

SOP: GBT.006
Revision: 1.0
Title: Use of TR Series Top-Loading Balance (Denver Instruments)

1.0 Purpose

To describe correct procedure for using the Denver Top-loading balance (Model 603) to obtain accurate and precise sample weights.

2.0 Scope

This procedure applies to all weighing operations in the Biotechnology laboratory.

3.0 Responsibility

All students, lab assistants and instructors in the Biotechnology laboratory should be able understand and apply this procedure. Students shall be trained in the use of this balance the first lab of every class.

4.0 Procedure

4.1 Materials:

- 4.1.1 TR Top-loading balance Model 603
- 4.1.2 Calibration weights
- 4.1.3 Weigh boats, weigh paper or other suitable sample container (e.g. beaker, graduated cylinder, Erlenmeyer flask)
- 4.1.4 Permanent black ink pen
- 4.1.5 Laboratory Notebook and /or data sheet

4.2 Procedure:

- 4.2.1 Balance should be in “standby mode”.
- 4.2.2 Record the traceability information for the balance and the sample.

- 4.2.3 Check to see if level (observe level bubble located above digital display and below weighing pan - bubble should be inside black ring in center).
- 4.2.3a If balance is not level adjust feet to level. Begin with the foot that is opposite the side of the bubble and turn clockwise until the bubble moves into black ring. Repeat with other feet using same principle. Be sure all feet are firmly on the tabletop surface (the balance is stable or steady - cannot rock)
- The bubble moves toward a foot when that foot is turned clockwise.
The bubble moves away from a foot when that foot is turned counterclockwise.
- 4.2.4 Press Display on/off button (located on right side of digital display).
- 4.2.5 Press the “ZERO” key (key labeled “zero” below digital display) to access desired weighing mode.
- 4.2.5a The digital display should default to “weigh” in the lower left hand corner of the digital display. “Weigh” should also appear in smaller letters in the upper right hand corner. The units of “g” (for grams) should appear to the right of the 0.00 display. If any other display is present consult your supervisor (instructor).
- Note:** *Pressing the mode keys to the right of the zero key will change the weighing mode and the units displayed.*
- 4.2.6 Calibrate the balance if necessary. See support SOP # GBT.006A.
- 4.2.7 Place the object to be weighed in the center of the weighing pan.
- 4.2.7a. Taring: Place the empty container (e.g. weigh boat, beaker,...) in the center of the weighing pan.
- 4.2.7b Press “Zero”. The digital display should now read “0.000”
- 4.2.8 Add sample to the container and wait for stability icon to appear in the upper left hand corner of the digital display.
- 4.2.9 Record, print out or send to a computer the weight of the sample.

Currently in the Biotech labs students must hand record this data.

4.2.10 Remove the object weighed and return the balance to the standby mode by pressing the display on/off button (located on right side of digital display).

4.2.11 Be sure the balance area is clean and dry.

5.0 Documentation

Simple Weighing - Traceability Record Sheet

Operator: _____ Date: _____

Study Number: _____

1. Balance Information :

Balance # : _____ Location : _____

Manufacturer: _____

Model #: _____ TR 603D _____

Serial Number: _____

Calibration verified: _____

2. Environmental Conditions:

Temperature: _____ °C

Relative Humidity: _____ %

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General SOPs and Exercises
for All Biotechnology Laboratories©

Biotechnology Program
Montgomery College
Germantown, MD
BSMaT

3. Calibration:

Calibration Source: ANSI/ASTM Set Class 2 (100 grams through 10 milligrams)
S/N: 00-J18700-1
Date: 07/26/00
Primary Set MT155 NIST Test # 822/26551-0 10/26/99
Secondary Set # MT50/53 04/14/00
Denver Instrument Company
Arvada Colorado

	Mass		
	<u>Calibration</u>	<u>Display</u>	<u>Settling Time</u>
Calibration tested:	_____ g	_____ g	_____ sec
	_____ g	_____ g	_____ sec
	_____ g	_____ g	_____ sec

Simple Weighing - Traceability Record Sheet

Operator: _____ Date: _____

Study Number: _____

4. Sample:

Sample Identification: _____

Sample Appearance: _____

Sample Mass: _____

SOP: GBT.006A
Revision: 1.0
Title: External Calibration Procedure for Denver Toploading Balance Model 603D

1.0 Purpose

To describe correct procedure for calibration of the Denver Top-loading balance (Model 603) in the Biotechnology laboratory using external ASTM certified weights.

2.0 Scope

This procedure applies to calibration of the Denver balances in the Biotechnology laboratory.

3.0 Responsibility

Any individual who is the first for that class period to use the balance to obtain a weight or if it appears there is a potential problem with the balance. Students shall be instructed in this procedure within the first 2 weeks of class.

