QC for Analytical Balances

• Check monthly with at least 2 ASTM class 1 ("S") weights *(1 in mg range; 1 in the g range)*

• Record weight measurements in a logbook

• Have the Class 1 weights re-certified based on the manufacturer's recommendation

• Have balance serviced by a professional yearly

Suggested process for verifying analytical balance accuracy and performance

1. If using an electronic balance, allow to warm up for at least 60 minutes.

2. Dust off the balance pan with a clean soft brush. Use a mild detergent, DI water and lint free wipe if necessary.

3. Check the balance leveling gauge to make sure bubble is inside the target.

4. Perform the internal calibration process if the balance has an on-board calibration function.

(Analytical Calibration Process Continued)

5. Zero the balance by pressing the "tare" bar (or button)

6. Place the first Class 1 weight on the clean balance pan with plastic forceps, allow the balance to stabilize, measure and record the observed weight in the logbook.

7. Repeat step 6 with the other weights.

8. Compare the observed weights to the acceptance ranges for the Class 1 weights. If any weight exceeds the acceptable range, ***discontinue using the balance and take corrective action.***

Suggested corrective action if balance fails the accuracy check

- Double check to make sure both the balance and weights are clean and that the balance is level.
- Re-check the Class 1 weight measurements
- Check an alternative weight set from another lab or plant
- Call a professional service technician

Tips for Handling Class 1 Weights

☞ *ALWAYS* handle weight using a plastic forceps provided with weights. *NEVER* touch the weights with your hands.

☞ *NEVER* use metal forceps; they will damage the weights

☞ *NEVER* store weights loose in a vial. *ALWAYS* store weights in the box or vial with the packaging provided.

☞ *ALWAYS* have your weights re-certified before they expire

☞ *NEVER* place weights on a dirty balance pan

What Class 1 weights should I use to check my balance in the <u>gram</u> range?

Consider how you are using the balance before selecting the appropriate weights. If you use the balance primarily for TSS, do you:

• Use Gooch crucibles? *(tare weights from 20-30 grams)*

  ✎ *Suggested weights: 20 g or 50 g*

• Use 47 mm filters in aluminum weighing pans? *(tare weights about 1 gram)*

  ✎ *Suggested weights: 1 g*

What Class 1 weights should I use to check my balance in the milligram range?

Again, consider how you are using the balance before selecting the appropriate weights.

• Do you weigh 47 mm filters directly? *(tare weights about 50-100 mg)*

       ☞*Suggested weight: 50mg or 100 mg*

  • Alternatively, consider what minimum amount of residue you must obtain (1mg) *(challenge yourself!)*

      ☞ *Suggested weight: 1 mg or 10 mg*

How do I determine what is an acceptable range for my Class 1 weights?

• The weight manufacturer will provide a certificate that lists the certified weights (masses) and nominal weights.

 • The manufacturer generally recommends a method for determining the acceptable range for your balance by making replicate weighings.(see Appendix for example)

Reasonable tolerance guidelines
• $\pm$ 0.5 milligrams for weights equal to or below 100 mg
• $\pm$ 1 mg for weights ranging from 100 mg to 1 gm
• $\pm$ 2 mg from weights greater than 1 gm

Example Balance Log

Date	Initials	Class 1 Weight	Measured Weight	Acceptable Range	Pass/Fail?	Corrective Action
7/5/01	RM	50 mg	49 mg	45-55 mg	Pass	
7/5/01	RM	1 gm	0.9994 gm	0.9995-1.0005 gm	Fail	Re-calibrated balance & repeated test below.
7/5/01	RM	1 gm	0.9997 gm	0.9995-1.0005 gm	Pass	Repeat OK
7/5/01	RM	20 gm	19.9985 gm	19.9980-20.0010 gm	Pass	

Determining Acceptance Ranges for Class 1 Weights Using a Manufacturer's Recommendation

- Make 20 replicate measurements of the class 1 weight
- Spread measurements out over several non-consecutive days for best results
- Determine the mean and standard deviation
- The *upper acceptable range* = certified weight + 3 standard deviations
- The *lower acceptable range* = certified weight - 3 standard deviations

Example 1
Determining the Acceptable Range for a 100 mg (0.1000 gm) Class 1 Weight

Item	Weight (grams)
Mean of 20 measurements	0.09999
Standard Deviation	0.000064
3 Standard Deviations	0.00019
Certified Weight	0.099998
Upper Acceptable Range	0.10019
Lower Acceptable Range	0.09980

Example 2
Determining the Acceptable Range for a 1 gram Class 1 Weight

Item	Weight (grams)
Mean of 20 measurements	1.00003
Standard Deviation	0.000047
3 Standard Deviations	0.000141
Certified Weight	1.0000026
Upper Acceptable Range	1.00014
Lower Acceptable Range	0.99986

Example 3
Determining the Acceptable Range for
a 50 gram Class 1 Weight

Item	Weight (grams)
Mean of 20 measurements	50.0013
Standard Deviation	0.000057
3 Standard Deviations	0.000171
Certified Weight	50.00009
Upper Acceptable Range	50.0003
Lower Acceptable Range	49.9999

Summary of Balance Accuracy Verification

☞ Check your balance monthly in the g and mg range

☞ Use certified class 1 ("S") weights

☞ Have balance serviced yearly

☞ Have weights re-certified before the expiration date

☞ Determine the acceptance range using the manufacturer's recommendation or use the reasonable tolerance guidelines

☞ Always record weight measurements, whether they passed or failed and corrective action in the logbook

☞ *NEVER* use a balance that fails the verification check!!