

CHAPTER 5

TEST WEIGHT PER BUSHEL APPARATUSES

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CHAPTER 5

TEST WEIGHT PER BUSHEL APPARATUSES¹**1. INTRODUCTION**

Test weight per bushel apparatuses enable inspectors to determine the approximate weight of a bushel of a particular lot of grain or rice. For official purposes, only use test weight per bushel apparatuses that are (1) a type and model approved by FGIS; (2) properly adjusted; (3) maintained in good operating condition; and (4) tested and examined at the prescribed intervals, in the proper manner, and found to be within tolerance.

2. TOLERANCES

- a. Kettle Accuracy. ± 1 gram.
- b. Beam/Scale Accuracy. ± 0.10 pound per bushel at any reading, deviation from test weights.
- c. Test Weight Accuracy. ± 0.15 pound per bushel, mean deviation from the standard test weight apparatus using wheat.

3. MAINTENANCE

Test weight per bushel apparatuses must be maintained in good operating condition. Check and adjust them prior to initial use and periodically thereafter, as needed. Each maintenance check shall encompass the following:

- a. Environmental Conditions. Ensure that the apparatus is mounted on a rigid table or base free of vibrations in a well illuminated, draft-free area.

¹Includes approved test weight per bushel apparatuses that utilize a weighing beam, or approved filling apparatuses, kettles, and electronic or mechanical scales.

- b. Funnel Height and Position.
- (1) Check the funnel height. The funnel's base should be exactly 2 inches above the top of the test kettle. You may use a ruler or other aid to measure; however, a length of 2-inch aluminum angle stock is recommended as a gauge, since it will rest on top of the kettle and maintain a perpendicular orientation to the top edge.
 - (2) Check the funnel position. The vertical center line of the funnel should pass directly through the vertical center of the test kettle. Adjust the funnel arm stop and kettle rest stops, if necessary.
- c. Level. Check that the apparatus is in a true level condition with a spirit level placed on the top of the kettle. The apparatus must be level front to back and side to side. (The bubble level mounted on the scale base may not be accurate and should not be used for this purpose.) Level by using the adjustable front legs. Once level, tighten the adjustable leg-locking nuts securely.
- d. Beam Balance. Determine if the beam is in balance by suspending the empty kettle from the beam load loop. Set the beam counterpoises to zero. The beam should indicate a balanced condition. If necessary, adjust the beam to balance with the balance ball.
- e. Kettle Condition. Ensure that the kettle is free of dents and that the top surface is smooth, straight, and level. If dented or out-of-round, repair and test the kettle. (See Water Volume Test.)
- f. Stroker Condition. Ensure that the stroker is smooth and straight, and that the edge has a round 3/16" radius. Overall dimensions are 12" x 1-3/4" x 3/8".
- g. Cleanliness. Ensure that the apparatus is clean. The test kettle may be cleaned with mild detergent and water. Do not use abrasive cleaners or steel wool.
- h. Wear. Clean the beam knife edge pivot and bearings with a soft cloth and check for wear. If cracked or chipped, replace the pivot or bearing. Replacement shall only be done by a service company and under no circumstances shall the knife edge pivot be filed down.

4. TESTING

A complete test requires checking the weighing accuracy of the device by performing either a scale test or a beam test. This is followed by a test of the apparatus and kettle by performing a grain test. The volume test may not be substituted for the grain test.

- a. Scale Accuracy Test. When an electronic or mechanical scale is used in lieu of the apparatus beam:
 - (1) No testing with weights is needed if the scale has been tested as described in Chapter 2, Grain Test Scales.
 - (2) If the scale has not been tested as described in Chapter 2 within the last 6 months, refer to Chapter 2 and perform the test, then proceed to the grain test.

- b. Beam Accuracy Test. Do not perform this test unless the gram weights or special pound-per-bushel weights that are needed have been tested and certified as Class F. Show the date the weights were last tested in the remarks section of the form FGIS-927.
 - (1) Hang the kettle from the beam.
 - (2) Zero balance the beam using the balance ball, with the poises set on zero. Then record the load (0 g) and the poise indication on the Beam Test section of the form FGIS-927. (The 0.1-pound per bushel graduations shall be broken down into 1/4 increments and read as 0.025, 0.050, 0.075, 0.100.)
 - (3) The primary and secondary beams must be tested at approximately 1/2 and full capacity. If using special weights, test at 5, 10, 30 and 60 pounds per bushel. (If using gram weights, test at 71, 142, 425, 850 grams. These weights are equivalent to 5, 10, 30, and 60 pounds per bushel.) For each of the four loads, place the appropriate weights in the kettle and adjust the poises to balance the beam. Record the beam reading.

