



United States
Department of
Agriculture

**Marketing and
Regulatory
Programs**

**Agricultural
Marketing
Service**

**Federal Grain
Inspection
Service**

Washington, D.C.

March 14, 2022

Moisture Handbook

Program Handbook

March 14, 2022

Moisture Handbook

Foreword

This Handbook sets forth the policies and procedures regarding the approval, alignment, calibration, operation, examination, and testing of moisture meters used in official inspection activities. The procedures contained in this Handbook are applicable to all Agricultural Marketing Service (AMS) Headquarters units, AMS field offices, sub-offices, and official agencies.

AMS's decision to approve and adopt the, GAC2700-UGMA, GAC2500-UGMA and Perten AM5200-A as official moisture meters does not mean that the Agency endorses or recommends these instruments for unofficial purposes over other similar instruments that are not approved for the official system. The Agency's selection of these instruments was based on AMS's unique operational needs. Other instrument models may be as or more suitable for a commercial entity's needs.

For any given product, all official moisture measurements will be performed using the GAC2700-UGMA, GAC 2500-UGMA, or Perten AM5200-A exclusively on and after the March 14, 2022.

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at [How to File a Program Discrimination Complaint](#) and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer, and lender.

TABLE OF CONTENTS

CHAPTER 1: GENERAL INFORMATION

CHAPTER 2: OPERATION AND TESTING OF THE GAC2700-UGMA

CHAPTER 3: OPERATION AND TESTING OF THE DICKEY-JOHN 2500 - UGMA

CHAPTER 4: OPERATION AND TESTING OF THE PERTEN AM5200-A

CHAPTER 5: REVISION HISTORY

CHAPTER 1

GENERAL INFORMATION

Contents

1.1	POLICY	2
1.2	RESPONSIBILITIES	3
1.3	RECORD KEEPING REQUIREMENTS	5
1.4	EQUIPMENT IDENTIFICATION.....	5
1.5	EQUIPMENT TESTING.....	6
1.6	TESTING SCHEDULE	6
1.7	REPAIRS	7

1.1 POLICY

Dependable, well-maintained, precision equipment is essential to the accurate inspection of all commodities¹. Poorly designed or manufactured equipment and equipment that is excessively worn or misadjusted may cause incorrect factor determinations.

a. Moisture.

Moisture is the water content of grain or related commodities ascertained by the USDA air-oven method or by any method which gives equivalent results.

b. Official Equipment.

To ensure the accuracy and integrity of official inspections, moisture meters used for official purposes must be:

- (1) A model and type² approved for use by AMS which gives results equivalent to the USDA air-oven method;
- (2) Installed and operated according to the manufacturer's recommendations and the guidelines established by this handbook and the appropriate Occupational Safety and Health Administration (OSHA) Standards, 29 CFR 1910;
- (3) Operated properly, utilizing officially approved calibration constants;
- (4) Maintained in good repair;
- (5) Tested at periodic intervals, in the prescribed manner, and found to be within tolerance; and
- (6) Protected from unauthorized adjustments.

c. Defective Equipment.

Moisture meters which have serious operating deficiencies, do not operate within tolerance limitations, or have not been tested when required, shall be considered to be not approved for official use and shall be removed from service until a subsequent test establishes their accuracy.

¹ The term "commodities," as used throughout the handbook, means grain, rice, beans, peas, lentils, oilseeds, and processed grain products.

² The mention of firm names or trade products does not imply that they are endorsed or recommended by the U.S. Department of Agriculture over other firms or similar products.

d. Elevator-Owned Equipment.

Elevator-owned moisture meters may be used by official agencies for official purposes provided that the above criteria are met. The Field Office Manager should also consider the following guidelines before approving the use of elevator-owned moisture meters by official agencies:

- (1) Review each situation, especially the methods that will be used to protect the meter from misuse or unauthorized adjustments.
- (2) Appropriate security measures shall be used on moisture meters.
- (3) If precautions are not adequate, do not approve the arrangement.

e. Commercial Equipment.

Commercial moisture meters are devices that are approved or allowed by local or State weights and measures jurisdictions as “legal for trade.” AMS official meters may meet stricter tolerances or design requirements than commercial meters; however, commercial meters may be considered for Official Commercial Inspection Services.

f. Government-Owned Equipment Loans.

- (1) Government-owned moisture meters may be loaned to official agencies during legitimate emergencies for short time periods. These temporary loan provisions must be documented.
- (2) No open-ended loans are to be approved.

1.2 RESPONSIBILITIES

a. AMS Headquarters.

- (1) Field Management Division shall:
 - (a) Maintain a List of Approved Equipment;
 - (b) Advise the AMS field offices on the selection and purchase of equipment;
 - (c) Assist in the purchase of inspection equipment;
 - (d) Assist APHIS Business Services (ABS) on joint purchase orders, blanket purchase arrangements, and purchases of new types of equipment;
 - (e) Assist ABS in the negotiation of maintenance contracts with applicable manufacturers; and
 - (f) Develop and publish policies and procedures pertaining to the maintenance, repair, use, and testing of moisture meters.

- (2) Technology and Science Division (TSD) shall:
 - (a) Evaluate new models and/or types of meters;
 - (b) Develop and maintain moisture meter calibrations;
 - (c) Maintain the Headquarters Standard meters in good repair;
 - (d) Test the Headquarters Standard meters;
 - (e) Provide samples for testing all AMS and official agency moisture meters;
 - (f) Evaluate test results and approve or reject all AMS and official agency moisture meters;
 - (g) Maintain test records for all AMS and official agency moisture meters;
 - (h) Evaluate alternate testing methods;
 - (i) Develop policies, procedures, work forms, and schedules for the testing of equipment;
 - (j) Administer the equipment testing program; and
 - (k) Train field personnel, in cooperation with the Digital Media group and other appropriate staff.

- b. AMS Field Offices, Sub-Offices, and Official Agencies. Each office shall be responsible for all equipment that is used officially by their office. This includes moisture meters that are provided for official use by a facility.
 - (1) Maintain official meters in good repair and ensure compliance with OSHA Standards.
 - (2) Designate an equipment specialist who will serve as the primary contact responsible for moisture meter testing.
 - (3) Test their official moisture meters.
 - (4) Maintain test and audit trail records for all moisture meters that are used officially by their office.
 - (5) Field offices shall assist TSD in resolving moisture meter performance problems at official agencies.

1.3 RECORD KEEPING REQUIREMENTS

FGIS developed the Equipment Capability Testing (ECT) online application to automate its nationwide program for testing and verifying the accuracy of equipment used to officially determine the quality and quantity of grain and related products. The program stores electronic data on the performance and location of each moisture meter in the official system. (Full implementation of ECT for UGMA meters is in process.)

- a. AMS Headquarters will provide maintenance of the online system and provide storage of equipment test records.
- b. Each official service point will enter equipment serial number and location data into ECT.
- c. Technology and Science Division will initiate check testing data records for the official moisture.
- d. Field offices and official agencies will enter their equipment testing results.

Note: Maintaining printed copies of the test forms is not necessary due to electronic data storage. However, it is up to the discretion of the Official Service Provider on whether they choose to maintain printed copies in addition to the electronic records.

1.4 EQUIPMENT IDENTIFICATION

- a. Serial Number.

All moisture meters shall be identified by a serial number.

- b. Test Decal.

The AMS test label (form FGIS-931, "Approved Label for Inspected Machinery,") shall not be required.

1.5 EQUIPMENT TESTING

Unless there is a need to know, sample results or target values should be withheld from the test unit operator until after test completion (blind testing).

a. Initial Tests.

New meters shall be tested prior to being put into service.

b. Periodic Tests.

- (1) All moisture meters, other than those which are in storage or used only at seasonal points, shall be tested periodically in accordance with the testing schedule, whenever practical.
- (2) Meters held in storage are not required to be tested unless they are “back- up meters.”
- (3) “Back-up meters” must be tested on schedule. Untested equipment may not be placed into service under any circumstances.
- (4) At seasonal inspection offices (those that are open less than 6 months a year), meters shall be tested once a year just prior to reactivation of the office.

c. Supplemental Tests.

Moisture meters shall be tested as soon as practicable whenever:

- (1) AMS Headquarters, a AMS field office, or an official agency has comparative inspection results or other information that shows the meter to be of questionable accuracy;
- (2) It becomes apparent that the meter has not been tested in accordance with the established testing schedule;
- (3) After any repairs or alterations (replacement of a Non-metrological part will not require the meter to be retested); or
- (4) After movement or shipping. If a meter is hand-carried with care, the field office or official agency manager may elect to omit the grain moisture test and perform only the weighing test.

1.6 TESTING SCHEDULE

Moisture meters shall be tested twice a year based on a schedule set by TSD with input from the official service providers.

1.7 REPAIRS

a. Repair.

Repair of official moisture meters shall be performed by factory-approved repair facilities by skilled company personnel only. Equipment Specialists are not authorized to repair meters.

b. Safety.

Before working on any equipment, read the instructions in the appropriate handbook section. Unplug equipment before beginning adjustments or cleaning.

CHAPTER 2

OPERATION AND TESTING OF THE DICKEY-JOHN GAC2700-UGMA

Contents

2.1	APPROVED CALIBRATIONS	2
2.2	ENVIRONMENTAL CONDITIONS	2
2.3	MAINTENANCE	3
2.4	OPERATION.....	12
2.5	CHECK TESTING OFFICIAL MOISTURE METERS	20
2.6	REPAIR OF OFFICIAL MOISTURE METERS.....	20

2.1 APPROVED CALIBRATIONS

Refer to Program Directive 9180.61, Official Moisture Meter Calibrations, for a listing of official calibrations, and meter models that can be used for specific grain types.

2.2 ENVIRONMENTAL CONDITIONS

UGMA meters should be operated in relatively controlled and clean environments where:

- a. Room temperatures are within 45-100 °F (7-38 °C). To reduce the chance for error codes and minimize the effects of temperature in official inspection, it is recommended that the room temperature be maintained within the range of 60-85 °F (15-30 °C).
- b. The instrument is placed on a level surface. Ensure the instrument is level using the bubble level at the top of the instrument; adjust the feet if necessary. The feet must be in firm contact with table to avoid rocking. Make sure that there is sufficient clearance between the GAC 2700 and the countertop so that the grain drawer is cleanly inserted into the instrument.
- c. The instrument is not subjected to perceptible vibrations when in operation.
- d. The instrument is not placed in close proximity to radio frequency transmitters such as mobile phones, wireless routers, two-way radios etc. Generally, no such transmitters should be operated within five feet of the instrument. If the instrument shows error messages such as “Empty Cell Measurement out of Spec,” any transmitters in the vicinity of the instrument should be moved further away from it to avoid erroneous moisture results.

2.3 MAINTENANCE

a. Cleaning Machine.

Performing continuous tests without cleaning can result in material accumulation on the external surface and around the measuring cell and adversely affect the moisture measurements. The DICKEY-john GAC2700-UGMA must be inspected and cleaned regularly to ensure continued accurate results.

(1) External Cleaning.

- (a) The LCD display may require periodic cleaning. Use a commercial cleaner for glass lenses to remove dust.

Note: Do not apply water, organic solvent or chemicals, such as acid and alkali to the LCD display.

- (b) The GAC® 2700 surface can be cleaned with any cleaner designed for plastic and stainless-steel surfaces.

Periodically use a rag to wipe the grain hopper and the upper grain hopper sensors.



(2) Internal Cleaning.

Two types of cleaning are recommended on an as needed basis:



- Daily clean
- Extensive clean

(a) Daily Clean Method.

A daily clean method allows cleaning the cell and door using an automated process. During the cleaning sequence, the hopper door automatically opens.

Note: The daily cleaning method should be performed first before proceeding to Extensive Cleaning Method.

To start the cleaning process:

- 1 At the Main Menu screen, press the **Device Information** button.
 - 2 Press  .
 - 3 'Cleaning mode as active' will appear.
 - 4 Remove the grain drawer.
 - 5 Using the supplied brush, manually remove any loose or stuck grain or dust from the measuring cell.
 - 6 Press the **CLOSE** button to return instrument to normal operation.
- Note: Hands should be clear from inside the instrument before pressing the CLOSE button.**
- 7 Insert grain drawer.
 - 8 Press  to return to the Home Screen.

(b) Extensive Cleaning Method.

Note: Extensive cleaning should be performed weekly or more often, as needed, based on surrounding environmental conditions. Factors such as dust, temperature extremes, grain dust, and external humidity vary from location to location. If there are any questions about the cleanliness or instrument performance, contact your local authorized service center.

Extensive cleaning of the instrument involves two steps to ensure optimum instrument performance:

- Internal mechanism cleaning

- Temperature sensor probe cleaning

1 Internal Mechanism Cleaning

Tool required for internal mechanism cleaning:

- Brush p/n 206410003 (included with instrument)

a Power down the instrument.



b Unplug power cord.



