



Laboratory Proficiency Testing for Slice Shear Force Measurements

August 2012

BACKGROUND

The Department of Agriculture (USDA), Agricultural Marketing Service (AMS), Livestock, Poultry and Seed (LPS) Program will certify carcasses and meat cuts for tenderness-marketing claims based on the American Society for Testing and Materials (ASTM) International tenderness standard. The basis for assessing tenderness that meets the performance requirements outlined in this document was established after consultation with an industry-working group convened by the LPS Program. The Industry Working Group was comprised of representatives of USDA, industry associations, processing companies, producers, technology providers, and academia.

PURPOSE AND SCOPE

The LPS Program *Operational Requirements for the USDA Certification of ASTM Tenderness Marketing Claims* specifies that slice shear force (SSF) will be the method of assessing tenderness. AMS approved third parties may conduct the SSF testing required to validate that the requirements of the ASTM tenderness standard have been met. Third party laboratories are approved to conduct SSF through proficiency testing conducted in conjunction with an AMS designated SSF reference laboratory. This document outlines the procedures and requirements of proficiency testing.

REFERENCE DOCUMENTS

1. Operational Requirements for the USDA Certification of ASTM Tenderness Marketing Claims. USDA LPS Program – DRAFT – July 2012.
2. Quality Systems Verification Programs General Policies and Procedures. Grading and Verification Division GVD 1000 Procedure.
3. Research Guidelines for Cookery, Sensory Evaluation and Instrumental Tenderness Measurements of Fresh Meat. American Meat Science Association, 1995.
4. Slice Shear Force Protocol for Large Volume. USDA, Agricultural Research Service (ARS) – <http://www.ars.usda.gov/SP2UserFiles/Place/54380530/protocols/SSFProtocolforlargevolume.pdf>
5. Standard Practice for User Requirements for Livestock, Meat, and Poultry Evaluation Devices or Systems. American Society for Testing Materials (ASTM) International Standard F 2341-05.
6. Standard Terminology for Livestock, Meat, and Poultry Evaluation Systems. ASTM International Standard F 2463-06.

7. Standard Test Method for Livestock, Meat, and Poultry Evaluation Devices. ASTM International Standard F 2343-06.
8. USDA Quality Systems Assessment (QSA) Program. Grading and Verification Division GVD 1002 Procedure.
9. Wheeler, T.L., Shackelford, S.D., and Koohmaraie, M. Beef longissimus slice shear force measurement among steak locations and institutions. Journal Animal Science 2007, 85:2283–2289

REQUIREMENTS

In addition to the required information as outlined in GVD 1000 Section 6, an individual or firm seeking to serve as an AMS approved party that conducts the SSF testing must: (1) provide documentation that describes the quality management system as outlined in GVD 1002 Section 6; and, (2) demonstrate conformance with the elements below.

Operational Requirements

Testing SSF instrument systems shall be used, operated, inspected, and maintained as described in ASTM International Standard F 2341-05. The areas addressed in this standard include instrument installation, operation, verification, inspection and maintenance, and operator training.

Test Samples

All testing will be conducted on 2.54-centimeter (one-inch) thick strip loin steaks. Sixty sets of duplicate steaks will be tested by each laboratory. The 60 sets of duplicate steaks should come from 30 strip loins. To ensure sufficient variation in tenderness, the strip loins shall include the following distribution of slice shear force as determined by the reference lab: not more than 75% < 17 kg and at least 10% > 25 kg.

The strip loins shall be obtained by the third party lab and shipped to the reference lab as soon as possible after harvest such that the reference lab can freeze 15 of the strip loins no later than 3 days postmortem and another 15 strip loins no later than 14 days postmortem. If the 3 day postmortem requirement cannot be met, then all 30 strip loins should be frozen no later than 7 days postmortem. The reference lab will cut the frozen strip loins into 2.54-centimeter (one inch) thick steaks and assign two sets of two adjacent steaks to the third party lab and two sets for the reference lab in a manner that blocks for potential location variation in slice shear force (ref lab steaks 1&2, third party lab steaks 3&4, ref lab steaks 5&6, third party lab steaks 7&8; with this order alternating among strip loins).

