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CENTER FOR DIETARY ASSESSMENT

SURVEY GUIDANCE DOCUMENT

**Routines and Procedures to Test
the Accuracy and Precision of
Digital Dietary Scales Used in
Quantitative 24-Hour Dietary
Recall Surveys**

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About *Intake*

Intake is a Center for Dietary Assessment that aims to strengthen policies and programs to improve nutritional status by increasing the availability, quality, comparability, and use of reliable dietary data in low- and middle-income countries (LMICs). We hope that the availability of valid, concise, effective diet-related metrics, along with *Intake* technical assistance for the planning, design, collection, analysis, and use of dietary data, can play an important role in helping actors in LMICs to develop evidence-based nutrition and agriculture policies and programs to ensure high-quality diets for all.

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Contents

1	Introduction	1
2	Routines for Testing Dietary Scales	3
	2.1 Testing Before First Use	3
	2.2 Testing During Standard Recipe Data Collection	3
	2.3 Testing During 24-Hour Dietary Recall Data Collection	3
	2.4 Testing During Survey Training and Piloting.....	4
3	Procedures for Testing Dietary Scales	5
	3.1 Standard Weights to Use for Testing.....	5
	3.2 Acceptable Accuracy and Precision of Measurements.....	6
	3.3 Log Sheets to Use for Testing	6
	3.4 Step-By-Step Procedures for Testing Dietary Scales	7
	3.5 Replacement of Faulty Dietary Scales	9
	Annex 1. Using Ad Hoc Reference Weights for Testing Dietary Scales	10
	Annex 2. Example of a Log Sheet for the Weekly Testing of Dietary Scales	11

BOXES

Box 1.	Recommended Procedure for Testing Dietary Scales for Use in Large-Scale Dietary Surveys	7
Box 2.	Simplified Procedure for Testing Dietary Scales in Households During 24-Hour Dietary Recall Data Collection	8

TABLE

Table 1.	Standard Weights Recommended for Testing Dietary Scales and Acceptable Accuracy and Precision of Scale Measurements	5
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1 Introduction

Dietary scales are often used to estimate the portion size of foods,¹ ingredients, and mixed dishes reported as consumed by survey respondents during quantitative 24-hour dietary recalls. High-quality dietary scales are essential when weighing reported foods directly or when portion size estimation methods entail the use of proxy materials such as playdough or dry rice. Dietary scales are also needed for obtaining weights of ingredients and mixed dishes during the collection of standard recipe data.² The dietary scales used to collect these data must be accurate³ and precise⁴ to ensure that the data from the survey are meaningful and not affected by errors related to the scales.

Little guidance is available on the routines and procedures to follow for ensuring well-functioning scales are being used in dietary surveys. This document aims to help fill that gap. In this guidance document, we describe the recommended routines and procedures for testing dietary scales intended for use in large-scale quantitative 24-hour dietary recall surveys in low- and middle-income countries (LMICs). The guidance in this document relates to digital dietary scales that meet the specifications recommended by *Intake*.⁵

To ensure that all dietary scales used in dietary surveys are in proper working order, *Intake* recommends that all scales are tested regularly during all stages of the survey in which they are used. Dietary scales should be tested before first use, each time they are set up for use (i.e., during the collection of standard recipe data and 24-hour dietary recall data with the survey respondent in the household), and routinely throughout data collection for the survey. Dietary scales should also be tested during field staff training and survey piloting, following the same frequency and using the same set of routines and procedures that are planned for use during data collection for the survey. A dietary scale should also be tested if it is dropped or handled roughly, gets wet, or if the display is unstable. To avoid potential damage to dietary scales, care should be taken to package dietary scales appropriately during all transport.

The “testing” of a dietary scale refers to following a set of specific procedures to check if the scale is functioning accurately and precisely when weighing objects of known weights. Testing is done by using multiple reference objects of known weights (i.e., a set of standard weights) that cover the full range of weights that are expected to be encountered during the intended use of the scale.⁶ If the weight measurements obtained during testing are not within the predetermined acceptable range for that standard object and this is confirmed after repositioning the scale and/or replacing batteries, the dietary scale should no longer be used.

Regular testing of dietary scales throughout all phases of survey work ensures that malfunctioning scales are promptly identified so they can be immediately replaced. The testing of a dietary scale after each set-up and before any weight measurements are taken is important to ensure that the scale is set up properly in the field on every data collection occasion. This entails placing the scale on a flat surface, blocking windy conditions, ensuring that the batteries are charged, and checking that the scale is displaying weights in grams, not in ounces. If the set-up is not done properly, even a well-functioning scale will produce erroneous measurements.