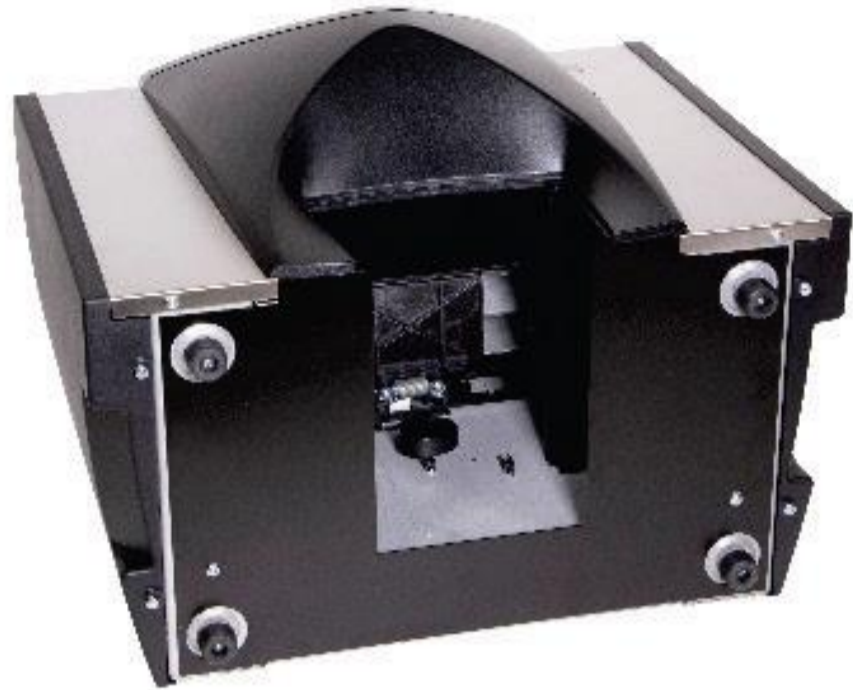
c Remove other accessory cords (USB and printer).



d Remove grain drawer.



e Place the instrument on its back.



f Manually pull down on trap door.



g Clean surfaces around measurement cell including hinge, trap door, and edge of cell with the supplied brush.



2 Cleaning the Temperature Sensor Probe.

The temperature sensor may require cleaning due to dust buildup and/or foreign material that has collected around the sensor that could potentially cause temperature error readings during analysis. Temperature sensor cleaning should be performed weekly or more often, as needed, based on surrounding environmental conditions. Factors such as dust, temperature extremes, grain dust, and external humidity vary from location to location. It is important the temperature sensor is visually inspected and cleaned each time a regular maintenance check of the instrument is conducted. If there are any questions about the cleanliness or instrument performance, contact your local authorized service center.

Note: It is crucial to sufficiently clean the sensor. For excessive dust and/or foreign material buildup on or around the temperature sensor, it is recommended the instrument be returned to DICKEY-john® Service or authorized service center.

Tools required for cleaning the temperature sensor probe:

- Standard 6" long cotton swab (i.e. McMaster-Carr p/n 7074T12)
- 99% Isopropyl Alcohol
- 10" flat head screw driver

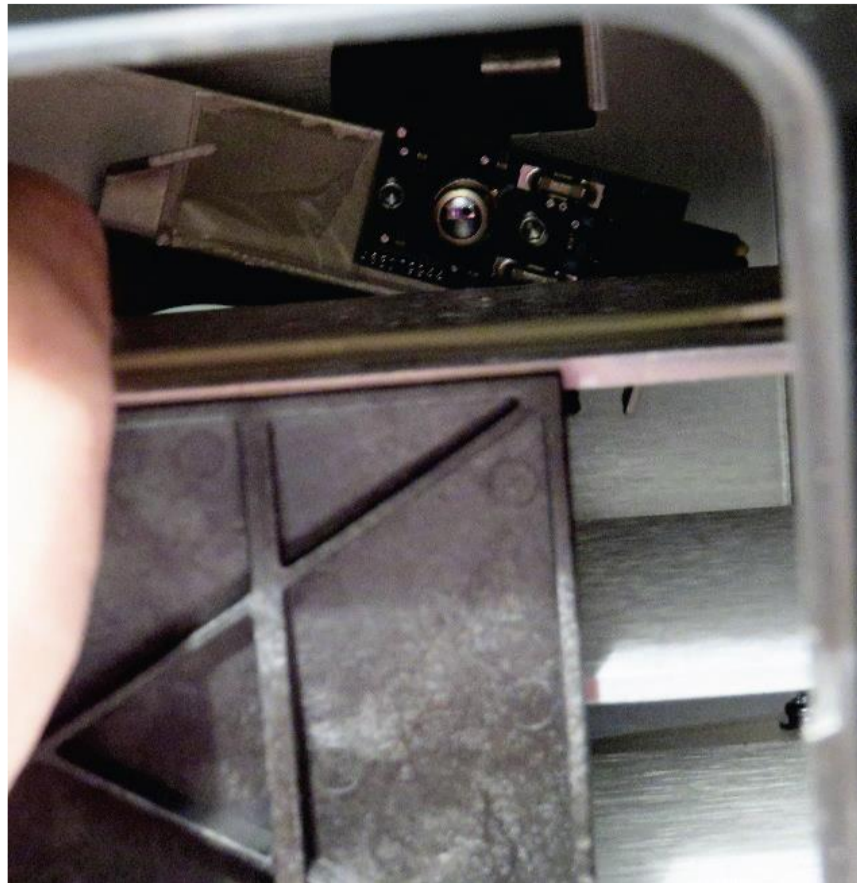
a Gently place instrument upside down.



b Locating Temperature Sensor.

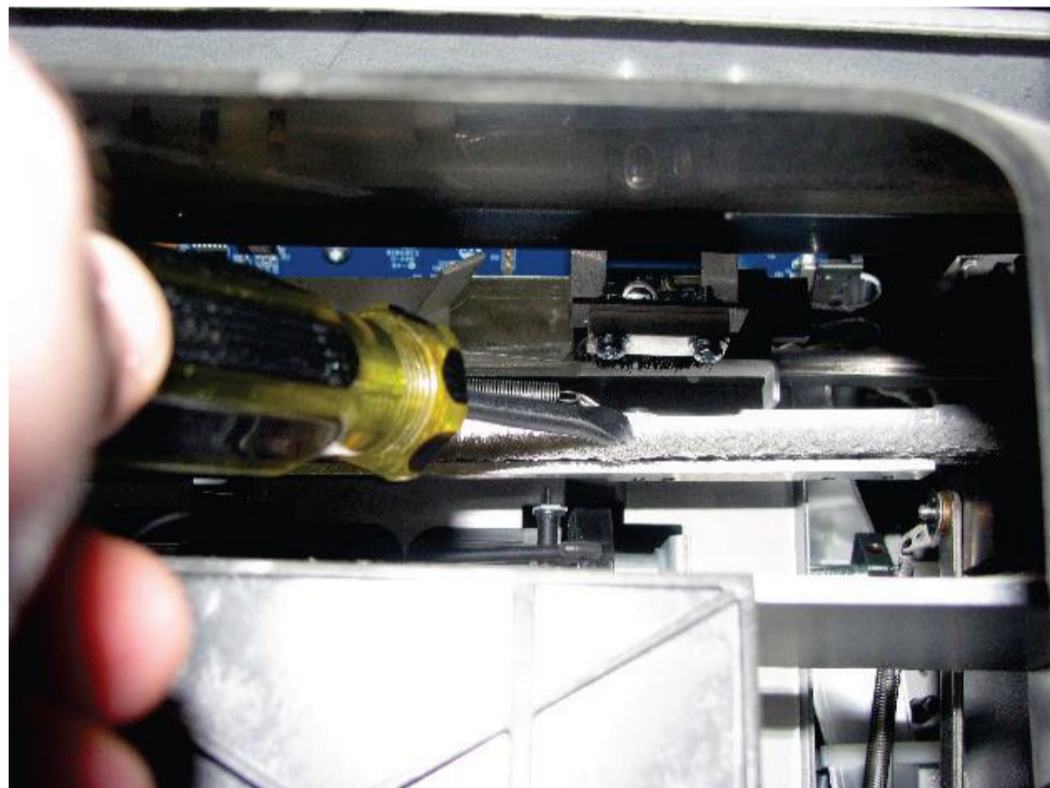
With the instrument placed upside down and looking inside the instrument, the sensor probe is located in the middle of the

instrument toward the top and front attached to a circuit board.



c Cleaning Brush Assembly.

Carefully place the head of the screwdriver (10" length recommended) at the bristles and use a sweeping side-to-side motion through the entire length of the bristles no fewer than three times.



d Gently Clean the Entire Infrared (IR) Temperature Sensor Surface.

Make sure you select the appropriate cotton swab as described. Wet one end of the cotton swab with 99 percent Isopropyl alcohol and clean with the wet end.

Temperature sensor



- e Allow the temperature sensor to dry for 90 seconds then gently clean with the dry end of the cotton swab.
 - f Visually inspect the temperature sensor as well as all other areas cleaned to ensure the instrument is free from debris. If there is any question about the cleanliness of the instrument, it should be returned to a dealer or authorized service center.
 - g If cleaning is acceptable, return instrument to upright position and replace the drawer.
 - h Reconnect power cable and accessory cords.
 - i Power on instrument.
- b. Electrical connections.
- Check the condition of the power cord and connections and ensure that a grounded plug is used.
- c. Moisture Meter Record Log.
- A permanent log book shall be established and maintained for each GAC2700-UGMA. The book shall be kept with the meter at the official use site. The log will be used as an important historical record to indicate:
- (1) Serial Number.
 - (2) Meter test dates, results, and comments.
 - (3) Date and type of each repair.
 - (4) Date and location for each transfer to a new site and associated weight check results.

- (5) Date and initials for each calibration change (both official and unofficial).
- (6) Date, time, and initials when checking audit trail, calibrations version, weight accuracy etc., following return from cross utilization.
- (7) Other notable events.

Log Book Example

DATE	ACTION	NAME OF PERSON MAKING THE ENTRY
8-15-12	Rec'd s/n 1131-20123	
	from Dickey-John	ZL
9-2-12	Returned from Repair	
	-Load Sensor	BF
9-4-12	Moved to XYZ Lab	
	Passed weight check	BF
9-10-12	Calibration Change	ZL
9-12-12	Audit Trail Check	ZL
9-29-12	Weight Check - Passed	BF
10-15-12	Checked Calibrations for	
	Corn, Soybeans, + Sorghum	ZL

2.4 OPERATION

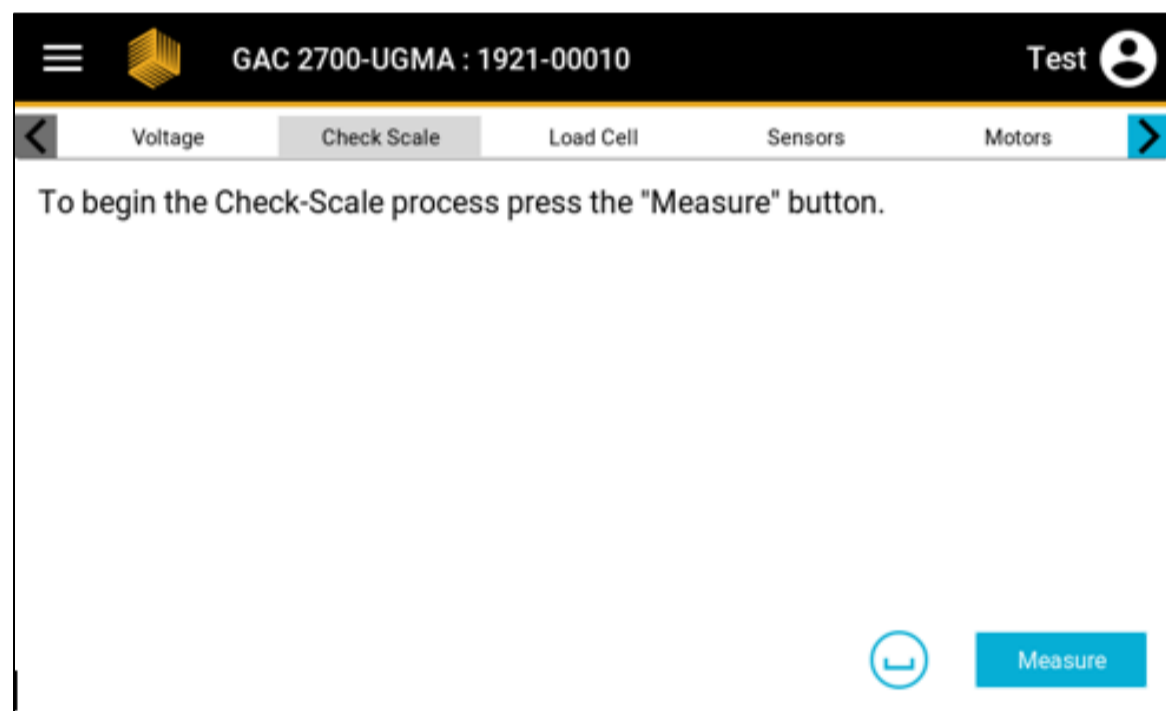
a. Cross-utilized Equipment.

When moisture meters are used by both official agency and unofficial (elevator) personnel, the elevator shall not make any changes to the meter set-up unless approved and witnessed by the official agency. When a meter has been out of official agency control, the official agency shall clean (if necessary), follow setup guidelines (Section 3.2), and check the operation of the meter before commencing daily operations. This should include a weighing accuracy test, calibration version verification, and review of audit trail.

