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The Importance of Using Error Weights in Strain-Load Testing

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In the strain-load test of a scale, an unknown quantity of material or objects is applied to the load-receiving element of a scale to establish a reference load to which test weights are then added. The strain-load test is used to determine the accuracy of a portion of the total weighing range of a scale. Field personnel frequently utilize strain-load tests when testing large capacity scales so that accuracy can be verified in the weighing ranges where many of these scales are typically used. Strain-load tests are also frequently utilized when the amount of test weight available for testing is less than the minimum test loads required under Table 4 of the Scales Code in NIST Handbook 44.

To properly perform a strain-load test, error weights should be used to determine a reference point for the unknown load prior to adding the test weights to complete the test. Failure to determine a specific reference point using error weights can cause unacceptable errors in the performance results of this particular test. WMD frequently receives inquires regarding the use of error weights in testing scales. The paragraphs below describe procedures for conducting strain-load tests, including procedures for determining necessary reference points, on scales having beam and digital indication.

Using Error Weights on a Beam Scale

During normal use of a beam scale, loads are weighed by balancing the weighbeam to within the smallest graduation employed on any of the weighbars. However, balancing a beam to within the smallest graduation on a weighbar seldom causes a true balance condition. Instead, scale users are normally placed in the position having to choosing the poise settings that most correctly balance a beam. Oftentimes, one setting will cause the beam to rise beyond true balance while the next higher setting will cause the beam to remain below true balance. When strain-load testing a scale having a beam indication, the beam must be precisely balanced with the unknown load applied to the platform before the test weights are added to complete the test. Error weights are used in conjunction with poise settings to precisely balance the weighbeam with the unknown load applied. Proper balancing of the beam using error weights establishes the needed reference for completing this test. The procedure for conducting a strain-load test on a beam scale is as follows:

1. At zero load, balance in an amount of error weight equal to the maximum tolerance value applicable to the total of all test weights that will be used in the strain-load testing of the scale.
2. Apply the unknown load and slide the poises on the various weighbars to positions that cause the beam to become balanced to within the closest minimum graduation on the weighbar having the smallest size graduation.
3. Precisely balance the beam by adding or removing error weights from the platform in increments of 0.1d.

4. Total the amount of error weight on the platform and make note of it. The total amount of error weight and unknown load on the platform represents your reference point for the strain-load test.
5. Total the values of all poise settings and record the total on the inspection report, identifying the value as the weight of the unknown load.
6. Apply known test weights in predetermined increments or all at one time.
7. Add the reference weight of the unknown load to the value of the applied test weights and adjust the poises on the weighbars to equal the sum.
8. Properly balance the beam by adjusting the amount of error weight on the platform.
9. Determine the amount of error in the scale by totaling the amount of error weight on the platform and subtracting from it the amount used to balance the beam with the unknown load applied (reference amount from step 4).

After performance results have been determined and recorded for all of the test weights, remove the test weights and the unknown load from the platform. Verify that the scale returns to the initial zero-load balance by returning the amount of error weight initially added to the platform in step 1.

Using Error Weights on a Digital Scale

To perform the strain-load test on a scale having digital indications, error weights are used to establish, as a reference point, the center of the displayed division representing the unknown load. Once the center of the displayed division has been established, test weights can then be added and scale errors determined by direct reading of the indication. The procedure for conducting a strain-load test on a scale having digital indications is as follows:

1. Apply 10 error weights, each having a value of 0.1d, to the platform and zero the scale.
2. Apply the unknown load. Record the displayed value and identify it as the weight of the unknown load.
3. Remove error weights from the platform in 0.1d increments until the indication just begins flashing to the next lower division.
4. In a separate location on the platform begin a second group of error weights by adding back all of the error weights that were just removed in the previous step.
5. Continue adding additional error weights to this second group in 0.1d until the displayed indication just begins flashing to the next higher division.
6. Total the error weight in the second group and remove one-half of it from the platform. Doing so places the indication at the proper reference, i.e., in the center of the displayed division and properly establishes your reference point for the strain-load test.
7. Apply known test weights in predetermined increments or all at one time.
8. Add the weight of the unknown load (determined in step 2) to the value of the known test weights applied.
9. Scale error is determined by subtracting the summed value from step 8 from the displayed indication.

After performance results have been determined and recorded for all of the test weights, return weights equal to one division to the scale platform, remove the known test weights and the unknown load, and verify that the scale returns to zero.

It's important to note that for strain-load tests, tolerances are applied only to the known test weights or other known load portions (i.e., substitution loads) of the total test load.

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