	<p style="text-align: center;"><i>Instruments</i></p> <p style="text-align: center;">Pitt County Sheriff's Office Forensics Services Unit <i>Issued by the Drug Chemistry Technical Leader</i></p>	<p>Effective Date: 2018/10/22</p>	<p>Ver.: 3</p>
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1.0 Purpose - This procedure specifies the required elements for the calibration and operation of electronic balances.

2.0 Scope – This procedure applies to electronic balances used in the Drug Chemistry and Blood Alcohol sections of the Pitt County Sheriff's Office Forensic Services Unit.

3.0 Definitions

- **Calibration** – Checking or adjusting (by comparison with a standard) the accuracy of a measuring instrument. Calibrations are performed by approved vendors for all balances in the Pitt County Sheriff's Office Forensic Services Unit.
- **Calibration Verification (QC check)** – Periodic confirmation of the reliability of equipment, instrumentation, and/or reagents.
- **Performance Verification** – The initial confirmation of the reliability of a previously or externally validated method or instrument.
- **Primary Reference Standard Weight** – Reference standard weights which have documentation issued by an approved vendor authenticating the calibration status.
- **Reference Standard** - Measurement standard designated for the calibration of other measurement standards (reference standards or equipment)
- **Secondary Reference Standard Weight** – 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

- *Mettler* Electronic analytical balance (XS204DR, XS204)
- *Mettler* Electronic bench top balance (XS6002-S)
- *Mettler* Electronic table top balance (XSR6002-S)
- *Fisher* Electronic bench top balance (Accu-2202)
- *Ohaus* Electronic bulk balance (300BX Base with T31P Indicator)

4.2 Materials and Reagents

- Weighing boats
- Paper, boxes, plastic bags, flasks or other appropriate weighing vessels
- Primary and secondary reference standard weights

5.0 Procedure

5.1 Standards and Controls

5.1.1 Performance Verification of New Balances

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- 5.1.1.1 All new balances shall be installed and leveled according to manufacturer's specifications prior to being used for casework.
- 5.1.1.2 All new balances shall be calibrated by an approved vendor prior to being used for casework. The certificate(s) of calibration shall be stored in the Document Management (DM).
- 5.1.1.3 Prior to being used for casework, all new balances shall undergo the procedure for the yearly balance study (See the [Technical Procedure for Measurement Assurance](#)). Data collected in association with this study shall be stored in the DM.

5.2 Calibrations

- 5.2.1 All balances and primary reference standard weights shall be calibrated yearly by an approved vendor. The certificates of calibration shall be stored in DM.
- 5.2.2 Recertification for primary reference standard weights used in the Drug Chemistry Section shall be completed every year by an approved ISO accredited outside vendor.
- 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 [Technical Procedure for Measurement Assurance](#) for requirements of a successful recheck and documentation procedures.
- 5.2.4 Reference standard weights calibration certificates and secondary standard weight recheck documentation shall be stored in DM.

5.3 Calibration Verification (QC Checks)

- 5.3.1 The chemist shall perform a monthly QC check on all section balances using the reference standard weights listed below, according to the model of the balance. Data from the monthly QC checks shall be recorded on a log, and archived yearly in DM. Reference standard weights are stored in the Blood Alcohol (BAC) laboratory.
 - 5.3.1.1 *Mettler* XS204 and
Mettler XS204DR (Calibrated for use in lower range ONLY)
0.0100, 0.1000, 1.0000, 10.0000, 50.0000 gram reference standard weights
 - 5.3.1.2 *Fisher* accu-2202, *Mettler* XS6002-S, and *Mettler* XSR6002-S
0.10, 1.0, 10.00, 100.00, 1000.00 gram reference standard weights
 - 5.3.1.3 *Ohaus* 300BX (Calibrated for use up to 30 kg ONLY)
1.000, 2.000 and 10.000 kilogram reference standard weights

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- 5.3.2 Turn on the balance and ensure it is clean, level and functioning properly.
- 5.3.3 Prior to each weighing event, tare the balance with nothing on the pan.
- 5.3.4 Place the standard weight on the pan and record results. Data obtained from the monthly QC checks shall be stored in the DM.
- 5.3.5 Acceptable 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 for each model. See the Measurement Assurance Yearly Report for current values.
- 5.3.6 Daily, prior to each balance being used for casework, the chemist(s) shall perform a QC Check using one reference standard weight (primary or secondary) in the same manner as the Monthly QC Check. Results shall be recorded in the balance log, and archived yearly in DM.
- 5.3.7 If results of the monthly and daily QC checks are within the range for the model, the balance may be used for casework.
- 5.3.8 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.
 - 5.3.8.1 Steps may include cleaning, leveling, re-taring, or contacting an approved vendor.
- 5.3.9 When a balance has been placed out of service (e.g., maintenance/calibration, or malfunction), correct operation shall be demonstrated by a successful monthly QC check prior to being returned to casework.
 - 5.3.9.1 Chemists shall examine the effect(s), if any, of a malfunction on analysis results and implement the [Procedure for Corrective Action](#) as required.

5.4 Application of Procedure on Evidence

- 5.4.1 The user shall ensure the balance is turned on, clean, level and properly functioning before use each day it is used for casework.
- 5.4.2 Perform a QC Check using one reference standard weight. (See above)
- 5.4.3 Choose desired units of measure according to balance instructions.
 - 5.4.3.1 For the *Ohaus* bulk balance: Record weights from bulk balance in kilogram units only. Do not use the pound setting on the bulk balance. Do not use for

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weights above 30.00 kilograms, as this will exceed the calibrated range for this balance.