Note any deviation using the method described in step 2, above.

- (4) You may test the beams at additional loads if desired.
- (5) Perform a sensitivity test on the beam by placing weights equaling 850 g (approximately 60 pounds per bushel) in the kettle and adjusting the poises to balance the beam. Then add 1 g to the kettle. This additional weight should be sufficient to move the beam from balance to the extreme top of the trig loop. (For test purposes, the 1 g shall be considered equal to the 0.10 pound per bushel sensitivity requirement.)
- (6) Failure of the beam to pass the sensitivity test in step 5 or to yield results in error more than ± 0.10 pounds per bushel from the target weight in steps 2, 3, or 4 indicates that the beam is out-of-tolerance. Such beams must be replaced or repaired by a qualified mechanic before being used for official purposes.

c. Water Volume Test.

- (1) When to perform a volume test on the test weight kettle:
 - (a) On a new (or recently repaired) test weight per bushel kettle.
 - (b) Whenever its accuracy is in question.
 - (c) At least each two years (recommended).
- (2) Testing the Test Weight Kettle Using an Even-Arm Balance.
 - (a) This test requires special equipment and a scale with a capacity of at least 2,000 g x 0.1 g. If such equipment is not available, contact the FGIS field office or headquarters.
 - (b) Thoroughly clean the kettle to be tested.
 - (c) Place a standard (Class F) weight(s) equivalent to 1,098.08 grams in the kettle. Then, place a piece of plate glass 5 inches in diameter by 1/4 inch in thickness on the kettle.
 - (d) Put the kettle (with the glass and weights) on the platter of an approved balance-type scale. Balance the scale by using the appropriate amount of counterbalance weights.

- (e) Remove the kettle (with the standard weights and glass) from the platter (without disturbing the counterbalance weights).
- (f) Place the kettle on the center of a towel. Remove the glass and the standard weight(s) from the kettle, then fill the kettle to overflowing with distilled water at 68 °F (± 1 degree). (Note: It is advisable to fill the kettle with water at 67 °F and then allow it to raise 1 degree before continuing the test.)
- (g) Using a flashlight to find all air bubbles, eliminate the air bubbles from the inside of the kettle by touching the bubbles with a glass rod or thermometer. Slide the glass plate across the top of the kettle to remove the excess water. Then, leave the kettle exactly level-full with no air bubbles under the plate. If bubbles appear, remove the glass and begin the procedure again.
- (h) Wipe off all moisture from the outside of the kettle and glass with a towel.
- (i) Carefully place the filled kettle (with the glass covering plate in place) on the balance. Do not disturb any counterbalance weights previously set on the scale.
- (j) Allow the pointer on the balance to come to rest. If the kettle and weights are in exact balance when the pointer stops oscillating, the capacity of the kettle is correct. If the pointer comes to rest at any other position, place a 1-gram weight on the light side of the balance. If the 1-gram weight is sufficient to swing the pointer to or across the balance mark, the error in the kettle capacity is within the allowable tolerance, and the kettle may be used.
- (k) Should the 1-gram weight be insufficient to cause the balance-type scale's pointer to swing back, do not use the kettle until it is adjusted to yield the proper result.

- (3) When using an electronic scale.
 - (a) Place the dry kettle and glass plate on the scale and record the tare weight to the nearest 0.1 gram in the Volume Test section of form FGIS-927, Test Weight per Bushel Apparatus.
 - (b) Follow the same filling procedure as above.
 - (c) Place the filled kettle and glass plate on the scale and record the gross weight to the nearest 0.1 gram.
 - (d) If the difference between the second reading and the first reading is $1,098.08 \pm 1$ gram the kettle capacity is within the allowable tolerance and the kettle may be used.
- (4) Adjusting the Test Weight Kettle. Small deviations beyond the 1-gram tolerance can be corrected by slightly bulging the bottom of the kettle in or out, depending on whether the volume needs to be decreased or increased.
 - (a) Place the kettle on a firm, smooth foundation in either an inverted or upright position, depending on whether the bottom is to be bulged in or out.
 - (b) Hold a soft piece of wood against the bottom of the kettle and strike the wood to bulge the kettle.
 - (c) After bulging the kettle slightly, test the kettle to determine if additional bulging is needed.
 - (d) After all kettle corrections are made, check to determine if the kettle rests in a level position. If the kettle has a tendency to rock, it may be possible to repeat the correction process so that the kettle volume is still correct and the kettle rests flat. If this cannot be done, replace the kettle.

d. Grain Test.

