TECHNICAL REPORT

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Copper, lead and zinc sulfide concentrates — Step-by-step procedure for the testing of static scales

Concentrés sulfurés de cuivre, de plomb et de zinc — Procédure pas à pas pour les essais des bascules statiques

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Foreword

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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ISO/TR 15855, was prepared by Technical Committee ISO/TC 183, *Copper, lead and zinc ores and concentrates*.

Copper, lead and zinc sulfide concentrates — Step-by-step procedure for the testing of static scales

1 Scope

This Technical Report outlines simple procedures to check the performance and calibration status of static scales. The test sequence is intended for routine applications, generating results which can be used to calculate explicit scale performance parameters (precision, bias and linearity) in accordance with the relevant equations shown in ISO 12745, *Copper, lead and zinc ores and concentrates — Precision and bias of mass measurement techniques*. It is stressed that the basic procedures described below do not replace comprehensive technical manuals published by National Weights and Measures authorities to comply with legal and other specific requirements.

2 General Information

ISO 12745 provides a general summary of testing principles and procedures for weighbridges (in 5.3), hopper scales (in 5.4), gantry scales (in 5.5) and platform scales (in 5.6), augmented by a list of test mass categories in clause 6.

Weighbridges, hopper and platform scales represent the most common systems encountered in the context of concentrate mass determinations for commercial consignments. Although the principles of testing are similar, details vary depending on the availability and number of certified weights and the level of automation (in the case of hopper scales having built-in reference weights).

3 Frequency of testing

The frequency of in-house and routine scale performance tests (in addition to mandatory certification intervals stipulated by regulatory authorities) observed in practice ranges from none to as high as three times per consignment in the case of some fully automated weighing hopper installations. The disparity reflects the absence of explicit guidelines as well as different risk perceptions and available resources. Routine scale performance checks carried out once per commercial consignment, before the loading or discharge commences, are regarded as an optimum requirement by many operators. However, it is practically impossible to carry out such checks once per commercial consignment, because the tests cause delays in loading or discharge and are very expensive. In addition, improved stability of scales in recent times should allow reduced frequency of testing. It is therefore recommended that the frequency of testing be decided by agreement between the parties concerned, based on the risk and the reliability of the scales.

4 Precision test procedures

4.1 General

Although precision tests do not require certified test weights, it is stressed that they provide no information concerning potential bias or linearity problems.

4.2 Determining the precision of weighbridges by replicate tests

a) Check, and if necessary, adjust the zero setting of the scale.

b) Place a truck or rail wagon (selected at random) on the weighbridge and record the gross weight W_1.

c) Remove the truck or wagon from the weighbridge and check/adjust the zero setting again.

d) Place the same truck or rail wagon [from step b)] on the weighbridge and record the gross weight W_2.

A minimum of four duplicate determinations (four data pairs W_1, W_2) are recommended in order to calculate the scale precision, in accordance with ISO 12745.

4.3 Determining the precision of hopper scales by replicate tests

a) Check and, if necessary, adjust the zero setting of the scale.

b) Use a test mass of about five to ten times the scale's readability or sensitivity (e.g. 25 kg for a scale sensitivity of 5 kg) to produce paired weight measurements with and without this test mass respectively, and record the corresponding gross weights W_1 and W_2.

A minimum of six data pairs (W_1, W_2) from a single weighing cycle are recommended in order to calculate the scale precision, in accordance with ISO 12745.

5 Calibration (bias and linearity test) procedures

5.1 General

Bias and linearity tests require at least one certified reference weight of suitable mass (1 t or 2 t). In the case of hopper scales, the weight or weights are usually suspended from the weigh frame.

The use of a large number of smaller reference weights (for example a set of 100 individually certified test weights of 20 kg each, in accordance with the requirements of National Weights and Measures authorities) is a suitable alternative, especially where the entire test sequence has to be performed manually.

5.2 Calibration procedure using a single certified test weight

This procedure applies to situations where only one certified test weight (or set of small weights having an equivalent total mass) covering a small part of the scale's designated range is available. Individual calibration points at increasing initial loads are generated by adding the certified test weight W_{cert} at a given load state W_0 and comparing the expected scale reading $W_1 = W_{\text{cert}} + W_0$ to the observed value W_2. The scale deviation at a given point is thus given by $W_2 - W_1$.

A minimum of three determinations is recommended, and one test each at initial loads of: zero; approximately half the scale capacity; approximately full scale capacity less the certified weight.

a) Check and, if necessary, adjust the zero setting of the scale.

b) Place the certified test weight on the scale and record the first calibration point (data pair) W_1, W_2.

c) Remove the certified test weight, add a quantity of material of approximately equal to half the scale capacity, and record the exact weight.

d) Add the certified test weight to the scale and record the second calibration point, W_1, W_2.

e) Remove the certified test weight, add a further quantity of material to produce a total approximately equal to half the scale capacity, and record the exact weight.

f) Add the certified test weight to the scale and record the third calibration point W_1, W_2.

5.3 Calibration procedure using a set of certified test weights

This procedure applies to situations where a set of certified test weights covering the scale's entire designated range is available. Individual calibration points over the full range are generated by the incremental addition or subtraction of individual test weights, comparing the expected (certified) weight W_1 at each stage with the corresponding scale readout W_2. The scale deviation at a given point is calculated as $W_2 - W_1$ as in 5.2.

a) Check and, if necessary, adjust the zero setting of the scale.

b) Place the first certified test weight on the scale and record the first calibration point (data pair) W_1, W_2.

c) Add the second certified test weight to the scale and record the second calibration point W_1, W_2.

d) Repeat step c) for the third and subsequent test weight in the series.

e) Remove the individual test weights, one at a time, and record the resulting data pairs, W_1, W_2 as well as the final readout at zero load.

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