

STANDARD OPERATING PROCEDURES
DIVISION OF COMPARATIVE MEDICINE
UNIVERSITY OF SOUTH FLORIDA

SOP#: 1019

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TITLE: **Certification of Scales and Balances**
SCOPE: This procedure describes USF Comparative Medicine's (CM) method for certifying scales and balances.
RESPONSIBILITY: Facility Manager, Assigned Program Personnel
PURPOSE: To outline the procedure for monitoring the accuracy of the scales and balances used in CM.

I. PURPOSE

1. To ensure that weighing equipment used in animal facilities for the generation, measurement, or assessment of animal health and research data is adequately inspected and maintained in accurate working order.

II. RESPONSIBILITY

1. It is the responsibility of the Facility Manager and assigned staff to ensure that weighing equipment located in the animal facility is appropriately maintained in good working order and available for research personnel as requested.
2. The following equipment/supplies are required:
 - a. Set of known weights – MT#11124078
 - b. CMDC # 262 Weight Scale Certification Record Sheet
 - c. Certification labels

III. PROCEDURES

1. Preparation for calibration:

Find out the technical characteristics of the weighing instrument (max weight, d value), the accuracy requirement.

Typically, the whole measurement range is certified and the **certification is performed in the location where the instrument is being used**. Ensure you have enough weights for the certification procedure available.

The weighing instrument should be switched on at least 30 minutes before the certification.

Check the scale in a controlled environment. The temperature of the weights should be stabilized to the same temperature where the testing is to be done.

Test weights should be stored in their original box and put back immediately in their

storage place after use. **Test weights will only be handled with appropriate tools such as tweezers, forks, handles or gloves.**

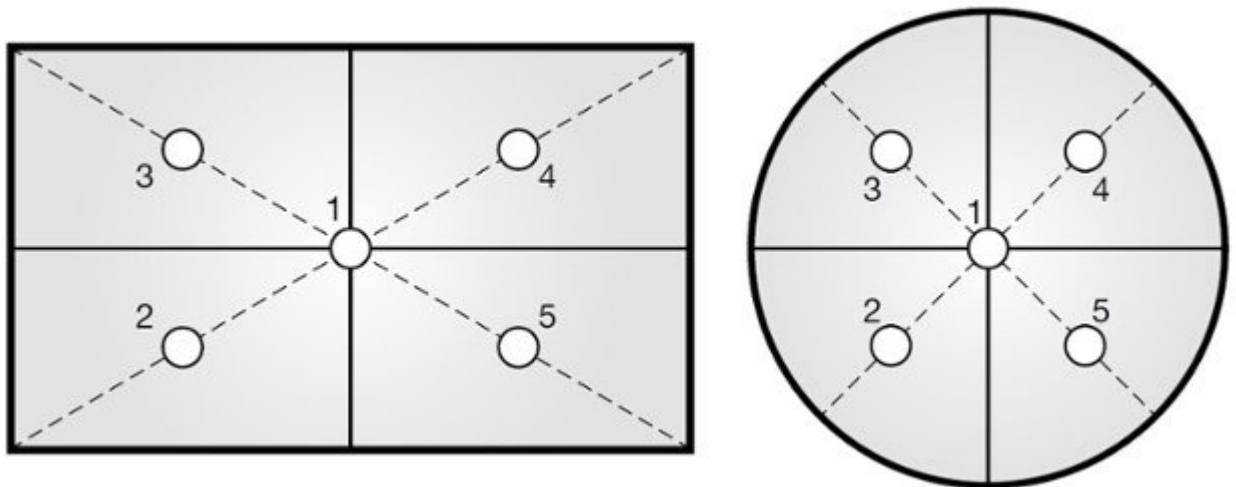
The weighing instrument should be at a horizontal level. There may be a bubble-level to use to ensure it is level by adjusting the feet.

Perform a few pre-tests by placing weights close to the maximum of the range on the instrument and to ensure it works normally.