- (1) Test Preparations for Initial, Periodic, and Supplemental Tests.
 - (a) The testing office (FGIS Headquarters, in the case of field office Standard equipment, or the field office, in the case of all other

equipment) shall prepare test samples of Hard Red Winter wheat consisting of 1050 grams of dockage-free wheat.

- (b) Provide three samples to each test unit operator for testing one apparatus. The samples shall, as practicable, represent the normal range of test weight results, 58 to 62 pounds per bushel.
 - (c) The testing office shall test the samples using the Headquarters Standard or field office Standard for test weight; next, place them in moisture-proof containers, numbered from one to three; and then, send them to the appropriate offices for testing.
 - (d) Do not provide results to the test unit operator at this time.
- (2) Test Procedures.
- (a) Test Weight Accuracy Test.
 - 1) Place the closed sample cans near the test apparatus and allow them to equalize to room temperature for 24 hours prior to the test.
 - 2) Thoroughly clean the test weight per bushel apparatus, zero balance it, and place the kettle in position.
 - 3) Empty the first sample into a hand sieve bottom pan and mix it.
 - 4) Position the hopper, close the hopper valve, and then pour the sample into the hopper.
 - 5) Open the hopper valve and allow all of the grain to fall into the kettle, with the excess wheat overflowing into a catch pan. Stroke the kettle cleanly with three full-length zigzag motions (with the stroker held lightly on the kettle in a vertical position).

- 6) Place the kettle on the weigh beam of the test weight per bushel apparatus (or on the platter on an approved electronic scale), or pour it into an approved the Toledo scale pan.
- 7) Weigh the sample and record the weight in the grain test section of the form FGIS-927. For beam type scales, record the weight to the nearest 1/4 graduation of a tenth pound per bushel. For electronic scales, record the actual weight indicated. For Toledo scales, convert the weight to pounds per bushel using the test weight conversion chart (Grain Inspection Handbook, Book II, Chapter I, Appendix A).
- 8) Repeat the procedure (steps 3 through 7) four more times for sample No. 1. Record all weights on the form FGIS-927. Examine the five test results, mark through the low and high weights, and average the three remaining weights. Record the average on the form FGIS-927.
- 9) Test the second and third samples in the same manner as the first. Record the results on the form FGIS-927.

(3) Test Record.

- (a) Return the samples in moisture-proof containers to FGIS Headquarters or the field office, as appropriate. Include with the samples a properly completed form FGIS-927.
- (b) Upon receipt of the returned forms and samples, the testing office shall complete the form by recording their (standard) test results and then comparing the results of the two tests. If the average variation of the test results is within the allowable deviation, the apparatus is acceptable.
- (c) In the case of out-of-tolerance equipment, document on the form FGIS-927 all pertinent facts and actions (including adjustments, retest, and follow-up actions).
- (d) After evaluating the test results, the original of the completed form FGIS-927 shall be returned to the test unit operator. A copy of the

form shall be retained by the testing office.

- (e) An approval label shall be affixed to the base or hopper of the filling apparatus. Discontinue the practice of affixing to the kettle.

FORM FGIS-927, "TESTWEIGHT CHECKTEST"

U.S. DEPARTMENT OF AGRICULTURE
GRAIN INSPECTION, PACKERS AND STOCKYARDS ADMINISTRATION
TESTWEIGHT CHECKTEST

FORM APPROVED OMB NO. 0590-0013
Public reporting burden for this collection of information is estimated to average 0.63 hours per response and .007 hours of record keeping, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, reviewing and completing the reporting burden, and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Agriculture, Clearance Officer, OIRM, AG Box 7630, Washington, D.C. 20250, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, D.C.

NOTE: TEST UNIT OPERATOR FILL IN SHADED AREAS ONLY

DATE MAILED 7-1-96 1 FIELD OFFICE Baltimore 2 AGENCY Baltimore MD 3 LOCATION Baltimore MD 4

SCALE / BEAM TEST

Before proceeding with test review Chapter 5 of the Equipment Handbook. Clean, level, and balance the scale, filling apparatus, and kettle. Test weights must have a current Class F Report of Test.

