

KCMC Biotechnology Laboratory	STANDARD OPERATING PROCEDURE	Effective Date 17 April 2007	SOP-Number EQP.006.01
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Title: CALIBRATION OF LABORATORY BALANCES			

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This SOP has been read and understood by:

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Annual Review	
By	Date

**KCMC Biotechnology
Laboratory**

**STANDARD
OPERATING
PROCEDURE**

Effective Date
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Purpose

Maintenance and calibration procedures for analytical balances, and top-loading balances, performed to assure quality testing results.

Principle

Modern electronic analytical balances used in clinical and some research laboratories work on the principle of magnetic force restoration. When an object is weighed, the force that is registered is lifted by an electromagnet. The electrical current required to oppose the downward motion of the weight in the magnetic field is measured by a detector and converted to a weight that can be read on the balance's digital display panel (Available Balances: 1. Model: TE 64- Sartorius, weighing capacity 60g, readability= 0.1mg; 2. Model: TE 212- Sartorius, weighing capacity 210g, readability = 0.01g; 3. Model: Scout Pro Spu 202, weighing capacity 200g, 0.01g).

Responsible Personnel

The Biotechnology Laboratory Director and the Laboratory Manager have the responsibility to establish this procedure. The QA/QC Coordinator is responsible for the control of SOP documentation. The QA/QC Coordinator and the Laboratory Manager are responsible for the implementation of the procedure and for ensuring that all appropriate personnel are trained. All technicians working in the biotechnology laboratory are responsible for reading and understanding this SOP prior to performing the procedures.

Definitions

AMR- Analytical measurement range
CAP- College of American Pathologists
CV- Coefficient of variation
NIST- National Institute of Standards
SD – Standard Deviation
SOP- Standard Operating Procedures
QA/QC- Quality Assurance/Quality Control
Tech- Technician

Precautions

Standard precautions should be used if the balance is used to weigh biohazard materials (See Biohazard Safety, SOP-Number SFT.001).

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Instruments

1. Sartorius Talent (Electronic Analytical and Precision Balance and Precious Metal Scale), Model: TE 64, Max. 60g, d=0.1mg.
2. Sartorius, Model: TE 212, Max. 210g, d=0.01g
3. Scout, Model: Scout Pro Spu 202, Max. 200g, d=0.01g

Equipment

Weights of 1 mg, 10 mg, 200 mg and 1 g (For Analytical Balance)
Weights of 200 mg, 1 g, 10 g and 100 g (For Top-loading Balances)
Plastic weighing boats
Forceps
Cotton gloves
Recording sheets (Appendices A to F)
Analytical Balance Acceptability Criteria (Appendix G)

Calibration Intervals

Recommended Testing Intervals:

- Daily - Auto calibration and calibration verification with one weight.
- Annual – Calibration check and Reproducibility Tests
- Linearity and Corner load testing are recommended but not required (See Section V below and Appendices E and F).

As a requirement verification of accuracy must be performed every time a balance is used for the creation of analytical calibrators and weighed-in controls and when gravimetrically calibrating pipettes.

Procedure

I. Maintenance:

- A. Clean the balance with a soft brush following each use. If necessary, clean the balance with a damp cloth to remove debris and allow the balance to dry before the next use.
- B. Prior to use, check for spilled substances, that the balance is level and on a firm surface free from drafts or air currents.
- C. Check the balance pan to ensure that it is properly seated.

II. Balance Internal Calibration

- A. Perform an auto-calibration or internal calibration according to the instruction in the instrument manual. Calibration/adjustment can only be performed when there is no load on the balance/scale, the balance/scale is tared and the internal signal is stable.

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Stepwise:

1. Tare the balance/scale
2. Begin calibration: Calibration weight is displayed without weight unit
3. Place the indicated calibration weight on the balance/scale.
4. After calibration, the calibration weight is displayed with weight unit.
5. Remove the calibration weight

B. Perform the Daily Calibration Check as outlined in section III below.

III. Daily Calibration Check:

- A. Check your balance for drift each day using an external weight. Use **10 mg weight** for the analytical balance and **10 g weight** for the top-loading balance.
- B. Weigh the external weight following the instructions for operation outlined in section IV below.
- C. Document the results on the Daily Calibration Check sheet (See Appendix B) and check that the weight is within the allowable range.
- D. If the weight is not within the acceptable range, take the balance out of service until corrective action can be performed or it is repaired by the service representative.

