



## NATIONAL TYPE EVALUATION PROGRAM

# Certificate of Conformance

for Weighing and Measuring Devices

**For:**

Grain Analyzer  
Moisture (grain) and Test Weight (grain)  
Dielectric  
Model: AM5200

**Submitted By:**

Perten Instruments, Inc.  
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**Standard Features and Options**

- Liquid Crystal Touch Screen Display
- Menu System (color touch screen)
- Printer (optional)
- USB Interface Ports
- Audit Trail

**Conditions of Certification:**

This Certificate covers the use of the AM5200 only with the grains and calibrations listed on Page 5. Moisture and test weight per bushel calibration data will be reviewed annually.

AM5200 meters must be installed in a system, which provides means for printing audit trail information, if the optional printer is not available.

Certificates of Conformance are issued after successful completion of Phase I NTEP testing. To maintain a current NTEP Certificate of Conformance for grain moisture meters, the manufacturer must participate in the NTEP on-going calibration program that represents Phase II. Under Phase II, the manufacturer is provided calibration data for use in making calibration updates. NTEP Certificates of Conformance are run annually to reflect these calibration updates. Calibrations for commodities, or constituents other than moisture, not listed on page 5 of this Certificate may be used on this device at the discretion of the regulatory body having authority over the device.

This device was evaluated under the National Type Evaluation Program and was found to comply with the applicable technical requirements of "NIST Handbook 44: Specifications, Tolerances and Other Technical Requirements for Weighing and Measuring Devices." Evaluation results and device characteristics necessary for inspection and use in commerce are on the following pages.

Kurt Floren  
Chairman, NCWM, Inc.  
Effective: September 12, 2011

Tim Tyson  
Chairman, National Type Evaluation Program Committee  
Issued: September 14, 2011

Expiration: June 30, 2012

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**Application:** For use in determining the moisture content and test weight per bushel of whole grain samples in commercial grain applications.

**Identification:** The identification sticker listing the manufacturer's name, serial number, model name, and NTEP Certificate of Conformance number is located on the rear of the meter.

**Sealing:** The AM5200 uses an audit trail (change log) as a means of providing security for metrologically significant parameters. The form of audit trail used by the device is an event logger, which keeps a record of all changes to the Unified Grain Moisture algorithm or metrological adjustment. Accesses to metrological menu items protected by a security password, either through the keypad or through remote communication, are automatically logged into the audit trail. Each audit trail entry includes the event description, the event detail, and the time and date of the change. (See "Field Inspection Notes" for details on accessing audit trail information.)

**Operating Ranges:**

Ambient Temperature Range (Environment): 41 °F to 104 °F (5 °C to 40 °C)

Temperature Difference (Room to Grain Temperature): 63 °F (35 °C) below Ambient and 36 °F (20 °C) above Ambient, see comments on Page 3

Grain Temperature Range: 0 °C to 45 °C (32 °F to 113 °F) for all grains and moistures except those listed in Table 1.

**Table 1: Grain Temperature Range by Moisture Range**

| Grain                 | Extended Temperature Range: -20 °C to 45 °C (-4 °F to 113 °F) for Moisture range | Temperature Range: 0 °C to 45 °C (32 °F to 113 °F) for Moisture range |
|-----------------------|--|---|
| Corn                  | Less than or equal to 18% moisture   | Above 18% moisture  |
| Durum Wheat           | Less than or equal to 16% moisture   | Above 16% moisture  |
| Soybeans              | Less than or equal to 16% moisture   | Above 16% moisture  |
| Wheat excluding Durum | Less than or equal to 16% moisture   | Above 16% moisture  |

Grain Moisture Range: Refer to Page 3

**Conditions of Operations:** The AM5200 is a fully automatic grain moisture meter. The appropriate sample size is determined by the instrument. An approximate 700 ml or 560 g sample is required.

