

Performance Monitoring Protocol (QA/QC) for Balances

1 Scope

This document addresses performance monitoring (QA/QC) of analytical balances in the Chemistry Unit (CU). It is applicable to CU personnel utilizing balances to make a significant measurement (i.e., a measurement that requires an estimation of measurement uncertainty).

2 Principle

A balance is an instrument used to measure mass to a high degree of precision and accuracy. All balances and the mass reference standards are calibrated annually by an external calibration service provider (see *FBI Laboratory Practices for the Calibration and Maintenance of Equipment*). Many of the balances listed below adjust automatically overnight, with a change in ambient conditions, or when prompted by a user. These adjustments are often referred to as an autocalibration, but are different from a true calibration and will be considered an adjustment. The calibration status of a balance will be checked prior to conducting a significant measurement (i.e., a measurement that requires an estimation of measurement uncertainty) to ensure that any adjustments to the balance have not affected the calibration status of the balance. Other definitions and guidelines for following this protocol are outlined in the *Instrument Operation & Systems Support- General Instrument Maintenance Protocol*.

3 Equipment/Materials/Reagents

3.1 Balances

Refer to Resource Manager in Forensic Advantage (FA) for a listing of balances.

4 Standards and Controls

4.1 Mass Reference Standards

Refer to Resource Manager in FA for a listing of mass reference standards.

5 Calibration

Applicable balances and mass reference standards (see Resource Manager in FA) will be calibrated annually by an external calibration service provider (see *FBI Laboratory Practices for the Calibration and Maintenance of Equipment*). Balances and mass reference standards will be clearly marked with the calibration date and calibration due date. Original calibration certificates and supporting records (if applicable) will be maintained by CU.

6 Sampling or Sample Selection

Not applicable.

7 Procedures

7.1 Calibration Check

Only select balances have been designated for use in significant measurements. All balances are clearly marked as 'traceable' or 'not traceable' to indicate whether or not they can be used for a significant measurement. The following 'Calibration Check' procedure will be performed on 'traceable' balances prior to the first use of the balance to make a significant measurement on a given day. Since the mass reference standards are sent out annually for calibration, the daily 'Calibration Check' will be waived during the time period when the weight sets are out for external calibration.

Non-significant measurements on balances (whether 'traceable' or 'not traceable' balances) do not require a 'Calibration Check'.

- a. Verify that the balance is clean.
- b. If available on the particular balance, run the internal 'autocalibration' feature.
- c. Verify that the balance is properly zeroed.
- d. Refer to the applicable log sheet and measure each of the indicated weights (also shown below in section 8, for example a 0.1 mg resolution balance requires the measurement of the 100 milligram, 1 gram, and 10 gram weights), ensuring that the balance is properly zeroed between measurements. Handle the weights carefully with the provided forceps. Allow the balance to stabilize before recording the observed weight.
- e. Refer to the 'Decision Criteria' on the log sheet (and shown below in section 8). If a measured weight is outside of the 'Tolerance' range, provide the data to the CU Quality Assurance Program Manager for assessment of the calibration status of the balance. Record the appropriate information on the log sheet.
- f. If a balance calibration is found to be out of specification, the IOSS Manager or appropriate instrument support personnel will determine the corrective action to be taken.

8 Decision Criteria

Compare the measured weight with the tolerances listed in the table below. Each balance log sheet is labeled with the balance resolution and the corresponding tolerances.

Balance Resolution	'Calibration Check' Weights	Tolerance
0.1 mg (e.g., Mettler ML104-1)	100 mg (Rice Lake T549)	± 0.3 mg
	1 g (Rice Lake T549)	± 0.3 mg
	10 g (Rice Lake T549)	± 0.3 mg
0.001 g / 0.01 g (e.g., PJ-360-1)	2 g (Rice Lake T549)	± 0.002 g
	20 g (Rice Lake T549)	± 0.002 g
	100 g (Rice Lake T549)	± 0.02 g
0.1 g (e.g., Denver SI-8001-2)	5 g (Rice Lake T549)	± 0.2 g
	500 g (Troemner 1000045859)	± 0.2 g
	2 kg (Troemner 1000045858)	± 0.2 g

9 Calculations

Not applicable.

10 Measurement Uncertainty

Measurement uncertainty information for CU balances is maintained in a binder and electronically (e.g., Excel[®] spreadsheets) by the CU Quality Assurance Program Manager. The Type A repeatability uncertainty component of the balances will be updated annually using the 'Calibration Check' data.

Measurement uncertainty worksheets are available on Chemnet. The expanded uncertainty is provided at a 99.7% confidence level on the worksheets. If a weight is determined by the difference of more than one weighing (i.e., weight by difference) then the expanded uncertainty for the measurement will be calculated as the root-sum-square (RSS) of the expanded uncertainty of each weighing.

11 Limitations

Only properly trained personnel will perform duties involved in the maintenance or troubleshooting of these instruments. As mentioned in section 7, forceps should always be used

when handling weights.

12 Safety

Take standard precautions for the handling of all chemicals, reagents, and standards. Refer to the *FBI Laboratory Safety Manual* for the proper handling and disposal of all chemicals. Personal protective equipment should be used when handling any chemical and when performing any type of analysis.

13 References

Manufacturer's Instrument Manuals for the specific models and accessories used.

"General Instrument Maintenance Protocol" (Inst 001) *Instrument Operation and Systems Support SOP Manual*

"Chemistry Unit Procedures for Estimating Measurement Uncertainty" (CUQA 13) *Chemistry Unit Quality Assurance and Operations Manual*

ASCLD/LAB-International Policy on Measurement Traceability

ASCLD/LAB-International Policy on Measurement Uncertainty

FBI Laboratory Operations Manual

FBI Laboratory Safety Manual

Rev. #	Issue Date	History
2	01/23/17	Removed 'external calibration requirements' language from sections 2 and 5. Updated balance models in section 3. Updated storage locations of weights in section 4.1. Changed documentation to records, and QATU to FASU in section 5. Specified that CU maintains copies of calibration certificates in section 5. Updated tables in section 8 (removed '0.01 g' resolution table, changed balance models in table where applicable). Changed Type A data recalculation frequency to annually in section 10. Added reference.
3	10/04/18	Revised section 1 to include personnel. Minor grammar revision to section 2 and updated IOSS name (also updated IOSS name in sections 7 and 13). Revised sections 3, 4, and 5 to remove specific balances/mass reference standards; added section 3.1 and moved mass reference standards to section 4.1. Edited section 5 to reflect original calibration records are maintained in CU. Updated heading in Section 6. Minor edit to section 7.1 for brevity and included sentence addressing non-significant measurements. Removed reference to gloves since weights are to be handled with forceps. Minor edits to table in section 8 for clarity.

Approval

Redacted - Signatures on File

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