¹ For simplicity in language, in this document, we use the term “foods” to refer to both foods and beverages.

² Standard recipes are “average” recipes that aim to reflect the way that mixed dishes are usually prepared by respondents in the survey area. Standard recipe data, including the weight of all ingredients used and the weight of prepared mixed dish, are typically collected through group cooking sessions.

³ The accuracy of a dietary scale refers to how close the weight measurement provided by the scale is to the true weight of the object.

⁴ The precision of a dietary scale refers to how consistent weight measurements provided by the scale are when the same object is weighed multiple times.

⁵ See Vossenaar et al. (2020). *Recommended Specifications for Dietary Scales for Use in Quantitative 24-Hour Dietary Recall Surveys in Low- and Middle-Income Countries*. Available at [Intake.org](https://intake.org).

⁶ When testing a dietary scale before data collection with a survey respondent, a simplified procedure entailing the use of a single standard weight may be used.

In this guidance document, we first outline the recommended routine for the testing of dietary scales at each stage of survey work in which they are used (Section 2). Then we describe the recommended procedures for testing the scales at each stage of survey work; this includes recommendations on the standard weights that should be used, the acceptable level of accuracy and precision of weight measurements, the use of log sheets, step-by-step testing procedures, and how to replace “faulty” or malfunctioning scales (Section 3).

2 Routines for Testing Dietary Scales

2.1 Testing Before First Use

All dietary scales should be tested before first use. During this initial testing, each scale should be labeled with a unique identifier (e.g., alphanumeric code) so that the performance of each scale can be tracked over time. The labeling of each scale in this way can also be helpful for monitoring the overall inventory of scales purchased and for tracking which survey staff member is equipped with which scale.

Ideally, all dietary scales are tested together immediately after purchase at the same location by a single person (e.g., by the survey coordinator) or by a small team of people. The survey coordinator should create a log sheet to record measurements of standard weights for each dietary scale and to document scales that need to be replaced. The recommended procedure described in Box 1 is appropriate to use for this initial testing.

2.2 Testing During Standard Recipe Data Collection

Standard recipes are “average” recipes that aim to reflect the way that mixed dishes are usually prepared by respondents in a survey area. Standard recipes can be used for mixed dishes that are known to be prepared similarly across a defined survey area, so that the collection of detailed recipe information during the 24-hour dietary recall interview with the survey respondent can be bypassed. The collection of standard recipes is typically done as part of pre-survey activities. Cooking sessions are organized to collect the necessary recipe data as the mixed dish is prepared; this includes recording data on the mixed dish preparation methods, the weight of ingredients added to the mixed dish, and the total amount of the mixed dish prepared.

The use of well-functioning scales during standard recipe data collection is essential to ensure the collection of accurate data on the ingredient proportions used in commonly consumed mixed dishes. Should a faulty scale be used during standard recipe data collection, a substantial amount of error could be introduced into the results of the survey since the faulty standard recipe data collected would likely be applied to the recall data for a non-negligible number of survey respondents.

All dietary scales used for standard recipe data collection should be tested each day of data collection. The accuracy and precision of the scales should be tested on site during set-up; before the cooking session begins and before any weight measurements are collected. If a second cooking session is held the same day and the scales are not moved, it is not necessary to test the scales again that day.

Before standard recipe data collection, the survey coordinator should create a log sheet to record measurements of standard weights for each scale and to document any possible need for replacing a dietary scale. The survey coordinator should be present for the testing of the scales, but it is generally the standard recipe data recorder⁷ who should be responsible for carrying out the actual testing of the scales. The recommended procedure described in Box 1 is appropriate to use for the testing of dietary scales during standard recipe data collection.

2.3 Testing During 24-Hour Dietary Recall Data Collection

During the 24-hour dietary recall data collection phase of the survey, two different types of tests for dietary scales should be conducted on a routine basis: one to allow the field supervisor to oversee weekly testing of all scales assigned to his/her data collection team; and one to ensure that the scale is properly set up and functioning well in the respondent’s household during the 24-hour dietary recall. The exact frequency and extent of such testing during the data collection phase of the survey will depend on what is feasible in each specific field setting.

⁷ This is the person who records the weights of all ingredients, empty pots, and mixed dishes prepared during the collection of standard recipe data.

