

1 Calibration, Inspection, and Weight of a weighing instrument (balance) <G1-7-182>

3 (はかり(天秤)の校正, 点検と分銅 <G1-7-182>)

4
5 In the periodic calibration (including calibration when a
6 device is introduced/installed) to evaluate that a balance used
7 satisfies the required performance, it is necessary to obtain
8 calibration results that include uncertainties for the weights
9 used as the standard of mass and for a balance used as a meas-
10 uring device for the purpose of ensuring traceability to the
11 international system of units (SI). To ensure the validity of
12 calibration results, it is necessary that the calibration is per-
13 formed in compliance with the international technical guide-
14 lines (ISO/IEC 17025, etc.), and it is recommended to obtain
15 a properly documented calibration certificate accordingly.

16 The weight that conforms to the Japan Industrial Standards
17 (JIS B 7609)¹⁾ and has nominal value or precision grade that
18 meets the requirements for a balance should be selected. In
19 some cases, it is enough to use only the nominal value of the
20 weight for inspection, but in the cases, the maximum allow-
21 able error determined by the indicated value and precision
22 grade of the weight should not exceed one-third of the ac-
23 ceptance criterion for accuracy (trueness). Or, when the con-
24 ventional mass value of the weight for inspection (mass value
25 when the density of the weight at 20°C is regarded as 8000
26 kg/m³, and the density of air is regarded as 1.2 kg/m³) is con-
27 sidered, the expanded uncertainty of the calibration should
28 not exceed one-third of the acceptance criterion. When mul-
29 tiple weights are used for inspection, it is necessary to sum
30 up the uncertainties of calibration of the weights, and the sum
31 should not exceed one-third of the acceptance criterion. In the
32 inspection of eccentricity and repeatability, it is not specified
33 to use a calibrated weight, but it should be ensured that the
34 mass of the weight does not change during inspection.

35 In the inspection using an external weight, it is ensured that
36 a balance meets the specifications required. Inspection of a
37 balance must be performed based on each standard operating
38 procedure, and the frequency and interval of inspections dif-
39 fer depending on the risks associated with the test method and
40 weighing. The adjustment of sensitivity error by automati-
41 cally or manually operation using an internal weight can be
42 partially replaced with inspection using an external weight.

43 The table below shows check items, method for determi-
44 nation, and acceptance criterion for each device characteristic
45 for a balance.

Character- istic	Check item	Method for determination	Acceptance criterion
Sensitiv- ity error	Deviation be- tween mass value and indi- cated value of a weight	A value obtained by dividing the differ- ence between the mass value of weight around the balance's	Not more than 0.05%

		capacity and the indi- cated value by the mass value of the weight	
Linearity error	Deviation be- tween the mass value and indi- cated value over the entire speci- fication range	The maximum value of deviation between the mass value and indicated value of a weight at each point, which was obtained by dividing the spec- ification range (from zero point to the maximum weight point) into 3 to 6 points	Not more than 0.05%
Eccen- tricity error	Deviation be- tween the mass value and indi- cated value when weighing is performed at a position devi- ated from the center of the weighing pan	The maximum value of deviation between the mass value and indicated value of weights when they are placed at the cen- ter and the four cor- ners of the weighing pan. At that time, the mass values of the weights should be not less than 30% of the balance's capac- ity.	Not more than 0.05%
Repeata- bility	Degree of con- sistency of indi- cated values when a same sample was re- peatedly weighed in a short time under the same condi- tions (proce- dures, operator, place, etc.)	Calculate from the standard deviation of indicated values ob- tained by loading and unloading a weight, whose weight is not less than 100 mg and about 5% of the bal- ance's capacity, not less than 10 times.	Not more than 0.10%

46 Among balances used for proving trade certification, the
47 reference weight used for the verification and testing of a
48 specified measuring instrument cannot be used for the check
49 of accuracy (trueness) of the balance used by the JP because
50 it is not a weight traceable to the international system of units
51 (SI) in that results not including the valuation of the calibra-
52 tion with evaluation of uncertainties in the inspection of the
53 reference weight.

54 References

- 55 1) International Recommendation OIML R111-1:2004;
56 The Japanese Standards Association, JIS B 7609:2008,
57 Weights