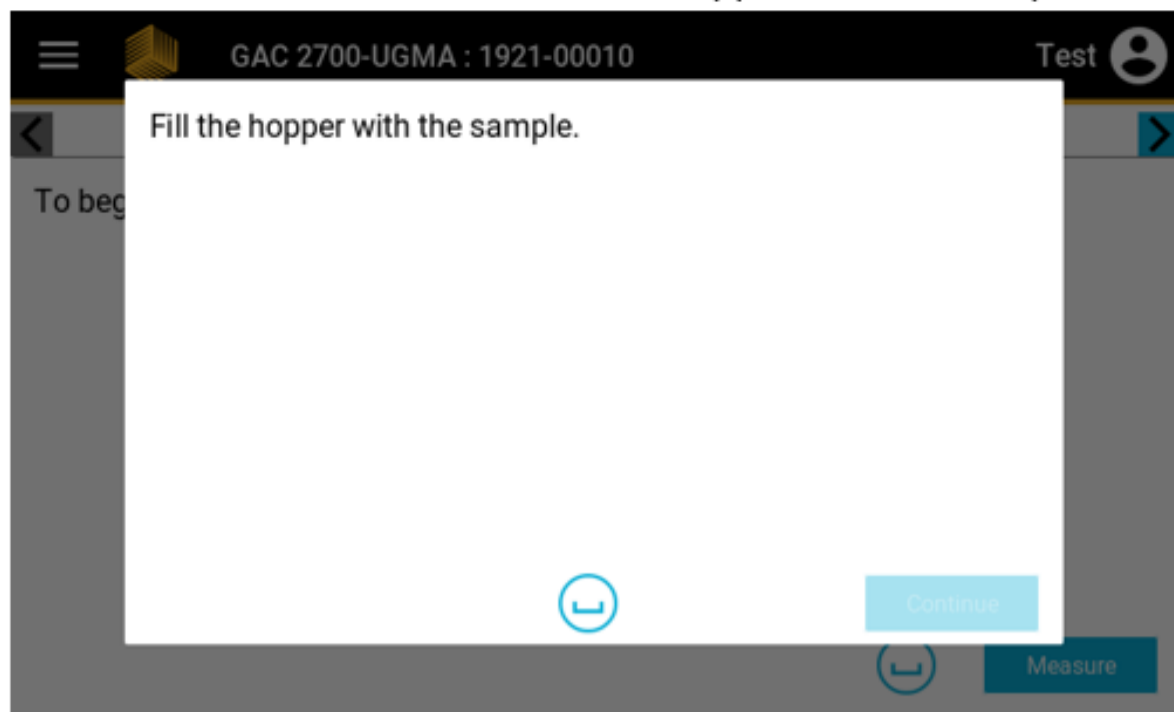
(1) Weighing Test.

If the instrument was not tested in the most recent checktest cycle, perform the official checktest— including the “weighing accuracy test” as described in Section 3.5 under the Check Test Instructions. Otherwise, follow the instructions below.

- (a) Navigate to the **DIAGNOSTICS** menu and scroll left or right as needed and select the “Check Scale” tab at the top of the screen.



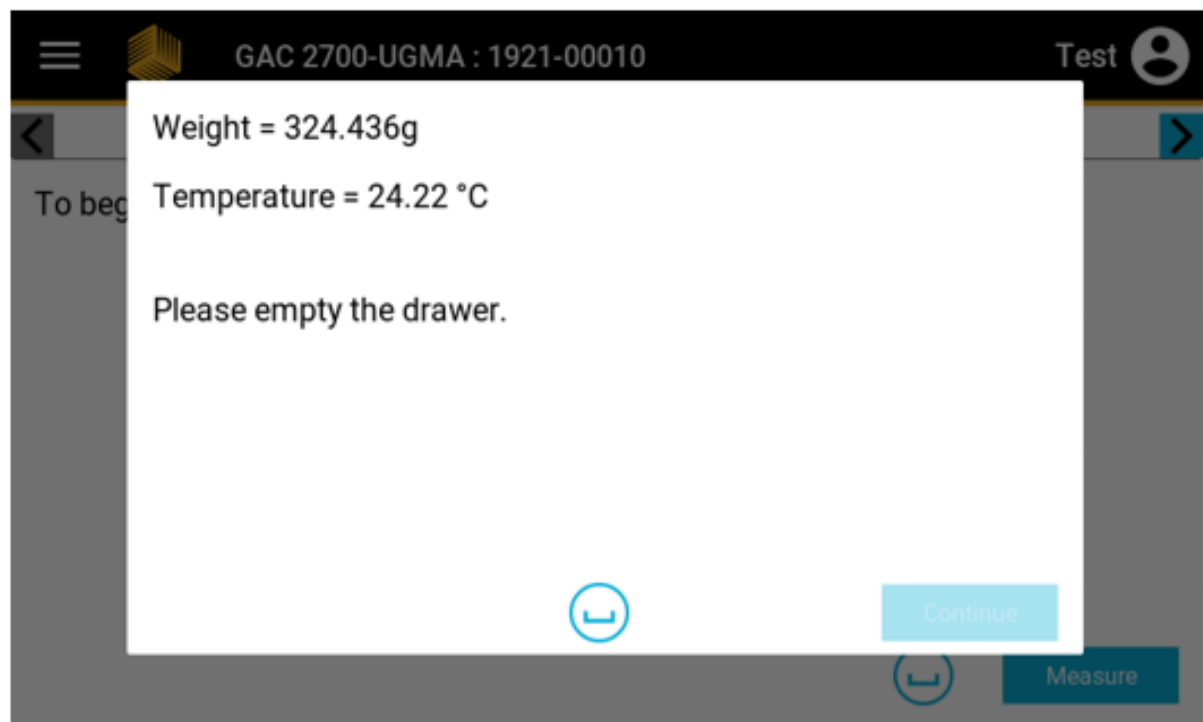
- (b) Press the “MEASURE” button. Fill the hopper with the sample when prompted.



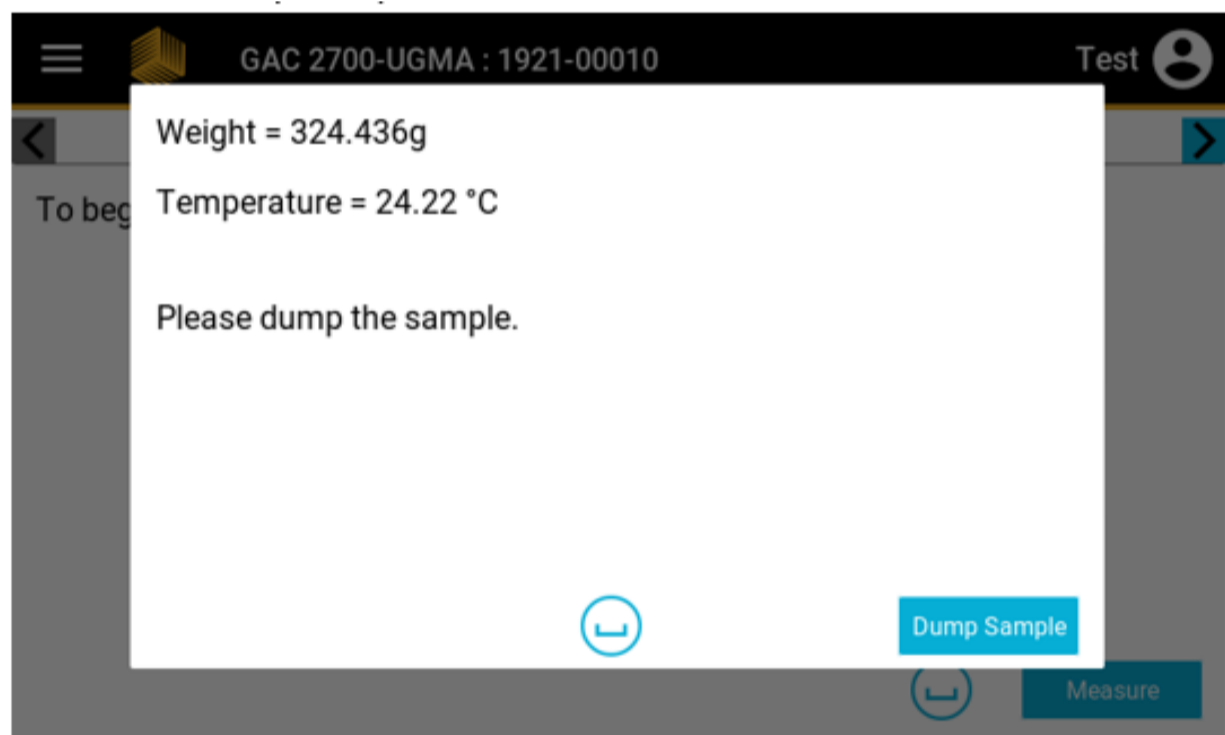
- (c) When enough grain has been loaded so that the hopper sensors are blocked, the GAC2700 will enter “Measuring” status. For the test use a soybean sample (use wheat if soybeans not available).



- (d) The GAC2700 automatically drops the grain, performs grain strike-off, and displays the weight of the grain and its temperature.



- (e) Record the unit's weight reading. Remove and set aside all excess grain that fell into the drawer. Replace drawer.
- (f) Press the "Dump Sample" button.



- (g) Weigh the grain from the drawer on an approved scale and compare the reading to the value reported by the GAC2700. If the difference is within +/- 1.0 gram then the machine is within tolerance (for a single test). **If it is within this tolerance proceed to verify the calibration version (Step 2), otherwise continue to Step 1(h).**

Note: If a location does not have an approved scale on site, record the weight from the meter then double bag the grain portion (to prevent moisture weight loss) and transport the bagged portion to another laboratory for weighing on an approved scale (within 48 hrs. at most). Make sure to record this event and results in the log book.

- (h) Repeat process four more times with same sample and average all 5 results. If the average difference is within +/- 0.5 grams, then the machine is within tolerance. Weight errors exceeding +/- 0.5 grams require instrument repair.

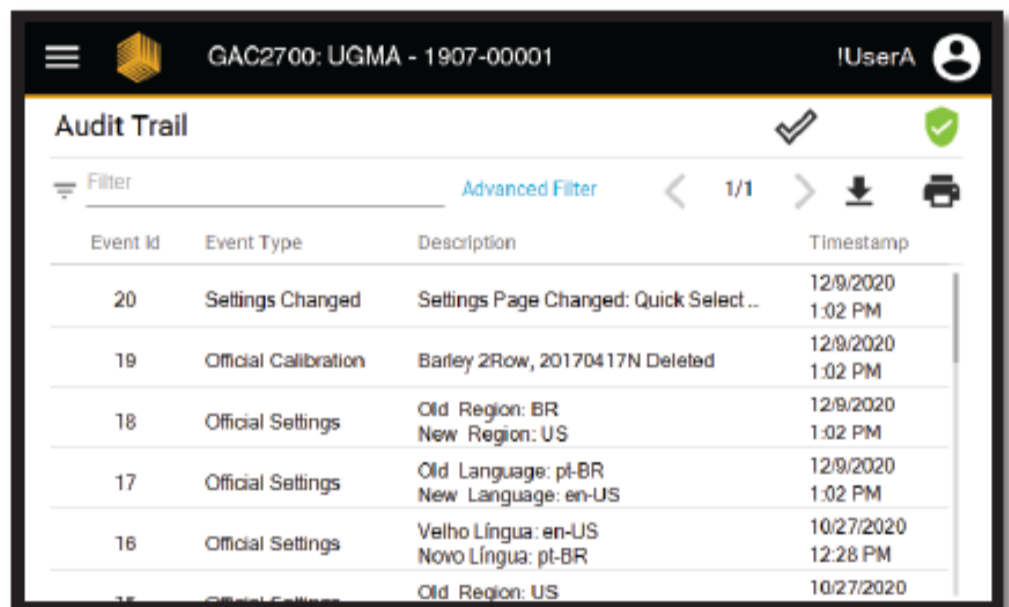
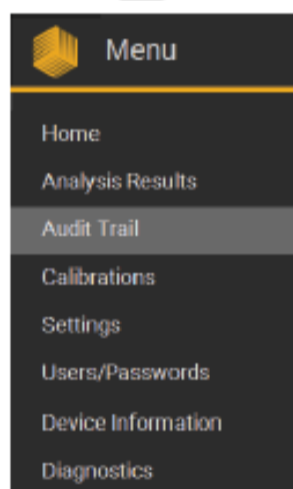
(2) Calibration Version Verification.

Follow instructions outlined in **Section 3.5.**

(3) Review of Audit Trail.

Review the Audit Trail log and make sure there have been no system modifications while the instrument has been out of official agency control. The list of events that is saved to this database include calibration additions, software updates, calibration modifications, service events, error messaging, and changes made to instrument settings. The Audit Trail will provide a log of these changes.

NAVIGATION FROM  SCREEN:



- (4) If problems are found, remove the unit from official service until corrected. Whatever method of security check is performed, it must be recorded in the Log Book and the entry initialed.
- (5) Maintain Current Date and Time for accurate records. (See Operators Manual)

b. Test Weight per Bushel.

This function is not approved for official use.