**Field Inspection Notes:** The calibration names listed on Page 5 will be used in all instruments of the approved models without variation.

**UGMA Calibration Constants May Be Viewed on the Instrument By:**

1. Select Menu.
2. Scroll to, and select, System info.
3. Scroll to, and select, UGMA revision number.
4. Select Back to return to the previous screen.

**Grain Calibration Versions and Grain Specific Adjustments (slope and bias) May Be Viewed on the Instrument By:**

1. Select Menu.
2. Select Products.
3. Select Product settings.
4. Select product (grain type) to be viewed.
5. Select profile name to see the unique calibration version.
6. Select Back to return to the previous screen.
7. Scroll to view the bias and slope settings.
8. Select Back to return to the previous screen.

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**Field Inspection Notes Continued:****Steps to View and Print Audit Trail (Change Log) Entries of the AM5200 Are:**

1. Select Menu.
2. Select Log book.
3. Select Change log to view all changes.
4. Use the up and down arrows to view the events on the instrument.
5. Select Print to print out the 9 most recent entries.
6. Select Next to print out the next set of entries or All to print entire Change Log (Audit Trail) or Back to stop printing. Or,
7. Insert a USB thumb drive and select Import/Export.
8. Select Export Raw Data and wait for the completion message.
9. Select Ok and Back to return to the previous screen.
10. The thumb drive contains a folder with the Change Log on it that may be viewed or printed from a computer.

**Test Conditions:**The following tests were performed on each of two instruments submitted for evaluation. The emphasis of the evaluations was on the device design, operation, and compliance with temperature requirements. For purposes of the evaluation, room temperature was defined as  $22^{\circ}\text{C} \pm 2^{\circ}\text{C}$ .

Basic instrument tests were conducted using a stable moisture hard red winter wheat (HRW) sample between 12 and 14 percent moisture to check the effect of power supply fluctuations, storage temperature, leveling, warm-up time, test weight per bushel sample volume, test weight per bushel initial precision, and humidity. Instrument stability and instrument temperature sensitivity tests were conducted using HRW samples selected from all three 2 percent moisture intervals in the 10 to 16 percent moisture range and representative of the test weight per bushel range of 56 - 61 pounds per bushel (lb/bu). Testing for calibration performance was performed using corn, soybeans, and hard red winter wheat samples over a 6 percent moisture range.

Testing for test weight per bushel calibration performance was performed using the following grains and constituent ranges: Corn 12 to 18 percent moisture and 52.6 to 60.0lb/bu test weight; Durum wheat 10 to 16 percent moisture and 57.7 to 64.7lb/bu test weight; grain sorghum 10 to 16 percent moisture and 57.6 to 62.3lb/bu test weight; HRS wheat 10 to 16 percent moisture and 58.0 to 63.9lb/bu test weight; HRW wheat 10 to 16 percent moisture and 55.1 to 64.1lb/bu test weight; Hard White wheat 8 to 14 percent moisture and 59.2 to 65.7 lb/bu test weight; LGRR 10 to 16 percent moisture and 42.0 to 47.0lb/bu test weight; MGRR 10 to 16 percent moisture and 43.5 to 48.4lb/bu test weight; Oats 8 to 14 percent moisture and 33.7 to 44.2 lb/bu; Six Row Barley 10 to 16 percent moisture and 43.5 to 53.9lb/bu test weight; SRW wheat 10 to 16 percent moisture and 55.4 to 63.7lb/bu test weight; Soft White wheat 10 to 16 percent moisture and 57.4 to 64.4lb/bu test weight; Soybean 10 to 16 percent moisture and 54.8 to 59.4lb/bu test weight; sunflower 6 to 12 percent moisture and 27.4 to 33.5lb/bu test weight; and Two Row Barley 10 to 16 percent moisture and 48.1 to 53.4lb/bu test weight.

