WEIGHTS & MEASURES
CONNECTION
NIST
National Institute of Standards and Technology
U.S. Department of Commerce
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Inside this Issue

This Month in History

October 1, 1908 - The Model T, a car designed for the mass population by Henry Ford, appeared for sale.

October 5, 1882 - Robert Goddard (1882 - 1945) was born in Worcester, Massachusetts. He is thought of as the "Father of the Space Age." He is credited with launching the world's first liquid-fueled rocket and developed other apparatus for rocket machines.

October 13, 1775 - The U.S. Navy's birthday.

October 13, 1792 - George Washington laid the cornerstone for the White House originally it was known as the "Presidental Palace." The building was designed by James Hoban to be three stories high with over 100 rooms. President John Adams and family moved in when it was completed in November of 1800.

Ocober 14, 1947 - Chuck Yeager, a U.S. Air Force pilot, broke the sound barrier while he was testing a research plane.

October 20, 1818 - The United States and Brittan agreed to set the Canadian borders at the 49th parallel.

October 21, 1915 - The American Telephone and Telegraph Company sent the first transatlantic radio voice message from Virgina to Paris.

FALL

NIST welcomes the cool fall weather. The picture above is of the Administration building and a few of the trees showing their fall wardrobe. The picture on the right is one of the campus residents posing for his photograph. There are a few of his friends in the background.

Determining Reference Test Weight per Bushel Value of Grains

By G. Diane Lee

"Test weight per bushel" is a measurement of the weight of a volume of grain required to fill level a Winchester bushel measure of 2 150.42 cubic inches (equivalent to 32 quarts) in capacity[1]. Test weight per bushel is one of the measurements used by the U.S. Department of Agriculture (USDA), Grain Inspection Packers and Stockyards Administration (GIPSA) in grain grading. For example, USDA No. 1 hard red spring wheat has a minimum limit for test

weight per bushel of 58.0 pounds per bushel. In the market place, test weight per bushel is a commercial measurement because it affects the market value of grain. When a farmer sells grain, the grain price may be "discounted." If "discounted" for test weight, the farmer receives less money for the grain if the test weight per bushel measurement is under a certain specified target weight per bushel, such as 58.0 pounds per bushel. Many grain moisture meters, currently in commercial use, that are covered by a National Type Evaluation Program (NTEP) Certificate of Conformance, provide grain test weight per bushel measurements that are used to assess the amount of money a farmer will receive for grain. As such, the "test weight per bushel" measurement must be verified for accuracy. The process used to verify the accuracy of a meter's test weight per bushel measurement begins in the laboratory. Both the NTEP laboratory and state weights and measures laboratories use a reference test weight per bushel measurement procedure, and specific equipment to determine the reference test weight per bushel values of various grains. Once a reference test weight per bushel value is determined for the grains, the grains are used to verify the accuracy of the test weight per bushel feature on meters. Both the NTEP laboratory and State Weights and Measures field inspectors verify the accuracy of the weight per bushel measurement of meters by comparing the results of the weight per bushel measurement on the meter to the reference "test weight per bushel" value of the grain samples that are placed in the meter for measurement. This article addresses the laboratory equipment, equipment maintenance, and reference procedures for test weight per bushel because of its importance in determining the accuracy of the test weight per bushel measurement of meters.

Equipment

To determine reference test weight per bushel measurements of grain, use test weight per bushel equipment approved by USDA, GIPSA. The USDA, GIPSA Equipment Handbook includes two lists of GIPSA approved equipment: active and inactive. The active equipment list includes GIPSA approved equipment that is commercially available. The inactive equipment list contains GIPSA approved equipment no longer manufactured or widely marketed, but

