Electronic Balance Inspection Protocol

1. Documentation

The purpose of this standard is to stipulate procedures and tolerances in inspection that is performed at installation of electronic balances or inspection that is performed periodically.

2. Scope

This standard shall apply to inspection of electronic balances performed by service engineers at Shimadzu's overseas sales companies or distributors. Note, however that this standard is a recommended standard laid down by the Weighing Instrument Group, Quality Assurance Department, Analytical & Measuring Instruments Division, Shimadzu Corporation. If the party requesting the inspection specifies different standards, they shall be given preference.
This standard shall not apply to inspection of Type Approval Models laid down in OIML R76.

3. Reference Documentation

ZF4A-6009 Electronic Balance Inspection Record

4. Related Documentation

OIML R76-1 Nonautomatic weighing instruments Part 1

5. Classification and Inspection Tolerances

1) Before inspecting electronic balances, determine the classification of instruments and the inspection tolerances (maximum permissible errors).
2) Determine the classification by the minimum number of display digits d and weighing capacity of the electronic balance, and set the inspection tolerances according to the determined classification. To be more specific, this shall be in accordance with Tables 1 and 2.
3) For dual-range electronic balances (multiple range instruments), set the classification and inspection tolerances for each range.
4) For electronic balances having an extended or auxiliary indicating device, the display on the extended indicating device or auxiliary indicating device shall be regarded as minimum number of display digits d.

Table 1. Classification of Instruments

Minimum number of display digits **d**	Largest number of minimum number of display digits d = weighing capacity/d			
	≤5,000	≤50,000	≤500,000	>500,000
1 g	4	3	2	1
0.1 g	4	3	2	1
0.01 g	3	3	2	1
0.001 g	2	2	2	1
0.0001 g	2	2	2	1
≤0.00001 g	AA	AA	AA	AA

Table 2. Maximum Permissible Errors

Classification	Load expressed by minimum number of display digits d = load value/minimum number of display digits d								
	≤500	≤2,000	≤5,000	≤20,000	≤50,000	≤200,000	≤500,000	≤2,000,000	>2,000,000
4	±5d	±10d	±15d						
3	±5d			±10d	±15d				
2	±5d					±10d	±15d		
1	±5d							±10d	±15d
AA	±10d							±20d	±30d

6. Inspection Procedure

6-1. External Appearance and Functions

There shall be no abnormalities in the external appearance and functions of the following and otherwise:

1) LCD Display 2) Level Gauge 3) Level Adjuster 4) TARE function

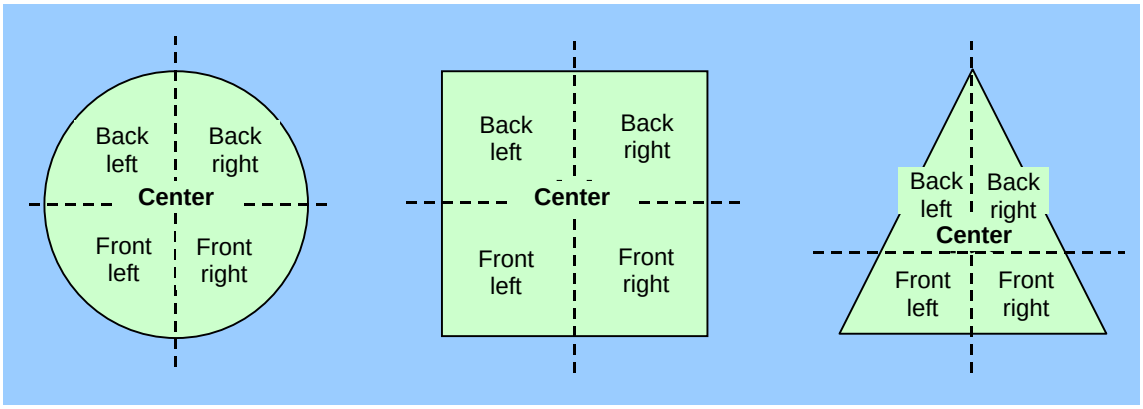
6-2. Performance

6-2-1. Repeatability (Inspection is performed for both the small and large ranges in the case of dual-range electronic balances.)