Temperature Difference (Room to Grain Temperature): Sample temperature sensitivity, the effect of differences between room and grain temperature, was tested for the following grains: corn, soybeans, and HRW wheat.

Moisture calibration constants listed on this Certificate are evaluated using procedures and tolerances specified for either the Phase I Type Evaluation testing or the Phase II On-going Moisture Calibration Program. The categories are described as follows:

**Phase I Type Evaluation:** Phase I Type Evaluation testing for Corn, HRW wheat, and soybean calibration performance is over the 6% moisture range listed in the first column of Table 2 and evaluated during the Accuracy testing. Calibration performance is evaluated and approved in 2% moisture intervals. The calibration is approved for a specified moisture interval if the average bias, i.e., the difference between predicted moisture values and reference air oven values for samples within the 2% moisture intervals, does not exceed one-half the handbook 44 acceptance tolerance.

The initial evaluation for the remaining NTEP grain moisture calibrations listed on the Certificate performance are evaluated over the 6% moisture range listed in the first column of Table 2 during the Bias Check testing. A set of 10 to 12 samples is used to verify that the calibration bias is within  $\pm 0.40$  of the GIPSA reference air oven.

**Phase II On-going Moisture Evaluation:** After a meter has been in the on-going national calibration program, the calibration performance is evaluated annually over the 2% moisture intervals for the moisture range listed in the second column of Table 2.

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**Test Conditions Continued:** The calibration meets the evaluation criteria and remains listed on the Certificate if the average bias, i.e., the difference between predicted moisture values and reference air oven values for samples within the 2% moisture intervals, does not exceed one-half the Handbook 44 acceptance tolerance over the moisture range listed in the first column of Table 2 and does not exceed one-half the Handbook 44 acceptance tolerance plus a 95% confidence interval over the remaining 2% moisture intervals in the moisture range listed in the second column of Table 2.

Table 2: NTEP Moisture Evaluation Ranges

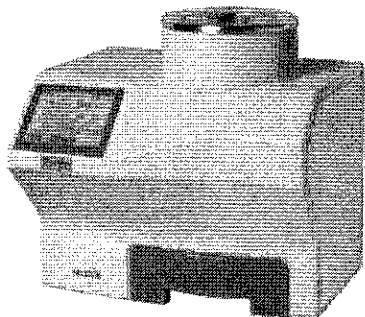
| Grain                   | Phase I Type Evaluation 6% Moisture Range | Phase II On-Going Evaluation Moisture Range |
|-------------------------|---|---|
| Corn                    | 12 – 18%                                  | 10 – 26%                                    |
| Grain Sorghum           | 10 – 16%                                  | 10 – 18%                                    |
| Durum Wheat             | 10 – 16%                                  | 8 – 16%                                     |
| Hard Red Spring Wheat   | 10 – 16%                                  | 8 – 18%                                     |
| Hard Red Winter Wheat   | 10 – 16%                                  | 8 – 18%                                     |
| Hard White Wheat        | 8 – 14%                                   | 8 – 14%                                     |
| Soft Red Winter Wheat   | 10 – 16%                                  | 10 – 18%                                    |
| Soft White Wheat        | 10 – 16%                                  | 8 – 16%                                     |
| "All Class" Wheat       | 10 – 16%                                  | 8 – 18%                                     |
| Wheat Excluding Durum   | 10 – 16%                                  | 8 – 18%                                     |
| Long Grain Rough Rice   | 10 – 16%                                  | 10 – 20%                                    |
| Medium Grain Rough Rice | 10 – 16%                                  | 10 – 20%                                    |
| "All Class" Rough Rice  | 10 – 16%                                  | 10 – 20%                                    |
| Oats                    | 8 – 14%                                   | 8 – 14%                                     |
| Soybeans                | 10 – 16%                                  | 8 – 18%                                     |
| Sunflower Seed          | 6 – 12%                                   | 6 – 16%                                     |
| Six-Row Barley          | 10 – 16%                                  | 8 – 16%                                     |
| Two-Row Barley          | 10 – 16%                                  | 8 – 16%                                     |
| "All Class" Barley      | 10 – 16%                                  | 8 – 16%                                     |

