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Device Just Calibrated – Acceptance Tolerances Apply, Right?

By Rick Harshman

Which NIST Handbook 44 (Specifications, Tolerances, and Other Technical Requirements for Weighing Devices) tolerances (acceptance or maintenance) would apply if you were testing a commercial weighing or measuring device that had been in service more than 30 days, that was not under official rejection for failing to conform to performance requirements, and for which the device owner acknowledged that a service agency had just calibrated the device the week before? Would your answer to this question be any different if you learned that the service agency had calibrated the device within the last 24 hours? How about just prior to your arrival? You might be surprised to learn that not only is the answer the same in each of these instances – but also that the correct answer is "maintenance tolerances." Now consider another scenario. What if the official test was being conducted by a service agency (i.e., you were present only to witness the official test and take action based upon the results of the service agency's test) and during the course of the test, the service technician performing the test elected to make an adjustment to bring the performance errors closer to zero value. With the understanding that a complete retest would then be needed, might this affect which tolerances would apply to the results of that retest? WMD frequently receives inquiries relative to the proper application of tolerances as they relate to equipment that has recently undergone adjustment. This article will outline a few of the more common scenarios and explain which tolerances apply to them and why.

Tolerances that apply to recently calibrated devices being tested by field officials

While it may seem logical that acceptance tolerances would apply to all devices being officially tested immediately following completion of accuracy adjustments (or perhaps even within 30 days of completion of accuracy adjustments), this is not the case. NIST Handbook 44 (HB-44) paragraphs G-T.1. and G-T.2. specify the conditions in which acceptance and maintenance tolerances are to be applied. According to paragraph G-T.1., the only time the more stringent acceptance tolerances would apply to a device that had been in service for more than 30 days would be if that device were being tested within 30 days following corrective service after being officially rejected for failure to perform to performance requirements or within 30 days after major reconditioning or overhaul. Paragraph G-T.2 specifies that maintenance tolerances apply to equipment in actual use, except as provided in G-T.1. Thus, maintenance tolerances apply in cases where:

- officials are conducting performance tests on devices that have been in service for more than 30 days, and
- those devices are not being officially tested for the first time within 30 days of corrective service following official rejection for failing to perform to performance requirements.

This is true regardless of when the performance of those devices was last adjusted.

G-T.1. Acceptance Tolerances. - Acceptance tolerances shall apply to:

(a) equipment to be put into commercial use for the first time;
(b) equipment that has been placed in commercial service within the preceding 30 days and is being officially tested for the first time;
(c) equipment that has been returned to commercial service following official rejection for failure to conform to performance requirements and is being officially tested for the first time within 30 days after corrective service;
(d) equipment that is being officially tested for the first time within 30 days after major reconditioning or overhaul; and
(e) equipment undergoing type evaluation.
(Amended 1989)

G-T.2. Maintenance Tolerances. - Maintenance tolerances shall apply to equipment in actual use, except as provided in G-T.1.

There are those who sometimes take the position that acceptance tolerances should be applied to such "already in-service" and "recently calibrated" devices. To support their position, they are often quick to point out that when equipment is adjusted; those making the adjustments must bring performance errors as close as practical to zero value as required by HB-44 paragraph G-UR.4.3. They justify the application of acceptance tolerances to such devices by concluding that these devices are required to be calibrated to within at least acceptance tolerances in order to satisfy this requirement.

G-UR.4.3. Use of Adjustments. - Weighing elements and measuring elements that are adjustable shall be adjusted only to correct those conditions that such elements are designed to control, and shall not be adjusted to compensate for defective or abnormal installation or accessories or for badly worn or otherwise defective parts of the assembly. Any faulty installation conditions shall be corrected, and any defective parts shall be renewed or suitably repaired, before adjustments are undertaken. Whenever equipment is adjusted, the adjustments shall be so made as to bring performance errors as close as practicable to zero value.

