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Grain Inspection Handbook

Book II

Grain Grading Procedures

United States Department of Agriculture

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Program Handbook

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Foreword

The effectiveness of the official U.S. grain inspection system depends largely on an inspector's ability to sample, inspect, grade, and certify the various grains for which standards have been established under the United States Grain Standards Act (USGSA), as amended. In view of this fact, the Federal Grain Inspection Service (FGIS) published the Grain Inspection Handbook.

Book II, Grain Grading Procedures, sets forth the policies and procedures for grading grain in accordance with the Official United States Standards for Grain. The information contained in this handbook is applicable to official grain inspection services performed by FGIS, delegated State agencies, and designed State and private agencies. Persons interested in obtaining official services may contact any FGIS field office or official agency.

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1.1 DEFINITIONS

File Sample. The extra unworked portion cut from the representative sample that may be used in conjunction with the work sample when needed.

Samples retained for grade should be approximately 1,400 grams or more, except for the lighter grains (e.g., oats or barley) that require less grain to determine grade.

For factor only tests or official criteria (e.g., wheat protein or falling number), smaller file samples should prove sufficient to handle review services.

File samples larger than 1,400 grams may be retained if deemed necessary to provide subsequent inspection service.

Kind of Grain. A determination as to whether a sample meets the definition of a specific grain or oilseed as established in the Official U.S. Standards for Grain.

Official Agencies (OA). State and private partners authorized by FGIS to provide official inspection and weighing services to the domestic and export grain trade on FGIS behalf.

Official Personnel. Any authorized Department employee or person licensed by FGIS to perform all or specified functions under the Act.

Official Service Providers (OSP). Federal offices and State and private agencies authorized by FGIS to provide official inspection and weighing services to the domestic and export grain trade.

Representative Portion. A specified quantity of grain divided out from the representative sample by means of an FGIS-approved device.

Representative Sample. The terms “Representative Sample” and “Original Sample” are used interchangeably in the Grain Inspection Handbook. Both terms refer to a sample size of approximately 2,500-3,000 grams in size drawn from a lot by official inspection personnel using approved procedures and sampling devices. For more information on sampling, refer to Book I, “Sampling Procedures.”

Review Inspection. All follow-up grade inspections available (reinspection, appeal, or board appeal).

Work Sample. A representative portion of grain; approximately 1,000 - 1,050 grams, used to make determinations required for a particular grain.

1.2 STANDARD ABBREVIATIONS

ADM	Admixture
ADU	Amber Durum wheat
ANFL	Animal Filth
MOTH	Angoumois moths
BADS	Badly stained
BADW	Badly weathered
BLY	Barley
BRDX	Bird excreta
BLCH	Bleached
BLIT	Blight
BLAL	Blue aleurone
BLB	Blue barley
BLMB	Blue Malting barley
BNS	Bottom not sampled
BRIT	Bright
BC	Broken corn
BCFM	Broken corn and foreign material
GLAS	Broken glass
BN	Broken kernels
BNFM	Broken kernels and foreign material
K	Canola
CSTB	Castor beans
CL	Class
CRSE	Coarse
CBUR	Cockleburs
COFO	Commercially objectionable foreign odor
CCL	Contrasting classes
CADM	Conspicuous admixture
C	Corn
CROT	Crotalaria
CSF	Cultivated sunflower seed
DK	Damaged kernels
DKT	Damaged kernels (total)
DST	Damaged seeds (total)
DHV	Dark, Hard, and Vitreous
DNS	Dark Northern Spring wheat
DEF	Defects (total)
DH	Dehulled
DENT	Dent
DIAT	Diatomaceous earth
DISC	Distinctly discolored
DGK	Distinctly green kernels
DLQ	Distinctly low quality
DKG	Dockage
DUWH	Durum wheat
DYED	Dyed
ERG	Ergoty
ERC	Erucic acid
EHVY	Extra heavy
FINE	Fine foreign material
FLAX	Flaxseed
FLIN	Flint
FDK	Frost-damaged kernels
FLAD	Flint and Dent
FM	Foreign material
FMOR	Foreign material other than rye
FMOW	Foreign material other than wheat
FMWR	Foreign material other than wheat or rye
GARB	Garlic bulblets
GAR	Garlicky
GLUC	Glucosinolates
GR	Grain
HP	Handpicked
HPFM	Handpicked foreign material
HADU	Hard Amber Durum wheat
HARD	Hard kernels
HRS	Hard Red Spring wheat
HRW	Hard Red Winter wheat
HVAC	Hard and Vitreous Kernels of Amber Color
HDWH	Hard White wheat
HT	Heat-damaged kernels
HTG	Heating
HVY	Heavy
IADM	Inconspicuous admixture
IDK	Insect-damaged kernels
INF	Infested
IBF	Injured-by-frost
IBHT	Injured-by-heat
IBM	Injured-by-mold
IBS	Injured-by-sprout
LGANX	Large Animal Excreta
LGST	Large stones
LGAR	Light garlicky

LSM	Light smutty
LIME	Limed
MSFM	Machine separated broken kernels and foreign material
MB	Malting barley
MWTH	Materially weathered
MDKG	Mechanically separated dockage
X	Mixed
XC	Mixed corn
XGR	Mixed grain
XS	Mixed sorghum
XSB	Mixed soybeans
XWHT	Mixed wheat
M	Moisture
MDK	Mold-damaged kernels
MUST	Musty
NS	Northern Spring wheat
NSG	Not standardized grain
O	Oats
ODOR	Odor
OIL	Oil
OCL	Other classes
OCOL	Other colors
ODK	Other damaged kernels
OG	Other grains
OLI	Other live insects injurious to stored grain
OT	Other types
OWH	Other White wheat
PL	Plump
PROT	Protein
PMS	Purple mottled or stained
RS	Red Spring wheat
RODX	Rodent excreta
RYE	Rye
SCOR	Scoured
SHBN	Shrunken and broken kernels
SS	Similar seeds
SRB	Six-rowed barley
SRMB	Six-rowed malting barley
SRBM	Six-rowed blue malting barley
SLW	Slightly weathered
SKBN	Skinned and broken kernels
SBAL	Smut balls
SMUT	Smutty
SRW	Soft Red Winter wheat
SWW	Soft White wheat
S	Sorghum
SBLY	Sound barley
SO	Sound oats
SOUR	Sour
SB	Soybeans
SBOC	Soybeans of other colors
SPL	Splits
STND	Stained
SKD	Stinkbug damaged
STON	Stones
SC	Stress cracks
SCL	Subclass
SMT	Suitable malting type
SULF	Sulfured
SF	Sunflower seed
TANS	Tannin sorghum
TW	Test weight
THIN	Thin
TOM	Total other material
TRET	Treated
TRIT	Triticale
TRB	Two-rowed barley
TRMB	Two-rowed malting barley
UNCL	Unclassed wheat
FSUB	Unknown foreign substance
WASH	Washed
WAXY	Waxy
LW	Weevils (live)
WWH	Western White wheat
WHT	Wheat
WOCL	Wheat of other classes
WHAL	White aleurone
WHCB	White Club wheat
WHC	White corn
WHS	White sorghum
WW	White wheat
WB	Wild buckwheat
WBG	Wild brome grass seed
WO	Wild oats
YC	Yellow corn
YSB	Yellow soybeans

Note: Abbreviations may be expressed in upper or lower case.

1.3 VISUAL GRADING AIDS

The visual grading aids system represents the foundation for the national inspection system's subjective quality control program, providing an effective management tool for aligning inspectors and assisting them in making proper and consistent subjective grading decisions. These images are approved by the FGIS Board of Appeals and Review (BAR) for use in the Official inspection program and referenced throughout the multiple volumes of the Grain Inspection Handbook. The visual grading system consists of the following:

a. Visual Reference Images (VRI). Image guides used to ensure consistent and uniform application of grading interpretations and illustrate types of damage in conjunction with written descriptions.

b. Interpretive Line Prints (ILP). Appearance images used as an aid in making subjective grade determinations on general appearance with written descriptions.

c. Other Factors (OF). Visual aids used in identifying other factors that are not considered damage, such as: foreign substances, weed seeds, toxic substances, types of commodities, and insects injurious to stored grain.

d. Miscellaneous Aids. Inspectors may use a magnifying glass or similar device for visual identification of small objects

Requirements. All Official Service Providers (OSP), including both FGIS Field Offices and Official Agencies, are required to ensure access to current FGIS generated VRI-ILP for the commodities inspected by the OSP at every inspection location. The OSP is not required to have every VRI available at all times, just the VRIs that apply to the commodity for which they are providing official inspections at that time. (I.e., if the OSP is inspecting Corn, the Corn VRIs must be on-site and accessible to the inspector.)

1.4 WORK RECORDS

Forms. FGIS personnel must use the following to record all sampling and inspection information:

a. FGIS-920, “Grain Sample Ticket”

b. FGIS-918, “Sample Pan Ticket”

c. FGIS-919, “Sampling Ticket”

d. FGIS-921, “Inspection Log”

Official Agency personnel must use similar work forms to record all sampling and inspection information. Official inspection personnel must document inspection information during sampling and grading. Additional information is in the Grain Inspection Handbook IV, Forms and Certificates.

1.5 PRELIMINARY EXAMINATIONS

The sampler must: (1) observe the uniformity of the grain as to class, quality and condition; (2) make preliminary determinations for "Heating, Infestation, and Odor;” (3) draw the representative sample; and (4) report relevant information to the inspector.

The inspector must review the sampler's remarks/information. If the inspector suspects the sample is not representative, the inspector should consult the sampler and, if necessary, dismiss the inspection or arrange to obtain another sample.

1.6 BASIS OF DETERMINATION

Each chapter in the Grain Inspection Handbook, Book II, Grain Grading Procedures, provides a definition for basis of determination which establishes the rules for testing/analyzing all factors. Do not analyze any factor until the basis for making the determination is known.

1.7 SUBMITTED SAMPLE INSPECTIONS

Section 800.80 of the regulations under the USGSA require that a submitted sample inspection service be based on a submitted sample of sufficient size to enable official personnel to perform a complete analysis for grade. If a complete analysis for grade cannot be performed because of an inadequate sample size or other conditions, the request for service must be dismissed or a factor only inspection may be performed upon request.

For the purpose of providing a complete inspection, due to the requirement that the test weight of the grain be shown on each certificate for grade, “sufficient size” is defined as being of sufficient quantity to overflow the test weight kettle (minimum). Samples containing less than this amount must be limited to factor only inspection.

The amount of sample required to be submitted for a factor only inspection depends on the property or quality of each factor being requested. Certain objective factors/official criteria (e.g., moisture, protein, or oil content) require specific quantities of grain in order for the equipment used in the determination to function properly. Whenever the amount of grain used in these determinations deviates from the prescribed amount, the accuracy of the determination is sacrificed. Consequently, inspection requests for samples containing less than these specified amounts must be dismissed.

For factors not dependent on equipment requiring specific work portion sizes, the amount of sample submitted for factor only inspections may vary since the inspection results only represent the amount of grain submitted. The analysis of a submitted sample for subjective factors (e.g., damage or foreign material) or other objective factors (e.g., dockage or shrunken and broken kernels) is not compromised through the use of portion sizes which are less than those specified in individual chapters of this handbook. Consequently, unless restricted by equipment performance requirements, factor only inspection requests may be performed on submitted samples which contain less grain than the portion size prescribed in this handbook.

1.8 FGIS-APPROVED DIVIDER

An approved divider reduces the size of a grain sample while maintaining the representativeness of the original sample. Use an FGIS-approved Boerner divider, or an FGIS-approved divider that gives equivalent results, when reducing a sample to the portion size required for a specific test/analysis. Use an approved divider to obtain subportions of a sample for analysis unless otherwise specified.

