
Technical Procedure for Balances – Drug Chemistry

1.0 Purpose - This procedure specifies the required elements for the calibration and use of top loading, analytical, and bulk balances.

2.0 Scope - This procedure applies to all electronic balances in the Drug Chemistry Sections of the State Crime Laboratory.

3.0 Definitions

- **Calibration** - Checking or adjusting (by comparison with a standard) the accuracy of a measuring instrument. Calibrations are performed by approved service contractors for all balances in the State Crime Laboratory Drug Chemistry Section.
- **Performance verification** - The initial confirmation of the reliability of a previously or externally validated method or instrument.
- **Primary reference standard weights**– Reference standard weights which have documentation issued by an approved vendor authenticating the calibration status.
- **Quality control (QC) Check** - Periodic confirmation of the reliability of equipment, instrumentation, and/or reagents.
- **Reference Standard** – Measurement standard designated for the calibration of other measurement standards (reference standards or equipment).
- **Secondary reference standard weights** – Reference standard weights, used in the course of casework, that have the calibration status verified by comparison to primary reference standard weights.

4.0 Equipment, Materials and Reagents

4.1 Equipment

- Section balances (top loading, analytical, and bulk)

4.2 Materials and Reagents

- Weighing boats or paper
- Paper, boxes, plastic bags or other weighing vessels
- Reference standard weights

5.0 Procedure

5.1 Standards and Controls

5.1.1 The static weighing process shall be used for weighing events in the drug chemistry section, to include casework as well as monthly QC checks.

5.1.1.1 The static weighing process involves two weighing events. The first occurs when the scientist/technician tares the weighing vessel. The second occurs when the scientist/technician removes the tared weighing vessel from the balance, adds the measurand to the weighing vessel, and returns the weighing

vessel and measurand to the balance. See **5.4** for application of weighing procedure on evidence.

5.1.2 New balances

5.1.2.1 New balances shall be installed and leveled according to manufacturer's specifications. A calibration shall be performed by an approved ISO accredited vendor prior to use.

5.1.2.1.1 Initial calibration by the vendor shall be documented in Resource Manager of Forensic Advantage (FA) by Section personnel.

5.1.2.2 Prior to being used for casework, all new balances in the Drug Chemistry Section shall first undergo a QC check as defined in **5.1.3**.

5.1.2.2.1 This procedure shall be performed by the Balances Coordinator (or designee) and documented as the Performance Verification in Resource Manager in FA.

5.1.2.3 See the [Procedure for Measurement Assurance](#) for determining the uncertainty of measurement for new balances.

5.1.3 QC Checks

5.1.3.1 Top Loading Balances Assigned to Forensic Scientists

5.1.3.1.1 The Forensic Scientist, or designee, shall perform a monthly QC check on the top loading balance using the following reference standard weights: 0.10, 1.00, 2.00, 5.00, 10.00, 20.00, 50.00, 100.00, and 1000.00 grams.

5.1.3.1.2 Results of the monthly QC check shall be documented in the Resource Manager section of FA and shall also be recorded on a data collection sheet to be used for yearly uncertainty of measurement calculations.

5.1.3.1.3 The user shall ensure the balance is clean, level, and properly functioning before use each day it is used for casework.

5.1.3.1.4 Prior to daily use in casework, a single point reference standard weight QC check shall be performed on the balance, and recorded by the Forensic Scientist in possession of the balance.

5.1.3.2 Bulk Balances

5.1.3.2.1 Bulk balance(s) shall have a monthly QC check performed by the Balances Coordinator (or designee) using at least three reference standard weights. The specific weights used will

depend on the certified reference weights available at the respective laboratories.

5.1.3.2.2 Results of the monthly QC check shall be recorded in the Resource Manager section of FA and shall also be recorded on a data collection sheet to be used for yearly uncertainty of measurement calculations.

5.1.3.2.3 Prior to each use for casework, bulk balance(s) shall have a daily QC Check performed by the Forensic Scientist using a single point reference standard weight, which shall be selected based on the weight of the item of interest. Results of the daily QC check shall be documented in the Resource Manager section of FA.

Note: In the case where only one set of weights is obtained by the laboratory (bulk balance weights), they shall be considered primary weights that may be used for casework.

5.1.3.3 Analytical Balances

5.1.3.3.1 Analytical balances shall have a monthly QC check performed by the Balances Coordinator (or designee) using the following reference standard weights: 0.0100, 0.0200, 0.0500, 0.1000, 0.5000, and 1.0000 gram.

5.1.3.3.2 Results of the QC check shall be recorded in Resource Manager in FA and shall also be recorded on a data collection sheet to be used for yearly uncertainty of measurement calculations.

