



## INSTRUMENT INSTALLATION PROCESS: INSTRUMENT GRADING SYSTEMS FOR BEEF CARCASSES

### 1. Purpose

The U.S. Department of Agriculture (USDA), Agricultural Marketing Service (AMS), Livestock and Poultry (L&P) Program, approves and utilizes beef carcass grade factors made by approved instruments in determining the official quality and yield grades of beef carcasses. The L&P Program approves instrument systems that meet specific requirements outline in [QAD 511 Procedure: Instrument Approval Process, Instrument Grading Systems for Beef Carcasses](#)<sup>1</sup>. These performance attributes are tested in a controlled environment under the requirements outlined in the above referenced procedure. This document is intended to encompass testing of the instrument systems once they are in a production environment.

The purpose of this document is to provide a performance standard for objectively assessing conditionally approved instruments in the field setting. An instrument must be tested at each facility for which it is intended to be utilized. The instrument must demonstrate that it provides the same output as it did in the approval process outlined in QAD 511 Procedure: *Instrument Approval Process, Instrument Grading Systems for Beef Carcasses*.

### 2. Scope

The provisions of this procedure applies to facilities utilizing an instrument grading system for beef carcasses.

### 3. References

[QAD 500 Procedure: Beef, Bullock, and Bull Grading Methods and Procedures](#)

[QAD 511 Procedure: Instrument Approval Process, Instrument Grading Systems for Beef Carcasses](#)

[QAD 513 Procedure: Data Requirements, Instrument Grading Systems for Beef Carcasses](#)

[QAD 515 Procedure: Beef Carcass Instrument Grading Procedures](#)

[United States Standards for Grades of Carcass Beef](#)

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<sup>1</sup> This document outlines requirements for instruments and/or systems used in the official USDA Grading system. Regulatory requirements for the purchase of livestock by packers on a carcass grade, carcass weight, or carcass grade and weight basis is covered by the AMS Packers and Stockyards Division under 9 CFR 201.71 and 9 CFR 201.99.



#### 4. Identification of Establishment

The facility that intends to use an approved device will send a request for approval of use of an approved instrument to the L&P, Standards and Specifications Division (SSD). In this request, the facility will outline which technology (instrument and manufacturer) that it would like to utilize.

#### 5. Data Collection

##### 5.1 Stationary

A minimum of 50 carcasses will be selected following the on-line evaluation by the instrument, while being connected to the facility's data network, to be railed off for stationary measurement. The instrument will be disconnected from all outside data networks and used again to re-image all 50 carcasses while they are stationary. The facility will then provide L&P with both the images and associated data.

A USDA Gold Standard Committee (Committee) will evaluate and measure each carcass for ribeye area, fat thickness, and final yield grade. The Committee will include three L&P experts from the following: National Meat Supervisor, Assistant National Meat Supervisor and Meat Supervisors from the Gold Standard Team. The Gold Standard Team is selected each year during correlation activities.

Scores for ribeye area, fat thickness, and yield grade will be averaged between the experts to determine a mean expert score for each grade factor.

##### 5.2 At Chain Speed

Expert marbling calls on a minimum of 500 carcass sides will be collected by the Committee. The Committee will be set up prior to or immediately following, the on-line evaluation by the instrument. Carcasses will be evaluated by the experts in an adequately illuminated (a minimum of 100-foot candle power) area. The Committee will independently evaluate the marbling score in accordance with the [\*United States Standards for Grades of Carcass Beef\*](#). Marbling score will be recorded to the nearest 10 marbling score units.

The instrument used for this test will be connected to the facility's server and data network. No more than 70% of carcass sides used for this test will come from one side (i.e., right side or left side). Upon completion of sample collection, the facility will provide L&P with the images and associated data from the carcasses collected.

A mean expert marbling score (MEMS) will be calculated. Carcass data will be excluded from the test if the standard deviation of the samples for that carcass is greater than 50 marbling units and/or if the absolute difference between any one expert's independent observation is greater than or equal to 50 marbling units from the average of the independent observations for that carcass.



Standard deviation is calculated based on the mean observation of each individual carcass by the committee. Once calculated, the deviation from the mean is determined for each team member's score. Deviations from the mean are squared and added to determine a sum of squares. The sum of squares is divided by (n-1) and the square root of the resulting variance provides the standard deviation.

### 5.3 Performance Requirements

Approval will be granted in accordance with the requirements below:

#### 5.3.1 Stationary

- The mean instrument measurements for marbling score, ribeye area, and fat thickness while connected to the plant server vs not connected to the plant server will not be found to differ ( $P < 0.05$ ) using a two-sided paired t-test.
  - i. Ribeye Area - Stationary Repeatability
    - 90% of the predicted ribeye area observations within 1.5 inches of the mean expert ribeye area.
  - ii. Fat Thickness - Stationary Repeatability
    - 90% of the predicted fat thickness observations within 0.2 inches of the mean expert fat thickness.

#### 5.3.2 At Chain Speed

- The standard deviation of the marbling residuals between MEMS and proposed instrument ( $RSD \leq 35$  marbling score units).
- Average residual =  $0 \pm 10$  marbling score units where the residual is the difference between the predicted instrument marbling score and mean expert panel marbling score.

## 6. Subject to Change

The provisions of this procedure are subject to revision by the L&P Program at any time.

## 7. Approval Request

Requests for approval will be submitted to:

Chad Nelson  
[chad.nelson2@usda.gov](mailto:chad.nelson2@usda.gov)  
(402) 281-8704



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Mark Perigen, Director  
Quality Assessment Division  
Livestock and Poultry Program

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Chad Nelson, National Meat Supervisor  
Standards and Specifications Division  
Livestock and Poultry Program

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