General Operating Procedures.

a. Check the divider for condition and cleanliness.

b. Close the hopper valve.

c. Place empty collection pans under the discharge spouts.

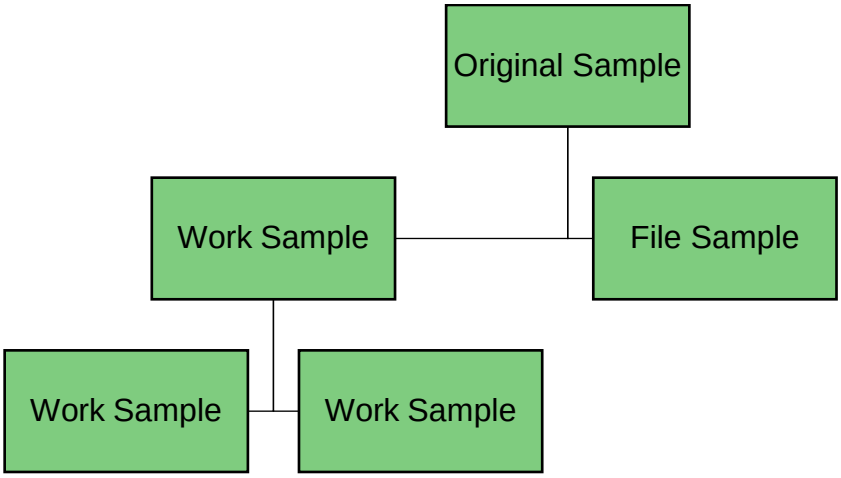
d. Pour the sample into the hopper.

e. Open the valve quickly. For large samples, feed more grain into the hopper during the dividing process.

For more specific information on the operation, maintenance, and performance testing of FGIS approved dividers, refer to the Equipment Handbook.

Process the original sample with an FGIS-approved divider to subdivide the original sample into a file sample and appropriate work portion samples. (Chart 1.1 – Processing Original Sample)

CHART 1.1 – PROCESSING ORIGINAL SAMPLE



All quantities referenced in this handbook are approximate unless otherwise specified. For specific information on processing the work sample, refer to the individual grain chapters.

1.9 ODOR

Official inspection personnel must determine the odor of grain, rice, edible beans, peas, lentils, and like commodities *by smelling the surface of the sample*.

Procedure. To ensure inspection uniformity in the application of odor, all official inspection personnel must observe the following:

a. The inspector(s) is/are responsible for making an impartial determination for all odors using their professional judgment.

b. Cold samples may need to be warmed before making an odor determination.

c. Stir or agitate the sample as necessary before making an odor determination.

d. Place the nose as close as possible to the surface of the sample *without the nose touching the sample*.

e. If the odor is distinct, apply the odor. If the odor is marginal, utilize a consensus approach to make an odor determination, when a proper number of inspectors are available.

f. Use a reference sample when necessary.

When grain has a "distinct" odor, it should be graded as musty, sour, or as having commercially objectionable foreign odor (COFO). The definition of "distinct", when it pertains to odor, is not the intensity of the off-odor, but the presence of the off-odor.

Fungicidal Additives. Fungicidal additives may contain propionic (or other) organic acids and are known to impart a vinegar-like odor to grain. When detected during official inspection, such an odor requires the inspector to make a determination of COFO.

a. If a vinegar-like odor is detected during an official inspection, official personnel must observe the following procedure:

(1) Immediately notify the applicant of odor;

(2) Allow the sample to aerate in an open container for up to 4 hours to see if suspected COFO will dissipate; and

(3) If COFO is still detected, certify accordingly.

Note: According to Directive 9060.2, "Implementation of the FGIS-FDA Memorandum of Understanding," lots of grain, rice, and pulses having COFO odor are considered actionable and should be reported to the Food and Drug Administration (FDA) as instructed.

b. If a fungicidal additive is applied after inspection per buyer and seller contractual agreement, official personnel must provide the following statement in the "Remarks" section of the certificate:

> "Applicant states fungicidal additive was applied to grain after sampling for the purpose of fungi control."

Consensus Approach. Under the consensus approach, if a clear majority (at least 2/3) of experienced licensed inspectors agree the sample contains a Musty, Sour, or COFO odor, grade the sample "U.S. Sample Grade." The consensus approach is not required if the initial inspector does not detect an odor or a distinct odor is detected.

Note: If the consensus of inspectors agree that a sample grade odor is present, but are undecided whether it is musty, sour, or COFO, the original inspector should make the final determination of which sample grade odor to apply to the sample.

The following are examples of a clear majority:

a. Two inspectors – both inspectors must agree.

b. Three inspectors – two of the three inspectors must agree.

c. Four inspectors – three of the four inspectors must agree.

d. Five inspectors – four of the five inspectors must agree.

e. Six inspectors – four of the six inspectors must agree.

1.10 MOISTURE METERS

FGIS approved moisture meters used by the AMS and its system of Official Inspection Providers for official grain moisture measurement. For more information, refer to Directive 9180.61, "Official Moisture Calibrations for Unified Grain Moisture Algorithm (UGMA) Compatible Meters."

a. Environmental Conditions. Ensure that the moisture meter is placed in a room that is within the manufacturer's basic requirements of 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 laboratory temperature be maintained within the range of approximately 60-85°F (15-30°C).

b. 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, an error message will be displayed. The moisture sample temperature is more restricted for some grain types and moisture ranges.

c. Analytical Portion Size. A representative portion size of approximately 400 grams is required for moisture testing purposes for oats and sunflower seed. For all other grains, a portion of approximately 650 grams is required.

d. Type of Container. Unless they can be tested within approximately 15 minutes, keep all samples in sealed, moisture-proof containers. Do not use containers, such as paper bags or fiber cartons, for moisture samples because they tend to draw moisture from the sample. Containers found to be most practical for retaining moisture are plastic, 1-pint containers.

Note: Do not place paper into moisture samples because paper absorbs moisture and lowers the moisture of the grain.

e. Recording Results. Official personnel will maintain a work record on the pan ticket and certificate.

f. General Operating Procedures. The Moisture Handbook contains operating instructions for each UGMA moisture meter. For additional instructions, refer to the appropriate operator's manual.

Note: The GAC2500-UGMA and Perten AM 5200-A are equipped to report moisture outside the approved range for the calibration. An error indication will notify the operator if the calibration range is exceeded. When the moisture reading exceeds the approved calibration range, another determination must be made from the work sample or file. If the second determination is not outside the approved calibration range, use the second moisture result. Otherwise, the final moisture must be based on the average of the two determinations and rounded to the nearest 0.1 percent moisture.

1.11 TEST WEIGHT PER BUSHEL APPARATUS

FGIS approved equipment used to determine test weight on a portion of sufficient quantity to overflow the kettle. Refer to the respective chapter covering the basis of determination for the grain being tested and its certification requirements.

General Operating Procedures.

a. Level and balance the test weight per bushel apparatus.

b. Close the hopper valve.

c. Pour the work sample into the hopper.

d. Center the hopper over the kettle.

e. Fill the kettle by opening the hopper valve quickly.

f. Once hopper is empty, move the hopper all the way to the left before proceeding. Do not jar the apparatus. Jarring could cause inaccurate results.

g. Using a standard stroker, stroke the kettle by holding the stroker in both hands with the flat sides in a vertical position. Level the grain in the kettle by making three full-length, zigzag motions with the stroker.

h. Convert the weight of the sample by either the "standard" method or one of the "alternate" methods, as shown below:

(1) Standard Method - Automatic Conversion. When using an electronic scale programmed to convert gram weight to pounds per bushel select the appropriate test weight mode. Place an empty sample pan or the test weight kettle on the scale and zero the scale. Pour the sample from the kettle into the sample pan or place the filled kettle onto the scale as appropriate. Read the result from the test weight mode selected.

(2) Alternate Method - Manual Conversion. Pour the sample from the kettle onto a general class scale, note the weight of the sample, find the gram weight on the test weight conversion chart and read the corresponding test weight per bushel shown to the right of the gram weight (Table 1.1 – Test Weight Per Bushel Conversions).

(3) Alternate Method – Beam Method. Carefully hang the kettle on the beam and move the weights until the beam is balanced. Read the test weight per bushel scale.

Note: While all grain samples may be weighed and converted to pounds per bushel (lb/bu) using these electronic programmed scales, *do not* use these scales to convert gram weight to kilograms per hectoliter (kg/ hl) for wheat, as they are only programmed to convert to kg/hl for grains other than wheat. Use conversion values in Table 1.1 – Test Weight Per Bushel Conversions whenever converting Durum and all other wheat.

i. Record the test weight per bushel as prescribed for the particular grain being tested. For more information, refer to the appropriate grain chapter in this handbook. Upon request, convert the pounds per bushel to kilograms per hectoliter. Refer to the test weight per bushel/kilogram per hectoliter conversion table (Attachment 2) or use the appropriate formula listed in Table1.1 – Test Weight Per Bushel Conversions, to determine kilograms per hectoliter. Record the results (to the nearest tenth kg/hl) in the "Remarks" section of the certificate.

TABLE 1.1 – TEST WEIGHT PER BUSHEL CONVERSIONS

From: Pounds Per Bushel (lb/bu)		To: Kilograms Per Hectoliter (kg/hl)	
Grain	**Input***	**Formula**	**Result**
Durum Wheat	**Pounds per bushel result**	**(lb/bu x 1.292) + 0.630**	**Kilograms per hectoliter**
All other Wheat types	**Pounds per bushel result**	**(lb/bu x 1.292) + 1.419**	**Kilograms per hectoliter**
All other grains	**Pounds per bushel result**	**lb/bu x 1.287**	**Kilograms per hectoliter**
*** Use the appropriate test weight per bushel result (i.e., whole and half pound, whole and tenth pound).**			

For more specific information on the operation, maintenance, and performance testing of the test weight per bushel apparatus, refer to the Equipment Handbook.

1.12 CARTER DOCKAGE TESTER

The Carter dockage tester uses aspiration (air) and a combination of riddles and sieves to prepare samples for grading by removing the readily separable foreign matter. Generally, the foreign material removed consists of all matter lighter, larger, or smaller than grain.