- 5.4.4** Tare the weighing boat or other weighing vessel that will hold the evidence.
- 5.4.5** Remove the tared weighing vessel from the balance.
- 5.4.6** For initial weights, remove the evidence from the packaging material, if possible, and place in/on the tared weighing vessel.
- 5.4.7** Gross weights of material received shall not be reported unless sample matrix prevents the complete removal of item packaging. Measurement assurance shall not apply in these instances and reported results will clearly designate a gross weight has been obtained.
- 5.4.8** For returned weights, replace the weighing vessel with the evidence back on the balance without taring and record digits displayed by the balance.

5.5 Calculations

- 5.5.1** When a trafficking amount of Marijuana is reported for a single item of evidence, the weight shall be reported in grams or kilograms with the appropriate uncertainty of measurement, and converted to pounds since the NC General Statutes are written with threshold levels of pounds.
- 5.5.2** When conversion of grams or kilograms to pounds is needed, the following NIST conversion factors shall be used as needed:

1000 grams = 1 kilogram
1 pound = 0.45359237 kilograms

- 5.5.3** Truncate the value for pounds to the tenths of a decimal place and report original weight and uncertainty of measurement information in grams or kilograms.

Examples:

Item 1
Marijuana – Schedule VI.
Net weight of material – 23.72 (+/- 0.XX) kilograms (confidence level 99.7%). (52.2 pounds)

Item 1
1.1) Three plastic bags
Marijuana – Schedule VI.
Net weight of material – 2,216.31 (+/- 0.03) grams (confidence level 99.7%).

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- 1.2) Four paper bags
Marijuana – Schedule VI.
Net weight of material – 2,385.05 (+/- 0.04) grams (confidence level 99.7%).
Total weight of all material analyzed for Item 1 = 10.1 pounds.

6.0 Reporting –

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

- 6.1.1** A notation that a net weight is being reported.
- 6.1.2** All digits displayed on the balance.
- 6.1.3** The corresponding calculated uncertainty of measurement 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: Cocaine – Schedule II

Net Weight of Material – 1.25 (+/- 0.0X) gram(s) (confidence level 99.7%).

(See the [Technical Procedure for Measurement Assurance](#) for current uncertainty.)

6.2 Gross weights may be recorded as needed. Gross weights may be reported for unanalyzed material, as needed. If reported, they shall be truncated to the tenths place, and uncertainty of measurement does not apply.


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

- 6.3.1** A notation that a gross weight of contents and packaging is being reported.
- 6.3.2** The truncated value for the digits displayed on the balance.
- 6.3.3** No measurement assurance values (calculated or reported).
- 6.3.4** Example for sticky black substance wrapped in plastic:

Material containing Heroin – Schedule I.

Gross weight of contents and packaging – 1.2 grams

- 6.3.5** The notation “Net weight of material - Less than 0.1 gram” is required to report all recordable weights less than 0.1 gram when a bench top balance or analytical balance is used to obtain the weight. Uncertainty of measurement does not apply in this situation.

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6.3.5.1 When the net weight of a single pharmaceutical unit is less than 0.1 gram, it is acceptable to record an actual weight less than 0.1 gram in the casefile, and report the results as "Net weight of (tablet, etc.) – Less than 0.1 gram" Uncertainty of measurement shall not be reported.

6.3.6 When pharmaceutical tablets other than opiate preparations and amphetamine are identified, reporting of the net weight is not required.

6.3.7 An amount of material which does not register on a bench top balance, or an amount that cannot be readily removed from the container in which it was submitted may be reported as a residue.

6.4 Uncertainty of Measurement – The uncertainty of measurement shall be calculated by the following formula:

$$U_{\text{final}} = \sqrt{(U_{\text{balance}})^2 \times N}$$

Which can be simplified to

$$U_{\text{final}} = \sqrt{N} \times U_{\text{balance}}$$

Where

U_{final} = Final uncertainty for the measurement process

U_{balance} = Total Expanded Uncertainty

N = number of weighings

(See the [Technical Procedure for Measurement Assurance](#) for current Uncertainty values.)

7.0 Limitations

7.1 The bulk balance is calibrated yearly only up to a 30 kilogram capacity. For this reason, the bulk balance shall not be used to weigh any single item that weighs more than 30 kilograms.

7.2 The *Mettler* XS204DR analytical balance is equipped with dual ranges. It shall have an uncertainty of measurement calculated for the lower range only. The upper range shall not be used for reported weights.

7.3 The analytical balance shall be used for weight determinations of material when hypergeometric or threshold sampling applies, AND the amount of material present in each unit prohibits reporting of measurement uncertainty if a bench top balance were used.

8.0 Safety – Make sure balance is plugged in and is not near a source of water.

9.0 References

Operator manuals for each balance model.

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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.

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

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

10.0 Records

- Certificates of calibration for balances in DM
- Certificates of calibration for reference standard weights in DM
- Monthly QC checks in DM
- Daily one point QC checks in logs near balances, archived in DM
- Annual secondary reference standard weights recheck reports in DM
- Yearly balance study data collected for new balances in DM

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REVISION HISTORY		
CURRENT VERSION	EFFECTIVE DATE	SUMMARY OF CHANGES
1	2017/11/14	Original Document.
2	2018/04/01	Header – Added “Drug Chemistry” Entire document – Updated “Illicit Drugs” to “Drug Chemistry” sections
3	2018/10/22	Definitions – Added primary and secondary reference standard weights. Equipment – Added new balance currently on order. Materials and Reagents – Clarified primary and secondary reference standard weights. 5.2.1 – Clarified which reference standard weights would be calibrated yearly by an approved vendor. 5.2.2 and 5.2.3 – Added recertification for primary and secondary reference standard weights. 5.3.1 – Clarified where QC check data is stored. 5.3.1.2 – Added new balance. 5.5.3 and 6.1.3 – Added confidence level to results examples.