5.1.3.3.3 Prior to each use for casework, analytical balance(s) shall have a daily QC Check performed by the Forensic Scientist using a single point reference standard weight, which shall be selected based on the weight of the item of interest. Results of the daily QC check shall be documented in the Resource Manager section of FA.

5.1.3.4 QC Checks are to be performed for all balances according to working instructions for each specific balance type. See the [Procedure for Measurement Assurance](#) for weight class requirements when performing QC checks.

5.1.3.4.1 Acceptable weight ranges for reference standard weights used for QC checks shall be calculated by adding and subtracting the values for Highest Expanded Uncertainty at 99.7 % Confidence Level. See the Drug Chemistry Section Annual Report for Uncertainty of Measurement (with traceability maps) for

current values. If results are within the range for the model, the balance may be used for casework.

5.1.3.4.2 If the results are outside these parameters, the balance shall not be used until all necessary steps have been taken to bring the balance into compliance.

- Steps may include cleaning, leveling, re-taring, or contacting the Section Balances Coordinator, or designee, who can then contact an approved ISO accredited outside vendor.

5.2 Calibrations

5.2.1 Calibration for all Drug Chemistry Section balances shall be done on a yearly basis by an approved ISO accredited vendor utilizing, at minimum, the same Class weights required for the determination of uncertainty as stated in the Procedure for Measurement Assurance.

5.2.1.1 Yearly calibrations shall be documented in Resource Manager of FA by Section personnel.

5.2.1.2 Certificates of Calibration issued shall be stored in the Resource Manager of FA.

5.2.2 Recertification for primary reference standard weights used in the Drug Chemistry Section shall be completed every three years by an approved ISO accredited vendor.

5.2.2.1 Reference standard weights calibration certificates shall be stored in the Resource Manager of FA.

5.2.2.2 In the case of primary weights that also serve as secondary reference standard weights (bulk balance weights used in casework), prior to use in casework, a verification shall be performed and documented in the Resource Manager of FA in accordance with the Procedure for Measurement Assurance.

5.2.3 Secondary reference standard weights shall be checked once during each calendar year against the primary reference standard set of weights. See the [Procedure for Measurement Assurance](#) for requirements of a successful recheck and documentation procedures.

5.2.4 When a Drug Chemistry Section balance has been placed out of service (e.g., maintenance/calibration, or malfunction), correct operation shall be demonstrated by a monthly QC Check as outlined above in **5.1.3**, prior to being reinstated for use in casework.

5.2.5 Balances that have been used for casework, but are not currently assigned to a Forensic Scientist, are placed out of service.

5.3 Sampling - See [Drug Chemistry Section Administrative Procedure for Sampling](#).

5.4 Application of Procedure on Evidence

- 5.4.1** Choose desired units of measure according to balance instructions. (Record weights from bulk balances in kilogram units only. Do not use the pound setting on the bulk balances. See “Calculations” **5.5** below for conversion factors.)
- 5.4.2** Tare the weighing vessel that will hold the evidence.
- 5.4.3** Remove the tared weighing vessel from the balance.
- 5.4.4** Remove evidence from packaging material, if possible, and place in/on the tared weighing vessel.
- 5.4.5** Return the tared weighing vessel with evidence to the balance pan and record weight observed from the balance.
- 5.4.6** Note in the FA case file if gross weights are recorded.
- 5.4.7** For net and gross weights received, record in the FA case files all digits displayed by the balance.
- 5.4.8** For returned weights, replace the weighing boat or other weighing vessel back on the balance without taring and record all digits displayed by the balance.
- 5.4.9** Record the weight of material to be returned in the FA case file.

5.5 Calculations

- 5.5.1** When a trafficking amount of Cannabis is reported for a single item of evidence, the weight shall be reported in grams or kilograms, as recorded, with the appropriate uncertainty of measurement, and the weight converted to pounds since the NC General Statutes are written with threshold levels of pounds. The value, in pounds, shall be truncated to the tenths decimal place.
- 5.5.1.1** When a threshold is present, either within an item or across items, AND all units are weighed on the same balance, the reported weights of all populations shall be added together and the final amount converted to pounds. Results of the conversion of all units analyzed shall be reported as “The total weight of all material analyzed for Item X = XX.X pounds.”
- 5.5.1.2** Uncertainty of measurement will not be converted for reporting purposes.
- 5.5.2** When conversion of grams or kilograms to pounds is needed, the following conversion factors shall be used as needed:
- 1000 grams = 1 kilogram
 - 1 pound = 0.45359237 kilograms

5.6 Reporting

5.6.1 When net weights are reported, the following shall be included on the report:

- A notation that a net weight is being reported.
- All digits displayed on the balance.
- The corresponding calculated uncertainty for that measurement reported to the same number of decimal places as the readability of the balance used and a statement of the level of confidence.
- Example for top loading balance:
X was analyzed and found to contain:
Identified Substance(s)
Net Weight of Material – 1.25 (+/- 0.0X) gram(s).
Measurement uncertainty of reported net weights is at a 99.7% level of confidence.