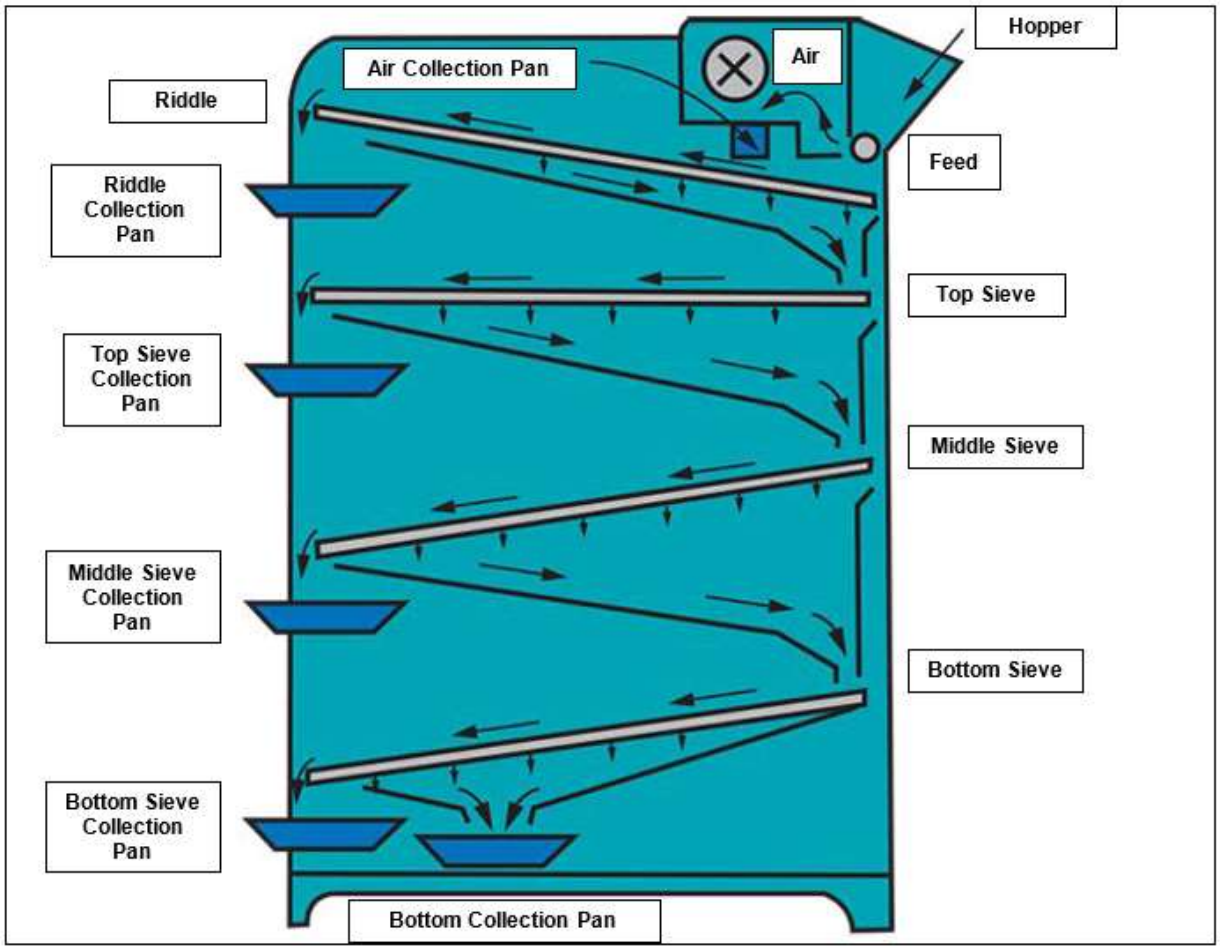


FIGURE 1.1 – CARTER DOCKAGE TESTER FLOW CHART

General Operating Procedures.

a. Set air and feed controls to the prescribed settings.

b. Place the riddle, if applicable, and sieve(s) in the prescribed locations. Table 1.2 – Dockage Tester Control Settings and sieves lists the proper riddles, sieves, air, and feed control settings to use for each type of grain.

TABLE 1.2 – DOCKAGE TESTER CONTROL SETTINGS AND SIEVES

Type of Grain	Air	Feed	Riddle	Top Sieve	Middle Sieve	Bottom Sieve
Wheat other than Durum	4	6	2		2	2
Durum wheat	4	6	25		2	2
Rye	4	6	25		2	2
Corn	1	10*		3		
Barley	4	6	6	8	6	
Flaxseed	3 ½	4	000	4	2	7
Sorghum	1	6	6	6		1
Triticale	4	6	25		2	2
Sunflower Seed	6*	7 ½	Oil Seed (35898)	3		8
Canola	5	3	000	4		
* Setting may vary, refer to the Equipment Handbook.						

Note: Wheat, rye, triticale, and canola have additional testing procedures when they contain excessive quantities of wild buckwheat, cob joints, chess and similar types of seeds, and flaxseed. Refer to the appropriate chapters for the limits and specific instructions on how to set the Carter dockage tester when this material is found.

c. Check the air collection pan to see if it is empty and place the collection pans in the prescribed locations.

d. Turn the tester on.

e. Pour the work sample into the hopper.

f. When all the grain has cleared the hopper, riddle (if applicable), and sieves, turn the tester off.

Note: There is no evidence of erroneous dockage results due to the dockage machine being left on between samples. As such, it is permissible to allow the Carter Day Dockage Tester to remain running between samples. However, this note and guidance does not apply to checktesting procedures due to the fact that checktest samples are used to determine the performance of each component of the dockage process.

g. Collect all material separated by the aspirator, riddle (if used), and sieves. Combine the material as prescribed in the chapter covering the particular grain.

Example of Percent Calculation:

(Weight of Dockage ÷ original sample weight) x 100
= percent mechanically separated dockage.
(24.70g ÷ 250g) x 100 = 9.88% mechanically separated dockage.

For more specific information on operation, maintenance, and performance testing procedures, refer to the Equipment Handbook.

1.13 MECHANICAL SIEVE SHAKER

The grading of certain grains requires that some portions be sieved. This is accomplished either by: (1) hand; or (2) mechanical sieving. Mechanical sieving is preferred over the hand-sieving method because the results are more uniform and accurate in counting the number of strokes.

The mechanical sieve shaker has a range of 1 to 120 strokes, always starting and stopping in the same position. One complete stroke should take approximately 1 second.

TABLE 1.3 – FACTORS THAT REQUIRE SIEVING

Grain	Factor	Strokes	Manufacturers' Designation Sieve Size (Inches)	Metric Conversion Millimeters
Wheat	Shrunken and Broken Kernels	30	0.064 x 3/8 oblong*	1.63 x 9.53
Barley	Thin: Barley Thin: Six-rowed Malting Barley Thin: Two-rowed Malting Barley Plump	30 30 30 30	5/64 x 3/4 slot * 5/64 x 3/4 slot * 5.5/64 x 3/4 slot * 6/64 x 3/4 slot *	1.98 x 19.05 1.98 x 19.05 2.18 x 19.05 2.38 x 19.05
Rye	Thin and Plump	30	0.064 x 3/8 oblong*	1.63 x 9.53
Soybeans	Foreign Material	5	8/64 round	3.175
Triticale	Shrunken and Broken Kernels	30	0.064 x 3/8 oblong*	1.63 x 9.53
Oats	Thin	30	0.064 x 3/8 oblong*	1.63 x 9.53
Sunflower Seed	Admixture	See Chapter 11	5/64 inscribed circle	1.98
Canola	Dockage	30 30 30	0.028 x 15/32 oblong 0.035 x 15/32 oblong 0.0395 x 15/32 oblong	0.71 x 11.906 0.89 x 11.906 1.0 x 11.906
* Precision sieves, refer to the Equipment Handbook.				

General Operating Procedures.

a. Refer to the individual grain chapters for the basis of determination and portion size.

b. Make sure the shaker is level.

c. Select the proper sieve and place it over a bottom pan.

d. Mount the sieve and bottom pan in the sieve shaker making sure that the slotted or oblong perforations are parallel with the sieving action.

e. Set the stroke counter for the required number of strokes.

f. Gently pour the representative portion of grain in the center of the sieve.

g. Turn the machine on (actuate).

h. After the required number of strokes has been completed, the machine will automatically stop.

i. Carefully remove the sieve and bottom pan. Jarring the sieve will cause the material remaining on top to pass through the perforations, leading to inaccurate results.

j. Combine the material lodged in the perforations with the material that remained on top of the sieve. To remove the lodged material from the perforations, rub the sieve bottom gently. Tapping will warp the sieve and lead to inaccurate results in future determinations.

If an approved mechanical shaker is unavailable, inspectors may handsieve the sample. When handsieving, hold the sieve level in both hands with elbows close to the sides. In a steady motion, move the sieve from left to right approximately 10 inches and then return from right to left. Repeat this motion the required number of times specified in the individual grain chapters.

For more specific information on the operation, maintenance, and performance testing of sieves and sieve shakers, refer to the Equipment Handbook.

1.14 BARLEY PEARLER

The barley pearler dehulls barley and sunflower seed for certain factors. The machine uses a carborundum wheel controlled by a time switch. The wheel removes the hulls and a screen separates the hulls and powdered barley or sunflower seed hulls from the pearled barley or sunflower seed.

Barley pearlers are individually standardized by adjusting the length of time the barley remains in the pearling chamber while the wheel is in motion. Post the standardized pearling time clearly on each machine.

General Operating Procedures.

a. Run the pearler and open the slide to ensure that the pearling chamber is empty.

b. Remove and empty the drawers that catch the barley hulls and pearled portion. Replace them.

c. Securely close the slide.

Note: Complete steps (a) through (c) *before* placing the portion into the pearler.

d. Pour the sample into the hopper and replace the lid.

e. Set the time for the grain being pearled.

f. After pearling, pull out the slide and allow the pearled portion to drop into the drawer. With the slide open, briefly restart the machine and clear the pearling chamber.

g. Proceed with the determination as described in the appropriate chapter of the handbook.

For more specific information on the operation, maintenance, and performance testing of barley pearlers, refer to the Equipment Handbook.

1.15 LABORATORY SCALES

Scales that have been evaluated by FGIS or a National Type Evaluation Program (NTEP) authorized laboratory and approved by NTEP as meeting commercial and FGIS criteria.

Weigh work portions and separations from work portions using an approved grain test scale with an appropriate division size shown in Table 1.4 – Required Division Sizes.

TABLE 1.4 – REQUIRED DIVISION SIZES

Work Portion	Division Requirement		Accuracy Class
	e	d	
≤ 100 grams	**e ≤ 0.1 gram**	**d ≤ 0.01 gram**	**II (expanded resolution)**
> 100 gram	**e ≤ 0.1 gram**	**d ≤ 0.1 gram**	**II, III**
> 500 grams	**e ≤ 1 gram**	**d ≤ 1 gram**	**II, III**
d = The smallest scale division displayed. e = The size of the division used for accuracy test purposes. Refer to the Equipment Handbook for additional information.			

Some expanded resolution scales have cross-hatching over the least significant digit on the display. The last digit is ignored when testing the scale but should be used when weighing work portions or separations.

Choose the appropriate scale based on the work portion size. The work portion and the separation must be weighed using a scale with the same (or better) maximum division size.

Example: Scale Selection by Work Portion Size

a. Weigh a work portion of 1,000 grams on a scale with e ≤ 1 gram d ≤ 1 gram. Weigh the separation on the same (or better) scale.

b. Weigh a work portion of 250.4 grams on a scale with e ≤ 0.1 gram d ≤ 0.1 gram. Weigh the separation on the same (or better) scale.

c. Weigh a work portion of 60.02 grams on a scale with e ≤ 0.1 gram d ≤ 0.01 gram (expanded resolution is acceptable). Weigh the separation on the same (or better) scale.

Certain factors are sometimes certified to the nearest hundredth percent. Therefore, use a scale with e ≤ 0.1 gram d ≤ 0.01 gram (expanded resolution is acceptable).

If you need assistance in determining if a scale is being used appropriately, or that it is configured with the correct division size, consult the Approved Equipment List or contact the Policies and Procedures, and Market Analysis Branch.

1.16 ROUNDING

When certifying official results, use the procedure for rounding unless otherwise specified. A hand-held calculator or computer may be used to calculate results.

When the figure to be rounded is followed by a figure greater than or equal to 5, round to the next higher figure (i.e., report 6.35 as 6.4 and 0.45 as 0.5). When the figure to be rounded is followed by a figure less than 5, retain the figure (i.e., report 8.34 as 8.3 and 1.22 as 1.2).

Record all the information on the certificate, as shown in Table 1.5 – Certifying Percentages and Test Weight.