Scale Brand / Model / Serial No. / Date of Test
FANIBANKS G140315 7-2-96 **5a**

Scale Test for Electronic or Mechanical Grain Scales: This scale was tested in accordance with Chapter 2 of the Equipment Handbook and found to be within tolerance. YES NO

Beam Test: Complete test below. Tolerance is ± 0.10 pound.

Load	Beam Reading		Error	Load	Beam Reading		Error	Sensitivity @ 60 lb/bu	Beam Response		
	g	lb			g	lb			Yes	No	
0	0	0.000	0.000	10	10.050	0.050	0.050	850 ± 1 g	b	Yes	No
5	5	5.000	0.000	30	30.000	0.000			b	Yes	No

GRAIN TEST

Before the Grain Test, check alignment of the funnel and kettle. Record results to 0.00 pound for mechanical or electronic scales. For beams, the 0.1 pound graduations should be estimated to 1/4 graduations and recorded as 0.025, 0.050, 0.075, or 0.100 pounds. For each sample, strike the highest and lowest drops and average the remaining three results.

TEST UNIT/Beam/Filler Brand & Serial No. / Date of Test
FANIBANKS G140315 6a

TEST UNIT/Beam/Filler Brand & Serial No. / Date of Test
PHILIP A98334 6b

TEST SUMMARY

Drop	KETTLE Brand & Serial No. <u>Charks #103</u>			KETTLE Brand & Serial No. <u>Seedbuir #201</u>			TEST UNIT	STD. UNIT	DIFFERENCE	Mean Deviation from Standard (Total Diff. ÷ 3)	MDS Tolerance = 0.15 lb / bu	TOTAL
	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3						
1	58.000	60.000	62.000	60.00	60.00	62.05	58.025	60.034	62.025	180.084		180.084
2	58.025	60.050	62.075	57.97	60.10	62.00	58.013	60.000	62.043	180.058		180.058
3	58.025	60.050	62.050	57.94	59.87	62.07	.012	.034	-.018	0.025		0.025
4	58.050	59.075	62.025	58.12	60.08	62.01						
5	58.025	60.050	62.000	58.10	59.92	62.17						
Avg	58.025	60.034	62.025	58.013	60.000	62.043						0.01

Results by: [Signature] 7/2/96

Remarks: Last volume test 7/94. 8
WTS tested 9/95 Class F

VOLUME TEST

Scale Used in Test / Brand / Model / Serial No. 7a KETTLE Brand & Serial No. 7b Results By / Date of Test: 7c

GROSS - TARE - NET WEIGHT (1,098.08 ± 1.0 g at 68 °F.) OR Filled kettle ± 1.0 g of Standard counter weight. YES NO

Form FGIS 927 (7-96) Previous Editions are Obsolete.

INSTRUCTIONS FOR COMPLETING FORM FGIS-927,
"TESTWEIGHT CHECKTEST"

1. Date the test samples and form FGIS-927 are mailed to the FGIS field office or agency, as applicable.
2. FGIS field office participating in the test.
3. Agency that performed the test, when applicable.
4. Location of the field office or agency that is being tested.
5. Complete either Scale Test or Beam Test.
 - a. Scale Test. Certify that the electronic (or mechanical, general-class scale) has been tested in accordance with appropriate instructions in Chapter 2.
 - b. Beam Test. Show the load in the kettle, the beam readings, and the error. Reading minus target weight equals error. Do not fill in for electronic scales.
6. Grain Test.
 - a. Test unit's brand and serial number.
 - b. Test unit's results, shown as indicated (or to 0.00 pound) for electronic scales. For beams, the tenth pound per bushel graduations shall be broken down into 1/4 increments and read as 0.025, 0.050, 0.075, 0.100.
 - c. For each sample, examine the five readings and strike the highest and the lowest result.
 - d. Average of the remaining three readings, shown to 0.000 pound per bushel.
 - e. The summary "TOTAL" result for the Test Unit is the sum of the averages from Samples 1, 2 and 3.
 - f. Total Difference is divided by 3 to yield mean deviation from standard (MDS), shown to 0.01 lb/bu.

g. Mean deviation from standard tolerance is ± 0.15 lb/bu.

7. Volume Test.

a. Record the brand, model and serial number of the scale or balance used to test the kettle volume.

b. Record the brand and serial number of the kettle.

c. Name of test operator and date.

d. For electronic balances, record the tare, gross, and net weight. For mechanical balances, check mark "YES" the deviation from target value is ≤ 1.0 g.

8. Remarks. Show date of last volume test, date that Class F weights were tested, etc.