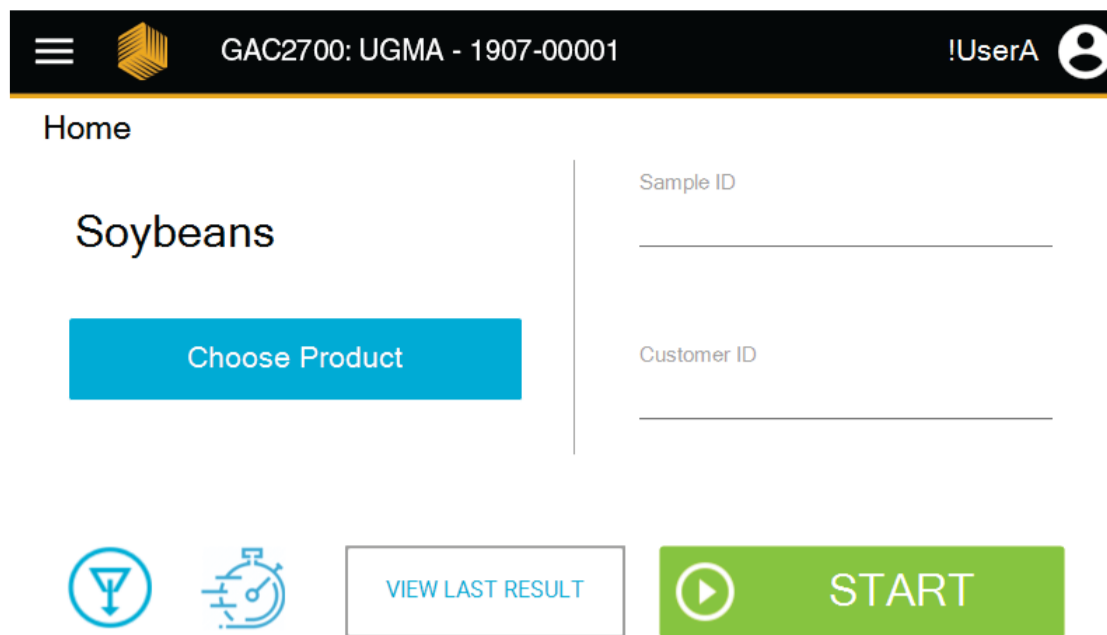
c. Power-On.

The GAC2700-UGMA is powered on by pressing the On/Off button located on the front panel (below). A series of Startup screens load after the system is turned on. A status bar will indicate self-checks are occurring and, upon completion, the Instrument Information screen is displayed for several seconds before the Home Menu screen displays.




d. Grain Selection.

- (1) Go to Home screen, press the **Choose Product** button. Select the grain that is to be analyzed.




e. Grain Analysis.

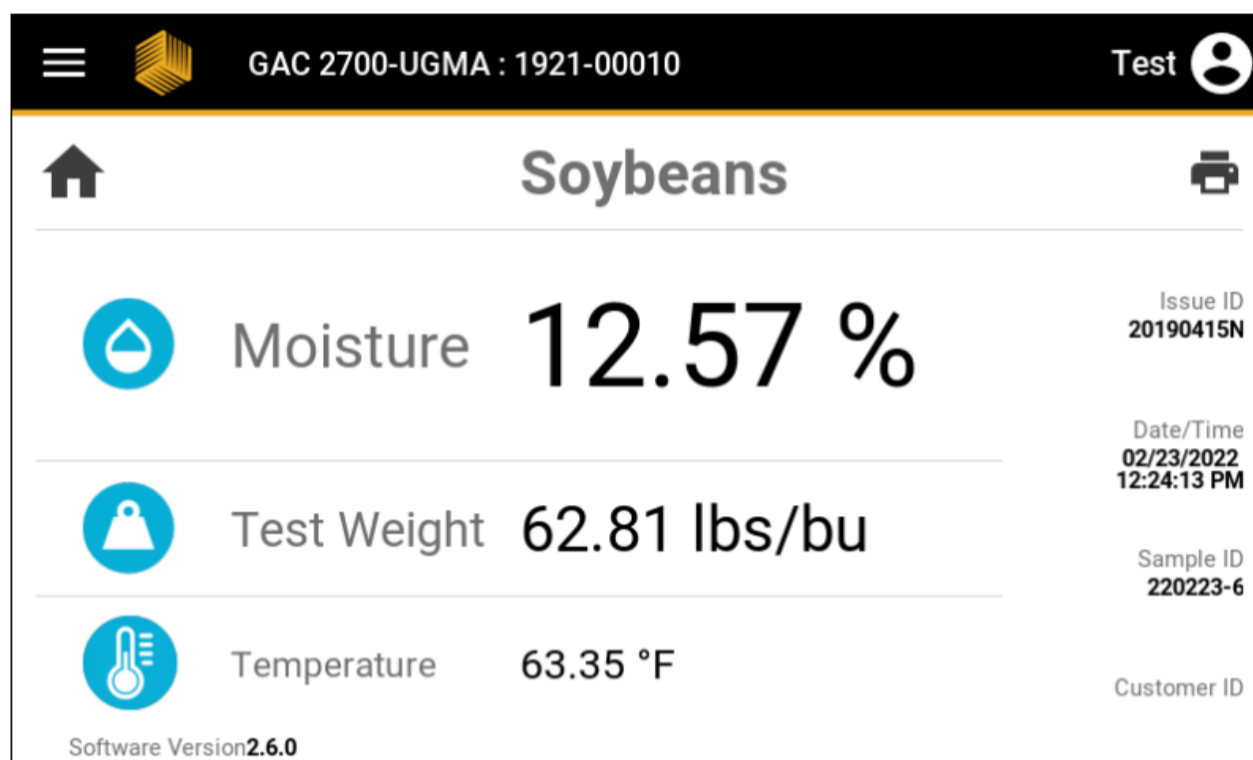
- (1) After the grain is selected, an optional Sample ID and Customer ID entry screen will appear. A Sample ID/Customer ID name can be entered by using the keypad that appears if the line is pressed. Once completed press 
- (2) Pour the sample into the Upper Hopper.
- (3) The **START** button will change to Green when there is enough grain in the hopper to properly run a sample.



- (4) Press the **START** button.

Note: If for some reason the user decides not to measure the sample in the upper hopper, the  button will transfer the sample from the upper hopper to the grain drawer.

- (5) The cell fills and the striker arm moves across the top of the test cell to wipe away excess grain.
- (6) During analysis, an animated progress circle indicates measurement in progress.
- (7) The measurement results screen appears when test is complete.

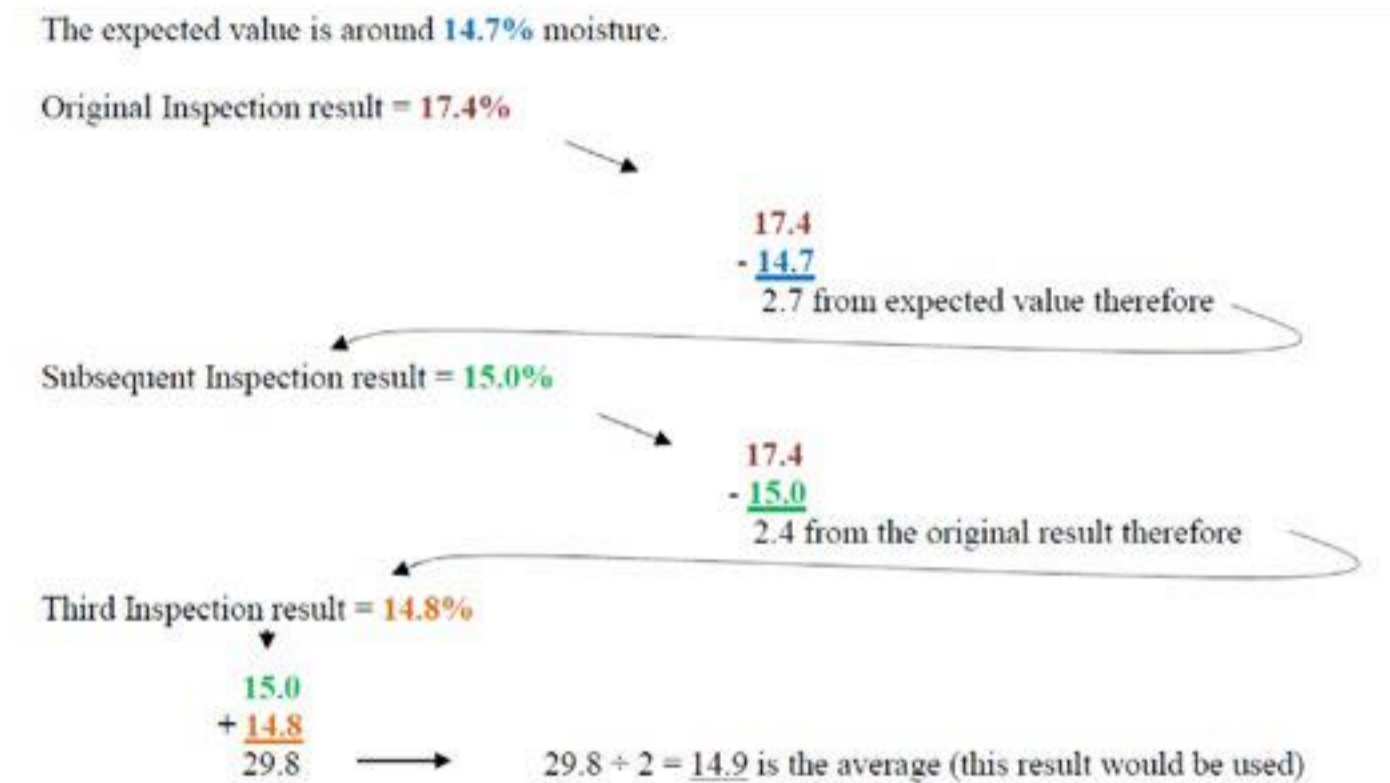


Note: Do not insert fingers or foreign objects into the opened hopper doors.


- (8) The measurement results screen displays the Selected Product Name, Sample Identification (Issue ID), percent Moisture Content, Test Weight, and Temperature. Additional information that appears on this screen is the Date/Time of the sample taken, the Sample ID, the Customer ID (if applicable), and the Software Version number.
- (9) Addressing Suspected Erroneous Results:
 - (a) If the result appears to be a gross error (meaning there is reason to believe the error is more than 2 percent moisture different from the expected value or that of a similar lot of grain), one subsequent test may be performed. (Before repeating the test, check the cleanliness of the instrument, verify that the correct calibration was selected, and remove from the sample any large debris that may have hindered the flow of grain into the test cell.)
 - (b) If the second test result is within 1 percent moisture of the first, report the original result
 - (c) If the second test result is not within 1 percent moisture of the original, perform a third test and report the average of the two results that are closest to each other.

Note: This policy may only be used when the official operator suspects that a gross error has occurred; it must not be used to justify retesting to obtain a desired moisture reading. The original inspection otherwise consists of one drop. The interested party may request a review and/or appeal inspection according to established procedures.

(d) Example:



(10) To Change Product:

- (a) At the measurement result screen, press the  button.
- (b) Select the **Choose Product** button. Select the grain that is to be analyzed.
- (c) Proceed to fill hopper with new product.

(11) Test results are automatically saved to the unit.

(12) Grain automatically dumps into the drawer after the test. Drawer capacity is approximately three tests. After three tests the drawer must be emptied before another measurement can be made.

f. Sample Temperature.

The GAC2700-UGMA grain sample maximum temperature range limit is 0 to 113°F (-18 to 45°C). The moisture sample temperature is more restricted for some grain types and moisture ranges. If the grain sample has a temperature outside this range an error code will be displayed.

- g. For additional instructions, refer to the GAC2700-UGMA operator's manual.

2.5 CHECK TESTING OFFICIAL MOISTURE METERS

Refer to the UGMA-Compatible Moisture Meter Checktesting Procedures (Attachments A and B) on the [Moisture Equipment page of the AMS website](#) for instructions.

Refer to the *UGMA-Compatible Moisture Meter Checktesting Form* on the [Moisture Equipment page of the AMS website](#) for the appropriate form/spreadsheet.

If you have any questions regarding the check test, contact Instrumentation Inspection Branch (816) 702-3800.

2.6 REPAIR OF OFFICIAL MOISTURE METERS.

a. General.

All repairs to official meters shall be made by the manufacturer. Users shall not attempt to make repairs or adjustments other than as outlined in this handbook or the GAC2700-UGMA operator's manual.

- b. To aid the manufacturer in determining the types of repairs needed, thoroughly describe the malfunction or operational difficulty, and provide any other pertinent information concerning the condition of the meter.
- c. When packing the meter for shipment, be sure to follow the operator's manual instruction.
- d. Upon return from repair, the meter shall be check tested.

CHAPTER 3

OPERATION AND TESTING OF THE DICKEY-JOHN GAC2500-UGMA

Contents

3.1	APPROVED CALIBRATIONS	2
3.2	ENVIRONMENTAL CONDITIONS	2
3.3	MAINTENANCE	3
3.4	OPERATION	6
3.5	CHECK TESTING OFFICIAL MOISTURE METERS	12
3.6	REPAIR OF OFFICIAL MOISTURE METERS.....	12

3.1 APPROVED CALIBRATIONS

Refer to Program Directive 9180.61, Official Moisture Meter Calibrations, for a listing of official calibrations, and meter models that can be used for specific grain types.