TABLE 1.5 – CERTIFYING PERCENTAGES AND TEST WEIGHT

Factor	Grain	Certified to
Class	Barley	Nearest whole percent
Class and Subclass	Wheat	Nearest whole percent
Dockage	Flaxseed, and Sorghum, Barley, Triticale, Wheat, Rye	Whole percent, fraction disregarded Whole & half percent, fraction disregarded Nearest tenth percent
Ergot	All Grains	Nearest hundredth percent
Foreign material and/or foreign material & fines	Mixed grain Sunflower seed All other grains	Nearest whole percent Nearest whole & half percent[1] Nearest tenth percent
Flint and Dent, Flint, & Waxy	Corn	Nearest whole percent
Kind of grain	All grains	Nearest whole percent
Each kind of grain	Mixed grain	Nearest whole percent
Plump	Barley	Range[2]
Sclerotinia	Soybeans Canola	Nearest tenth percent Nearest hundredth percent
Smut	Barley	Nearest hundredth percent
Stones	Canola	Nearest hundredth percent
Test weight	Corn, Rye, Sorghum, Soybean, Triticale, & Wheat All other grains	Whole & nearest tenth pound & whole & nearest tenth kilogram Whole & half pound, fraction disregarded, & whole & nearest tenth kilogram
All other factors	All grains	Nearest tenth percent

[1] Sunflower seed foreign material is reported as follows: 0.0 to 0.24 as 0.0 percent, 0.25 to 0.74 as 0.5 percent, etc.

[2] Ranges of plump must be: Below 50 percent, 50 to 55 percent, 56 to 60 percent, 61 to 65 percent, etc.

1.17 EQUIPMENT AND MATERIALS

The equipment and materials for performing the bleach test, used to determine germ-damaged kernels in sorghum and wheat, and for the iodine test, used to determine waxy corn, are as follows:

a. Safety Equipment – Bleach and Iodine Tests.

(1) Full face protection shield.

(2) Impervious plastic or rubber apron and gloves.

(3) Exhaust system.

(4) Eye wash station.

(5) Handheld spray.

b. Equipment and Materials - S/J Mixer Bleach Test. Properly functioning equipment and adherence to established procedures are vital to the successful removal of the sorghum seedcoat.

(1) Potassium Hydroxide (KOH) Pellets (85-90%). KOH is a caustic chemical that functions to generate the heat necessary for the bleaching reaction to occur. Due to the hygroscopic nature (readily absorbs water) of this chemical, continued or prolonged exposure to air/moisture significantly reduces its strength. To ensure that the KOH provides satisfactory, repeatable results, it is critical to control the amount and purity of the KOH pellets used in the bleaching process.

(a) Do not use KOH pellets that appear shiny or that clump together. Such conditions indicate that the pellets have absorbed water to the extent that it will significantly reduce the KOH's heat generating capability.

(b) Between samples and at the end of the day make sure the lid is tightly secured to the jar.

(2) Sodium Hypochlorite (Bleach). Bleach serves a dual purpose in the bleaching process. It provides the moisture necessary to generate heat by dissolving the KOH pellets. Bleach also combines with the KOH to chemically remove the seedcoat. To ensure that a satisfactory reaction occurs, control the type, amount, and concentration of bleach used in the process as follows:

(a) Measure exactly 40.0 ml of bleach using a 50-ml or 100-ml graduated cylinder or a dispenser. If dispensers are used, they must meet the following criteria:

1 Cylinder capacity: 50mL.

2 Accuracy: ± 1.0 percent.

3 Reproducibility: ± 0.1 percent.

When ordering dispensers, make sure the plunger assembly is capable of fitting the type/size of reagent bottle you are using. A dispenser meeting this criteria is the Brinkman dispensette which is available through Fisher Scientific (1-800-766-7000).

(b) Use major brands of bleach only (e.g., Clorox or Purex) that contain at least 5.25% active ingredients. Do not use regional or local brands due to the potential variations that exist in the concentration level of the bleach.

(c) To maintain a consistent concentration of bleach (5.25%), record the purchase/expiration (3 months after purchase) date of the bleach on the bottle. Replace any bleach exceeding the expiration date.

(3) Vinegar to neutralize any spilled KOH.

(4) Teaspoon.

(5) Polyethylene-coated weighing paper, 3-inches in diameter.

(6) Balance.

(7) 100-mL graduated cylinder.

(8) Timer. Verify the accuracy of the timer setting immediately prior to sorghum harvest and as necessary thereafter to maintain a mixing time of 3 minutes ± 10 seconds.

(9) S/J mixer. Make sure there is no hesitation in the rotation of the stirring blade. Adhere to the following procedure:

(a) Stir jar and assembly for S/J mixer.

(b) One extra stirring head for each mixer as well as several mixing jars are recommended.

(10) Small tea strainer.

(11) Paper towels.

(12) Drying apparatus (hair dryer modified with sieve to dry bleached kernels).

c. Equipment and materials - Iodine Test. The equipment and materials for determining waxy corn are as follows:

(1) Cutting implement. Sharp knife or razor blade.

(2) Spray bottle. Dark-colored, trigger-spray, polyethylene bottle; or an amber colored borosilicate glass with atomizer bulb.

(3) Petri dish, porcelain plate, or other stain-resistant container.

(4) Wax paper, plastic wrap, or plastic sheets to spread on work surfaces.

(5) Iodine stock solution. Follow steps (a) through (f) listed below to prepare the iodine stock solution:

Note: Protect containers of iodine (crystals and solutions) from physical damage. Perform all mixing in a well-ventilated area or within the working area of a laboratory hood.

(a) Weigh out 10 grams of iodine crystals and 20 grams of potassium iodide crystals.

(b) Measure 1,000 ml of distilled water.

(c) Pour the distilled water into an amber-colored bottle.

(d) Dissolve the 20 grams of potassium iodide crystals in the distilled water.

(e) Add the 10 grams of iodine crystals.

(f) Mix thoroughly. Label the bottle, “Iodine Stock Solution.” Post poison labels on the bottles.

Note: Iodine crystals and potassium iodide crystals can be purchased from chemical supply companies or from pharmacies.

1.18 FILE SAMPLE RETENTION (GRAIN)

a. General. To accomplish the mission of the agency, FGIS has established the policy of maintaining an effective record management program. Part of the official record system is the maintenance of file samples retained for reference or review purposes. For detailed procedures, refer to Directive 9170.13, "Uniform File Sample Retention System."

b. Use of File Sample. Official personnel must establish and maintain a file sample retention system in accordance with the regulations and applicable instructions. File samples may be used for:

(1) Monitoring purposes by official personnel;

(2) Supplementary completion of the original grade (e.g., infestation or odor);

(3) Review by interested persons;

(4) Reinspections, appeals, and Board appeals;

(5) Answering trade complaints;

(6) Training.

c. Sample Retention. Official personnel may, at their discretion, keep file samples for a period longer than required. The minimum retention periods (calendar days) are shown in Table 1.6 – File Sample Retention:

TABLE 1.6 – FILE SAMPLE RETENTION

CARRIER	MINIMUM DAYS			
	IN	OUT	EXPORT	OTHER
Trucks	**3**	**5**	**30**	**-**
Railcars	**5**	**10**	**30**	**-**
Barges (River)	**5**	**25**	**-**	**-**
Ships & Barges (lake or ocean)	**5**	**25**	**90**	**-**
Ships (short voyage) 5 days or less	**5**	**25**	**60**	**-**
Export Containers	**-**	**-**	**60**	**-**
Bins & Tanks	**-**	**-**	**-**	**3**
Submitted Samples	**-**	**-**	**-**	**3**

Note: When an agency file sample is either used to complete an appeal inspection or selected for monitoring, the monitoring office must maintain the sample for the applicable retention period.

d. Sample Size. File samples must be of sufficient size to accommodate subsequent examinations or analysis. Samples retained for grade should be approximately 1,400 grams or more, except for the lighter grains (e.g., oats or sunflower seed), that require less grain to determine grade. For factor only tests or official criteria (e.g., wheat protein or falling number), smaller file samples should prove sufficient to handle review services. File samples larger than 1,400 grams may be retained if deemed necessary to provide subsequent inspection service.

e. Retention of Worked File Samples. If possible, retain an unworked portion of a representative sample or submitted sample as the final file. The worked portion may be retained as the final file only when insufficient sample is available for an unworked file sample.

For each submitted sample or officially inspected lot examined for grade, factors, or official criteria, a file sample must be retained except for the categories noted below:

(1) Rejected Sublots. All rejected sublots (i.e., material portions due to grade or condition factors) at export locations which are returned to the facility.

(2) Elevator Elects. Grain returned to the elevator before a sublot is designated by inspection personnel, or a sublot that is inspected and found acceptable under the inspection plan, but the elevator elects to return the sublot to the house.

(3) Mycotoxin Samples. All aflatoxin and vomitoxin testing services in which the contractual specifications have been satisfied.

(4) Official Commercial Inspection Service (OCIS) Samples. Unless requested by the applicant for service or an interested party, or when deemed necessary by the field office manager.

f. File System. Official personnel must maintain a sample filing system that permits efficient retrieval of file samples and ensures adherence to required retention periods (Section 1.18 (c) above). Further, file samples must be protected against theft, manipulation, substitution, and unauthorized use.

Use large polyethylene bags, semi-rigid plastic containers, or metal containers to retain file samples. Use metal or semi-rigid plastic containers when samples contain an off odor.

g. Disposal Procedures. Official personnel must keep complete and accurate disposition records. After file samples have served their intended purpose, dispose of the grain in accordance with criteria outlined in section 800.81(e) of the regulations and applicable instructions as follows:

(1) Upon the applicant's request, return the file samples to the applicant.

(2) If the applicant does not request the return of the grain, it may be sold, donated, or destroyed;

(3) If the grain contains toxic substances (e.g., treated seed or aflatoxin), dispose of the grain in accordance with applicable Federal, State, and local laws.

1.19 UNOFFICIAL INSPECTION SERVICES

Occasionally, official personnel receive requests from applicants (processors, producers, seed companies) to perform certain analysis on grain or grain related products. While many tests differ from official determinations, some analyses are the same or very similar. The actual testing methodology used is often specified by trading rules or by the specific applicant.

Official personnel who receive such requests for analysis or service (e.g., seed grain testing, brown test in corn, or yield in oats) may perform the service(s) on an unofficial basis. However, official service providers may not perform any service on an unofficial basis that they are designated or authorized to provide on an official basis.

When an inspection or weighing service is requested on a sample or a lot of grain which does not meet the requirements for grain set forth in the Official U.S. Standards for Grain, a certificate showing the words "Not Standardized Grain" will be issued according to the instructions.

1.20 METRIC SYSTEM

The following tables are provided to assist in the conversion from the U.S. measurement system (inch-pound) to the metric system:

TABLE 1.7 – CONVERSIONS

A = C ÷ B			C = A x B	
Symbol	**A Inch – Pound Unit**	**B Factor**	**Symbol**	**C Metric Unit**
bu	bushels (U.S.)	35.239	hl	hectoliters
gal	gallons (U.S.)	3.785	L	liters
in	inches	25.4	mm	millimeters
lb	pounds	0.4536	kg	kilograms
lb/bu	pounds per bushel	*	kg/hl	kilograms per hectoliter
qt	quarts (dry)	1.101	L	liters
qt	quarts (liquid)	0.946	L	liters
ton	tons (short)	0.907	t	metric tons
* Refer to Table1.1 – Test Weight Per Bushel Conversions for conversion factors.				