5.6.2 When only a gross weight can be obtained due to sample matrix, the following shall be included on the report:

- A notation that a gross weight of contents and packaging is being reported.
- The truncated value for the digits displayed on the balance (See the [Procedure for Measurement Assurance](#) for values to report based on the balance used).
- No measurement assurance values (calculated or reported), and no statement of the level of confidence.
- Example for sticky black substance wrapped in plastic:
X was analyzed and found to contain:
Identified Substance(s)
Gross weight of contents and packaging – 1.2 grams.

5.6.3 Uncertainty of Measurement – The uncertainty of measurement shall be calculated according to [Procedure for Measurement Assurance](#). See the **Drug Chemistry Section Annual Report for Uncertainty of Measurement (with traceability maps)** for current uncertainty.

6.0 Limitations

6.1 If the balance does not read to the hundredths place due to units chosen (e.g., bulk balances) or due to the quantity of material being weighed, record in the case file all digits displayed on the balance.

6.2 See the balance manual and/or calibration certificate for maximum capacity values for each type of balance.

6.3 Top loading balances equipped with dual ranges are calibrated on a yearly basis in the lower range only. For this reason, dual range top loading balances are to be used in the lower range only.

7.0 **Safety** - Make sure balance is plugged in and is not near a source of water.

8.0 References

Operator Manuals for each balance model.

Moffat, A.C., et al., eds. *Clarke's Isolation and Identification of Drugs*. 2nd Edition. London: Pharmaceutical Press, 1986.

Butcher, K.S, et al., ed. *The International System of Units (SI) – Conversion Factors for General Use*. National Institute of Standards and Technology, NIST Special Publication: U.S Department of Commerce, May 2006: 11.

Virginia Department of Forensic Sciences. Controlled Substances Procedure Manual. Document 221-D100 Revision 7, February 6, 2012.

9.0 Records

- Certificates of Calibration for balances
- Certificates of Calibration for reference weights
- QC Check entries in Resource Manager section of FA
- QC Check entries on the Shared drive (Sharepoint)
- **Drug Chemistry Section Annual Report for Uncertainty of Measurement (with traceability maps)**

10.0 Attachments - N/A

Revision History		
Effective Date	Version Number	Reason
02/01/2021	13	<p>Throughout document – Updated “individual” and “tabletop” balance wording to “top-loading” balance</p> <p>Throughout document – Added references to Procedure for Measurement Assurance</p> <p>4.2 – Added weighing paper</p> <p>5.1.1 – Added static weighing process</p> <p>5.1.2.1, 5.1.2.2 – Added ISO accreditation requirement; Updated process for new balances</p> <p>5.1.3.1.1, 5.1.3.1.2 – Updated values used in top-loading monthly QC Checks and location used for recording data</p> <p>5.1.3.1.4 – Reworded for clarification</p> <p>5.1.3.2.1, 5.1.3.2.2 – Updated bulk monthly QC Checks to three data points and location used for recording data</p> <p>5.1.3.2.3 – Added requirement to record bulk single point reference QC Check in Resource Manager</p> <p>5.1.3.3.1, 5.1.3.3.2 – Updated values used in analytical monthly QC Checks and location used for recording data</p> <p>5.1.3.3.3. – Added requirement to record analytical single point reference QC Check in Resource Manager</p> <p>5.1.3.4.1 – Relocated (former 5.1.2.2.6)</p> <p>5.1.3.4.2 – Added designee</p> <p>5.2.1 – Added class requirement for weights</p> <p>5.2.1.2, 5.2.2.1 – Specified storage location for calibration certificates</p> <p>5.2.2.2 – Added verification of bulk primary weights used in casework</p> <p>5.2.4 – Added QC Check for out-of-service balances being reinstated to casework</p> <p>5.5.1, 5.5.1.1 – Replaced “marijuana” with “cannabis” and added requirement to truncate value in pounds Clarified directions to report final weight in pounds across multiple populations</p> <p>5.5.1.2 – Added</p> <p>5.6.1, 5.6.2 – Clarified decimal places for uncertainty and statements of level of confidence; Reworded examples for clarification</p> <p>6.2 – Clarified maximum capacity values for each balance</p> <p>Records – Added QC Check entries on the Shared Drive (Sharepoint) and Drug Chemistry Section Annual Report for Uncertainty of Measurement (with traceability maps)</p>