3.2 ENVIRONMENTAL CONDITIONS

UGMA meters should be operated in relatively controlled and clean environments where:

- a. Room temperatures are within 45-100 °F (7-38 °C). To reduce the chance for error codes and minimize the effects of temperature in official inspection, it is recommended that the room temperature be maintained within the range of 60-85 °F (15-30 °C).
- b. The instrument is placed on a level surface. Ensure the instrument is level using a minimum 6-inch carpenter level.
- c. The instrument is not subjected to perceptible vibrations when in operation.
- d. The instrument is not placed in close proximity to radio frequency transmitters such as mobile phones, wireless routers, two-way radios etc. Generally, no such transmitters should be operated within five feet of the instrument. If the instrument shows error messages such as “Empty Cell Measurement out of Spec,” any transmitters in the vicinity of the instrument should be moved further away from it to avoid erroneous moisture results.

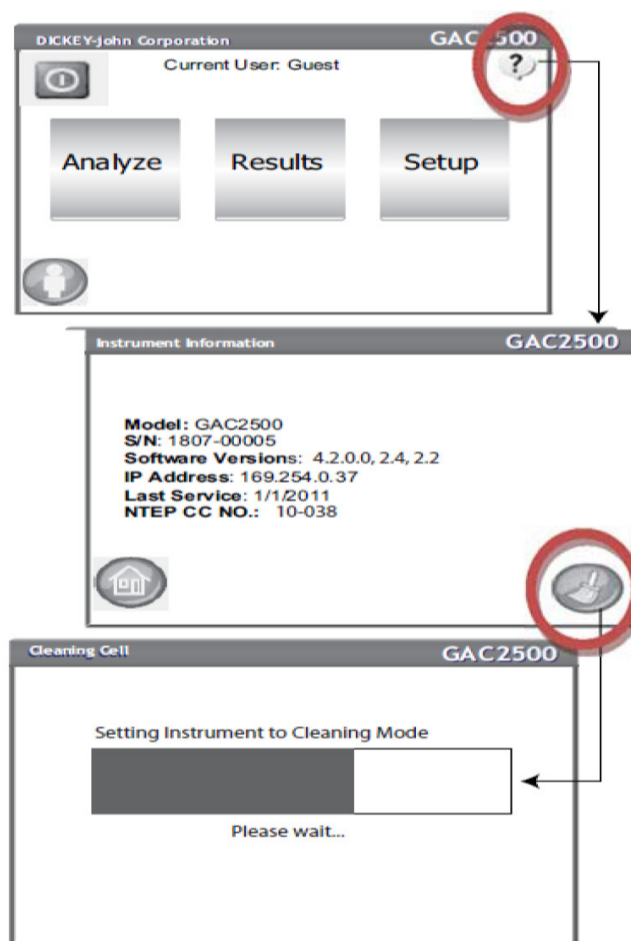
3.3 MAINTENANCE

a. Cleaning Machine.

Performing continuous tests without cleaning can result in material accumulation on the external surface and around the measuring cell and adversely affect the moisture measurements. The DICKEY-john GAC2500-UGMA must be cleaned regularly to ensure continued accurate results. A special mode is provided to assist in cleaning the cell and door.

To start the cleaning process:

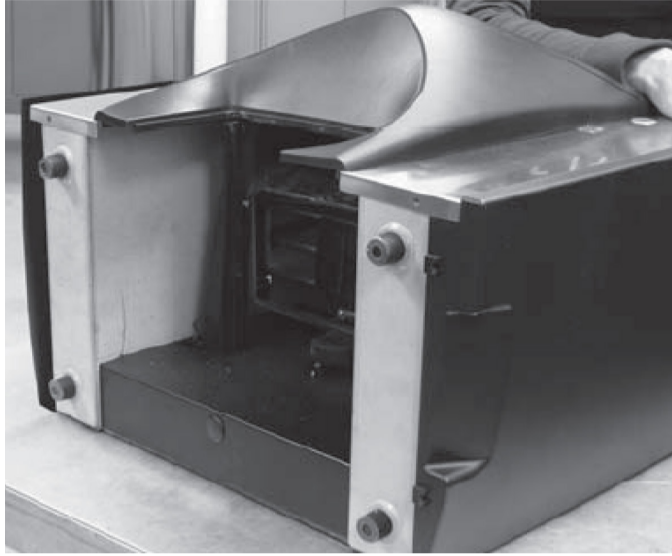
- (1) At the Main Menu screen, press the Instrument Information button.
- (2) At the Instrument Information screen, press the Clean button. Pressing the Clean button automatically begins the cleaning sequence and opens the hopper door and the dump door (version 2.4 CE/IL board firmware).



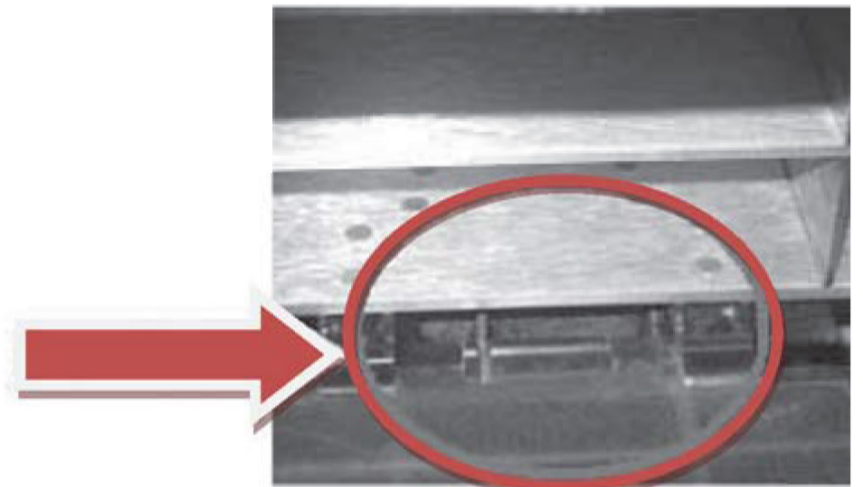
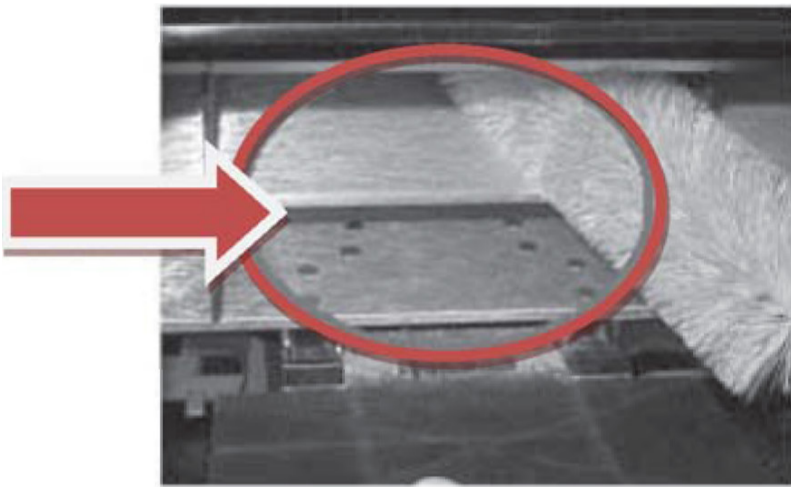
- (3) Remove the grain drawer.



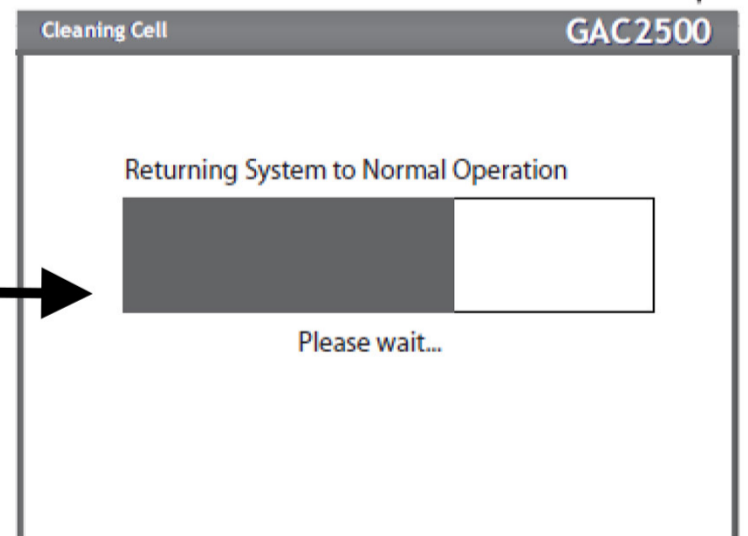
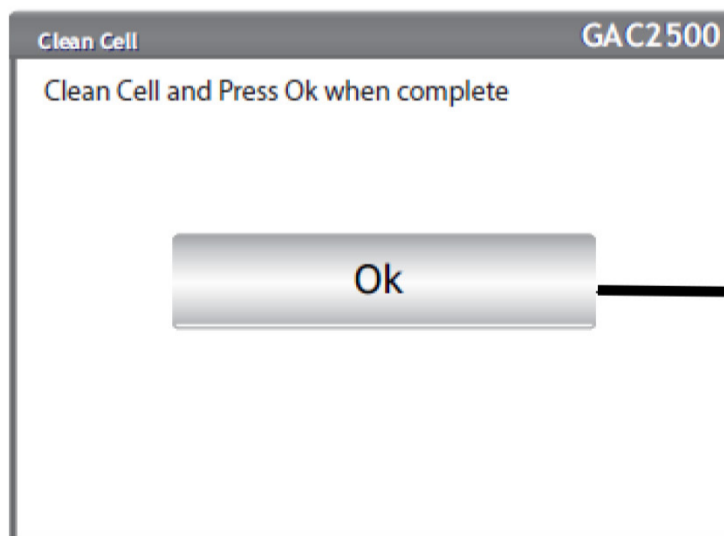
- (4) Manually remove any loose or stuck grain from the measuring cell.
- (5) Place the unit on back side.



- (6) Clean surfaces around measurement cell including hinge, trap door, and edge of cell.



- (7) When cleaning is complete, return instrument to upright position.
- (8) Press the OK button to return instrument to normal operation.



Note: Hands should be clear from inside the instrument before pressing the OK button.

- (9) Insert grain drawer.

b. Cleaning Temperature Sensor.

For instructions, refer to the latest GAC2500- UGMA operator’s manual. To retrieve a copy online, go to the [DICKY-john website](#) and look under the “Downloads” list and select GAC 2500 UGMA & INTL Operator’s Manual.

c. Electrical connections.

Check the condition of the power cord and connections, and ensure that a grounded plug is used.

d. Moisture Meter Record Log.

A permanent log book shall be established and maintained for each GAC2500-UGMA. The book shall be kept with the meter at the official use site. The log will be used as an important historical record to indicate:

- (1) Serial Number.
- (2) Meter test dates, results, and comments.
- (3) Date and type of each repair.
- (4) Date and location for each transfer to a new site and associated weight check results.
- (5) Date and initials for each calibration change (both official and unofficial).
- (6) Date, time, and initials when checking audit trail, calibrations version, weight accuracy etc., following return from cross utilization.
- (7) Other notable events.

Log Book Example

DATE	ACTION	NAME OF PERSON MAKING THE ENTRY
8-15-12	Rec'd s/n 1131-20/23	
	from Dickey-John	ZL
9-2-12	Returned from Repair	
	-Lead Sensor	BF
9-4-12	Moved to XYZ Lab	
	Passed weight check	BF
9-10-12	Calibration Change	ZL
9-12-12	Audit Trail Check	ZL
9-29-12	Weight Check - Passed	BF
10-15-12	Checked Calibrations for	
	Corn, Soybeans, & Sorghum	ZL

3.4 OPERATION

a. Cross-utilized Equipment.

When moisture meters are used by both official agency and unofficial (elevator) personnel, the elevator shall not make any changes to the meter set-up unless approved and witnessed by the official agency. When a meter has been out of official agency control, the official agency shall clean (if necessary), follow installation guidelines (Section 3.2), and check the operation of the meter before commencing daily operations. This should include a weighing accuracy test, calibration version verification, and review of audit trail.

(1) Weighing Test.

If the instrument was not tested in the most recent checktest cycle, perform the official checktest— including the “weighing accuracy test” as described in Section 3.5 under the Check Test Instructions. Otherwise, follow the instructions below.

- (a) Navigate to the **Check Scale** mode and proceed to test a soybean sample (use wheat if soybeans not available). After the instrument gives a weight reading, weigh the sample recovered from the test cell on an approved scale. Compare the two readings. If the difference is within +/- 1.0 gram then the machine is within tolerance (for a single test). **If it is within this tolerance proceed to verify the calibration version (Step 2), otherwise continue to Step 1(b).**

Note: If a location does not have an approved scale on site, record the weight from the meter then double-bag the grain portion (to prevent moisture weight loss) and transport the bagged portion to another laboratory for weighing on an approved scale (within 48 hrs at most). Make sure to record this event and results in the log book.