TABLE 1.8 – EQUIVALENTS

Weight	Length	Volume	
		Dry	**Liquid**
grain = 0.06 g	1 in = 2.54 cm	1 pt = 0.28 L	1 pt = 0.473 L
1 oz = 28 g	1 in = 25.4 mm = .304 m	1 qt = 1.10 L	1 qt = 0.946 L
1 lb = 0.45 kg	1 yd = 0.914 m	1 gal = 35.24 L	1 gal = 3.785 L
1 bu = 352.4 hl			
1 ton = 907 kg = 0.907 t			
1 ppb = 1 µg/kg			

TABLE 1.9 – MEASURES

Pounds Per Bushel (trade weight)		Bushels Per Ton			Bushels to Metric Tons	
		Grain	Short	Metric (t)		
Wheat, Soybeans, Triticale	60	Wheat, Soybeans, Triticale	33.3	36.7	Wheat, Soybeans	= bu. x .027
Corn, Sorghum, Flaxseed, Rye	56	Corn, Sorghum, Flaxseed, Rye	35.7	39.4	Corn, Sorghum, Rye	= bu. x .025
Canola/Rapeseed	50	Canola/Rapeseed	40.0	44.0	Canola/Rapeseed	= bu. x .023
Barley	48	Barley	41.7	45.9	Barley	= bu. x .022
Oats	32	Oats	62.5	68.9	Oats	= bu. x .015
Sunflower Seed	24	Sunflower Seed	83.3	91.9	Sunflower Seed	= bu. x .011

ATTACHMENT 1
GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU)

275 - 291.5		292 - 308.5		309 - 325.5		326 - 342.5	
Grams	lb/bu	Grams	lb/bu	Grams	lb/bu	Grams	lb/bu
275	19.4	292	20.6	309	21.8	326	23.0
275.5	19.4	292.5	20.6	309.5	21.8	326.5	23.0
276	19.5	293	20.7	310	21.9	327	23.1
276.5	19.5	293.5	20.7	310.5	21.9	327.5	23.1
277	19.5	294	20.7	311	21.9	328	23.1
277.5	19.6	294.5	20.8	311.5	22.0	328.5	23.2
278	19.6	295	20.8	312	22.0	329	23.2
278.5	19.6	295.5	20.8	312.5	22.0	329.5	23.2
279	19.7	296	20.9	313	22.1	330	23.3
279.5	19.7	296.5	20.9	313.5	22.1	330.5	23.3
280	19.8	297	21.0	314	22.2	331	23.4
280.5	19.8	297.5	21.0	314.5	22.2	331.5	23.4
281	19.8	298	21.0	315	22.2	332	23.4
281.5	19.9	298.5	21.1	315.5	22.3	332.5	23.5
282	19.9	299	21.1	316	22.3	333	23.5
282.5	19.9	299.5	21.1	316.5	22.3	333.5	23.5
283	20.0	300	21.2	317	22.4	334	23.6
283.5	20.0	300.5	21.2	317.5	22.4	334.5	23.6
284	20.0	301	21.2	318	22.4	335	23.6
284.5	20.1	301.5	21.3	318.5	22.5	335.5	23.7
285	20.1	302	21.3	319	22.5	336	23.7
285.5	20.1	302.5	21.3	319.5	22.5	336.5	23.7
286	20.2	303	21.4	320	22.6	337	23.8
286.5	20.2	303.5	21.4	320.5	22.6	337.5	23.8
287	20.2	304	21.4	321	22.6	338	23.8
287.5	20.3	304.5	21.5	321.5	22.7	338.5	23.9
288	20.3	305	21.5	322	22.7	339	23.9
288.5	20.4	305.5	21.6	322.5	22.8	339.5	24.0
289	20.4	306	21.6	323	22.8	340	24.0
289.5	20.4	306.5	21.6	323.5	22.8	340.5	24.0
290	20.5	307	21.7	324	22.9	341	24.1
290.5	20.5	307.5	21.7	324.5	22.9	341.5	24.1
291	20.5	308	21.7	325	22.9	342	24.1
291.5	20.6	308.5	21.8	325.5	23.0	342.5	24.2

343 - 361.5		362 - 380.5		381 - 399.5		400 - 418.5	
Grams	lb/bu	Grams	lb/bu	Grams	lb/bu	Grams	lb/bu
343	24.2	362	25.5	381	26.9	400	28.2
343.5	24.2	362.5	25.6	381.5	26.9	400.5	28.3
344	24.3	363	25.6	382	26.9	401	28.3
344.5	24.3	363.5	25.6	382.5	27.0	401.5	28.3
345	24.3	364	25.7	383	27.0	402	28.4
345.5	24.4	364.5	25.7	383.5	27.1	402.5	28.4
346	24.4	365	25.7	384	27.1	403	28.4
346.5	24.4	365.5	25.8	384.5	27.1	403.5	28.5
347	24.5	366	25.8	385	27.2	404	28.5
347.5	24.5	366.5	25.9	385.5	27.2	404.5	28.5
348	24.6	367	25.9	386	27.2	405	28.6
348.5	24.6	367.5	25.9	386.5	27.3	405.5	28.6
349	24.6	368	26.0	387	27.3	406	28.6
349.5	24.7	368.5	26.0	387.5	27.3	406.5	28.7
350	24.7	369	26.0	388	27.4	407	28.7
350.5	24.7	369.5	26.1	388.5	27.4	407.5	28.7
351	24.8	370	26.1	389	27.4	408	28.8
351.5	24.8	370.5	26.1	389.5	27.5	408.5	28.8
352	24.8	371	26.2	390	27.5	409	28.9
352.5	24.9	371.5	26.2	390.5	27.5	409.5	28.9
353	24.9	372	26.2	391	27.6	410	28.9
353.5	24.9	372.5	26.3	391.5	27.6	410.5	29.0
354	25.0	373	26.3	392	27.7	411	29.0
354.5	25.0	373.5	26.3	392.5	27.7	411.5	29.0
355	25.0	374	26.4	393	27.7	412	29.1
355.5	25.1	374.5	26.4	393.5	27.8	412.5	29.1
356	25.1	375	26.5	394	27.8	413	29.1
356.5	25.2	375.5	26.5	394.5	27.8	413.5	29.2
357	25.2	376	26.5	395	27.9	414	29.2
357.5	25.2	376.5	26.6	395.5	27.9	414.5	29.2
358	25.3	377	26.6	396	27.9	415	29.3
358.5	25.3	377.5	26.6	396.5	28.0	415.5	29.3
359	25.3	378	26.7	397	28.0	416	29.3
359.5	25.4	378.5	26.7	397.5	28.0	416.5	29.4
360	25.4	379	26.7	398	28.1	417	29.4
360.5	25.4	379.5	26.8	398.5	28.1	417.5	29.5
361	25.5	380	26.8	399	28.1	418	29.5
361.5	25.5	380.5	26.8	399.5	28.2	418.5	29.5

419 - 437.5		438 - 456.5		457 - 475.5		476 - 494.5	
Grams	lb/bu	Grams	lb/bu	Grams	lb/bu	Grams	lb/bu
419	29.6	438	30.9	457	32.2	476	33.6
419.5	29.6	438.5	30.9	457.5	32.3	476.5	33.6
420	29.6	439	31.0	458	32.3	477	33.7
420.5	29.7	439.5	31.0	458.5	32.3	477.5	33.7
421	29.7	440	31.0	459	32.4	478	33.7
421.5	29.7	440.5	31.1	459.5	32.4	478.5	33.8
422	29.8	441	31.1	460	32.5	479	33.8
422.5	29.8	441.5	31.1	460.5	32.5	479.5	33.8
423	29.8	442	31.2	461	32.5	480	33.9
423.5	29.9	442.5	31.2	461.5	32.6	480.5	33.9
424	29.9	443	31.3	462	32.6	481	33.9
424.5	29.9	443.5	31.3	462.5	32.6	481.5	34.0
425	30.0	444	31.3	463	32.7	482	34.0
425.5	30.0	444.5	31.4	463.5	32.7	482.5	34.0
426	30.1	445	31.4	464	32.7	483	34.1
426.5	30.1	445.5	31.4	464.5	32.8	483.5	34.1
427	30.1	446	31.5	465	32.8	484	34.1
427.8	30.2	446.5	31.5	465.5	32.8	484.5	34.2
428	30.2	447	31.5	466	32.9	485	34.2
428.5	30.2	447.5	31.6	466.5	32.9	485.5	34.3
429	30.3	448	31.6	467	32.9	486	34.3
429.5	30.3	448.5	31.6	467.5	33.0	486.5	34.3
430	30.3	449	31.7	468	33.0	487	34.4
430.5	30.4	449.5	31.7	468.5	33.1	487.5	34.4
431	30.4	450	31.7	469	33.1	488	34.4
431.5	30.4	450.5	31.8	469.5	33.1	488.5	34.5
432	30.5	451	31.8	470	33.2	489	34.5
432.5	30.5	451.5	31.9	470.5	33.2	489.5	34.5
433	30.5	452	31.9	471	33.2	490	34.6
433.5	30.6	452.5	31.9	471.5	33.3	490.5	34.6
434	30.6	453	32.0	472	33.3	491	34.6
434.5	30.7	453.5	32.0	472.5	33.3	491.5	34.7
435	30.7	454	32.0	473	33.4	492	34.7
435.5	30.7	454.5	32.1	473.5	33.4	492.5	34.7
436	30.8	455	32.1	474	33.4	493	34.8
436.5	30.8	455.5	32.1	474.5	33.5	493.5	34.8
437	30.8	456	32.2	475	33.5	494	34.9
437.5	30.9	456.5	32.2	475.5	33.5	494.5	34.9

495 - 513.5		514 - 532.5		533 - 551.5		552 - 570.5	
Grams	lb/bu	Grams	lb/bu	Grams	lb/bu	Grams	lb/bu
495	34.9	514	36.3	533	37.6	552	38.9
495.5	35.0	514.5	36.3	533.5	37.6	552.5	39.0
496	35.0	515	36.3	534	37.7	553	39.0
496.5	35.0	515.5	36.4	534.5	37.7	553.5	39.0
497	35.1	516	36.4	535	37.7	554	39.1
497.5	35.1	516.5	36.4	535.5	37.8	554.5	39.1
498	35.1	517	36.5	536	37.8	555	39.2
498.5	35.2	517.5	36.5	536.5	37.8	555.5	39.2
499	35.2	518	36.5	537	37.9	556	39.2
499.5	35.2	518.5	36.6	537.5	37.9	556.5	39.3
500	35.3	519	36.6	538	38.0	557	39.3
500.5	35.3	519.5	36.6	538.5	38.0	557.5	39.3
501	35.3	520	36.7	539	38.0	558	39.4
501.5	35.4	520.5	36.7	539.5	38.1	558.5	39.4
502	35.4	521	36.8	540	38.1	559	39.4
502.5	35.5	521.5	36.8	540.5	38.1	559.5	39.5
503	35.5	522	36.8	541	38.2	560	39.5
503.5	35.5	522.5	36.9	541.5	38.2	560.5	39.5
504	35.6	523	36.9	542	38.2	561	39.6
504.5	35.6	523.5	36.9	542.5	38.3	561.5	39.6
505	35.6	524	37.0	543	38.3	562	39.6
505.5	35.7	524.5	37.0	543.5	38.3	562.5	39.7
506	35.7	525	37.0	544	38.4	563	39.7
506.5	35.7	525.5	37.1	544.5	38.4	563.5	39.8
507	35.8	526	37.1	545	38.4	564	39.8
507.5	35.8	526.5	37.1	545.5	38.5	564.5	39.8
508	35.8	527	37.2	546	38.5	565	39.9
508.5	35.9	527.5	37.2	546.5	38.6	565.5	39.9
509	35.9	528	37.2	547	38.6	566	39.9
509.5	35.9	528.5	37.3	547.5	38.6	566.5	40.0
510	36.0	529	37.3	548	38.7	567	40.0
510.5	36.0	529.5	37.4	548.5	38.7	567.5	40.0
511	36.0	530	37.4	549	38.7	568	40.1
511.5	36.1	530.5	37.4	549.5	38.8	568.5	40.1
512	36.1	531	37.5	550	38.8	569	40.1
512.5	36.2	531.5	37.5	550.5	38.8	569.5	40.2
513	36.2	532	37.5	551	38.9	570	40.2
513.5	36.2	532.5	37.6	551.5	38.9	570.5	40.2

