Prepared by: Megan K Rooney Date: 8-30-17

Reviewed by: Sam Williams Date: 11-30-17

Approved by: [signature] Date: 12-01-2017

The colored ink stamp indicates this is a controlled document. Absence of color indicates this copy is not controlled and will not receive revision updates.

CONTROLLED DOCUMENT

Purpose

This document provides the procedures to calibrate, clean, weigh materials, and perform routine maintenance on top-loading and analytical laboratory balances.

Scope / Field of Application

This standard operating procedure applies to all chemists and technicians using OTSC top loading and analytical balances.

Definitions and Acronyms

NA

Responsibilities

Laboratory Attendant - follow SOP, perform calibration checks and maintain record log

Chemists - follow weighing/balance SOP

Lab Management – ensure SOP is followed

Materials Required

Weight set, stainless steel, NIST/NVLAP certified yearly, 0.1, 1, 10, 50, and 100 g range

Weights, for calibration of top-loading balances, as needed

Procedure

Calibration:

Calibration is an important factor in assuring quality results. Without a proper calibration, the balance is unable to produce results which are viable and consistent. Therefore, it is essential to routinely check the calibration of a balance. There are three methods that will be incorporated in order to establish this routine.

First, the balances are to be checked and calibrated by a certified service technician biannually. The biannual maintenance records should be maintained in a balance logbook or file along with the biweekly and day of use calibration records. The maintenance should be recorded with the date, company, technician, and reason for maintenance.

Second, every other week (biweekly) the technician/chemist or his designee will check the calibration of the balance in his/her respective lab with NIST rated weights. The weights selected for checks should include weights that bracket the normal weighing range. The biweekly calibration records should include: descriptive title, name, manufacturer, model number, AAS and/or AEX number (of balance and weight set), room number, required calibration frequency, allowed "working" limits, initials and date of calibration, and responsible chemist review. The weights must be within the accuracy range that will be determined for each balance.

Third, a "day of use" external calibration will be performed by the analyst. NIST-rated weights have been assigned an AAS number, and most balances have been assigned a weight based on usage needs (these weights are not the same weights used for the biweekly checks). The balance check is to be performed on **"day of use"**. Once check has been performed for the day, it does not need to be repeated on that day. Calibration weights should be handled with special plastic tipped tweezers. "Day of Use" calibration logs should be kept at each balance and should include the following information: descriptive title, name, manufacturer, model number, AAS and/or AEX number of balance and weight used, room number, required calibration frequency, allowed "working" limits, initials and date of calibration, and responsible chemist review. The weights must be within the accuracy range that will be set for each balance

Some balances have an internal weight that is utilized to calibrate the balance. Other balances need an external weight to be calibrated. Refer to balance manuals for the specific procedures for each balance. NOTE: **The internal calibration does not take the place of the "day of use" calibration check.**

Top Loading Balance:

The following steps are to be followed to check the calibration of the top load balances (for biweekly or day of use). A calibration that approximately spans the weighing range should be performed using the NIST traceable weight set, with a single calibration reading for each weight. (Day of use will be a single weight.) Before calibrating, make certain the balance is clean. Do not touch the weights directly with your hands. Use a dust-free glove, tweezers or a Kimwipe to handle the weight. (See cleaning protocol).

Check the bubble to make sure the balance is level. If it is not, level the balance by turning the balance feet. The level bulb is usually located at the rear of the balance for top load balances. Turn the leveling feet clockwise to raise the balance and counter-clockwise to lower the balance. The balance cannot be moved and then used without a readjustment or check of the level.

With the balance pan empty, press the tare button. This should result in a reading of 0.00.

Place a clean weight on the weighing pan by using a Kimwipe or a pair of tweezers. Record the value on a calibration form. If the range is not within the limits, discontinue use of the balance and investigate the problem. See Balance Ranges and Limits below. If balance has a CAL function (Sartorius BA4100S), an internal calibration can also be done using the specified weights (Class S) listed in the balance manual.