1) In the case of models with built-in calibration weights, calibration shall be performed using those built-in weights.
2) Repeat placing and removing a single weight (up to two weights if necessary) close to 1/2 or above the weighing capacity at least five times, and record the measurement values at the zero point and when the load is placed.
   Instead of recording the measurement values of the zero point, the load may be placed after setting the display to zero each time and only the measurement values when the load is placed may be recorded.
3) Calculate the width (maximum value - minimum value) for each of the zero point values and values when the load is placed (when the zero point is not measured in step 2) above, only the value when the load is placed). Those values shall be taken as "Passed" if they fall within the inspection tolerances.

6-2-2. Eccentric Error (Only the large range shall be inspected in the case of dual-range electronic balances.)

1) Place a single weight close to between 1/3 to 1/2 of the weighing capacity in order at the following positions, and record the measurement values.
   Center, front left, front right, back right, back left, center (See figures below.)
   The "center" refers to the center of the dish, and other positions refer to the center of each area after dividing the top surface of the dish into four areas.
   For example, in the case of a round dish, place the weight at positions half the radius away from the center of the circle.
2) If the differences (called the "eccentric error") between the average value of the two values when the weight is placed in the center and the values at positions other than the center are all within the inspection tolerances, then those values shall be taken as "Passed." The difference with the first center value, not the average value of the two values when the weight is placed in the center, may be taken to be the corner load error.



6-2-3. Linearity (Inspection is performed for both the small and large ranges in the case of dual-range electronic balances.)

1) Set four or more observation points including close to the weighing capacity. Set the observation points referring to the following:
   A) Points that divide the weighing range equally, or their vicinity
   B) Point where inspection tolerance changes
   C) Load region of special interest to the party requesting the inspection
2) Place weights corresponding to the set observation points in the following order, and record the measurement values. Instead of recording the measurement value of the zero point, the load may be placed after setting the display to zero each time and only the measurement values when the load is placed may be recorded.
   Zero point
   No. 1 (smallest) observation point
   No. 2 observation point
   No. 3 observation point
   • • • •
   Largest observation point (near weighing capacity)
   Zero point
3) Subtract the average value of the first and last "zero points" from the measurement value of each observation point. (This is not required when the zero points are not measured in step 2) above.)
4) Obtain the differences (called "linearity") between each of the values calculated in step 3) above and the conventional mass of the placed weights. Those values shall be taken as "Passed" if they fall within the ± inspection tolerances.

7. Inspection Record

The Electronic Balance Inspection Record (ZF4A-6009) in Attached Drawing 1 or a form compliant with this shall be used.

Attached Drawing 1. Example of Inspection Record

ZF4A-6009

Record No.

Electronic Balance Inspection Record ☐Before Adjustment ☐After Adjustment

Weighing Instrument Group
Quality Assurance Department
Analytical & Measuring Instruments Division
Shimadzu Corporation

Client Name		Inspection Date	
		Performer	
Instrument	Model Name		
	Serial Number	Load	Tolerance
	ID Number	g or less	g
	Weighing Capacity g	Readout Classification	g or less g
	Minimum Display g		g or less g
Installation Site		Test Weights Used	

** In the case of dual-range models, annotate as "value of large range/value of small range".*

1. External Appearance and Functions

LCD Display	Good/Bad	Level Gauge	Good/Bad	Other	
TARE Function	Good/Bad	Level Adjuster	Good/Bad		Good/Bad

2. Performance

1) Repeatability

	Large Range (Unit: g) Zero Point	Load (g)	Judgement
1			
2			☐ **Pass**
3			
4			☐ Fail
5			
6			
Width			

	Small Range (Unit: g) Zero Point	Load (g)	Judgement
1			
2			☐ **Pass**
3			
4			☐ Fail
5			
6			
Width			

2) Eccentric Error (Large range only)

Position	Load (Unit: g) (g)	Deviation (Unit: g)
Center		
Front Left		
Front Right		
Back Right		
Back Left		
Center		
Judgement	☐ **Pass** ☐ Fail	

Remarks

3) Linearity

** For conventional mass, enter the value obtained by rounding to the nearest integer so that the minimum number of digits is the same as the minimum display digits of the instrument being inspected.*

Large Range	Weight (Unit: g) Nominal Value	Conventional Mass	Reading (Unit: g)	Deviation (Unit: g)	Judgement
Zero					
g					
g					☐ **Pass**
g					
g					☐ Fail
Capacity					
Zero					

Small Range	Weight (Unit: g) Nominal Value	Conventional Mass	Reading (Unit: g)	Deviation (Unit: g)	Judgement
Zero					
g					
g					☐ **Pass**
g					
g					☐ Fail
Capacity					
Zero					

Overall Judgement ☐ **Pass** ☐ **Fail**