571 - 589.5		590 - 608.5		609 - 627.5		628 - 646.5	
Grams	lb/bu	Grams	lb/bu	Grams	lb/bu	Grams	lb/bu
571	40.3	590	41.6	609	43.0	628	44.3
571.5	40.3	590.5	41.7	609.5	43.0	628.5	44.3
572	40.4	591	41.7	610	43.0	629	44.4
572.5	40.4	591.5	41.7	610.5	43.1	629.5	44.4
573	40.4	592	41.8	611	43.1	630	44.4
573.5	40.5	592.5	41.8	611.5	43.1	630.5	44.5
574	40.5	593	41.8	612	43.2	631	44.5
574.5	40.5	593.5	41.9	612.5	43.2	631.5	44.6
575	40.6	594	41.9	613	43.2	632	44.6
575.5	40.6	594.5	41.9	613.5	43.3	632.5	44.6
576	40.6	595	42.0	614	43.3	633	44.7
576.5	40.7	595.5	42.0	614.5	43.4	633.5	44.7
577	40.7	596	42.0	615	43.4	634	44.7
577.5	40.7	596.5	42.1	615.5	43.4	634.5	44.8
578	40.8	597	42.1	616	43.5	635	44.8
578.5	40.8	597.5	42.2	616.5	43.5	635.5	44.8
579	40.8	598	42.2	617	43.5	636	44.9
579.5	40.9	598.5	42.2	617.5	43.6	636.5	44.9
580	40.9	599	42.3	618	43.6	637	44.9
580.5	41.0	599.5	42.3	618.5	43.6	637.5	45.0
581	41.0	600	42.3	619	43.7	638	45.0
581.5	41.0	600.5	42.4	619.5	43.7	638.5	45.0
582	41.1	601	42.4	620	43.7	639	45.1
582.5	41.1	601.5	42.4	620.5	43.8	639.5	45.1
583	41.1	602	42.5	621	43.8	640	45.2
583.5	41.2	602.5	42.5	621.5	43.8	640.5	45.2
584	41.2	603	42.5	622	43.9	641	45.2
584.5	41.2	603.5	42.6	622.5	43.9	641.5	45.3
585	41.3	604	42.6	623	44.0	642	45.3
585.5	41.3	604.5	42.6	623.5	44.0	642.5	45.3
586	41.3	605	42.7	624	44.0	643	45.4
586.5	41.4	605.5	42.7	624.5	44.1	643.5	45.4
587	41.4	606	42.8	625	44.1	644	45.4
587.5	41.4	606.5	42.8	625.5	44.1	644.5	45.5
588	41.5	607	42.8	626	44.2	645	45.5
588.5	41.5	607.5	42.9	626.5	44.2	645.5	45.5
589	41.6	608	42.9	627	44.2	646	45.6
589.5	41.6	608.5	42.9	627.5	44.3	646.5	45.6

647 - 665.5		666 - 684.5		685 - 703.5		704 - 722.5	
Grams	lb/bu	Grams	lb/bu	Grams	lb/bu	Grams	lb/bu
647	45.6	666	47.0	685	48.3	704	49.7
647.5	45.7	666.5	47.0	685.5	48.4	704.5	49.7
648	45.7	667	47.1	686	48.4	705	49.7
648.5	45.8	667.5	47.1	686.5	48.4	705.5	49.8
649	45.8	668	47.1	687	48.5	706	49.8
649.5	45.8	668.5	47.2	687.5	48.5	706.5	49.8
650	45.9	669	47.2	688	48.5	707	49.9
650.5	45.9	669.5	47.2	688.5	48.6	707.5	49.9
651	45.9	670	47.3	689	48.6	708	49.9
651.5	46.0	670.5	47.3	689.5	48.6	708.5	50.0
652	46.0	671	47.3	690	48.7	709	50.0
652.5	46.0	671.5	47.4	690.5	48.7	709.5	50.1
653	46.1	672	47.4	691	48.7	710	50.1
653.5	46.1	672.5	47.4	691.5	48.8	710.5	50.1
654	46.1	673	47.5	692	48.8	711	50.2
654.5	46.2	673.5	47.5	692.5	48.9	711.5	50.2
655	46.2	674	47.5	693	48.9	712	50.2
655.5	46.2	674.5	47.6	693.5	48.9	712.5	50.3
656	46.3	675	47.6	694	49.0	713	50.3
656.5	46.3	675.5	47.7	694.5	49.0	713.5	50.3
657	46.3	676	47.7	695	49.0	714	50.4
657.5	46.4	676.5	47.7	695.5	49.1	714.5	50.4
658	46.4	677	47.8	696	49.1	715	50.4
658.5	46.5	677.5	47.8	696.5	49.1	715.5	50.5
659	46.5	678	47.8	697	49.2	716	50.5
659.5	46.5	678.5	47.9	697.5	49.2	716.5	50.5
660	46.6	679	47.9	698	49.2	717	50.6
660.5	46.6	679.5	47.9	698.5	49.3	717.5	50.6
661	46.6	680	48.0	699	49.3	718	50.7
661.5	46.7	680.5	48.0	699.5	49.3	718.5	50.7
662	46.7	681	48.0	700	49.4	719	50.7
662.5	46.7	681.5	48.1	700.5	49.4	719.5	50.8
663	46.8	682	48.1	701	49.5	720	50.8
663.5	46.8	682.5	48.1	701.5	49.5	720.5	50.8
664	46.8	683	48.2	702	49.5	721	50.9
664.5	46.9	683.5	48.2	702.5	49.6	721.5	50.9
665	46.9	684	48.3	703	49.6	722	50.9
665.5	46.9	684.5	48.3	703.5	49.6	722.5	51.0

723 - 741.5		742 - 760.5		761 - 779.5		780 - 798.5	
Grams	lb/bu	Grams	lb/bu	Grams	lb/bu	Grams	lb/bu
723	51.0	742	52.3	761	53.7	780	55.0
723.5	51.0	742.5	52.4	761.5	53.7	780.5	55.1
724	51.1	743	52.4	762	53.8	781	55.1
724.5	51.1	743.5	52.5	762.5	53.8	781.5	55.1
725	51.1	744	52.5	763	53.8	782	55.2
725.5	51.2	744.5	52.5	763.5	53.9	782.5	55.2
726	51.2	745	52.6	764	53.9	783	55.2
726.5	51.3	745.5	52.6	764.5	53.9	783.5	55.3
727	51.3	746	52.6	765	54.0	784	55.3
727.5	51.3	746.5	52.7	765.5	54.0	784.5	55.3
728	51.4	747	52.7	766	54.0	785	55.4
728.5	51.4	747.5	52.7	766.5	54.1	785.5	55.4
729	51.4	748	52.8	767	54.1	786	55.5
729.5	51.5	748.5	52.8	767.5	54.1	786.5	55.5
730	51.5	749	52.8	768	54.2	787	55.5
730.5	51.5	749.5	52.9	768.5	54.2	787.5	55.6
731	51.6	750	52.9	769	54.3	788	55.6
731.5	51.6	750.5	52.9	769.5	54.3	788.5	55.6
732	51.6	751	53.0	770	54.3	789	55.7
732.5	51.7	751.5	53.0	770.5	54.4	789.5	55.7
733	51.7	752	53.1	771	54.4	790	55.7
733.5	51.7	752.5	53.1	771.5	54.4	790.5	55.8
734	51.8	753	53.1	772	54.5	791	55.8
734.5	51.8	753.5	53.2	772.5	54.5	791.5	55.8
735	51.9	754	53.2	773	54.5	792	55.9
735.5	51.9	754.5	53.2	773.5	54.6	792.5	55.9
736	51.9	755	53.3	774	54.6	793	55.9
736.5	52.0	755.5	53.3	774.5	54.6	793.5	56.0
737	52.0	756	53.3	775	54.7	794	56.0
737.5	52.0	756.5	53.4	775.5	54.7	794.5	56.1
738	52.1	757	53.4	776	54.7	795	56.1
738.5	52.1	757.5	53.4	776.5	54.8	795.5	56.1
739	52.1	758	53.5	777	54.8	796	56.2
739.5	52.2	758.5	53.5	777.5	54.9	796.5	56.2
740	52.2	759	53.5	778	54.9	797	56.2
740.5	52.2	759.5	53.6	778.5	54.9	797.5	56.3
741	52.3	760	53.6	779	55.0	798	56.3
741.5	52.3	760.5	53.7	779.5	55.0	798.5	56.3

799 - 817.5		818 - 836.5		837 - 855.5		856 - 874.5	
Grams	**lb/bu**	**Grams**	**lb/bu**	**Grams**	**lb/bu**	**Grams**	**lb/bu**
799	56.4	818	57.7	837	59.0	856	60.4
799.5	56.4	818.5	57.7	837.5	59.1	856.5	60.4
800	56.4	819	57.8	838	59.1	857	60.5
800.5	56.5	819.5	57.8	838.5	59.2	857.5	60.5
801	56.5	820	57.8	839	59.2	858	60.5
801.5	56.5	820.5	57.9	839.5	59.2	858.5	60.6
802	56.6	821	57.9	840	59.3	859	60.6
802.5	56.6	821.5	58.0	840.5	59.3	859.5	60.6
803	56.6	822	58.0	841	59.3	860	60.7
803.5	56.7	822.5	58.0	841.5	59.4	860.5	60.7
804	56.7	823	58.1	842	59.4	861	60.7
804.5	56.8	823.5	58.1	842.5	59.4	861.5	60.8
805	56.8	824	58.1	843	59.5	862	60.8
805.5	56.8	824.5	58.2	843.5	59.5	862.5	60.8
806	56.9	825	58.2	844	59.5	863	60.9
806.5	56.9	825.5	58.2	844.5	59.6	863.5	60.9
807	56.9	826	58.3	845	59.6	864	61.0
807.5	57.0	826.5	58.3	845.5	59.6	864.5	61.0
808	57.0	827	58.3	846	59.7	865	61.0
808.5	57.0	827.5	58.4	846.5	59.7	865.5	61.1
809	57.1	828	58.4	847	59.8	866	61.1
809.5	57.1	828.5	58.4	847.5	59.8	866.5	61.1
810	57.1	829	58.5	848	59.8	867	61.2
810.5	57.2	829.5	58.5	848.5	59.9	867.5	61.2
811	57.2	830	58.6	849	59.9	868	61.2
811.5	57.2	830.5	58.6	849.5	59.9	868.5	61.3
812	57.3	831	58.6	850	60.0	869	61.3
812.5	57.3	831.5	58.7	850.5	60.0	869.5	61.3
813	57.4	832	58.7	851	60.0	870	61.4
813.5	57.4	832.5	58.7	851.5	60.1	870.5	61.4
814	57.4	833	58.8	852	60.1	871	61.4
814.5	57.5	833.5	58.8	852.5	60.1	871.5	61.5
815	57.5	834	58.8	853	60.2	872	61.5
815.5	57.5	834.5	58.9	853.5	60.2	872.5	61.6
816	57.6	835	58.9	854	60.2	873	61.6
816.5	57.6	835.5	58.9	854.5	60.3	873.5	61.6
817	57.6	836	59.0	855	60.3	874	61.7
817.5	57.7	836.5	59.0	855.5	60.4	874.5	61.7