2.3.1 Testing with Three Standard Weights At Least Once a Week

Throughout the data collection phase of a dietary survey, dietary scales should be tested at least once a week at a convenient location that allows the field supervisor for each dietary data collection team to oversee the testing of all scales assigned to his/her team members. This testing helps ensure that the scales are providing accurate and precise 24-hour dietary recall data during the survey.

Before data collection for a dietary survey begins, the survey coordinator should create a log sheet on which all enumerators should record measurements of standard weights during the testing of each scale and document any possible need for scale replacement. The field supervisor should be present for the testing of the scales, but it is generally the enumerators who are responsible for carrying out the weekly testing.

The recommended procedure described in Box 1 is appropriate to use for the weekly testing of dietary scales during data collection. After completing the testing of the dietary scales assigned to him/her, each enumerator should submit the completed testing log for each tested scale to the field supervisor for his/her review.

2.3.2 Testing with a Single Standard Weight After Set-Up and Before Collecting 24-Hour Dietary Recall Data from the Survey Respondent

In addition to the weekly testing of dietary scales with the team, each enumerator should test the scale assigned to him/her during set-up in a respondent's household for the collection of 24-hour dietary recall data. The testing of dietary scales in the household is important, not only to ensure that the scale is functioning properly and has not incurred any damage in transport, but also to ensure that the scale has been properly set up before collecting data.

The procedure for testing a dietary scale in the household can be simplified from the procedure described in Box 1 by using a single standard weight for the testing instead of three standard weights. This simplified procedure described in Box 2 can help to reduce both the time required to be spent at a household where data are being collected and the burden of equipment that the enumerator must carry in the field.

To ensure that the standard weight used for scale testing in households is not too burdensome to carry, a single standard weight that is in the light to medium range is recommended (see Table 1). If it is not feasible to purchase a certified weight for each enumerator, it is possible to substitute the certified weight with an ad hoc reference weight such as a tin of tuna (see Annex 1).

Before beginning data collection, the survey coordinator should create a log sheet for enumerators to record measurements of the standard weight used for scale testing during data collection in households, as well as any possible needed replacement of a dietary scale. If the testing of the scale indicates that the scale needs to be replaced, the 24-hour dietary recall interview with the respondent may need to be rescheduled. Each enumerator's completed log sheet should be submitted at the end of each day of data collection to the field supervisor for his/her review.

2.4 Testing During Survey Training and Piloting

Throughout the training of field staff and piloting of the survey, all dietary scales should be tested according to the specific routines and procedures defined for the data collection phase of the survey. The detailed set of routines and procedures to follow should be included in the training curriculum for field supervisors and enumerators. Over the course of training, field supervisors should become proficient in overseeing the weekly testing of scales, and each enumerator should become proficient at carrying out the weekly testing of the dietary scale assigned to him/her, as well as the testing conducted after set-up in each household is complete.

Dietary scales should also be tested by the lead trainer each time the scales are used in a demonstration during a supervisor or enumerator training session (e.g., training on portion size estimation methods). This testing is recommended to emphasize the importance of scale testing after each set-up and before use. If a faulty scale is identified during training, this should be documented according to the defined survey procedures, and the scale should be replaced.

3 Procedures for Testing Dietary Scales

3.1 Standard Weights to Use for Testing

The standard weights used to test dietary scales should collectively cover the full range of weights that are expected to be encountered during the survey (including both standard recipe and 24-hour dietary recall data collection). A summary of the recommended standard weights to use for testing scales for each phase of the survey is provided in Table 1. Ideally, three standard weights (one light weight, one medium weight, and one heavy weight) are used to test dietary scales. However, when enumerators test scales in the households of respondents, it may only be feasible to carry and use a single standard weight. When this is the case, a light-medium weight should be used.

Table 1. Standard Weights Recommended for Testing Dietary Scales and Acceptable Accuracy and Precision of Scale Measurements

	Standard weight description	Standard weight within the following range ¹	Acceptable accuracy and precision of measurements ²	Additional information for choosing a weight range for standard weights
Three standard weights ³ used to test dietary scales: <ul style="list-style-type: none"> ▪ before first use ▪ during standard recipe data collection ▪ weekly during the data collection phase of the survey 	Light weight	10 g to 30 g	±1 g	Use 10 g to 20 g for surveys that include infants and young children who consume small portion sizes.
	Medium weight	200 g to 300 g	±5 g	
	Heavy weight	500 g to 800 g	±10 g	Use this weight range if non-standard recipes will not be collected during 24-hour dietary recall interviews and the maximum weight capacity of the scale is 5 kg.
		2,000 g to 3,000 g	±50 g	Use this weight range if non-standard recipes will be collected during 24-hour dietary recall interviews with respondents and the maximum weight capacity of the scale is 5 kg.
		5,000 g to 6,000 g	±100 g	Use this weight range if non-standard recipes will be collected during 24-hour dietary recall interviews with respondents and the maximum weight capacity of the scale is 10 kg to 15 kg.
One standard weight ⁴ to test dietary scales after set-up in the household before collecting 24-hour dietary recall data from the survey respondent	Light-medium weight	50 g to 100 g	±1 g	

¹ A standard weight with a value within this range should be used.

