Suppose that the three-platform weighing system consists of three separate scales that have capacities of 100 000 x 20 lb, 100 000 x 20 lb and 150 000 x 20 lb. The summed weight display would have a capacity of 350 000 x 20 lb, for which n = 17 500. This exceeds the maximum for a Class III L scale. Based upon Table 3, Parameters for Accuracy Classes, the scale should meet the tolerances for a Class II scale. The scale cannot meet these tighter tolerances. This violates the concept of the accuracy classes.

The following example is an even worse case, but there isn't anything to prevent this type of weighing system to be installed if the exemptions are adopted. Suppose that the three-platform weighing system consists of three separate scales that have capacities of 50 000 x 5 lb, 100 000 x 10 lb and 150 000 x 20 lb. The summed weight display would have a capacity of 300 000 x 5 lb, for which n = 60 000. This gives the impression that the scale can weigh a 300 000-lb load with an accuracy on the order of 5 lb. This is unacceptable and would return the U.S. market to the uncontrolled competitive marketplace for truck scales that existed before the accuracy classes were adopted. This should not be allowed.

Unfair Competition and Weighing Errors

Weights and measures requirements and enforcement practices should promote fair competition among manufacturers of measuring equipment. Scales used in the same application should be required to meet the same requirements. Requirements in Handbook 44 should not favor one manufacturer over another. Scales Code paragraph T.N.1.1. specifically states that the tolerance is a performance requirement that is independent of the design principle used in the scale. OIML

R76 (2006 Edition) 2.2 has a broader scope on this concept (i.e., all requirements apply, not just performance requirements regardless of design) and states, "The requirements apply to all instruments irrespective of their principles of measurement."

The proposed changes, if adopted, would mean that the three weighing elements of the three-platform scale would be treated as independent scales and not as part of a single weighing system. Hence, T.N.4.4. would apply to each independent scale as a separate entity, but would not apply to the entire weighing system. Therefore, the sections of each individual scale need to agree only with the other sections in the individual scales, but there isn't any requirement for agreement with the sections of the other scales that comprise the weighing system. However, a vehicle scale consisting of only one platform must have all sections agree within the tolerance over the entire length of the weighing platform for the trucks. Consequently, the proposed exemption would result in different performance requirements being applied to scales used in the same application. **This is NOT fair competition.** The same requirements should apply to all scales used in the same application. **The proposed exemption conflicts with T.N.1.1.**

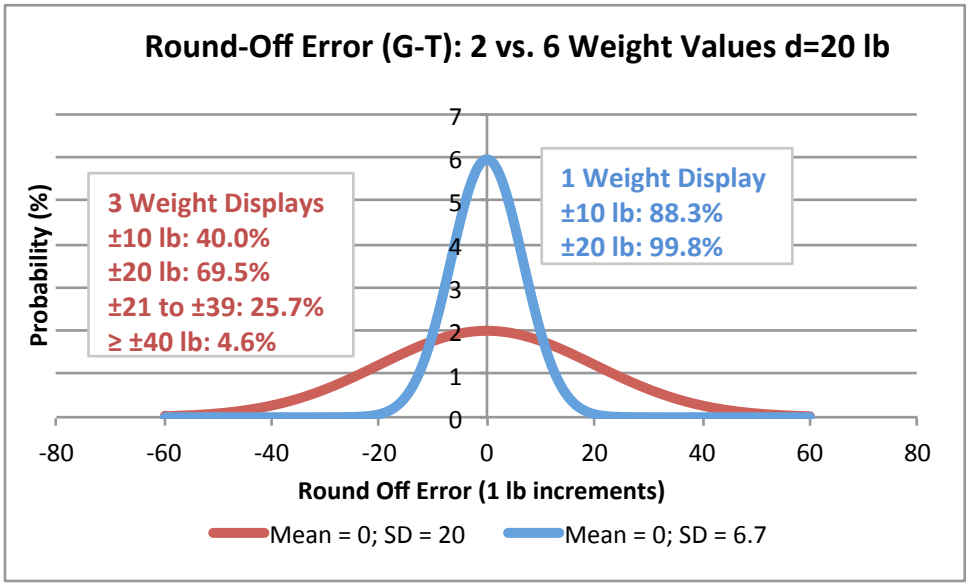
This lack of agreement among sections would result in larger weighing errors in commercial measurement. Suppose that the first scale has two sections and all of the errors for an 80 000-lb load is at the limit of maintenance tolerance of +160 lb. Suppose that the second scale has zero error at 80 000 lb, but the third scale has errors of -160 lb at 80 000 lb for all sections. These errors would be acceptable under the proposed changes. Hence, there could be difference among sections from one end of the scale to the other of 320 lb. However, a single platform vehicle scale would have to agree within 160 lb over the entire length of the vehicle scale. This regulatory approach is unfair and should not be allowed. If the weighing system consisting of the three scales is required to comply with T.N.4.4. as a single weighing system, as currently required under Handbook 44, then all sections both the single platform scale and the three-platform scale have to agree within 160 lb. **This is the only reasonable way to apply the requirement.** Although weighing loaded highway trucks would distribute an 80 000-lb load over the three platforms, this example illustrates that the weighing errors associated with weighing trucks would be greater if the changes proposed in these two items are adopted, rather than to require the sections of all three scales to agree when treated as a single weighing system.

The rounding errors when summing three digital weight indications are significantly larger than for a scale with a single weight display. When a truck is weighed on a weighing system comprised of three scales, each digital weight indication is rounded to the nearest 20 lb, i.e., each weight indication has a potential round off error of ±10 lb. As a result, the summed total weight display has a potential for a rounding error of ±30 lb. Since the net weight of the truck is usually determined by weighing the gross weight and tare weight of the vehicle, both the gross and tare weight each have a potential round off error of ±30 lb. Consequently, the net weight of the load has a potential round off error of ±60 lb. For a vehicle scale with one digital weight display, the total potential round off error for the net weight is ±20 lb.

Realistically, one must look at the distribution of the gross and tare weights that are rounded off to the nearest 20 lb. The chart below shows the normal distributions of the round off errors of the net weights to the nearest 20 lb, when calculated in 1-lb increments. For a truck scale with a single digital weight display, the table in the chart for a single weight indicator shows that 88.3%

of the net weights will have round off errors of 10 lb or less. None of the round off errors for the net weight will exceed ±20 lb. On the other hand, the vehicle scale with three digital weight displays that are summed to get the total gross and tare weights (from which the net weight is computed), only 40% of the net weight values will have round off errors of ±10 lb or less. Only 69.5% of the net weights will have round of errors of ±20 lb or less. There will be 4.6% of the net weights that have round off errors of 40 lb or more.

The question can be raised as to whether or not mathematically summed weight values comply with G-S.5.2.2.(c), since the rounding error associated with the total weights of the trucks on the scale often exceed 0.5d. In other words, the total weight of the truck is not rounded to the nearest scale division, since the rounding error often exceeds 10 lb.



In conclusion, if the proposed exemptions for the summed digital weight indication are adopted, the errors when weighing trucks would be larger than when the three-platform scale is treated as a single weighing system. The proposed changes conflict with the objectives of the accuracy classes for scales. These items should be withdrawn.