875 - 889.5		890 - 904.5		905 - 919.5		920 - 934.5	
Grams	**lb/bu**	**Grams**	**lb/bu**	**Grams**	**lb/bu**	**Grams**	**lb/bu**
875	61.7	890	62.8	905	63.8	920	64.9
875.5	61.8	890.5	62.8	905.5	63.9	920.5	64.9
876	61.8	891	62.9	906	63.9	921	65.0
876.5	61.8	891.5	62.9	906.5	64.0	921.5	65.0
877	61.9	892	62.9	907	64.0	922	65.0
877.5	61.9	892.5	63.0	907.5	64.0	922.5	65.1
878	61.9	893	63.0	908	64.1	923	65.1
878.5	62.0	893.5	63.0	908.5	64.1	923.5	65.2
879	62.0	894	63.1	909	64.1	924	65.2
879.5	62.0	894.5	63.1	909.5	64.2	924.5	65.2
880	62.1	895	63.1	910	64.2	925	65.3
880.5	62.1	895.5	63.2	910.5	64.2	925.5	65.3
881	62.2	896	63.2	911	64.3	926	65.3
881.5	62.2	896.5	63.2	911.5	64.3	926.5	65.4
882	62.2	897	63.3	912	64.3	927	65.4
882.5	62.3	897.5	63.3	912.5	64.4	927.5	65.4
883	62.3	898	63.4	913	64.4	928	65.5
883.5	62.3	898.5	63.4	913.5	64.4	928.5	65.5
884	62.4	899	63.4	914	64.5	929	65.5
884.5	62.4	899.5	63.5	914.5	64.5	929.5	65.6
885	62.4	900	63.5	915	64.6	930	65.6
885.5	62.5	900.5	63.5	915.5	64.6	930.5	65.6
886	62.5	901	63.6	916	64.6	931	65.7
886.5	62.5	901.5	63.6	916.5	64.7	931.5	65.7
887	62.6	902	63.6	917	64.7	932	65.8
887.5	62.6	902.5	63.7	917.5	64.7	932.5	65.8
888	62.6	903	63.7	918	64.8	933	65.8
888.5	62.7	903.5	63.7	918.5	64.8	933.5	65.9
889	62.7	904	63.8	919	64.8	934	65.9
889.5	62.8	904.5	63.8	919.5	64.9	934.5	65.9

ATTACHMENT 2
TEST WEIGHT PER BUSHEL/KILOGRAM PER HECTOLITER CONVERSION CHART – WHEAT

lb/bu	kg/hl Durum Wheat	kg/hl Other Wheat	lb/bu	kg/hl Durum Wheat	kg/hl Other Wheat	lb/bu	kg/hl Durum Wheat	kg/hl Other Wheat
50.0	65.2	66.0	54.4	70.9	71.7	58.8	76.6	77.4
50.1	65.4	66.1	54.5	71.0	71.8	58.9	76.7	77.5
50.2	65.5	66.3	54.6	71.2	72.0	59.0	76.9	77.6
50.3	65.6	66.4	54.7	71.3	72.1	59.1	77.0	77.8
50.4	65.7	66.5	54.8	71.4	72.2	59.2	77.1	77.9
50.5	65.9	66.7	54.9	71.6	72.3	59.3	77.2	78.0
50.6	66.0	66.8	55.0	71.7	72.5	59.4	77.4	78.2
50.7	66.1	66.9	55.1	71.8	72.6	59.5	77.5	78.3
50.8	66.3	67.1	55.2	71.9	72.7	59.6	77.6	78.4
50.9	66.4	67.2	55.3	72.1	72.9	59.7	77.8	78.6
51.0	66.5	67.3	55.4	72.2	73.0	59.8	77.9	78.7
51.1	66.7	67.4	55.5	72.3	73.1	59.9	78.0	78.8
51.2	66.8	67.6	55.6	72.5	73.3	60.0	78.2	78.9
51.3	66.9	67.7	55.7	72.6	73.4	60.1	78.3	79.1
51.4	67.0	67.8	55.8	72.7	73.5	60.2	78.4	79.2
51.5	67.2	68.0	55.9	72.9	73.6	60.3	78.5	79.3
51.6	67.3	68.1	56.0	73.0	73.8	60.4	78.7	79.5
51.7	67.4	68.2	56.1	73.1	73.9	60.5	78.8	79.6
51.8	67.6	68.3	56.2	73.2	74.0	60.6	78.9	79.7
51.9	67.7	68.5	56.3	73.4	74.2	60.7	79.1	79.8
52.0	67.8	68.6	56.4	73.5	74.3	60.8	79.2	80.0
52.1	67.9	68.7	56.5	73.6	74.4	60.9	79.3	80.1
52.2	68.1	68.9	56.6	73.8	74.5	61.0	79.4	80.2
52.3	68.2	69.0	56.7	73.9	74.7	61.1	79.6	80.4
52.4	68.3	69.1	56.8	74.0	74.8	61.2	79.7	80.5
52.5	68.5	69.2	56.9	74.1	74.9	61.3	79.8	80.6
52.6	68.6	69.4	57.0	74.3	75.1	61.4	80.0	80.7
52.7	68.7	69.5	57.1	74.4	75.2	61.5	80.1	80.9
52.8	68.8	69.6	57.2	74.5	75.3	61.6	80.2	81.0
52.9	69.0	69.8	57.3	74.7	75.5	61.7	80.3	81.1
53.0	69.1	69.9	57.4	74.8	75.6	61.8	80.5	81.3
53.1	69.2	70.0	57.5	74.9	75.7	61.9	80.6	81.4
53.2	69.4	70.2	57.6	75.0	75.8	62.0	80.7	81.5
53.3	69.5	70.3	57.7	75.2	76.0	62.1	80.9	81.7
53.4	69.6	70.4	57.8	75.3	76.1	62.2	81.0	81.8
53.5	69.8	70.5	57.9	75.4	76.2	62.3	81.1	81.9
53.6	69.9	70.7	58.0	75.6	76.4	62.4	81.3	82.0
53.7	70.0	70.8	58.1	75.7	76.5	62.5	81.4	82.2
53.8	70.1	70.9	58.2	75.8	76.6	62.6	81.5	82.3
53.9	70.3	71.1	58.3	76.0	76.7	62.7	81.6	82.4
54.0	70.4	71.2	58.4	76.1	76.9	62.8	81.8	82.6
54.1	70.5	71.3	58.5	76.2	77.0	62.9	81.9	82.7
54.2	70.7	71.4	58.6	76.3	77.1	63.0	82.0	82.8
54.3	70.8	71.6	58.7	76.5	77.3	63.1	82.2	82.9

TEST WEIGHT/KILOGRAMS PER HECTOLITER CONVERSION CHART – OTHER GRAINS											
lb/bu	kg/hl	lb/bu	kg/hl	lb/bu	kg/hl	lb/bu	kg/hl	lb/bu	kg/hl	lb/bu	kg/hl
23.0	29.6	26.1	33.6	29.2	37.6	32.3	41.6	35.4	45.6	38.5	49.5
23.1	29.7	26.2	33.7	29.3	37.7	32.4	41.7	35.5	45.7	38.6	49.7
23.2	29.9	26.3	33.8	29.4	37.8	32.5	41.8	35.6	45.8	38.7	49.8
23.3	30.0	26.4	34.0	29.5	38.0	32.6	42.0	35.7	45.9	38.8	49.9
23.4	30.1	26.5	34.1	29.6	38.1	32.7	42.1	35.8	46.1	38.9	50.1
23.5	30.2	26.6	34.2	29.7	38.2	32.8	42.2	35.9	46.2	39.0	50.2
23.6	30.4	26.7	34.4	29.8	38.4	32.9	42.3	36.0	46.3	39.1	50.3
23.7	30.5	26.8	34.5	29.9	38.5	33.0	42.5	36.1	46.5	39.2	50.5
23.8	30.6	26.9	34.6	30.0	38.6	33.1	42.6	36.2	46.6	39.3	50.6
23.9	30.8	27.0	34.7	30.1	38.7	33.2	42.7	36.3	46.7	39.4	50.7
24.0	30.9	27.1	34.9	30.2	38.9	33.3	42.9	36.4	46.8	39.5	50.8
24.1	31.0	27.2	35.0	30.3	39.0	33.4	43.0	36.5	47.0	39.6	51.0
24.2	31.1	27.3	35.1	30.4	39.1	33.5	43.1	36.6	47.1	39.7	51.1
24.3	31.3	27.4	35.3	30.5	39.3	33.6	43.2	36.7	47.2	39.8	51.2
24.4	31.4	27.5	35.4	30.6	39.4	33.7	43.4	36.8	47.4	39.9	51.4
24.5	31.5	27.6	35.5	30.7	39.5	33.8	43.5	36.9	47.5	40.0	51.5
24.6	31.7	27.7	35.6	30.8	39.6	33.9	43.6	37.0	47.6	40.1	51.6
24.7	31.8	27.8	35.8	30.9	39.8	34.0	43.8	37.1	47.7	40.2	51.7
24.8	31.9	27.9	35.9	31.0	39.9	34.1	43.9	37.2	47.9	40.3	51.9
24.9	32.0	28.0	36.0	31.1	40.0	34.2	44.0	37.3	48.0	40.4	52.0
25.0	32.2	28.1	36.2	31.2	40.2	34.3	44.1	37.4	48.1	40.5	52.1
25.1	32.3	28.2	36.3	31.3	40.3	34.4	44.3	37.5	48.3	40.6	52.3
25.2	32.4	28.3	36.4	31.4	40.4	34.5	44.4	37.6	48.4	40.7	52.4
25.3	32.6	28.4	36.6	31.5	40.5	34.6	44.5	37.7	48.5	40.8	52.5
25.4	32.7	28.5	36.7	31.6	40.7	34.7	44.7	37.8	48.6	40.9	52.6
25.5	32.8	28.6	36.8	31.7	40.8	34.8	44.8	37.9	48.8	41.0	52.8
25.6	32.9	28.7	36.9	31.8	40.9	34.9	44.9	38.0	48.9	41.1	52.9
25.7	33.1	28.8	37.1	31.9	41.1	35.0	45.0	38.1	49.0	41.2	53.0
25.8	33.2	28.9	37.2	32.0	41.2	35.1	45.2	38.2	49.2	41.3	53.2
25.9	33.3	29.0	37.3	32.1	41.3	35.2	45.3	38.3	49.3	41.4	53.3
26.0	33.5	29.1	37.5	32.2	41.4	35.3	45.4	38.4	49.4	41.5	53.4