**Evaluated By:** C. Brenner and S. Coulibaly (GIPSA Type Evaluation and Calibration Group) 11-087

**Type Evaluation Criteria Used:** NIST, Handbook 44: Specifications, Tolerances and Other Technical Requirements for Weighing and Measuring Devices, 2011. NCWM, Publication 14: Grain Moisture Meters & Near Infrared Grain Analyzers, 2011.

**Conclusion:** The results of the evaluation and information provided by the manufacturer indicate the device complies with applicable requirements.

**Information Reviewed By:** J. Truex (NCWM) 11-087

**Example of Device:**

Model AM5200

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This meter uses a common moisture equation, Unified Moisture Algorithm (UMA) for all grain types. The constants for the UGMA2010version are:

Unified Moisture Algorithm Constants:

K0: -123.1240 K1: 115.2250

K2: -39.8120 K3: 6.9279

K4: -0.5735 K5: 0.0181

This meter also groups different grains together to compensate for grain specific densities and adjustments (slope and bias). The following table lists the grain specific adjustments for each grain grouping associated with the UGMA 2010version.

**Grain Specific Calibration Constants for Moisture and Test Weight per Bushel Meter Update – 2011**  
**The Effective Date for All Moisture and Test Weight per Bushel (TW) Calibrations is September 12, 2011**

| Grain                   | Designation   | Includes  | Moisture and Test Weight Calibration Profile Version*     | Grain Constants |               |             |            |
|-------------------------|---------------|---|---|-----------------|---------------|-------------|------------|
|                         |               |   |   | Moisture slope  | Moisture bias | TW slope US | TW bias US |
| Barley                  | barley        | 6-Row Barley<br>2-Row Barley  | BAR 110624-237.95480-1<br>Meets Phase I Type Evaluation   | 1               | 0             | 1           | 0          |
| Corn                    | corn          |   | CORN 110829-661.62927-1<br>Meets Phase I Type Evaluation  | 1               | 0             | 1           | 0          |
| Durum                   | durum         |   | DURUM 110624-253.44170-1<br>Meets Phase I Type Evaluation | 1               | 0             | 1           | 0          |
| Grain Sorghum or Milo   | sorghum       |   | SORG 101203-252.78460-1<br>Meets Phase I Type Evaluation  | 1               | 0             | 1           | 0          |
| Long Grain Rough Rice   | LGR Rice      |   | LGRR 101203-253.29190-1<br>Meets Phase I Type Evaluation  | 1               | 0             | 1           | 0          |
| Medium Grain Rough Rice | MGR Rice      |   | MGRR 101203-253.40860-1<br>Meets Phase I Type Evaluation  | 1               | 0             | 1           | 0          |
| Oats                    | oats          |   | OATS 110624-224.63710-1<br>Meets Phase I Type Evaluation  | 1               | 0             | 1           | 0          |
| Soybeans                | soybeans      |   | SOY 110624-254.23710-1<br>Meets Phase I Type Evaluation   | 1               | 0             | 1           | 0          |
| Sunflower Seed          | sunflower     |   | SFS 101203-234.23290-1<br>Meets Phase I Type Evaluation   | 1               | 0             | 1           | 0          |
| Wheat (exdur)           | wheat (exdur) | Hard Red Spring<br>Hard Red Winter<br>Hard White Wheat<br>Soft Red Winter<br>Soft White Wheat | WHT 110610-252.85720-1<br>Meets Phase I Type Evaluation   | 1               | 0             | 1           | 0          |

Note: \*The profile version is abbreviated to the alpha characters plus the first six numbers on the printout and on the display with the results. For example, BAR 110624-237.95480-1 is listed and displayed as BAR 110624.