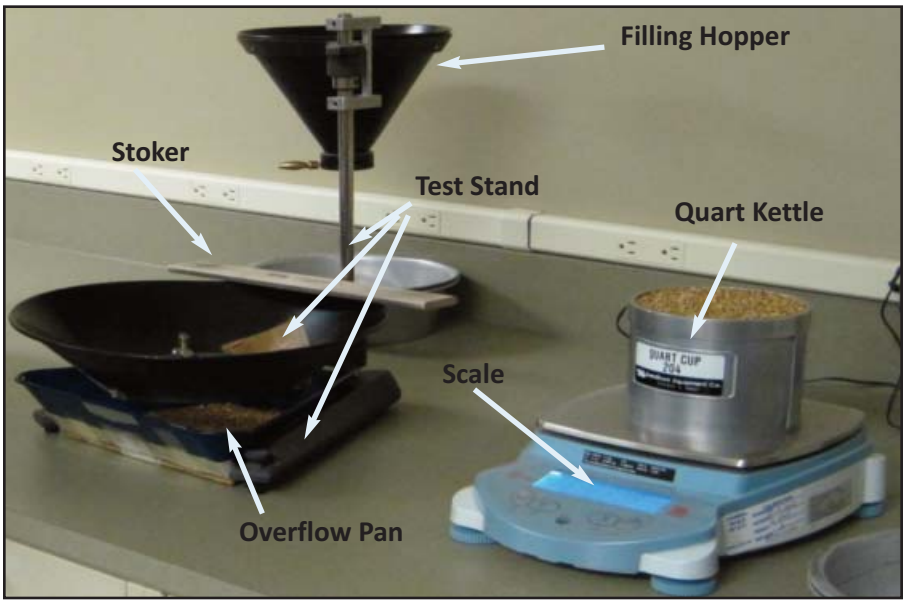

Figure 1. Test Weight per Bushel Equipment - Active Approved Equipment

Calendar 2013

Registration for training in the NIST Office of Weights and Measures is handled by Yvonne Branden at yvonne.branden@nist.gov.

Course descriptions can be viewed on the Office of Weights and Measures website by clicking on the name of the course. http://www.nist.gov/pml/wmd/calendar.cfm

October 6 - 9 (4 days)
Southern Weights and Measures Association (SWMA)
Embassy Suites Charleston
Charleston, WV
Contact: Richard McComas at rich.d.mccomas@wv.gov

October 9 - 10 (2 days)
NTEP Measuring Sector Meeting
Embassy Suites Hotel
Charleston, WV
Contact: NCWM at info@ncwm.net

October 10
Webinar - Internal Auditing Best Practices
2:00 p.m. to 4:00 p.m.
Class No. 5251

October 16 - 17 (2 days)
Northeastern Weights and Measures Association (NEWMA) Interim Meeting
Holiday Inn Norwich
Norwich, CT
Contact: James Cassidy at jcassidy@cambridgema.gov

October 17
Webinar - State Laboratory Annual Submission Process**
2:00 p.m. to 4:00 p.m.
Class No. 5249

October 21 - October 25 (5 days)
Handbook 130 - Packaging and Labeling
Glendale, AZ
Class No. 5269

October 21 - November 1 (2 weeks)
Mass Metrology Seminar
Class No. 5250
NIST/Gaithersburg, MD

November 4 - 7 (4 days)
Handbook 133 - *Checking the Net Contents of Packaged Goods*, Volumetric
Class No. 5289
NIST/Gaithersburg, MD

Novenber 18 - 20 (3 days)
Vehicle and Axle-load Scales
Class No. 5287
Las Cruces, NM

(continued on page 3)

is still approved for use. The equipment used to determine reference test weight per bushel values for grain are:

- a quart kettle,
- a scale specifically designed to measure test weight per bushel,
- a filling hopper,
- an over flow pan, and
- a stroker.

Figure 1 includes test weight per bushel equipment from GIPSA's active approved equipment list and currently in use at the USDA, GIPSA in Kansas City, Missouri.

Equipment Maintenance

The test weight per bushel equipment must be checked and adjusted prior to initial use; and periodically, thereafter, as needed. A maintenance schedule of the checks and adjustments made to the equipment must be documented. The specifications and maintenance for test weight per bushel equipment are included in GIPSA's Equipment Handbook, which can be downloaded from the USDA, GIPSA Website at http://www.gipsa.usda.gov/Publications/fgis/handbooks/equip_insphb.html.

Procedure for Determining the Reference Test Weight per Bushel Value of Grains

In general, the procedure used to determine the reference test weight per bushel of grain is to weigh one dry quart of the grain on a suitable scale that is designed to multiply the weight by 32, since there are exactly 32 quarts to a dry bushel. These specially designed scales provide a direct reading of test weight per bushel. Since these scales indicate 32 times the weight of the content in the dry quart, it is very important to follow procedures for determining the reference test weight per bushel values of grain.

The following is a step by step procedure to determine the reference test weight per bushel values of grain samples that are used to test meters or other equipment used to provide test weight per bushel measurements to customers in the marketplace.

1. Before starting the procedure, ensure that the equipment is positioned correctly by placing a level on top of the quart kettle to ensure that it is in a level condition on the test stand and position the filling hopper two inches above the top of the quart kettle. Procedures for measuring this distance are included in Chapter 5 of the USDA GIPSA Equipment Handbook.

2. Place the empty quart kettle on the scale; then zero the scale (Figure 2).

3. Close the bottom of the fill hopper; place about $1^1/_8$ quart of grain in the filling hopper, and place the quart kettle on the test stand.

Figure 2. Zero weight of the empty quart kettle.