² To our knowledge, there is no standard for acceptable accuracy and precision for dietary scales used for data collection in population-based dietary surveys. *Intake* recommends that the values shown here be used as the threshold limit for defining the acceptable accuracy and precision of weight measurements during scale testing. For more information about these recommendations, see Section 3.2.

³ Ideally certified weights are used for testing of dietary scales.

⁴ Ideally certified weights are used for testing of dietary scales; however, an ad hoc reference weight (see Annex 1) can be used for testing dietary scales after set-up in the household before collecting 24-hour dietary recall data from the survey respondent if it is not feasible to purchase a standard certified weight for all enumerators.

3.2 Acceptable Accuracy and Precision of Measurements

Scales for use in quantitative 24-hour dietary recall surveys should display weights to the nearest 1 gram and have a precision of 1% across the load range. However, this level of precision is not needed to estimate the amount of food reported as consumed during data collection for a dietary survey. This is because the error in reporting portion sizes is expected to be more than 1%, and because such a small difference in weight of food is not meaningful when estimating energy and nutrient intakes. To our knowledge, there is not an established standard for the acceptable accuracy and precision of scales used in dietary surveys.

The accuracy and precision ranges that *Intake* recommends for testing dietary scales are provided in the fourth column of Table 1. For light weights (10 g to 30 g) and light-medium weights (50 g to 100 g), the acceptable accuracy and precision of the measurements is ± 1 g. For medium weights (200 g to 300 g), the acceptable accuracy and precision of measurements is ± 5 g. For heavy weights 500 g to 800 g, 2,000 g to 3,000 g, and 5,000 g to 6,000 g, the acceptable accuracy and precision of the measurements is ± 10 g, ± 50 g, and ± 100 g, respectively.

The acceptable measurement errors range from 1% to 3% for the light-medium, medium, and heavy standard weights, but range from 3% to 10% for the light standard weight because dietary scales can only display measurements to the nearest 1 gram.

For a scale to be considered well-functioning for the dietary survey, all measurements of a standard weight must have acceptable accuracy and precision, defined as follows:

- An acceptable range of *accuracy* means that each weight measurement provided by the scale is within an acceptable range of the standard weight. When using a 200 g standard weight, all measurements between 195 g and 205 g would be acceptable.
- An acceptable range of *precision* means that the three weight measurements for a single weight provided by the scale are within an acceptable range of each other. When using a 200 g standard weight, the difference between the highest and the lowest measurement should be 5 g or less. Measurements of 195 g, 198 g, and 205 g would not be acceptable because there is a difference of 10 g between the highest and lowest measurement.

3.3 Log Sheets to Use for Testing

A log sheet to document dietary scale testing should be created by the survey coordinator for each testing routine described in Section 2. An example of a log sheet that enumerators can use for testing dietary scales with three standard weights at least once a week is provided in Annex 2. Forms used for testing scales before first use, during standard recipe data collection, and during 24-hour recall data collection in households will be different.

Log sheets used to record the results from the testing of dietary scales should include an identifier for the survey coordinator, field supervisor, and/or the enumerator; a description of the model and a unique identifier for the scale being tested; date of testing; and any other information deemed useful.

The log sheet should allow all measurements to be recorded to the nearest 1 gram. The log sheet should also include a column in which calculations are recorded to determine if the accuracy and precision of the scale measurements are within the acceptable ranges. Pocket calculators should be provided to enumerators to facilitate correct calculations. When using technology-assisted data recording, these calculations can typically be done by the software being used.

If a scale needs to be re-tested, a new row in the log sheet should be used for this purpose. The log sheet should provide a clear record of any scales that have been identified as not functioning, and those scales should be removed from use in the survey. A new log sheet will be needed for the new scale used to replace any faulty scale.