IV. General Operation of the Balance:

- A. Check that the balance is leveled and select an appropriate container or weigh boat.
- B. If applicable, allow the substance that is going to be weighed to come to room temperature.
- C. Turn on the balance/scale by pressing the '**on**' power switch.
- D. Place the weigh boat or container to be used on the center of the pan, close the balance door and tare the balance
- E. Open the balance door and add the substance or object to be weighed onto the weigh boat and close the door to avoid drafts and air currents.
- F. Allow the weight reading to stabilize and record the weight from the digital display panel.
- G. Carefully remove the weigh boat or container and the weighed object or substance from the balance and close the door.
- H. Turn off the balance by pressing the '**off**' switch.
- I. Clean the balance as outlined in maintenance procedure above (section I).

Note: Handling of calibration standard weights – When handling calibration weights always use forceps to avoid contamination with salts and oils from the hands (See procedural notes below).

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V. Annual Calibration Check /Accuracy Check

A. The requirements for the annual checking of balances are Reproducibility and Annual Calibration Check. That should be performed annually.and after the following:

1. Major maintenance is performed on the balance
2. The balance is moved to a new location
3. The performance of the balance is in question.

Required Annual Checks

A. Reproducibility Testing: Measures the ability of a balance to repeatedly deliver the same weight

Procedure: Repeatedly weigh a given object 20 times and analyze the results. Select a test weight that is nearly equal to the capacity of the analytical balance.

4. Tare the balance to read all zeros
5. Place the test weight on the pan and record the reading under the heading "Full Scale reading".
6. Remove the weight – do not rezero and record the reading under the column "Zero Reading".
7. Repeat steps 2 and 3 until there are 20 readings in both columns.
8. Using a spreadsheet (Appendix C) calculate the SD and CV% of the "Full Scale Reading" Column.
9. Compare the SDs and CVs to the instrument manufacturer's specifications (or see the recommended tolerance limits in Appendix G) and perform corrective action if the results obtained are not within acceptable limits.
10. Unacceptable results for the reproducibility test indicate that the balance is operating in an unstable environment or that the balance is in need of repair.

Following are the recommended external calibration weights;

Balance weighing capacity	Calibration weight
210 g	200 g
120 g	100 g
60 g	50 g

B. Annual Calibration Check/verification (Accuracy Testing): Refers to a comparison of weight readings of a standard or certified weight and the actual value of that standard weight.

Procedure

1. Select standard weights that cover the AMR of the balance.

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2. Tare the balance so that it reads zero.
3. Weigh each of the standard weights and record the observed weight in the log (Appendix C). Note that if different sets of weights are available, it is important to use the same weight in the same set each time. Compare the observed weights with the previous weighing.
4. The results are acceptable if there has been no significant change from previous weighing or are within tolerance limits available from the instrument manufacturer or as outlined in appendix G.
5. If a weight does not agree it should be reweighed and the new reading documented.
6. If the calibration results are not within the acceptable range the balance should be taken out of service and the manufacturer should be contacted for service.

VI. Procedural Notes:

- A. Test Weights: Treat standard test weights precision devices and handle with forceps. Direct hand contact should always be avoided. Take care to avoid sliding weights across any surface and especially stainless steel weighing pans. Store weights in a covered protected box.
- B. Temperature: The accuracy of an analytical balance is affected by room temperature. For the best stability temperature variation should not be more than one degree Celsius within any weighing period.
- C. Air Drafts: Moving air will affect measurements of .001mg or less. Ensure an enclosure around the weighing pan to avoid fluctuations in moving air.
- D. Static Electricity: Static electricity will affect the accuracy of an analytical balance. Avoid or minimize sources of static electricity such as carpets, plastic draft shields, and melamine or Formica table- tops.
- E. Vibration: Balances are very sensitive to any kind of vibration or movement. It may Obtain a very sturdy table for the analytical balance to minimize the effects of vibration or movement.

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Appendices

Appendix A: Weighing Balance: Daily Maintenance Log

Appendix B: Weighing Balance: Daily Calibration Log

Appendix C: Weighing Balance: Annual Reproducibility Test Record Form

Appendix D: Weighing Balance: Annual Calibration check/verification Form

Appendix E: Recommended Tolerance Limits

References

Morse, D., Baer, D., Laboratory Medicine. *Laboratory Balances: How They Work, Checking Their Accuracy*. ASCP: Chicago, IL Retrieved from the internet on 04/02/06 from www.ascp.org

EPA/OPP Microbiology Laboratory (2005) Standard Operating Procedure for Calibration and Maintenance of Weigh Balances. Ft. Meade, MD.

University of Adelaide (07/19/06). SOP for the Calibration and Use of the Mettler AE163 Analytical Balance. Retrieved from the internet on 11/17/06 from www.health.adelaide.edu.au/pharmacology/doc/SOP%20balances.pdf