While it may often be true that the same adjustments which bring performance errors as close as practical to zero value also cause some devices to perform to within acceptance tolerances, this is not always the case, nor was this the intent of paragraph G-UR.4.3. To prove this point, consider a device with mechanical weighing or measuring elements (e.g., liquid meters, scale levers, etc.). While in relatively new condition, minor adjustments and periodic maintenance may be all that's needed to maintain accuracy to within acceptance tolerances. However, as time passes and mechanical parts (e.g., seals, pivots, bearings, etc.) wear from regular use, this higher level of accuracy may no longer be achievable simply by making minor adjustments and performing regular maintenance. At some point in time, parts will become worn to the extent that performance errors cannot be adjusted to within acceptance tolerances, yet the device can still be adjusted and accuracy maintained to within maintenance tolerances. Once in this condition, the device is still considered suitable for commercial use and it would not be appropriate to require it be adjusted to within acceptance tolerances. Doing so would create an unnecessary financial burden on the device owner because to achieve the higher level of accuracy, parts would most likely need to be replaced or the device overhauled. This example demonstrates why two sets of tolerances were established in HB-44. Acceptance tolerances were intended to apply to new and recently reconditioned equipment and to equipment that is retested within 30 days of corrective service after being officially rejected for failure to conform to performance requirements. Maintenance tolerances include a limited allowance for the effects of normal wear on the accuracy of a device that is properly selected, installed, used, and maintained while still ensuring an acceptable degree of accuracy for commercial service. Thus, two sets of tolerances were established to minimize the cost of adjustment, recalibration, repair, and replacement to the owner of a commercial device.

Tolerances that apply to recently calibrated devices being officially tested by service agencies (witnessed by field officials)

So are the rules of applying tolerances any different when the official test of a device is being conducted by a service agency and only witnessed by an official? In some jurisdictions, service agencies conduct official tests on certain types of devices while officials in those jurisdictions often witness those tests and take action based upon their results. In some cases, the weights and measures jurisdiction may not have adequate equipment to conduct a complete test on certain kinds of devices and must rely on the service agency to provide the necessary equipment and perform the official test. Service personnel may voluntarily contact the weights and measures jurisdiction to arrange for an official to witness their test, which may be part of a regular maintenance agreement that the service agency has negotiated with the device owner.

With respect to the application of tolerances, the rules are the same regardless of whether a service agency or an official is performing the official test. However, if the service agency's test of a device is to be considered an official test, i.e., one in which the official witnessing and directing the test will either certify (by approval) or reject the device based upon the results of test, the official should apply the appropriate tolerances outlined in either paragraphs G-T.1. or G-T.2. as if he were conducting the test. In addition, the official witnessing the test must make certain that at least the minimum test procedures outlined in the NIST Examination Procedure Outline (EPO) applicable to that device type have been completed. Otherwise, the test should not be considered an official test and no action should be taken on the results of test by the official. Note that if no EPO has been developed for the type of device being tested, a minimum official test must include all of the procedures listed in the notes section of the particular HB-44 device code applicable to the device being tested.

When adjustments are made to correct an out-of-tolerance condition

If the service agency's test is considered an official test, there are only two possible outcomes regarding device performance. Either the device performs to within tolerances or it doesn't. If the results of the service agency's initial test exceed maintenance tolerances (for devices that have been in service for more than 30 days and are not currently under official rejection for failing to conform to performance requirements and being retested within 30 days after corrective service), the official witnessing the test should immediately consider and record that the device is rejected. To alleviate any misunderstandings, officials should, upon witnessing tolerances being exceeded during the test, make the service agency aware of the rejected status of the device and point out that any adjustments made must now bring performance errors as close as practicable to zero value and return accuracy to within at least acceptance tolerances. Since corrective service will need to be performed, acceptance tolerances apply to any retest performed within 30 days of that service.

When adjustments are made to bring "in-tolerance" results as close to zero error as practicable

However, if the results of the initial test are within maintenance tolerances, the device should be considered approved (providing it conforms to all other HB-44 requirements), yet, it is this scenario where officials are encouraged to exercise caution. Because the service agency's test of a device often serves two purposes, one purpose being part of the maintenance agreement the service agency has negotiated with the device owner, and the other purpose being the official test of the device, technicians will often want to make an adjustment to return performance errors as close as practicable to zero value. If adjustments are made, a complete retest of the device must be performed before it can be approved. However, because the device was never in a rejected status, maintenance tolerances would still apply to the results of the retest even though the performance of the device had just been adjusted. Be aware that whenever a technician makes an adjustment, they are required to adjust as specified in paragraph G-UR. 4.3. Use of Adjustments.

In conclusion, the rules for applying maintenance and acceptance tolerances are the same regardless of whom (an official or service agency) is performing the official test on a commercial weighing or measuring device. It's important that service personnel and officials witnessing tests conducted by service personnel understand and agree on the significance of the tests that are performed. Officials, whether conducting the test themselves or witnessing others conducting tests, must only take action on official tests, i.e., complete tests conducted in accordance with NIST EPO's and HB-44. For more information regarding the application of HB-44 tolerances, contact Rick Harshman at 301-975-8107 or by email at richard.harshman@nist.gov.