4.0 Procedures

4.1 Materials

- 4.1.1 TR Top-loading balance
- 4.1.2 Calibration weights

4.2 Procedure

- 4.2.1 Be certain balance has stabilized - power source, level and environment (temperature, humidity, wind).
- 4.2.2 Obtain the calibration standard and record traceability information.
- 4.2.3 Select “Mode” by pressing the soft key next to the zero key. “Mode” should appear in middle / upper left and “Calibrate” should appear in lower left corner of the digital display.
- 4.2.4 Press “Enter”. “Add weight” should appear in lower right corner of the digital display and 0.000 should appear in the center of the digital display.

- 4.2.5 Select a calibration mass close to the predicted sample / unknown mass.
- 4.2.6 Place the calibration mass in the center of the pan. *The calibration weight should be handled with plastic forceps or gloved hands only.*
- 4.2.7 The balance automatically recognizes the mass and auto-calibrates accordingly. Once calibrated the balance returns to the weigh display.
- 4.2.8 Record the calibration result. Report any problems to your supervisor (instructor).
- 4.2.9 Repeat steps 5-8 with two other calibration weights one on either side of the mass selected in step 5.
- 4.2.10 Return the calibration standard to its storage location.
- 4.2.11 Proceed with sample weighing operation.

Questions About Weighing Operations

1. Why do we never put anything back into a reagent bottle?
2. What steps should be taken when first using the balance?
3. What traceability information should be recorded for the balance?
4. A worker placed the stir plate next to the electronic balance (6-8" away) to speed up the transfer of the weighed material and decrease the risk of spillage loss. Was this a good idea? Why or why not?
5. Can you tare weigh a beaker or flask with a magnetic stir bar in it?
6. You are weighing out 125 mg of NaCl - do you expect to see a big pile or a little pile of NaCl? What should you weigh this on or into?
7. You are weighing out 275.0 grams of Tris - do you expect to see a big pile or a little pile of Tris? What should you weigh this on or into?
8. You are weighing out 0.550 g of DTT - do you expect to see a big pile or a little pile of DTT? What should you weigh this on or into?
9. When preparing a multi-component solution (e.g. PBS with $MgCl_2$) and have to weigh out several different solids - how to do this?

Weight Conversion problems:

1. How many grams are in 76.0 mg?
2. How many grams are in 2301.0 mg?
3. How many grams are in 230.0 mg?
4. How many grams are in 3.768 mg?
5. How many grams are in 45.2 mg?
6. How many mg are in 0.500 g?
7. How many mg are in 0.0241 g?
8. How many mg are in 1.04 g?
9. How many mg are in 0.181 g?

Questions About Weighing Operations (answer key)

1. Why do we never put anything back into a reagent bottle?

Possible contamination it is cheaper to through out a few grams then to risk ruining an entire experiment - time and \$\$ lost

2. What steps should be taken when first using the balance?

*Sign log book if present
Check level
Turn on and check zero
check calibration
if working properly record traceability information
tare weigh boat, paper or beaker
weigh material and record immediately and permanently
remove weighed material
turn-off balance and clean-up*

3. What traceability information should be recorded for the balance?

*Location and company #
serial #
manufacturer
Model #
calibration check*

4. A worker placed the stir plate next to the electronic balance (6-8" away) to speed up the transfer of the weighed material and decrease the risk of spillage loss. Was this a good idea? Why or why not?

Bad idea - the magnet in the stir plate will affect the accuracy of the balance

5. Can you tare weigh a beaker or flask with a magnetic stir bar in it?

No - magnet in stir bar may effect the reading

6. You are weighing out 125 mg of NaCl - do you expect to see a big pile or a little pile of NaCl? What should you weigh this on or into?

Little pile / weigh paper or small weigh boat

7. You are weighing out 275.0 grams of Tris - do you expect to see a big pile or a little pile of Tris? What should you weigh this on or into?

Big pile / large weigh boat or better a larger plastic beaker (~500 ml)

8. You are weighing out 0.550 g of DTT - do you expect to see a big pile or a little pile of DTT? What should you weigh this on or into?

Little pile / weigh paper or small weigh boat

9. When preparing a multi-component solution (e.g. PBS with $MgCl_2$) and have to weigh out several different solids - how to do this?

