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Use of Fuel Error Weights on NIST HB 105-8-Compliant Weight Carts

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NIST Handbook (HB) 105-8 is available for download at www.nist.gov/labmetrology. This new handbook requires 0.5-lb error weights to be added to the weight cart as the fuel level drops from the calibrated reference level. Use of these error weights is required with many large-capacity scale calibrations for the test standards to comply with the requirements of NIST Handbook 44, Appendix A (*Fundamental Considerations*), section 3.2. HB 44 requires the uncorrected error of standards to be less than one-third of the smallest tolerance tested.

NIST HB 105-8 was written so that weight cart users would be able to comply with the *Fundamental Considerations*. Part of the compliance was gained by the use of error weights to replace the weight of burned fuel during a scale calibration. A routine test of a 20-lb/div scale to maintenance tolerances requires that the error in the standard not exceed 6.666 lb in the first 500 d. An acceptance test in this case requires a maximum error in the standard of 3.333 lb in the first 500 d. One could say, "On a 20-lb/div scale, the error caused by fuel used cannot be seen." However, would that test load, having an 8-lb error, comply with the fundamental considerations? Possibly not! With the new fuel tank design required by HB 105-8, the maximum error due to consumed fuel will be less than 8 lb, since the fuel tank will hold a maximum of one gallon and the fuel weighs less than 8 lb/gal. It takes a minimum test load change of 10 lb to cause the scale indication to change by one division, so an error of 8 lb is not likely to be indicated by the scale. This test load will not comply if the scale tolerance is one scale division or less (acceptance test).

There are many sources of potential error in large-capacity scale testing, some of which are difficult to quantify. Controllable errors must be minimized. One error source that can be controlled is the error caused by burned fuel. A 0.5-lb error weight is added to the weight cart to replace each 0.5 lb of fuel burned as indicated on the fuel tank scale plate. If a weight cart is properly maintained so that errors caused by fluid levels (other than fuel) and contamination are kept to a minimum, the maximum error in the weight cart portion of the test load is held to less than 0.5 lb. This means that compliance with the Fundamental Considerations is now more likely for the test load. NOTE: When the weight cart is refueled, error weights equal to the weight of the replaced fuel must be removed from the weight cart to maintain the calibrated weight.

The use of fuel error weights may seem insignificant, but compliance with the Fundamental Considerations is a requirement, not something 'nice to have', and each source of error that can be eliminated or minimized makes compliance that much easier to achieve. Proper use of error weights to compensate for consumed fuel is a simple way of limiting test load error.