Randomly numbered frozen steaks (n=120) will be labeled and shipped overnight by the reference laboratory to third party laboratories participating in the proficiency testing.

Equipment

Cooking. Accurate slice shear force is accomplished using a variety of cooking methods using constant time or constant temperature endpoints (Wheeler et al., 2007). Cooking should be conducted in a manner and with a method known to provide consistent results. The cooking endpoint target is 70°C (158°F). Internal steak temperature must be measured with a calibrated

thermometer. Steak weights must be obtained with a calibrated scale with appropriate weighing capacity.

Shearing. Several testing machines are available that can be equipped with slice shear force attachments (see *Slice Shear Force Protocol for Large Volume*, USDA, Agricultural Research Service). Instruments should be equipped with a 50-100kg load cell and must be properly calibrated. SSF instrument systems must be verified and documented for accuracy on each production day as specified by ASTM Standard F 2341-05. Verification standards must cover each third of the normal operating range of the device for SSF.

Method/Procedure

Slice shear force should be conducted as described in protocols by USDA, Agricultural Research Service (ARS) U.S. Meat Animal Research Center (see *Slice Shear Force Protocol for Large Volume*, USDA, Agricultural Research Service).

Data Collection

Data should be recorded in the spreadsheet provided by the reference laboratory. Data recorded for each individual steak will include: frozen weight, refrigerator temperature, internal thawed temperature, cooking instrument (make and model), cooking time and temperature, internal cooked temperature, cooked weight, total thaw/cook loss, slice shear force.

Performance Assessment

The reference lab and the third party lab(s) will send completed data spreadsheets to USDA-AMS for performance assessment. Despite measures taken to ensure an adequate level of variation in slice shear force, the amount of variation in a given dataset will impact all statistics associated with slice shear force. To account for this fact, performance criteria will be normalized to the reference lab. Proficiency will be determined by conformance to the following key performance elements.

REQUIRED KEY PERFORMANCE ELEMENTS

- Repeatability of duplicate samples must be at least 90% of the repeatability of the reference lab.
 - Repeatability will be measured as: $R = \sigma^2_{\text{sample}} / (\sigma^2_{\text{sample}} + \sigma^2_{\text{error}})$
- Precision measured by the standard deviation of the differences (rSD). The ratio of the third party lab rSD to the reference lab rSD must be ≤ 1.40 .
- Accuracy measured by difference from the reference lab. The mean SSF of the third party lab cannot be less than ($P < 0.05$) the mean SSF for the reference lab. It is permissible for the third party lab to have a higher mean SSF than the reference lab because this will result in a more conservative approval for tenderness labeling.

APPROVAL PROCESS

Approval will be determined on a case-by-case basis. Interested parties must submit their quality management plan and supporting data that are reviewed through a desk audit. Once the desk audit is satisfactorily completed, the quality management system is verified through an onsite audit conducted by the Grading and Verification (GV) Division. Once the onsite audit is satisfactorily completed, approval will be granted.

ADDITIONAL INFORMATION

You may find more information about a documented quality management program in GVD 1000 Procedure - Quality Systems Verification Programs General Policies and Procedures and GVD 1002 USDA Quality Systems Assessment (QSA) Program.

Questions or comments pertaining to Grading and Verification Division Services should be submitted to:

James Riva, Deputy Director Grading and Verification Division, Technical Services
USDA, AMS, LPS Program
13952 Denver West Parkway
Building 53 Suite 350
Lakewood, CO 80401
Phone: (540) 288-2197

Questions or comments pertaining to these performance requirements should be submitted to:

Kenneth Payne, Acting Director, Standards, Research and Promotions Division
USDA, AMS, LPS Program
1400 Independence Avenue, S.W.
Room 2607 South Building
Washington, DC 20250-0254
Phone: (202) 260-8295
Email: kenneth.payne@ams.usda.gov

Approved: _____
Kenneth Payne, Acting Director
Standards, Research and Promotions Division

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