The object is to avoid cross contamination of chemicals and waste due to weighing errors

Use disposable spatulas and weigh boats - one for each chemical component

Open and work with one item at a time

Immediately replace lid when finished

Move each item to opposite side of balance when weighing operation is complete

Combine each weighed component into the dissolution vessel

Weight Conversion problems:

remember 1 gram = 1000 mg

1. How many grams are in 76.0 mg?

0.076 g

2. How many grams are in 2301.0 mg?

2.3010 g

3. How many grams are in 230.0 mg?

0.230 g

4. How many grams are in 3.768 mg?

0.003768 g

5. How many grams are in 45.2 mg?

0.0452 g

6. How many mg are in 0.500 g?

500 mg

7. How many mg are in 0.0241 g?

24.1 mg

8. How many mg are in 1.04 g?

1040. mg

9. How many mg are in 0.181 g?

181. mg

Instructors Notes on Balance Use

Overview /Flow:

- T Record Traceability (sample / balance)
- T Check level
- T Turn on balance & check calibration
- T Tare sample container
- T Weigh sample
- T Clean up - shut down balance, clean area
- T Proceed with sample use

General :

, No chemical or liquid should ever be placed directly on the weighing pan use a:

Weigh boat
Weigh paper (fold before use)
Beaker
Graduated cylinder
Erlenmeyer flask

Be sure the container is compatible with chemical - e.g. do not weigh chloroform in plastic

- , The container should weigh the least amount feasible to still contain the sample being weighed (e.g. do not use a 400 ml beaker to weigh 0.002 g of sample - use a small piece of weighing paper).
- , Use a Zerostat gun to neutralize static charges on your gloves, the spatula, the sample and container - do use near the balance. A sheet of Bounce (laundry fabric softener) might also be used but it can leave residues
- , Use the same balance for repeated weighings
- , Never return any excess reagent to the source container.
- , Balance should be at ambient temperature (temperature at which weighing will be obtained) for at least 24-48 hours prior to measurement.
- , Balance power source should be free of voltage / current fluctuations - do not connect to same outlet that has other devices which are switching on and off - e.g. water bath, incubator, BSC, hot plate, fluorescent or UV lights, electrophoresis equipment...
- , It is advisable to connect to the power through a surge suppressor.
- , Balance should ***not*** be located near the following:
 - magnets (e.g. stir plates)'
 - Drafts (doors or windows, traffic areas)
 - Chemicals or liquids
- , Never apply manual pressure to the weigh pan. Do not wipe or clean the pan while it is

still installed on the balance. Use a brush to brush off solids from around the balance area and use a kim wipe to dab up liquid spills.

- , Never drop objects onto the pan - gently place on the pan and remove gently.
- , Exceeding the maximum weighing capacity of the balance can damage or even break some balances - be sure to check the maximum capacity before weighing large amounts.
- , Balance should be calibrated on a regular basis (e.g. weekly).
- , Response / settling time of the balance should be fairly constant - the time required for the display to stabilize during repeated weighings of the same sample. Variable settling times may indicate a problem (balance malfunction or unstable weighing environment).
- , handle all items to weighed with gloved hands or forceps
- , Calibration weights should only be handled with plastic forceps to avoid scratches and cannot be dropped or otherwise damaged

Specific to Denver Top-Loading Balance in Biotechnology Laboratory:

- < The maximum capacity of the balance is 410 grams
- < The balance will read to the nearest 0.001 grams for weights below 100 grams and to the nearest 0.01 gram for weights between 100 and 410 grams.
- < The balance has a stability indicator that appears in the upper right hand corner of the digital display when the reading has stabilized and can recorded. Stabilization should occur within 2 seconds under normal conditions.
- < The balance should be reproducible to the nearest 0.001 grams for measurements below 100 grams and to nearest 0.01 grams for measurements between 100 - 410 g
- < Several different weigh units can be selected / appear in the digital display - be sure the correct

unit is displayed. Units can be changed using the soft keys.

- < The balance has been preset to obtain optimized weighings adjusted to the environmental conditions:
 - Temperature fluctuations
 - Vibration
 - Drafts

- < A special mode is available for weighing live animals (samples that might be moving during the measurement) and for determining the number of identical pieces in a given sample mass (e.g. tablets).

Simple troubleshooting :

often many problems can be corrected by turning the balance off and maybe even disconnecting the power and then turning it back on - just like a computer

Blank screen:

no power - check connections and switches
is it plugged in

“OVER” on digital display

maximum capacity of balance exceeded - this amount
cannot be weighed

Fluctuation in numbers on display	drafts (wind or temperature induced - minimize movement around balances - stabilize environment - draft cover)
	Surface vibrations - leaning or movement on counter surface
	Line voltage problems - voltage filter
	Check for interfering pieces of equipment (esp. magnetic devices) - relocate
	Sample is moving - use animal weighing mode
Incorrect weight	check display units - set correct units
	Weigh pan blocked or obstructed - remove blockage
	Sample not centered - part is leaning on balance housing - reposition so all of sample weight is on balance pan
	Balance out of calibration - re-calibrate or send for repair