Analytical Balance:

The following are the steps to be followed to check the calibration of the analytical balances (for biweekly or day of use). A calibration that approximately spans the weighing range should be performed using the NIST traceable weight set. (Day of use will be a single weight.) Before calibrating, make certain that the balance is clean. Do not touch the weights directly with your hands. Use a dust-free glove, tweezers or a Kimwipe to handle the weight. (See cleaning protocol). Make certain the doors are closed before calibration and during weighing to prevent air currents from affecting the readings. Do not lean on the benchtop as the vibrations will affect the readings.

Check the bubble to make sure the balance is level. If it is not, level the balance by turning the balance feet. The level bulb is usually located at the rear of the balance. Turn the leveling feet clockwise to raise the balance and counter-clockwise to lower the balance. The balance cannot be moved and then used without a readjustment or check of the level.

Make sure the balance pan is empty. Press the tare button; the output should be either 0.0000 or 0.00000.

Analytical balances are capable of using their internal weights for calibration. If the balance has a CAL button, press the button to calibrate. The reading will progress from C to CC.

Once it is finished, the reading will return to 0.0000. If balance has a knob for calibration (Sartorius 1602 MP*-1), turn the knob slowly until a C appears. Continue turning the knob until the knob is to the CAL position. The reading will display CC when the calibration is finished. The chemist must return the knob to its original (or middle) position before weighing; the display will again read 0.0000. See individual balance manuals for instructions pertaining to other models.

Place a clean weight on the weighing pan by using a dust-free glove, Kimwipe or a pair of tweezers. Record the value on a calibration form. If the range is not within the limits, discontinue use of the balance and investigate the problem. See Balance Ranges and Limits below.

Balance Ranges and Limits:

The weighing range indicates the minimum and maximum amounts the balances can weigh. See individual balance manuals for specifications.

The accuracy limit is used for the day of use and biweekly calibration checks. The limit indicates the amount that the weight can deviate from the certified amount.

Top Loading Balance Weight:	< 100 g ± 0.10 g
	> 100 g ± 0.50 g
Analytical Balance Weight	± 0.0005

Corrective Actions for Balance Problems:

If the biweekly balance check or "day of use" check is outside the limits, the balance should be re-examined. Clean, check the level, and recalibrate. Check for drafts or other conditions that may affect the balance. Check the calibration again with the weight. If it passes, record comments on the log sheet. If the check fails, then re-check with complete weight set. If the check fails in all weight ranges, the balance should be placed out of service by the technician. If the check passes at the lower weight ranges, the balance should only be used for weighing in the lower ranges and a warning sign should be applied to the balance. Same actions for pass and fail apply to biweekly checks.

For any balance problems, notify the analyst and supervisor so that the balance can be repaired or replaced.

Cleaning:

Cleaning is essential in everyday usage of the balances to maintain quality assurance in the laboratory since weighing is the most basic and yet one of the most important steps in an analysis. It is inevitable for the balances and weights to become dirty with everyday

use. Therefore, it is important to follow the proper methods carefully to obtain the most accurate results. The following methods for cleaning the balances and weights were developed to ensure quality results.

Balance

Unplug the balance before cleaning and do not use any harsh or abrasive cleaning agents. Allow nothing to enter the balance's internal mechanism. Also handle the balance pan with care, do not touch the balance pan feet on which it rests or the place where the pan contacts the balance. When cleaning the weighing pan with a liquid solution, remove the pan and clean it outside of the balance to prevent any liquids from running into the internal electronics and causing damage. If some material enters the balance housing, notify a supervisor immediately so proper care can be taken to limit the damage to the balance.

The balance should be cleaned as necessary. For simple cleaning, such as removing sample from the balance pan, a soft camel hair brush should be used. Make certain no small particles remain on the balance pan since even the smallest amount can affect a reading or corrode the pan.

If the balance pan cannot be cleaned simply by using a brush, then water may be used to wipe clean the weighing pan. A lint-free Kimwipe should be utilized to wipe away any dirt and water on the pan. The water should be put onto the Kimwipe, not balance.

