KCMC Biotechnology Laboratory	STANDARD OPERATING PROCEDURE	Effective Date 27 Nov 2007	SOP-Number EQP.006.02
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Title: CALIBRATION OF LABORATORY BALANCES

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Annual Review	
By	**Date**

Document History:

Version Number	Reason for Changes	Date

Copies distributed to:

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Purpose

Maintenance and calibration procedures for analytical, 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.

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.

Precautions

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

Balances

1. Sartorius Talent Analytical and Precision Balance, Model TE 64, Maximum weight 60g,
2. Scout, Top Loading Balance, Model Scout Pro Spu202, Maximum weight 200g.

Calibration Equipment

Calibration weights of 1 mg, 100 mg, 10 g. 50 g. (For Analytical Balance)
Calibration weights of 1g, 100 g and 200 g. (For Top-loading Balance)
Forceps (provided with weights)
Cotton gloves (provided with weights)
Record sheets (Appendices A to D)
Analytical Balance Acceptability Criteria (Appendix E)

Calibration Intervals

Recommended Testing Intervals:

- Daily (each day of use) - Auto calibration and calibration verification with one weight.
- Annual – Calibration check and Reproducibility Tests

Verification of accuracy must be performed every time a balance is used for the calibration of pipettes.

DAILY PROCEDURES

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.

D. Document that the cleaning was performed on the DAILY MAINTENANCE LOG.

II. **Internal Calibration**

Perform an auto-calibration or internal calibration according to the instruction in the instrument manual.

Analytical Balance:

1. Turn on the balance.
2. Tare the balance.
3. Hold down the Tare button for 2 seconds. The 50 g. calibration weight will be displayed.
4. Place the 50 g. weight in the center of the weighing pan.
5. After calibration, the calibration weight is displayed with weight unit.
6. Remove the calibration weight.
7. Document that the Internal Calibration was performed on the DAILY MAINTENANCE LOG.

Top Loading Balance

1. Press the On/Zero button for 5 seconds. MENU will appear and when the button is released CAL will appear.
2. Press the On/Zero button for 1 second and –C- will appear, then the 200 g. weight is displayed.
3. Place the 200 g. calibration weight in the center of the weighing pan.
4. Press the On/Zero button for 1 second. The display will read donE
5. Remove the calibration weight.

6. Document that the Internal Calibration was performed on the DAILY MAINTENANCE LOG.

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II. **Daily External Calibration Check**:

A. Check your balance for drift each day using an external weight. Use **10 mg weight** for the analytical balance and **100 g weight** for the top-loading balance.

B. Weigh the calibration weight.

C. Document the results on the DAILY CALIBRATION CHECK sheet (See Appendix B) and check that the weight is within the allowable range (see Table 1.).

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.

E. Document that the Daily Calibration Check was performed on the DAILY MAINTENANCE LOG.

Table 1. Acceptable Ranges for Calibration Weights

Weight	Acceptable Range
10 mg	$\pm$ 0.025 mg
100 g	$\pm$ 0.5 mg

III. **General Operation**

Analytical 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.

E. Tare the balance

F. Open the balance door and add the substance or object to be weighed into the weigh boat and close the door to avoid drafts and air currents.

G. Allow the weight reading to stabilize and record the weight from the digital display panel.

H. Carefully remove the weigh boat or container and the weighed object or substance from the balance and close the door.

I. Turn off the balance by pressing the **'off'** switch.

J. Clean the balance as outlined in maintenance procedure above (section I).

Top Loading Balance

A. Check that the balance is leveled and select an appropriate container or weigh boat. This is not necessary if weighing blood culture bottles for volume.

B. Turn on the balance/scale by pressing the **'on'** power switch.

C. Place the weigh boat or container (if used) on the center of the pan.

D. Tare the balance .

E. Allow the weight reading to stabilize and record the weight from the digital display panel.

F. Remove the object or weigh boat/container.

G. Turn off the balance by pressing the **'off'** switch.

H. Clean the balance as outlined in maintenance procedure above.

II. **Annual Reproducibility Check /Accuracy Check**

The requirements for the annual checking of balances are Reproducibility and Accuracy Check. These 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.

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.

1. Tare the balance to read all zeros
2. Place the test weight on the pan and record the reading under the heading "Full Scale reading". Use the same weights used for Daily Calibration – see Table 1.
3. Remove the weight – **do not tare the balance**.
4. Record the reading under the column "Zero Reading".
5. Repeat steps 2 and 3 until there are 20 readings in both columns.
6. Record results of the ANNUAL REPRODUCIBILITY spreadsheet (Appendix C) the SD and CV% of the "Full Scale Reading" Column will be calculated.
7. Compare the SDs and CVs to the instrument manufacturer's specifications. See Table 2.

8. Perform corrective action if the results obtained are not within acceptable limits.

9. 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	Calibration weight
Analytical	50 g
Top-Loading	200 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 the standard weights that cover the measurable range of the balance. See Table 2.
2. Tare the balance so that it reads zero.
3. Weigh each of the standard weights and record the observed weight in the ANNUAL CALIBRATION LOG (Appendix C). 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. See Table 3 for tolerance limits of certified weights.
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.

Table 2. Weights for Annual Calibration

Balance	Weights
Analytical	1 mg, 100 mg, 10 g, 50 g
Top-Loading	1 g, 100 g, 200 g.

Table 3. Tolerance Limits for Calibration Weights

Weight	Tolerance Limits
1 mg	±0.02 mg
100 mg	±0.05 mg
1 g	±0.1 mg
10 g	±0.2 mg
50 g	±0.3 mg
100 g	±0.5 mg
200 g	±1.0 mg

I. 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.

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.

Operating Instructions, Sartorius Talent Electronic Analytical and precision Balance, Sartorius AG, Goettingen, Germany, 2003.

Instruction Manual, Scout *Pro*® Balance, Ohaus Corporation, Pine Brook, NJ, 2005.

Appendices

Appendix A: Balance Calibration: Daily Maintenance Log
Appendix B: Balance Calibration: Daily Calibration Log
Appendix C: Balance Calibration: Annual Reproducibility Test Record Form
Appendix D: Balance Calibration: Annual Calibration check/verification Form
Appendix E: Balance Calibration: Recommended Tolerance Limits