November 18 - 22 (5 days)
Volume Metrology Seminar
Class No. 5252
NIST/Gaithersburg, MD

December 4 - 6 (3 days)
Train the Trainer
Class No. 5288
NIST/Gaithersburg, MD

2014

January 13 - 17 (5 days)
Fundamentals of Metrology Seminar
Class No. 5276
NIST/Gaithersburg, MD

January 19 - 22 (4 days)
National Conference on Weights and Measures (NCWM) Interim Meeting
Albuquerque, NM
info@ncwm.net

February 6
Webinar - Conducting an Effective Management Review
2:00 p.m. to 4:00 p.m.
Class No. 5255

February 20
Webinar - Internal Auditing Best Practices
2:00 p.m. to 4:00 p.m.
Class No. 5256

February 24 - March 7 (2 weeks)
Mass Metrology Seminar
Class No. 5285
NIST/Gaithersburg, MD

March 31 - April 4 (5 days)
Fundamental of Metrology
Class No. 5290
NIST/Gaithersburg, MD

April 11 - May 8 (2 weeks)
Mass Metrology Seminar
Class No. 5285
NIST/Gaithersburg, MD

May 5 - 8 (4 days)
Northeastern Weights and Measures Association (NEWMA) - Annual Meeting
Manchester, NH
Contact: James Cassidy at
jcassidy@cambridgema.gov

June 19 - 13 (5 days)
Laboratory Administration
Class No. 5291
NIST/Gaithersburg, MD

July 12 - 17
National Conference on Weights and Measures - Annual Meeting
Detroit, MI
Contact: info@ncwm.net *(continued on page 4)*

4. Position the fill hopper over the quart kettle by swiveling the fill hopper and fill the kettle from the hopper (Figure 3). Do not move the kettle while it is being filled.

5. Once the quart kettle is full, move the fill hopper away from the quart kettle being careful not to move the kettle.

Figure 3. Filling the quart kettle from the filling hopper.

Figure 3a. Remove excess grain.

6. Hold the stroker on each end with your fingers so that the sides are in a vertical position and place it lightly on the edge of the kettle without moving the kettle (Figure 3a).

7. Stroke the excess grain from the top of the quart kettle in a zigzag motion with three full strokes. Each stroke should cover 1/3 of the top of the kettle (Figure 3b).

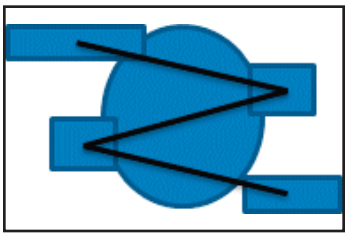

Figure 3b. Stroke pattern: Start with the stroker at the edge of the quart kettle and follow a zigzag pattern.

Important Note: Scales used to measure test weight per bushel are specially designed to provide an indication that is 32 times the weight of the grain in the quart kettle. So, if the quart kettle contains 1 pound, then the scale will show a weight per bushel indication of 32 pounds per bushel (1 to 32 ratio). It is extremely important to follow the procedure for step 6, stroking excess grain from the quart kettle because too much or too little grain removed, will impact the measurement by a multiple of 32 (e.g., if 1 ounce of grain is removed that should have been part of the measurement there will be a 2.0 pouinds per bushel error in the test weight per bushel measurement).
Example of calculation:

1 lb = 16 oz
1 oz/16 oz = 0.0625 lb,
so, 0.0625 lb x 32 = 2.0 lb

Figure 4. Weighing the quart kettle and grain.

8. Carefully remove the quart kettle from the stand and weigh the kettle and grain on the scale and record your results. (See figure 4.)

In accordance with the National Institute of Standards and Technology (NIST) Handbook (HB) 44, *Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices*, Section 5.56.(a) Grain Moisture Meters, paragraph N.1.1. Air Oven Reference Method Transfer Standards, repeat steps 1 through 8, 10 times and average the results for each grain type. The test weight per bushel value assigned to the grain samples is the average of 10 measurements. When assigning this value, it must be noted that when a standard is used without correction, the combined error and uncertainty in your measurement must be less than one-third of the applicable

August 14
Webinar - Calibration Certificate Evaluation
2:00 p.m. to 4 p.m.
Class No. 5292

August 18
Webinar - Contract Review
2:00 p.m. - 4 p.m.
Class No. 5293

August 25 - 29 (5 days)
Fundamentals of Metrology
Class No. 5277
NIST/Gaitersburg, MD

August 25
Webinar - Document Control and Record Keeping
2 p.m. - 4 p.m.
Class No. 5294

September 8
Webinar - Conducting an Effective Management Review
Class No. 5295

September 14 - 18
Western Weights and Measures Association (WWMA)
Contact: Brett Saum at bsaum@co.slo.ca.us

September 15
Webinar - Internal Auditing Best Practices
2:00 p.m. - 4:00 p.m.
Class No. 5296

October 19 - 24 (6 days)
Combined Regional Measurement Assurance Program
Class No. 5157
St. Louis, MO

*Invitation Only
**Limited to State Laboratory Program Participants

The Office of Weights and Measures

will glady include your weights and measures related events in our calendar.
Contact the Editor:
Linda.Crown@nist.gov

The Official Start of Autumn
September 23

tolerances, in accordance with NIST HB 44, Appendix A. Fundamental Considerations, Section 3.2. Tolerances for Standards.