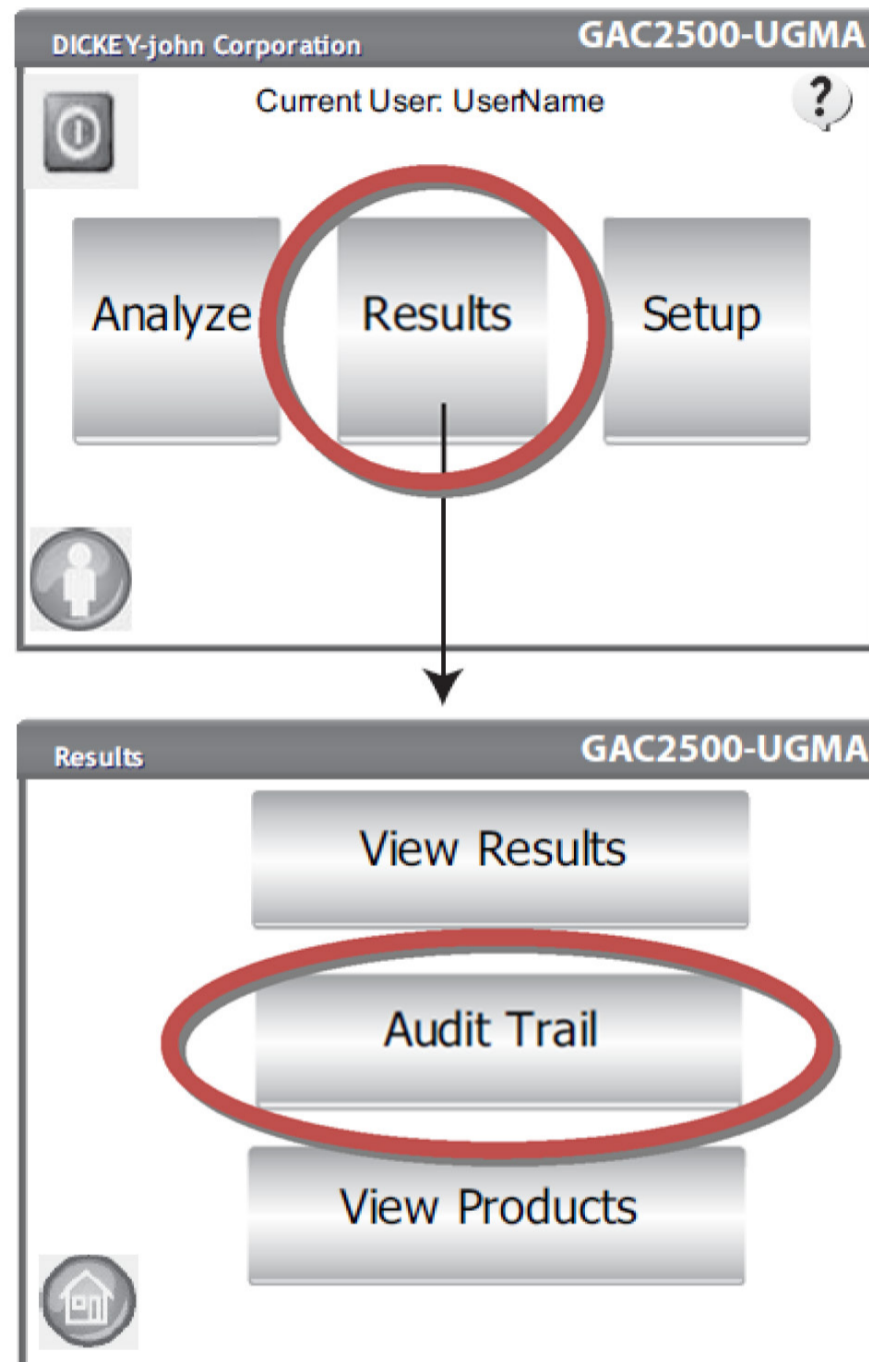
- (b) Repeat step 1(a) four more times with same sample and average all 5 results. If the average difference is within +/- 0.5 grams then the machine is within tolerance. Weight errors exceeding +/- 0.5 grams require instrument repair.

(2) Calibration Version Verification.

Follow instructions outlined in **Section 3.5.**

(3) Review of Audit Trail.

Review the Audit Trail log and make sure there have been no system modifications while the instrument has been out of official agency control. Any changes that relate to system functionality and testing are recorded and stored on the instrument. The Audit Trail will provide a log of these changes.



- b. If problems are found, remove the unit from official service until corrected. Whatever method of security check is performed, it must be recorded in the Log Book and the entry initialed.
- c. Maintain Current Date and Time for accurate records. (See Operators Manual)
- d. Test Weight per Bushel.

This function is not approved for official use.

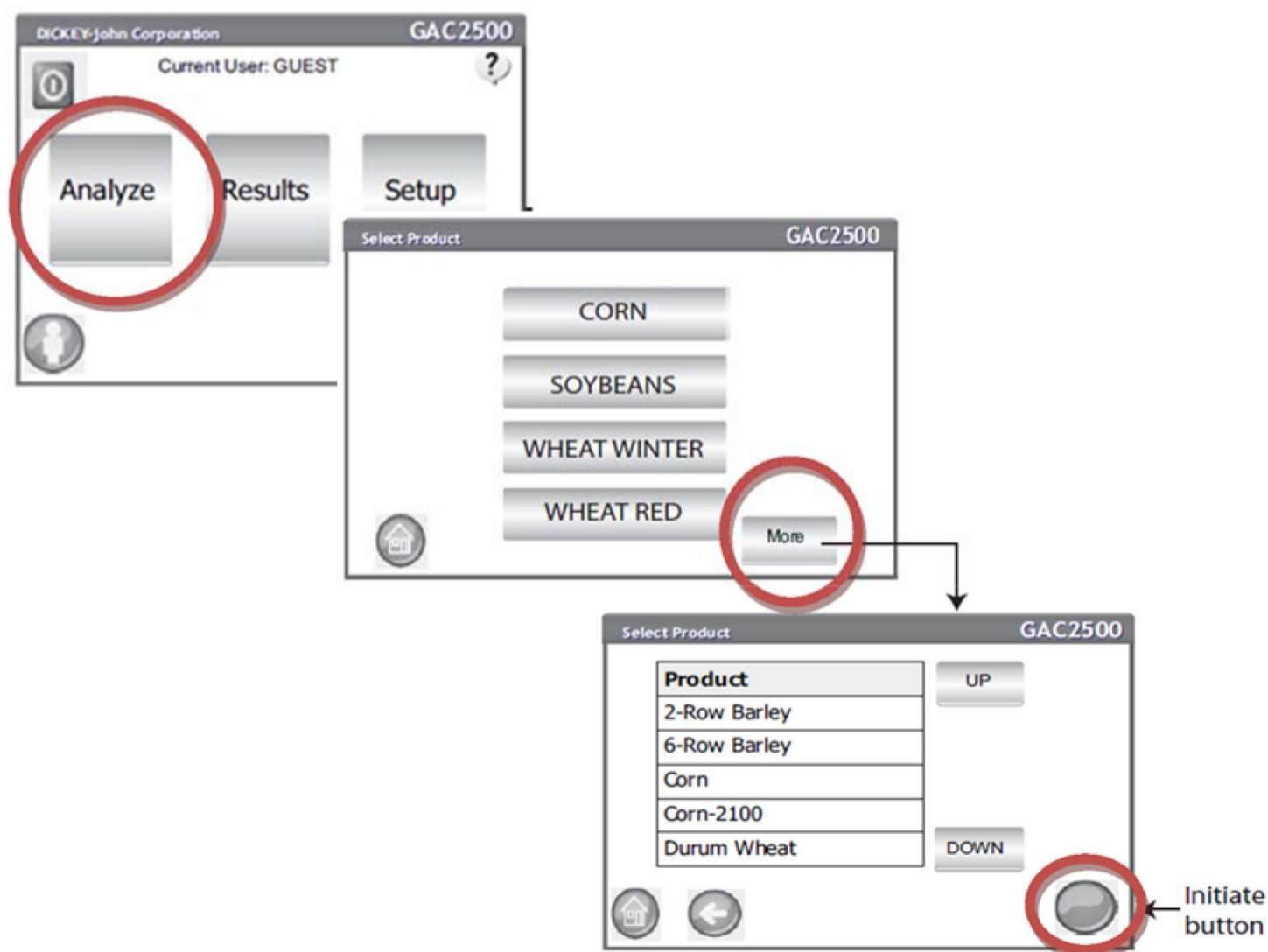
e. Power-On.

The GAC2500-UGMA is powered on by pressing the On/Off switch located on the front panel (below). A series of Startup screens load after the system is turned on. A status bar will indicate self-checks are occurring and, upon completion, the Instrument Information screen is displayed for several seconds before the Main Menu screen displays.



f. Grain Selection.

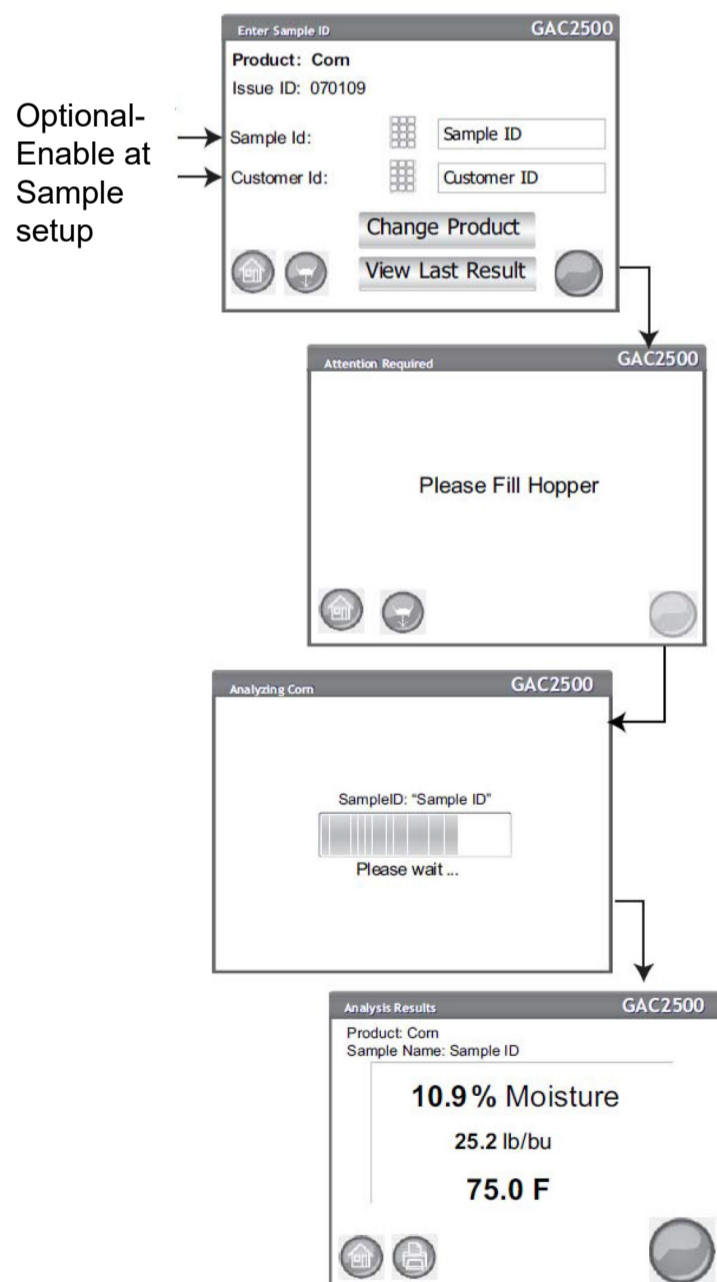
(1) At the Main Menu screen, press the **Analyze** button. A list of four grains appears on the Select Product screen. As grain types are selected during operation, the most recently used grain will appear at the top of the list.



- (2) To view additional grains not viewable on the top level Select Product screen, press the **More** button.
- (3) Press the **Up** and **Down** buttons to view grains.
- (4) Press the desired grain in the product table.
- (5) Once selected, press the **Initiate** button to accept.

g. Grain Analysis.

- (1) After the grain is selected, an optional Sample ID and Customer ID entry screen will appear. A Sample ID/Customer ID name can be entered by pressing the keypad located next to the input box.
- (2) Press the **Initiate** button to proceed.
- (3) Pour sufficient grain into the hopper until the grain reaches the hopper full sensors. An Error code will display if amount of sample is inadequate.
- (4) Press the **Initiate** button to begin test. Grain will dump into the measurement cell from the hopper. A test will only begin when the **Initiate** button is green.



- (5) The cell fills and the striker arm moves across the top of the test cell to wipe away excess grain.
- (6) During analysis, a testing status bar indicates progress.
- (7) An audible alarm indicates when test is complete and the Analysis Results screen appears.

Note: Do not insert fingers or foreign objects into the opened hopper doors.