3.4 Step-By-Step Procedures for Testing Dietary Scales

Box 1 provides the recommended procedure for testing dietary scales during the following phases of survey work: before first use (Section 2.1); during standard recipe data collection (Section 2.2); during survey data collection (i.e., weekly testing of dietary scales) (Section 2.3.1); and during training and survey piloting (Section 2.4).

Box 1. Recommended Procedure for Testing Dietary Scales for Use in Large-Scale Dietary Surveys

1. Ensure that each dietary scale is clearly labeled with a unique identifier. Scales should be labeled when tested before first use (as described in Section 2.1).
2. Create a log sheet to record measurements of standard weights for each scale (as described in Section 3.3).
3. Select three standard weights that collectively cover the full range of weights that are expected to be encountered for the intended use of the scale (as described in Section 3.1).
4. Set up the scale appropriately (i.e., on a flat, vibration-free surface that is not exposed to direct sunlight or wind) for each use (i.e., during standard recipe collection) or testing (i.e., before first use and weekly during the data collection phase of the survey).
5. Place the first standard weight on the scale three times. The scale does not need to be turned off or tared between measurements, but the display should go back to zero.
6. Place the second weight on a scale three times, and then place the third weight on the scale three times.
7. Record the three weights taken for each of the three standard weights (measured in Steps 5 and 6). Each weight should be recorded to the nearest 1 gram on the log sheet (as described in Section 3.3).
8. Check if the weight measurements are within the acceptable range of accuracy and precision that correspond to a given standard weight (as described in Section 3.2). If all weight measurements are within the acceptable range of accuracy and precision, skip to Step 12 below.
9. When one or more weight measurements are not within the acceptable range of accuracy or precision for a given standard weight used for scale testing, check that the scale is positioned correctly and that the batteries are charged. If necessary, reposition the scale and/or replace the batteries, and repeat Steps 4–8.
10. If one or more weight measurements are still not within the acceptable range for accuracy or precision, the scale should not be used. Document on the log sheet that the scale has been determined to be non-functioning, submit the log sheet to the survey coordinator or field supervisor, and replace the scale with a well-functioning scale for all future data collection (as described in Section 3.5).
11. Test the new scale and record the results on a new log sheet following the same procedure; return to Step 1.
12. Check that the log sheet is legible and complete before sharing with the survey coordinator or field supervisor.
13. Repeat the testing procedure for all scales to be tested.

Box 2 provides a simplified procedure that can be used for testing dietary scales after set-up and before collecting 24-hour dietary recall data from a respondent (as described in Section 2.3.2). The simplified procedure uses one standard weight instead of three standard weights.

Box 2. Simplified Procedure for Testing Dietary Scales in Households During 24-Hour Dietary Recall Data Collection

1. Ensure that each dietary scale is clearly labeled with a unique identifier. Scales should be labeled when tested before first use (as described in Section 2.1).
2. Create a log sheet to record measurements of standard weights for each scale (as described in Section 3.3).
3. As it is often not feasible for the enumerator to carry a series of weights, select one standard weight that will be used to test the scale (as described in Section 3.1).
4. Set up the scale appropriately (i.e., on a flat, vibration-free surface that is not exposed to direct sunlight or wind) for use in the household during 24-hour dietary recall data collection with the respondent.
5. Place the standard weight on the scale three times. The scale does not need to be turned off or tared between measurements, but the display should go back to zero.
6. Record the three weights taken using the single standard weight (measured in Step 5). Each weight should be recorded to the nearest 1 gram in the log sheet (as described in Section 3.3).
7. Check if the weight measurements are within the acceptable range of accuracy and precision that corresponds to the standard weight (as described in Section 3.2). If all weight measurements are within the acceptable range of accuracy and precision, skip to Step 11 below.
8. When one or more weight measurements are not within the acceptable range of accuracy or precision for the standard weight used for scale testing, check that the scale is positioned correctly, and the batteries are charged. If necessary, reposition the scale and/or replace the batteries, and repeat Steps 4–7.
9. If one or more weight measurements are still not within the acceptable range for accuracy or precision, the scale should not be used. Document on the log sheet that the scale has been determined to be non-functioning, submit the log sheet to the field supervisor, and replace the scale with a well-functioning scale for all future data collection (as described in Section 3.5). If needed, postpone data collection at the household until the dietary scale is replaced.
10. Test the new scale and record the results on a new log sheet following the same procedure; return to Step 1.
11. Check that the log sheet is legible and complete.
12. Repeat the testing procedure each time the scale is set up for collecting 24-hour dietary recall data within a household. There is no need to re-test the scale if multiple people are interviewed within a household, as long as the scale is not moved.
13. Share the completed log sheet with the field supervisor at the end of data collection for the day.

3.5 Replacement of Faulty Dietary Scales

If one or more weight measurements obtained are not within the pre-determined acceptable range for the standard weights, check that the dietary scale is positioned correctly and that the batteries are charged. Reposition the scale and/or replace the batteries, and repeat the testing procedure described in Box 1 or Box 2. If the scale continues to produce unacceptable measurements, the scale should be immediately replaced with a well-functioning scale. The faulty scale should be removed from the stock of survey supplies to ensure that the use of the scale is discontinued and, depending on the warranty conditions, possibly returned to the manufacturer.

All field supervisors need to have easy access to replacement dietary scales throughout data collection to ensure that any equipment that is found not to be in good working order can be replaced immediately without causing a delay in data collection. In practice, the replacement of dietary scales may not be immediately possible, and it may be necessary to reschedule the 24-hour dietary recall interview.

Replacement dietary scales should be tested following the procedures used for the survey and labeled with a new unique identifier; a new log sheet should be used for reporting the testing results for the replacement scale.

Annex 1. Using Ad Hoc Reference Weights for Testing Dietary Scales

- Ad hoc reference weights should only be used if the required number of certified weights required for all survey enumerators cannot be procured.
- Ad hoc reference weights should only be used to test dietary scales with a single standard weight before the 24-hour dietary recall in the household (as described in Section 2.3.2).
- Objects selected for use as an ad hoc reference weight should be solid and not prone to spilling or changing weight, such as through the absorption of humidity (e.g., not a bag of flour).
- Suitable objects might be a glass or plastic object (e.g., a cup or cube) or a canned item. The object should weigh 50 g to 100 g.
- A single ad-hoc weight of the same type should be acquired for each enumerator.
- The weight of each ad hoc reference weight should be determined, as follows:
 - Determine the weight of the ad hoc reference object using at least two different reliable and accurate dietary scales (i.e., scales that have already been tested for accuracy and precision as described in Box 1).
 - Weigh the ad hoc reference object **5 times** on each scale and determine the average of all 10 readings to the nearest 1 gram.
- Record the weight of the ad hoc reference object to the nearest 1 gram on a label and affix the label to the reference object.
- Independently derive the weight for each object to be used as an ad hoc reference weight, following the same procedure as described above (even though the objects used by different enumerators should theoretically be the same type/size/weight).

Annex 2. Example of a Log Sheet for the Weekly Testing of Dietary Scales

Date (dd/mm/yy) of measurements: |__| |__| |__| |__|

Field supervisor name and unique identifier: _____ |__| |__| |__| |__|

Enumerator name and unique identifier: _____ |__| |__| |__| |__|

Digital scale model and unique identifier: _____ |__| |__| |__| |__|

Replacement digital scale model and unique identifier: _____ |__| |__| |__| |__|

*This log sheet should only be used for the testing of one scale.
If a replacement scale is needed, a new log sheet should be used.*

Take ¹	Measurement (in grams) ²			Difference between the measurement and standard weight (in grams) ³			Acceptable accuracy ⁴	Difference between the highest and lowest measurement (in grams) ⁵	Acceptable precision ⁶
	1 st	2 nd	3 rd	1 st	2 nd	3 rd			
30 g light standard weight with an acceptable range of ±1 g									
1							<input type="checkbox"/>		<input type="checkbox"/>
2							<input type="checkbox"/>		<input type="checkbox"/>
300 g medium standard weight with an acceptable range of ±5 g									
1							<input type="checkbox"/>		<input type="checkbox"/>
2							<input type="checkbox"/>		<input type="checkbox"/>
3,000 g heavy standard weight with an acceptable range of ±50 g									
1							<input type="checkbox"/>		<input type="checkbox"/>
2							<input type="checkbox"/>		<input type="checkbox"/>

¹ If the measurements in Take 1 are considered unacceptable, check that the dietary scale is positioned correctly and that the batteries are charged. Reposition the scale and/or replace the batteries and repeat the testing, recording the measurements in Take 2.

² Record the measurement of the standard weight to the nearest 1 gram.

³ Use a pocket calculator to compute the difference between the measurement and standard weight.

⁴ Check this box if the difference between the measurement and standard weight is within the acceptable range.

⁵ Use a pocket calculator to compute the difference between the highest and lowest measurements.

⁶ Check this box if the difference between the highest and lowest measurements is within the acceptable range.



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