The consistent use of proper techniques and proper equipment are key to successfully determining the reference values for test weight per bushel.

Using the prescribed test procedures and correct equipment, as provided in this article along with maintaining your equipment in accordance with the USDA, GIPSA Equipment Handbook will reduce the variability and error in your reference test weight per bushel measurements made in the laboratory. Practice removing the excess grain from the quart kettle will result in better measurement repeatability. Additionally, grain samples with accurate weight per bushel values will help to ensure proper testing of meter weight per bushel measurements.

Resources for Test Weight per Bushel Reference Measurements

- USDA, GIPSA Equipment Handbook at: http://www.gipsa.usda.gov/Publications/fgis/handbooks/equip_insphb.html.

- Circular No. 921 "The Test Weight per Bushel of Grain: Methods of Use and Calibration of the Apparatus," June 1953, United States Department of Agriculture.

For additional information concerning this article you may contact Diane Lee of the NIST, Office of Weights and Measures (OWM) by e-mail at diane.lee@nist.gov.

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1 Circular No. 921 U.S. Department of Agriculture, June 1953

Note: It is policy of the National Institute of Standards and Technology to use metric units of measurement in all of its publications. However, in this newsletter the references to inch-pound units are used as they are commonly used in industry practice and in source documentation.

Employees at NIST are blessed with a beautiful park-like campus full of wildlife. The campus-setting is home to numerous inhabitents such as deer, geese, and groundhogs. Occasionally we see foxes, and in the past bears and wild cats have been sited.

We gladly share the meadows and lightly forested areas with them. If you have had the opportunity to visit us here in Gaithersburg, you have shared our pleasure.

A Little Fall Color

Retail Motor Fuel Device Training Video

By G. Diane Lee

The National Institute of Standards and Technology (NIST), Office of Weights and Measures (OWM) is nearing completion of a Retail Motor Fuel Dispenser (RMFD) training video. The video shows a weights and measures official performing the minimum tests of a RMFD at a typical gas station and includes the following tests:

- checking security seals on test measures and provers,
- wetting and draining test measures and provers,
- normal and slow flow tests,
- reading the meniscus, and
- the anti-drain test.

The tests demonstrated in the video are performed using both hand held test measures and provers. The video will be posted on the OWM website and will also be used in webinars and other instructor led RMFD training. One of the webinars planned for 2014, is a one-hour webinar on "Draining Test Measures and Provers." Participants interested in this webinar must request training using the NIST, Office of Weights and Measures Contacts System. After you receive notice that your request has been received, you will be notified of specific dates for this training. Instruction for requesting training in our Contacts System is available at: http://www.nist.gov/pml/wmd/upload/how-to-request-training1.pdf

For additional information concerning the webinar "Draining Test Measures and Provers" or other RMFD training, please contact G. Diane Lee by phone at 301-975-4405 or by email at diane.lee@nist.

Coming Soon!
Handbooks will be arriving at a mailbox near you.

NIST Handbook 130 (2014), *Uniform Laws and Regulations in the Areas of Legal Metrology and Engine Fuel Quality.*

NIST Handbook 133 (2014), *Checking the Net Contents of Packaged Goods.*

NIST Handbook 44 (2014), *Specifications, Tolerances and Other Technical Requirements for Weighing and Measuring Devices.*

Handbooks will be shipped based on the information provided by the National Conference on Weights and Measures (NCWM). Membership who have requested handbooks should receive them by the end of October. However, please note there will be more than one mailing of each document. Those that renewed their memberships early will receive their copies first. If you have any questions, you can contact NCWM at info@ncwm.net.

Have you checked out the training calendar?

Weights and Measures in the News

azdailysun.com

More than half of Falgstaff gas stations surveyed not dispensing fuel correctly

http://azdailysun.com/news/local/more-than-half-of-flagstaff-gas-stations-surveyed-not-dispensing/article_fd4c9ed0-0f6b-11e3-a079-001a4bcf887a.html

delawareonline

Two skimming devices found/Technology at pumps can steal card info

http://www.delawareonline.com/article/20130810/NEWS/308100029/Two-skimming-devices-found?gcheck=1&nclick_check=1

The Piedmont News Station

Inspectors make sure yogurt shops play by the rules in Guilford Co.

http://myfox8.com/2013/08/07/guilford-county-inspectors-make-sure-yogurt-shops-play-by-the-rules/