If necessary, a 1% soap solution may be used to help clean the weighing pan, but this must be used with care. The soap solution must be thoroughly washed off. Soap tends to leave a residue on the balance, therefore affecting the results of a weighing. A lint-free Kimwipe should be used to wipe off the balance pan.

If the stainless steel is discolored, a cleaner such as Simichrome polish may be used. This product will also remove light rust.

For the analytical balances, the windows may be cleaned with Windex and a lint-free Kimwipe. The Windex should be sprayed onto the Kimwipe and then applied to the windows. This will prevent any buildup from the spray.

Weights

The weights should never be handled without the use of a Kimwipe or tweezers. For the larger weights, powder-free gloves may be used when necessary. Fingerprints will affect the results of a weighing and will decrease the accuracy and the precision. Tweezers should be designed for use with the weight set. Incorrect tweezers could damage the weights by scratching the surface or causing nicks.

To clean the weights use ethyl ether and a lint-free Kimwipe. The ether should only be used in the ether room solvent hood. Wipe the weight until it is visually clean and no ether remains. The weights should be cleaned as needed.

Interferences:

There are several anomalies that may occur during the standard operation of the balances. A common occurrence is balance drift which can arise from several different factors. To check the balance for drift, tare the balance and see if the readout remains steady.

A common cause of balance drift is an improperly leveled balance. It is very important before each use of the balance that the level bubble is checked and the balance feet are adjusted if not properly aligned.

Balance drift also will occur if the doors on the analytical balance are left open during weighing. The doors must be tightly shut; air currents are capable of affecting the final weight. The effect of air currents on a reading varies depending on the conditions of the room in which the balance is used.

Vibrations in a room also result in balance drift. This problem is dependent on the room and building in which the balance is located.

Occasionally it is necessary to place a balance in a location that has a severe amount of vibrations. For example, when weighing toxic substances, it is necessary to weigh the substance in a fume hood. The problem of balance drift can often be resolved by placing the balance on a marble stand. Even if the balance is not in a fume hood, it is wise to place an analytical balance on a marble stand to protect the balance from slight movement cause from building vibrations or accidentally bumping the counter where the balance is placed.

Static electricity may cause balance drift and difficulty in weighing powders.

When a balance is moved from one room to another, the balance should be allowed to equilibrate in the new environment for about two hours in order to stabilize to ambient temperature conditions. If the balance is not in thermal equilibrium with the environment then balance drift will occur. When moving a balance from a cooler room to a warmer room, allow the balance to equilibrate for 2 hours unplugged to avoid condensation of moisture on or in the balance. Variations in humidity and temperature cause drift.

One way to resolve the problem of high humidity is by placing an AIR-DRYER (silica gel desiccator created for balances) on the inside of the balance to remove any moisture. An ideal location for the balance is a room with air conditioning 24 hours a day. Optimum conditions include avoiding exposure to extreme radiation of heat and aggressive chemical atmospheres.

Weighing tips:

Do not drop the object to be weighed onto the balance pan, this will damage the internal structure and the weights may no longer be accurate.

Do not leave a sample sitting on the weighing pan for extended periods of time. Also, make certain the sample and the balance are at the same temperature. If the sample is cold, condensation may form while weighing and the wrong amount will be measured. Be certain to re-tare the balance after use.

When there is a power outage, it is necessary to allow the balance to warm up for one hour.

When placing an object on the balance, allow the balance to equilibrate (display 'g') before continuing. Once the 'g' appears a weight can be taken or the scale can be tared.

Documentation

The following Quality Records shall be generated and managed:

Required Record	Custodian
Day of Use Calibration Log	Laboratory Attendant/Chemist
Completed Day of Use Logs	Quality Manager
Biweekly Calibration Log	Laboratory Attendant
Balance Service Records	Quality Manager
NIST Traceable Weight Records	Quality Manager
Out of Service Label	Laboratory Attendant/Chemist

OUT OF SERVICE LABEL
DO NOT USE
AFTER
DATE _____

Reference Procedures

NA

References

NA

Revision History

August 2012 New format.
June 2017 MKR – Added "day of use" checks and changed weekly calibration checks to biweekly. Updated and reviewed document.