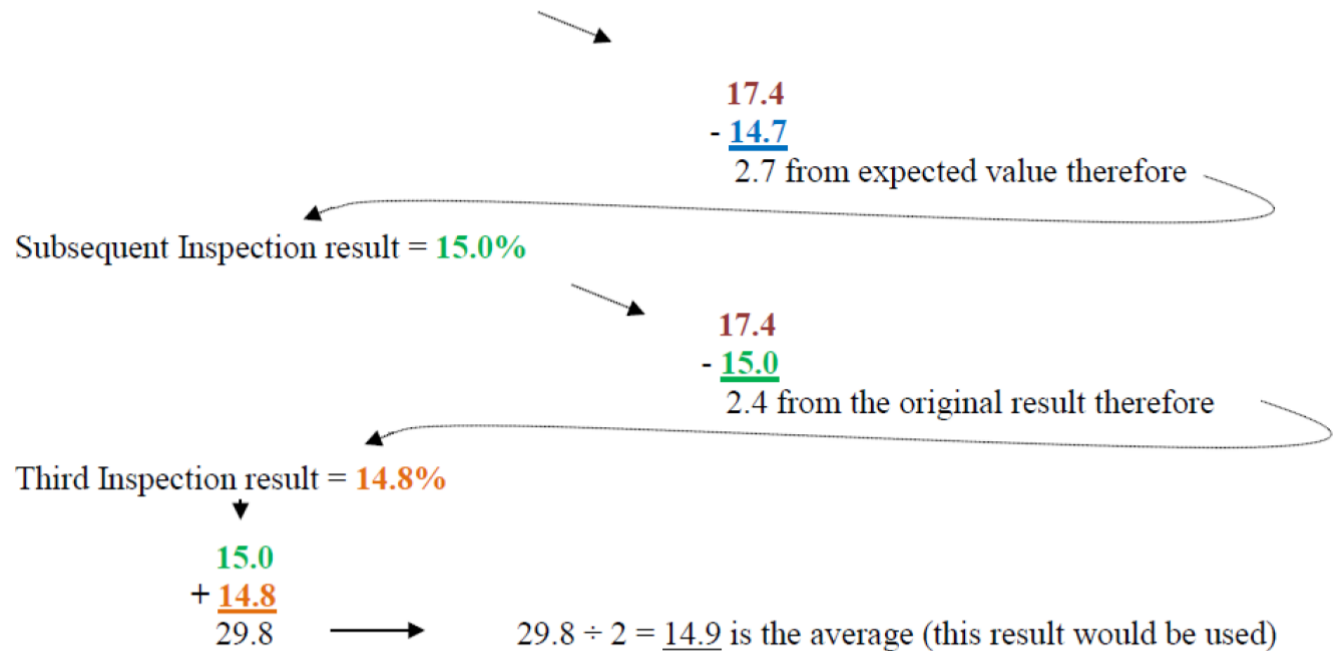
- (8) The Analysis Results screen displays the Selected Product Name, Sample Identification, percent Moisture Content, Test Weight, and Temperature.
- (9) Addressing Suspected Erroneous Results:
 - (a) If the result appears to be a gross error (meaning there is reason to believe the error is more than 2 percent moisture different from the expected value or that of a similar lot of grain), one subsequent test may be performed. (Before repeating the test, check the cleanliness of the instrument, verify that the correct calibration was selected, and remove from the sample any large debris that may have hindered the flow of grain into the test cell.)
 - (b) If the second test result is within 1 percent moisture of the first, report the original result
 - (c) If the second test result is not within 1 percent moisture of the original, perform a third test and report the average of the two results that are closest to each other.

Note: This policy may only be used when the official operator suspects that a gross error has occurred; it must not be used to justify retesting to obtain a desired moisture reading. The original inspection otherwise consists of one drop. The interested party may request a review and/or appeal inspection according to established procedures.

(d) Example:

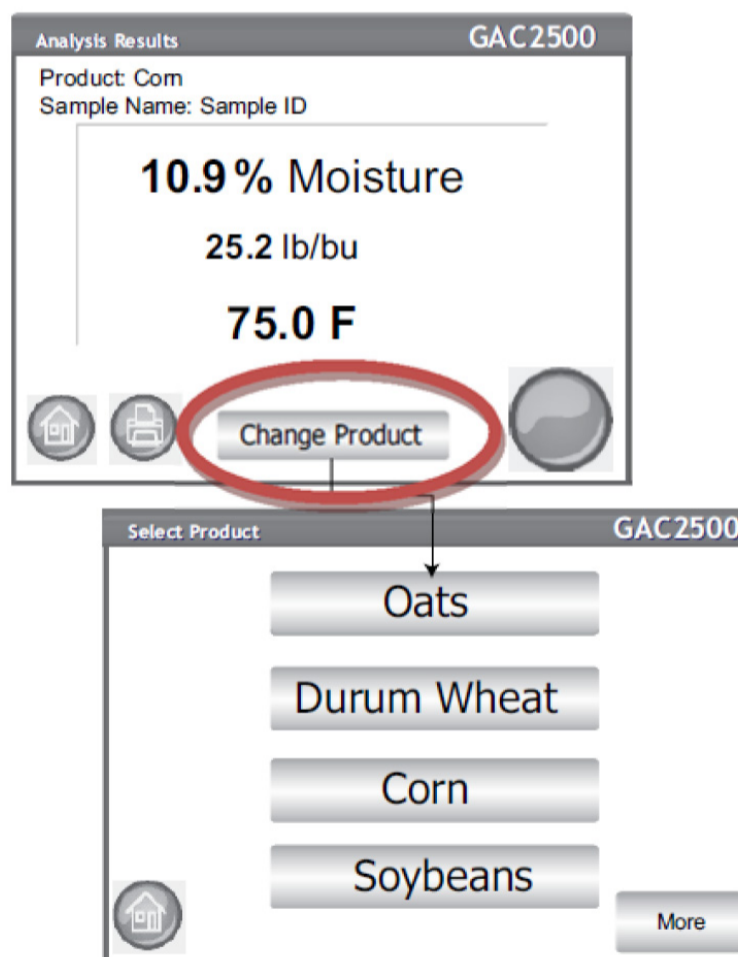
The expected value is around **14.7%** moisture.

Original Inspection result = **17.4%**



(10) To Change Product:

(a) At the Analysis Results screen, press the Change Product button.



(b) At the Select Product screen, choose the desired product.

(c) Proceed to fill hopper with new product.

(11) Test results are automatically saved to the unit.

- (12) If the unit is set to Manual advance after each analysis, press the Initiate button to return to the Sample ID screen to enter the next sample name and then initiate another test.

Grain automatically dumps into the drawer after the test. Drawer capacity is approximately three tests. After three tests the drawer must be emptied before another measurement can be made.

- h. Sample Temperature.

The GAC2500-UGMA grain sample maximum temperature range limit is 0 to 113°F (-18 to 45°C). The moisture sample temperature is more restricted for some grain types and moisture ranges. If the grain sample has a temperature outside this range an error code will be displayed.

- i. For additional instructions, refer to the GAC2500-UGMA operator's manual.

3.5 CHECK TESTING OFFICIAL MOISTURE METERS

Refer to the *UGMA-Compatible Moisture Meter Checktesting Procedures* (Attachments A and B) on the [Moisture Equipment page of the AMS website](#) for instructions.

Refer to the *UGMA-Compatible Moisture Meter Checktesting Form* on the [Moisture Equipment page of the AMS website](#) for the appropriate form/spreadsheet.

If you have any questions regarding the check test, contact Instrumentation Inspection Branch (816) 702-3800.

3.6 REPAIR OF OFFICIAL MOISTURE METERS

- a. General.

All repairs to official meters shall be made by the manufacturer. Users shall not attempt to make repairs or adjustments other than as outlined in this handbook or the GAC2500-UGMA operator's manual.

- b. To aid the manufacturer in determining the types of repairs needed, thoroughly describe the malfunction or operational difficulty, and provide any other pertinent information concerning the condition of the meter.
- c. When packing the meter for shipment, be sure to follow the operator's manual instruction.
- d. Upon return from repair, the meter shall be check tested.

CHAPTER 4

OPERATION AND TESTING OF THE PERTEN AM 5200-A

Contents

4.1	APPROVED CALIBRATIONS	2
4.2	ENVIRONMENTAL CONDITIONS	2
4.3	MAINTENANCE	2
4.4	OPERATION.	6
4.5	CHECK TESTING OFFICIAL MOISTURE METERS	10
4.6	REPAIR OF OFFICIAL MOISTURE METERS	10

4.1 APPROVED CALIBRATIONS

Refer to Program Directive 9180.61, Official Moisture Meter Calibrations, for a listing of official calibrations, and meter models that can be used for specific grain types.

4.2 ENVIRONMENTAL CONDITIONS

UGMA meters should be operated in relatively controlled and clean environments where:

- a. Room temperatures are within 45-100 °F (7-38 °C). To reduce the chance for error codes and minimize the effects of temperature in official inspection, it is recommended that the room temperature be maintained within the range of 60-85 °F (15-30 °C).
- b. The instrument is maintained and operated in a level condition. The Perten AM 5200-A is equipped with a level indicator and adjustable feet for this purpose. The feet should be adjusted to be in firm contact with the table surface to ensure that the instrument does not rock during operation. Remove top cover to view level indicator.
- c. The instrument is not subjected to perceptible vibrations when in operation.

The instrument is not placed in close proximity to radio frequency transmitters such as mobile phones, wireless routers, two-way radios etc. Generally, no such transmitters should be operated within five feet of the instrument. If the instrument shows error messages such as “Empty Cell Measurement out of Spec,” any transmitters in the vicinity of the instrument should be moved further away from it to avoid erroneous moisture results.

4.3 MAINTENANCE

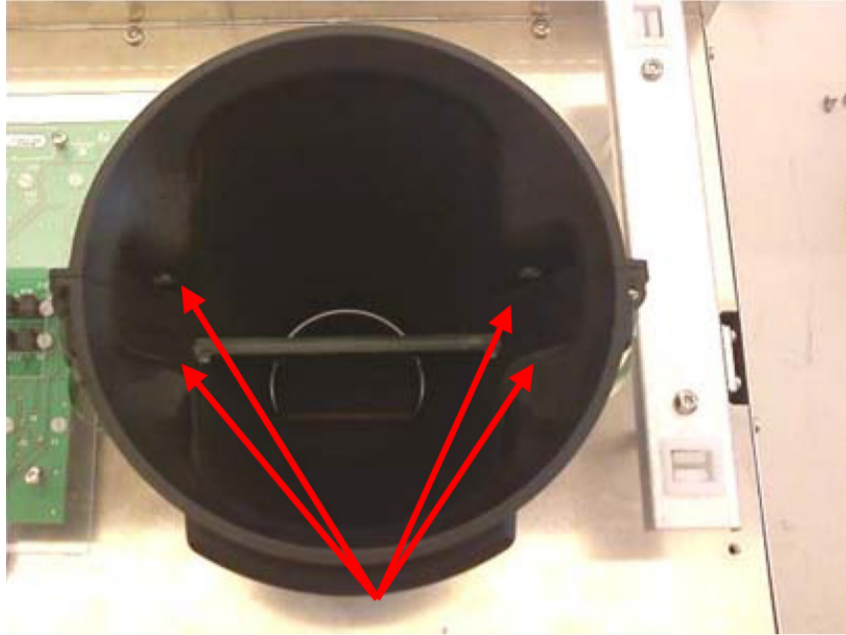
a. Cleaning Machine.

(1) Cleaning sample sensors.

- (a) Switch the power off and pull out the power cable.
- (b) Lift off the top cover



- (c) Inspect the four sensor lenses inside the funnel.



- (d) If the sensor lenses need to be cleaned, first use a gentle compressed air jet (such as “canned air” used for PC servicing). If this is inadequate, use a damp soft cloth to remove residue build up. Snap the top cover back on before plugging in the power cable.

(2) Cleaning the RF cell.

- (a) Prior to turning the power off, select

Menu,

General Settings,

Maintenance,

Check Scale,

Read Empty.

This opens the grain dump door to better access the RF cell.

- (b) Switch the power off and unplug the power cable.

- (c) Lift off the top cover.



- (d) Tilt back the black inner funnel.



- (e) After you have tilted back the inner black funnel, you will have access to the metal RF cell inside the instrument (only if you have completed 2(a)). If the cell needs to be cleaned, first use a gentle compressed air jet (such as “canned air” used for PC servicing). If this is inadequate, use a damp soft cloth to remove residue build up.
- (f) The plastic door on the bottom of the RF cell may also be accessed for cleaning by placing the instrument on its back and removing the grain box. The plastic door may be moved and cleaned with a damp soft cloth.
- (g) Reassemble and make sure to snap the top cover back on before plugging in the power cable.
- (3) Fuse Replacement.
The fuses mounted inside the instrument shall only be replaced by qualified service personnel. There are no user serviceable parts inside the instrument.
- (4) Electrical Connections.
To prevent operator injury or damage to the instrument, verify that the line voltage is correct before connecting to the main power. You find this information on the name plate of the instrument. Also ensure the main power cable is connected to a power outlet with protective earth ground.
In case the power cable connector must be replaced, the replacement must be made only by qualified service personnel.
- (5) For any other additional maintenance or cleaning instructions refer to the Perten AM 5200-A Operator’s Manual.

b. Moisture Meter Record Log.

A permanent log book shall be established and maintained for each Perten AM 5200-A. The book shall be kept with the meter at the official use site. The log will be used as an important historical record to indicate:

- (1) Serial Number.
- (2) Meter test dates, results, and comments.
- (3) Date and type of each repair.
- (4) Date and location for each transfer to a new site and associated weight check results.
- (5) Date and initials for each calibration change (both official and unofficial).
- (6) Date, time, and initials when checking audit trail, calibrations version, weight accuracy etc., following return from cross utilization.
- (7) Other notable events.

DATE	ACTION	NAME OF PERSON MAKING THE ENTRY
8-15-12	Rec'd s/n 1152201	
	from Perten	ZL
9-2-12	Returned from Repair	
	- Load Sensor	BF
9-4-12	Moved to XYZ Lab	
	Passed weight check	BF
9-10-12	Calibration Change	ZL
9-12-12	Audit Trail Check	ZL
9-29-12	Weight Check - Passed	BF
10-15-12	Checked Calibrations for	
	Corn, Soybeans, + Sorghum	ZL

4.4 OPERATION.

a. Cross-utilized Equipment.