2. Eccentricity test

In normal use of a weighing instrument the load is not always placed perfectly on the center of the load receptor. Sometimes the results of a weighing instrument can vary slightly depending if the load is placed in different locations on the load receptor. In order to test how much effect the location of the load has, the eccentricity test is performed.

In the eccentricity test, the reference load is placed in a few different specified locations on the load receptor. First, the load is placed in the center of the load receptor (the load's center of gravity) and the result is observed. Next, the load is placed in four different sectors of the load receptor, as illustrated in the picture below.



The test load used in an eccentricity test **should be at least one third (1/3) of the max load** of the weighing instrument and preferably using just one test load. That way it is easier to be sure that the load's center of gravity is in the specified location. For a weighing instrument with multiple ranges, the eccentricity test should be done with the highest range.

It is important to use the same load through the test.

Procedure for the eccentricity test

The indication is zeroed before the test. The test load is placed to location 1 and indication is recorded. The test load is then moved to locations 2 to 5 and **indication is recorded in**

each location on **CMDC XXX Weight Scale Certification Record Sheet**. Finally, the test load is placed again to location 1 to check that the indication has not drifted from the earlier indication in location.

The zero may be checked between each location to see that it has not changed. If necessary, the instrument can be zeroed in between each test.

Alternatively, you may also tare the instrument when the load is in location number 1, as this makes it easier to see any difference between locations.

Evaluation

The largest reading (positive or negative) of any of the 4 corners (2 to 5) is the eccentric load deviation.

3. Repeatability test

As any instrument, also weighing instruments may suffer from repeatability issues. This means that when the same load is measured several times, the result is not always exactly the same. To find out the repeatability of the instrument, a repeatability test is performed.

The repeatability test is performed by replacing the same load on the same place on load receptor (to avoid any eccentricity error) multiple times. Test should be done in identical and constant conditions and with identical handling.

The load used should be close to the maximum load of the instrument using one load only.

The load does not necessarily need to be a calibrated load, as the aim is to find out the repeatability. If possible, the load used should be a single load (not several small loads).

A repeatability test should be done at least 3 times.

In the repeatability test, the instrument is first zeroed, then the load is placed on load receptor and indication is recorded once it is stabilized. Then the load is removed and zero indication is checked and zeroed, if necessary. Then the load is placed again, and so on.

For a multi-range instrument, a load close but below the first range max is often sufficient.

Test Procedure:

- Empty the pan
- If required, place tare load on the weighing pan
- Tare the balance (if required press zero)
- Read the stable value from the display and note it
- Place the test weight in the center of the weighing pan

- Read the stable value from the display and note it
- Remove the test weight
- Repeat the measurements from 'tare the balance to 'remove test weight" 3 times
- Record the values on **CMDC #262 Weight Scale Certification Record Sheet**.

4. Weighing test

The purpose of the weighing test is to test the accuracy of the weighing instrument throughout its whole range in several steps, with increasing and decreasing weight.

Five different loads (test points) will be used. The highest load should be close to the maximum of the instrument. The smallest test load can be 10% of the maximum load, or the smallest weight normally used.

The most common practice is the following:

- Start with zeroing the instrument without any load.
- Set the loads of the first test point, wait for stabilization, and **record the indication**.
- Continue increasing the loads through all the increasing test points.
- Once the maximum load is recorded, start decreasing the loads through the decreasing test points.

Generally, the test points are selected so that they are equally distributed throughout the range. More test points can be used for the typical range of usage of the instrument.

Scale Accuracy: The scale is accurate to 2% for each weight. See example table below:

Weight	Scale Requirement	Calibration Reading
1 gram	.98 - 1.02 grams	<i>0.99 grams</i>
1 Kg	980 grams - 1020 grams	<i>997 grams</i>
5 Kg	4900 grams - 5100 grams	<i>4970 grams</i>

If any of the test fail, report the problem to the manager/supervisor and mark the instrument "out of control limits".

Approved:

Date: