Equipment Calibration and Maintenance

1.0 Purpose - This procedure specifies the required elements for the use of general laboratory equipment.

2.0 Scope - This procedure applies to Toxicology in the Raleigh, Triad and Western locations of the State Crime Laboratory.

3.0 Definitions

- Refer to Toxicology Definitions list

4.0 Equipment, Materials and Reagents

4.1 Equipment

- Mechanical pipettes
- Class A Volumetric flasks
- pH Meter with Electrode - pH combination, double junction, Ag/AgCl reference and thermometer
- Top Loading Balance
- Analytical Balance
- Liquid Handling Systems
- Toxicology refrigerators/freezers

4.2 Materials and Reagents

- Deionized water
- Beakers
- Reference standard weights
- Weighing vessels
- 10 % bleach solution

4.3 Commercial Reagents

- Buffer solutions, pH 4.00, pH 7.00, and pH 10.00, and other buffer solution strengths as needed
- 4 M Potassium Chloride saturated solution

5.0 New Equipment

5.1 A new and unique resource shall be created in Forensic Advantage (FA) Resource Manager for each new piece of general laboratory equipment.

5.1.1 At a minimum it shall contain the date received, a unique identifier (Serial Number), manufacturer, a description, the date the verification was performed, and the results of the performance verification.

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5.2 A Certificate of Calibration shall be added to FA prior to use for all of the following:

- Pipettes
- Liquid Handling Systems
- Volumetric Flasks

5.3 Pipettes and Liquid Handling Systems

5.3.1 All pipettes and Liquid Handling Systems shall have a performance check (refer to **8.0**) performed prior to use with casework.

5.4 Balances

5.4.1 New balances shall be installed and leveled according to manufacturer's specifications. A calibration shall be performed by an outside vendor prior to use.

5.5 Volumetric Flasks

5.5.1 New volumetric flasks used to make quantitative solutions will have their calibration checked prior to use.

5.5.1.1 Class A volumetric glassware must not exhibit a deviation from listed value greater than two percent.

5.5.1.2 Calibration Check Procedure

5.5.1.2.1 Use a calibrated balance capable of reading a +/- 2% deviation of the volumetric glassware being checked.

5.5.1.2.2 Tare the clean, dry glassware on the balance.

5.5.1.2.3 Remove the glassware and fill to the appropriate mark with ambient temperature deionized water.

5.5.1.2.4 Place on the balance and record the reading.

5.5.1.2.5 Calculate the percent deviation by the following equation:

% deviation = (100) (| (Weight of water in grams/Volume of glassware in milliliters) - 1.00|)

5.6 Refrigerators and Freezers

5.6.1 New refrigerators and freezers shall have the temperature checked using a NIST traceable thermometer prior to use.

5.6.1.1 The acceptable temperature range of the refrigerators shall be 2 °C – 8 °C.

5.6.1.2 The freezers shall be at 0 °C or below.

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6.0 Maintenance

6.1 Prior to returning equipment to use, correct operation shall be demonstrated by a performance check or calibration.

6.2 Pipettes

6.2.1 Clean with deionized water as needed

6.3 Volumetric Flasks

6.3.1 Clean with the appropriate solvent.

6.3.2 Volumetric Flasks that are damaged or cannot be cleaned thoroughly must be discarded.

6.4 Liquid Handling Systems

6.4.1 The Blood Alcohol Key Operator or designee shall flush the tubing with a 10 % bleach solution, or equivalent, once every **three months** to remove protein build-up and prevent bacterial growth in the tubing.

6.4.2 Syringes shall be replaced **yearly**.

6.4.3 Tubing shall be replaced as needed.

6.5 Balance

6.5.1 Maintain analytical balance level using the air bubble. If air bubble is not centered, use leveling feet to make adjustments.

6.5.2 Always place weighing sample in the middle of the weighing pan to prevent corner load errors.

6.6 Refrigerators and Freezers

6.6.1 Any maintenance to the coolant systems must be performed by a qualified refrigeration specialist.

6.6.2 Any refrigerator or freezer found to be out of tolerance or having maintenance performed shall have its contents transferred to a comparable refrigerator/freezer.

6.7 pH Meter

6.7.1 Fill the electrode with 4 M potassium chloride saturated solution as needed.

7.0 Calibration

7.1 For all of the following, calibrations shall be done on a yearly basis by an approved ISO accredited outside vendor. Certificates of Calibration shall be maintained in Forensic Advantage Resource Manager:

- Pipettes

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- Liquid Handling Systems
- Balances

7.2 Reference Standard Weights

7.2.1 Secondary Reference Standard Weights maintained by the Toxicology Section shall be checked annually against the Primary Reference Standard Weights maintained by the Drug Chemistry Section Balance Coordinator.

7.2.2 A successful recheck will require that the weights recorded for the secondary reference weights agree with the expected values within the expanded uncertainty measurement as stated on the annual balance calibration certificate of the balance used.

7.3 pH Meters

7.3.1 pH meters shall have a calibration performed daily prior to use.

7.3.2 The slope (electrode efficiency) must be greater than 95%. The calibration may be repeated if necessary to meet the requirement. Notify the Toxicology Technical Leader or designee if a slope greater than 95% cannot be obtained.

7.3.3 The Toxicology Technical Leader or designee shall evaluate the instrument and replace the electrode if necessary. If the problem cannot be corrected by replacing the electrode, service or replacement will be provided. The instrument shall be placed out of service until a slope greater than 95% is obtained.

8.0 Performance Checks

8.1 All performance checks shall be documented in the corresponding FA resource.

8.2 Mechanical Pipettes

8.2.1 The Pipette Coordinator or designee shall check the calibration every **two months** using a calibrated balance and deionized water. Results shall be recorded in the **Pipette Performance Check Log** along with the pipette information and the initials of the person performing the check. The results shall be within 3% for volumes greater than 10 µL or 10% for volumes equal to or less than 10 µL of the expected value.

8.2.1.1 Each check will be performed in duplicate.

8.2.1.2 For a single volume mechanical pipette:

8.2.1.2.1 Dispense the volume of deionized water into the container and record the results.

8.2.1.3 For an adjustable mechanical pipette, the calibration check shall be performed at both the lowest and highest settings of the pipette:

8.2.1.3.1 Dispense the lowest volume of deionized water into the container and record the results. Repeat for the highest volume setting.

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8.2.1.4 If the results are outside of the accepted range, clean the pipette and repeat the entire performance check. If the results are still outside of the accepted range, remove from service and notify the Toxicology Technical Leader

8.3 Liquid Handling Systems

8.3.1 The Pipette Coordinator or designee shall check the calibration every **two months** using a calibrated balance and deionized water. Results shall be recorded in the **LHS Performance Check Log** along with the pipette information and the initials of the person performing the check. The results shall be within 3% of the expected value.

8.3.1.1 Each check will be performed in duplicate.

8.3.1.2 Aspirate and dispense an air sample and the appropriate diluent volume into a container and weigh.

8.3.1.2.1 The result should be equivalent to the total volume dispensed. If the results are outside of 3%, remove from service and notify the Toxicology Technical Leader.

8.3.1.3 Aspirate the appropriate sample volume from the container and re-weigh the container.

8.3.1.4 Subtract **8.3.1.3** from **8.3.1.2**. Record the result of the subtraction. The result will be equivalent to the volume of sample removed in **8.3.1.3**. If the results are outside of 3%, remove from service and notify the Toxicology Technical Leader.

8.4 Balances

8.4.1 Prior to use, a QC check using two reference standard weights that bracket the weight of the items of interest shall be performed. Results shall be recorded in the **Balance Performance Check Log**. Refer to Balance Performance Check Log for acceptance criteria.

8.4.1.1 If acceptance criteria are not met, the balance shall be placed out of service until all necessary steps have been taken to bring the balance back into compliance and notify the Toxicology Technical Leader.

8.5 Refrigerators and Freezers

8.5.1 Each refrigerator and freezer shall have the temperature monitored. Temperature charts shall be maintained in the Forensic Advantage Resource Manager. All charts shall be labeled with the refrigerator serial number.

8.5.1.1 The acceptable temperature range of the refrigerators shall be 2 °C – 8 °C. The freezers shall be at 0 °C or below.

8.5.1.2 For refrigerators and freezers with automatic temperature charts, the charts shall be reviewed and changed weekly.

8.5.1.3 For all other refrigerators and freezers, the temperature shall be recorded on the manual temperature chart each working day.

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8.5.2 Any refrigerators or freezers that are out of tolerance or show any other refrigeration problems shall be reported to the Toxicology Technical Leader or designee, who will evaluate the nature of the problem and determine a solution.

8.5.3 The thermometers monitoring the daily temperature of the refrigerators and freezers shall be checked annually with a NIST traceable thermometer. If a refrigerator or freezer is found to be out of compliance, the Toxicology Technical Leader shall be notified immediately.

9.0 Calculations - N/A

10.0 Uncertainty of Measurement - N/A

11.0 Limitations - N/A

12.0 Safety – Use gloves when dealing with equipment which has been used with blood.

13.0 References - Operator Manuals for equipment used.

14.0 Records

- Temperature control record for Toxicology refrigerator/freezers
- Pipette certificates
- Pipette and Liquid Handling System Logbook
- pH Meter Logbook
- Balance Logbook

15.0 Attachments – N/A

Revision History		
Effective Date	Version Number	Reason
07/07/2017	1	Original Document
02/22/2019	2	5.1.1- addition 8.4.1-2% acceptance criteria removed. Reference Balance Performance Check Log for acceptance criteria. 8.5.1 – Inserted “each working day”, removed evidence technician

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