When moisture meters are used by both official agency and unofficial (elevator) personnel, the elevator shall not make any changes to the meter set-up unless approved and witnessed by the official agency. When a meter has been out of official agency control, the official agency shall clean (if necessary), follow installation guidelines (**Section 4.2**), and check the operation of the meter before commencing daily operations. This should include a weighing accuracy test, calibration version verification, and review of audit trail.

(1) **Weighing Test.** If the instrument has not been tested in the most recent checktest cycle, perform the official checktest— including the “weighing accuracy test” as described in **Section 4.5** under the Check Test Instructions. Otherwise, follow the instructions below.

- (a) Navigate to the **Grain Weight Check** mode and proceed to test a soybean sample (use wheat if soybeans not available). After the instrument gives a weight reading, weigh the same sample recovered from the test cell on an approved scale. Compare the two readings. If the difference is within +/- 1.0 gram, then the machine is within tolerance (for one test). **If it is within this tolerance proceed to verify the calibration version (Step 2), otherwise continue to Step 1(b).**

Note: If a location does not have an approved scale on site, record the weight from the meter then double-bag the grain portion (to prevent moisture weight loss) and transport the bagged portion to another laboratory for weighing on an approved scale (within 48 hrs at most). Make sure to record this event and results in the log book.

- (b) Repeat step 1(a) four more times with same sample and average all five results. If the average difference is within +/- 0.5 grams then the machine is within tolerance. Weight errors exceeding +/- 0.5 grams require instrument repair.

(2) Calibration Version Verification.

Follow instructions outlined in **Section 4.5**.

(3) Review of Audit Trail.

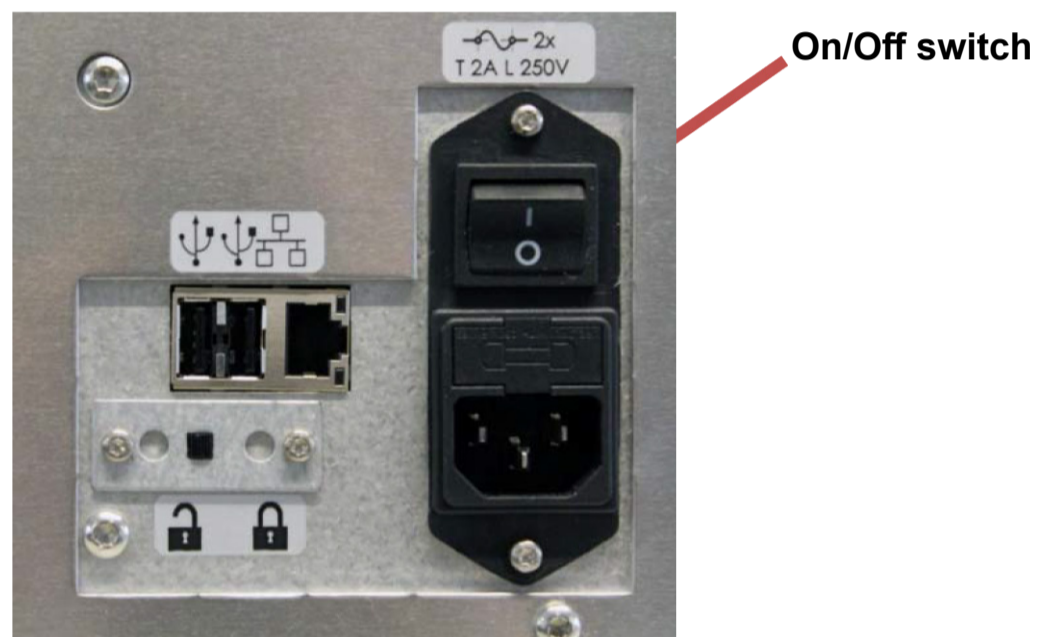
Review the Audit Trail log and make sure there have been no system modifications while the instrument has been out of official agency control. Any changes that relate to system functionality and testing are recorded and stored on the instrument. The Audit Trail will provide a log of these changes.

- b. If problems are found, remove the unit from official service until corrected. Whatever method of security check is performed, it must be recorded in the Log Book and the entry initialed.
- c. Maintain Current Date and Time for accurate records. (See Operators Manual)
- d. Test Weight per Bushel.

This function is not approved for official use.

- e. Power-On.

The power switch is on the rear of the unit, beside the main power inlet. It will take a few moments to initialize and to warm up. After the warm up is complete a notice will appear reminding the operator to make sure the grain box is empty and in its proper position. Once the **OK** button is pressed the product selection screen will appear indicating it is ready for use.



- f. Grain Selection.

Once the product screen appears select the desired product by pressing the corresponding button in the list. Use the arrow keys to scroll up and down in the list to display more products.



g. Grain Analysis.

- (1) After the desired grain is selected, pour sufficient sample into the hopper where there is enough sample in the hopper to reach the hopper full sensors. The machine will automatically start the analysis. Should you realize that you made a mistake and need to go back to the Products menu, press **Cancel**. The sample will remain in the funnel. Should you need to empty the sample into the sample box, press **Abort**.



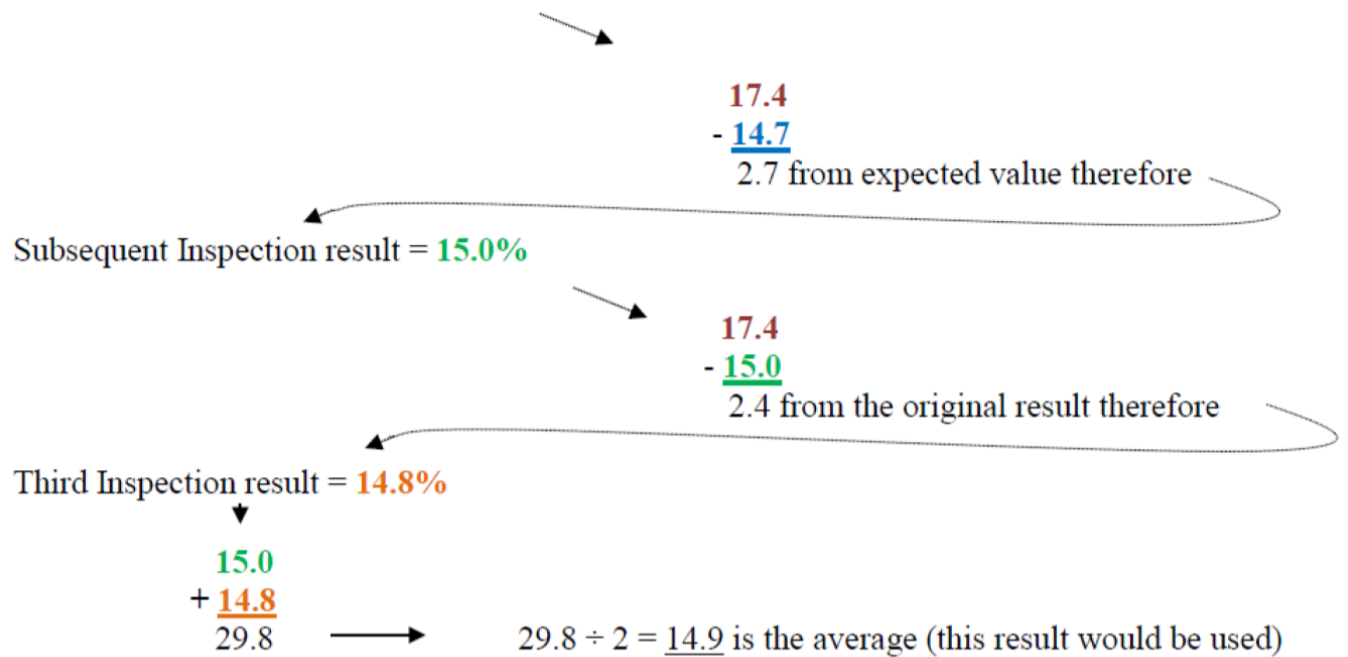
- (2) Enter Sample ID and press **Done** (only if sample ID is activated) to confirm and get to Analysis Results screen. The instrument can be set to use Sample ID to keep track of analyzed samples. If you use this feature, the instrument will now ask for a Sample ID. Press the white field, and an on-screen keyboard will be displayed. If the Sample ID field is grey, there will be no **Confirm** button and the instrument will automatically go to the Analysis Results screen and record results.
- (3) Addressing Suspected Erroneous Results.
 - (a) If the result appears to be a gross error (meaning there is reason to believe the error is more than two percent moisture different from the expected value or that of a similar lot of grain), one subsequent test may be performed. (Before repeating the test, check the cleanliness of the instrument, verify that the correct calibration was selected, and remove from the sample any large debris that may have hindered the flow of grain into the test cell.)
 - (b) If the second test result is within 1 percent of the first, report the original result.
 - (c) If the second test result is not within 1 percent of the original, perform a third test and report the average of the two results that are closest to each other.

Note: This policy may only be used when the official operator suspects that a gross error has occurred; it must not be used to justify retesting to obtain a desired moisture reading. The original inspection otherwise consists of one drop. The interested party may request a review and/or appeal inspection according to established procedures.

Example:

The expected value is around 14.7% moisture.

Original Inspection result = 17.4%



(4) Empty the Sample Box and put it back again.



Note: Keeping the sample box in place prevents rodents from entering the unit and causing damage.

(5) To analyze the next sample of the same sample type, just pour the sample into the funnel. To switch to a different sample type, press Products and follow instructions in step 1 above.

h. Sample Temperature.

The maximum temperature range limit is 0 to 113°F (-18 to 45°C). If the grain sample has a temperature outside this range it causes an error message will be displayed. The moisture sample temperature is more restricted for some grain types and moisture ranges.

i. For additional instructions, refer to the Perten AM 5200-A operator's manual.

4.5 CHECK TESTING OFFICIAL MOISTURE METERS

Refer to the *UGMA-Compatible Moisture Meter Checktesting Procedures* (Attachments A and B) on the [Moisture Equipment page of the AMS website](#) for instruction.

Refer to the *UGMA-Compatible Moisture Checktesting Form* on the [Moisture Equipment page of the AMS website](#) for the appropriate form/spreadsheet.

If you have any questions regarding the check test, contact Instrumentation Inspection Branch (816) 702-3800.

4.6 REPAIR OF OFFICIAL MOISTURE METERS

- a. General. All repairs to official meters shall be made by the manufacturer. Users shall not attempt to make repairs or adjustments other than as outlined in this handbook or the Perten AM 5200-A operator's manual.
- b. To aid the manufacturer in determining the types of repairs needed, thoroughly describe the malfunction or operational difficulty, and provide any other pertinent information concerning the condition of the meter.
- c. When packing the meter for shipment, be sure to follow the operator's manual instruction.
- d. Upon return from repair, the meter shall be check tested.

CHAPTER 5

REVISION HISTORY

Contents

Change No: 5	March 14, 2022	.....	2
Change No: 4	July 14, 2014	.....	2
Change No: 3	May 13, 2013	.....	2
Change No: 2	January 28, 2013	.....	2
Change No: 1	September 1, 2012	.....	3

Change No: 5 March 14, 2022

Foreword: Revised to replace GIPSA references with AMS and add GAC2700-UGMA.

Chapter 1: Revised to replace GIPSA references with AMS.

Chapter 2 Operation and Testing of the GAC2700-UGMA: Added this new chapter to include the detailed instructions for the newly approved GAC 2700-UGMA moisture meter. This chapter replace the “Reserved” chapter 2.

Chapter 3 Operation and Testing of the GAC 2500-UGMA: Revised to replace GIPSA references with AMS, update check test link, and update Instrumentation Inspection Branch contact information

Chapter 4 Operation and Testing of the Perten AM 5200-A – Revised to replace GIPSA references with AMS, update check test link, and update Instrumentation Inspection Branch contact information

Change No: 4 July 14, 2014

Chapter 3 Operation and Testing of the GAC2500-UGMA - Added Cleaning Temperature Sensor section under Maintenance and added hyperlink to operator’s manual.

Chapter 4 Operation and Testing of the Perten AM 5200-A – Added link to Perten’s operator’s manual.

Change No: 3 May 13, 2013

Chapter 1 General Information is revised to: Deleted items that reference the GAC 2100

Chapter 3 Operation and Testing of the GAC 2100 Moisture Meter – Deleted Chapter

Chapter 4 Operation and Testing of the GAC2500-UGMA - Renamed Chapter 3

Chapter 5 Operation and Testing of the Perten AM 5200-A – Revised moisture meter name to be consistent with formal documentation, Renamed Chapter 4

Change No: 2 January 28, 2013

Chapter 4 and 5, Operation and Testing of the GAC2500-UGMA and Perten AM5200-A Revised:

- Environmental Conditions – Items b & d
- Moisture Meter Log Book requirements
- Operation - cross-utilized equipment procedures

- addressing suspected erroneous results

Change No: 1 September 1, 2012

Chapter 1, General Information is revised to:

- Update to reflect current record keeping requirements such as Equipment Capability Testing (ECT), data entry, and maintenance of record. Also update to reflect title change to Technology and Science Division title and other administrative changes.
- Chapter 2, Moisture Meter Calibration move to “Reserve”
- Chapter 4 and 5, Operation and Testing of the GAC2500-UGMA and Perten AM5200-A
- Implement Maintenance, Operation, Check Testing, and Repair procedures for the new approved moisture machines.