TEST WEIGHT/KILOGRAMS PER HECTOLITER CONVERSION CHART – OTHER GRAINS											
lb/bu	kg/hl	lb/bu	kg/hl	lb/bu	kg/hl	lb/bu	kg/hl	lb/bu	kg/hl	lb/bu	kg/hl
41.6	53.5	44.7	57.5	47.8	61.5	50.9	65.5	54.0	69.5	57.1	73.5
41.7	53.7	44.8	57.7	47.9	61.6	51.0	65.6	54.1	69.6	57.2	73.6
41.8	53.8	44.9	57.8	48.0	61.8	51.1	65.8	54.2	69.8	57.3	73.7
41.9	53.9	45.0	57.9	48.1	61.9	51.2	65.9	54.3	69.9	57.4	73.9
42.0	54.1	45.1	58.0	48.2	62.0	51.3	66.0	54.4	70.0	57.5	74.0
42.1	54.2	45.2	58.2	48.3	62.2	51.4	66.2	54.5	70.1	57.6	74.1
42.2	54.3	45.3	58.3	48.4	62.3	51.5	66.3	54.6	70.3	57.7	74.3
42.3	54.4	45.4	58.4	48.5	62.4	51.6	66.4	54.7	70.4	57.8	74.4
42.4	54.6	45.5	58.6	48.6	62.5	51.7	66.5	54.8	70.5	57.9	74.5
42.5	54.7	45.6	58.7	48.7	62.7	51.8	66.7	54.9	70.7	58.0	74.6
42.6	54.8	45.7	58.8	48.8	62.8	51.9	66.8	55.0	70.8	58.1	74.8
42.7	55.0	45.8	58.9	48.9	62.9	52.0	66.9	55.1	70.9	58.2	74.9
42.8	55.1	45.9	59.1	49.0	63.1	52.1	67.1	55.2	71.0	58.3	75.0
42.9	55.2	46.0	59.2	49.1	63.2	52.2	67.2	55.3	71.2	58.4	75.2
43.0	55.3	46.1	59.3	49.2	63.3	52.3	67.3	55.4	71.3	58.5	75.3
43.1	55.5	46.2	59.5	49.3	63.4	52.4	67.4	55.5	71.4	58.6	75.4
43.2	55.6	46.3	59.6	49.4	63.6	52.5	67.6	55.6	71.6	58.7	75.5
43.3	55.7	46.4	59.7	49.5	63.7	52.6	67.7	55.7	71.7	58.8	75.7
43.4	55.9	46.5	59.8	49.6	63.8	52.7	67.8	55.8	71.8	58.9	75.8
43.5	56.0	46.6	60.0	49.7	64.0	52.8	68.0	55.9	71.9	59.0	75.9
43.6	56.1	46.7	60.1	49.8	64.1	52.9	68.1	56.0	72.1	59.1	76.1
43.7	56.2	46.8	60.2	49.9	64.2	53.0	68.2	56.1	72.2	59.2	76.2
43.8	56.4	46.9	60.4	50.0	64.4	53.1	68.3	56.2	72.3	59.3	76.3
43.9	56.5	47.0	60.5	50.1	64.5	53.2	68.5	56.3	72.5	59.4	76.4
44.0	56.6	47.1	60.6	50.2	64.6	53.3	68.6	56.4	72.6	59.5	76.6
44.1	56.8	47.2	60.7	50.3	64.7	53.4	68.7	56.5	72.7	59.6	76.7
44.2	56.9	47.3	60.9	50.4	64.9	53.5	68.9	56.6	72.8	59.7	76.8
44.3	57.0	47.4	61.0	50.5	65.0	53.6	69.0	56.7	73.0	59.8	77.0
44.4	57.1	47.5	61.1	50.6	65.1	53.7	69.1	56.8	73.1	59.9	77.1
44.5	57.3	47.6	61.3	50.7	65.3	53.8	69.2	56.9	73.2	60.0	77.2
44.6	57.4	47.7	61.4	50.8	65.4	53.9	69.4	57.0	73.4		

CHAPTER 2:
BARLEY

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2.1 GENERAL ORDER OF PROCEDURES

The breakdown and inspection for Barley are listed below in the following chapter according to its general order. The order of procedure may vary slightly depending on the quality of the barley and the tests requested. More information is available on the Agricultural Marketing Service Website (AMS), in the U.S. Standards for Barley, and the Board of Appeals and Review (BAR) Questions and Answers.

The inspection process provides various factor information used to determine grade and to provide further information on the condition or quality of barley. Each section of this chapter provides details on recording factor information. If requested by the applicant for inspection, additional information may be provided (e.g., an exact count on stones in addition to the percent by weight or a percent for a specific type of damage).

2.2 DEFINITION OF BARLEY

Definition. *Grain that, before the removal of dockage, consists of 50 percent or more of whole kernels of cultivated barley (Hordeum vulgare L.) and not more than 25 percent of other grains for which standards have been established under United States Grain Standards Act. The term "barley" as used in these standards does not include hull-less barley or black barley.*

Whole kernels are kernels with three-fourths or more of the kernel present. Other grains for which standards have been established are canola, corn, flaxseed, oats, rye, sorghum, soybeans, sunflower seed, triticale, and wheat.

Basis of Determination. Normally, a visual appraisal of the sample is sufficient to determine if it meets the definition of barley. If an analysis is necessary, make the determination before the removal of dockage on a portion of 25 grams.

If the sample does not meet the definition for barley, examine it further to determine if it is:

a. Another grain for which standards have been established; or

b. Not Standardized Grain (NSG). No further analysis is necessary on a sample designated as NSG unless a specific factor test is requested.

2.3 GRADES AND GRADE REQUIREMENTS

There are two classes of barley: Malting barley and Barley. Malting barley is divided into two subclasses: Six-rowed Malting barley and Two-rowed Malting barley. Barley is divided into three subclasses: Six-rowed barley, Two-rowed barley, and Barley. Malting barley subclasses are divided into four numerical grades. Barley subclasses are divided into five numerical grades and U.S. Sample Grade. Special grades emphasize qualities or conditions affecting the value and are added to and made a part of the grade designation. Special grades do not affect the numerical or sample grade designation.

TABLE 2.1 – GRADES AND GRADE REQUIREMENTS FOR SIX-ROWED MALTING BARLEY

Grade	Minimum Limits of -			Maximum Limits of -					
	Test Weight per bushel (pounds)	Suitable Malting Type (percent)	Sound Barley[1] (percent)	Damaged Kernels[1] (percent)	Wild Oats (percent)	Foreign Material (percent)	Other Grains (percent)	Skinned and Broken Kernels (percent)	Thin Barley* (percent)
U.S. No. 1	47.0	97.0	98.0	2.0	1.0	0.5	2.0	4.0	7.0
U.S. No. 2	45.0	97.0	98.0	3.0	1.0	1.0	3.0	6.0	10.0
U.S. No. 3	43.0	95.0	96.0	4.0	2.0	2.0	5.0	8.0	15.0
U.S. No. 4	43.0	95.0	93.0	5.0	3.0	3.0	5.0	10.0	15.0

[1] Injured-by-frost kernels and injured-by-mold kernels are not considered damaged kernels or considered against sound barley.

* Use the 5/64 x 3/4 slotted-hole sieve.

Note: Malting barley must not be infested, blighted, ergoty, garlicky, smutty, or contain any special grades. Upon request, malting barley varieties may be inspected and graded in accordance with standards established for the class Barley.

Six-rowed Malting that does not meet the requirements for U.S. Nos. 1, 2, 3, or 4 Malting must be graded under the Barley standards (Table 2.3 – Grades and Grade Requirements for Barley).

TABLE 2.2 – GRADES AND GRADE REQUIREMENTS FOR TWO-ROWED MALTING BARLEY

Grade	Minimum Limits of -			Maximum Limits of -					
	Test Weight per bushel (pounds)	Suitable Malting Type (percent)	Sound Barley[1] (percent)	Damaged Kernels[1] (percent)	Wild Oats (percent)	Foreign Material (percent)	Other Grains (percent)	Skinned and Broken Kernels (percent)	Thin Barley* (percent)
U.S. No. 1	50.0	97.0	98.0	2.0	1.0	0.5	2.0	4.0	5.0
U.S. No. 2	48.0	97.0	98.0	3.0	1.0	1.0	3.0	6.0	7.0
U.S. No. 3	48.0	95.0	96.0	4.0	2.0	2.0	5.0	8.0	10.0
U.S. No. 4	48.0	95.0	93.0	5.0	3.0	3.0	5.0	10.0	10.0

[1] Injured-by-frost kernels and injured-by-mold kernels are not considered damaged kernels or considered against sound barley.

* Use the 5.5/64 x 3/4 slotted-hole sieve.

Note: Malting barley must not be infested, blighted, ergoty, garlicky, smutty, or contain any special grades. Upon request, malting barley varieties may be inspected and graded in accordance with standards established for the class Barley.

Two-rowed Malting barley that does not meet the requirements for U.S. Nos. 1, 2, 3, or 4 Malting must be graded under the Barley standards (Table 2.3 – Grades and Grade Requirements for Barley).

TABLE 2.3 – GRADES AND GRADE REQUIREMENTS FOR BARLEY

Grade	Minimum Limits of -		Maximum Limits of -				
	Test Weight per bushel (pounds)	Sound Barley (percent)	Damaged Kernels[1] (percent)	Heat Damaged (percent)	Foreign Material (percent)	Broken Kernels (percent)	Thin Barley* (percent)
U.S. No. 1	47.0	97.0	2.0	0.2	1.0	4.0	10.0
U.S. No. 2	45.0	94.0	4.0	0.3	2.0	8.0	15.0
U.S. No. 3	43.0	90.0	6.0	0.5	3.0	12.0	25.0
U.S. No. 4	40.0	85.0	8.0	1.0	4.0	18.0	35.0
U.S. No. 5	36.0	75.0	10.0	3.0	5.0	28.0	75.0

U.S. Sample Grade shall be barley that:

a. Does not meet the requirements for grades U.S. Nos. 1, 2, 3, 4, or 5; or

b. Contains 8 or more stones or any number of stones which have an aggregate weight in excess of 0.2 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria* spp.), 2 or more castor beans (*Ricinus communis* L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 8 or more cocklebur (*Xanthium* spp.) or similar seeds singly or in combination, 10 or more rodent pellets, bird droppings, or equivalent quantity of other animal filth per 1-1/8 to 1-1/4 quarts of barley; or

c. Has a musty, sour, or commercially objectionable foreign odor (except smut or garlic odor); or

d. Is heating or otherwise of distinctly low quality.

[1] Includes heat-damaged kernels. Injured-by-frost kernels and injured-by-mold kernels are not considered damaged kernels.

* Use the 5/64 x 3/4 slotted-hole sieve.

2.4 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in Table 2.1 – Grades and Grade Requirements for Six-Rowed Malting Barley, Table 2.2 – Grades and Grade Requirements for Two-Rowed Malting Barley, or Table 2.3 – Grades and Grade Requirements for Barley. Use the following guidelines when assigning grades:

a. The letters “U.S.”;

b. The abbreviation “No.” and the number of the grade or the words “Sample Grade”;

c. The words “or better” when applicable;

d. The name of the subclass;

e. The applicable special grade(s) in alphabetical order;

f. The word “Dockage” and the percentage thereof.

For the subclass Barley, applicants may request that the percent of each barley type (i.e., six- and two-rowed) in the mixture be shown to the nearest whole percent in the “Results” section of the certificate.

2.5 SPECIAL GRADES

Special grades draw attention to unusual conditions in the grain and are made part of the grade designation. The special grades and special grade requirements for barley are shown in the United States Standards for Barley. Details for determining special grades are included in referenced sections. Definitions and examples of the designations for special grades in barley are:

a. Blighted Barley. Barley that contains more than 4.0 percent of fungus-damaged and/or mold-damaged kernels. (Section 2.23)

Example: U.S. No. 4 Two-rowed Barley, Blighted, Dockage 0.5%

b. Ergoty Barley. Barley that contains more than 0.10 percent ergot. (Section 2.20)

Example: U.S. No. 3 Two-rowed Barley, Ergoty, Dockage 1.5%

c. Garlicky Barley. Barley that contains three or more green garlic bulblets, or an equivalent quantity of dry or partly dry bulblets in 500 grams of barley. (Section 2.14)

Example: U.S. No. 2 Six-rowed Barley, Garlicky

d. Infested Barley. Barley that is infested with live weevils or other live insects injurious to stored grain. (Section 2.11)

Example: U.S. No. 1 Barley, Infested

e. Smutty Barley. Barley that has kernels covered with smut spores to give a smutty appearance in mass, or which contains more than 0.20 percent smut balls. (Section 2.21)

Example: U.S. No. 3 Two-rowed Barley, Smutty

2.6 OPTIONAL GRADE DESIGNATION

The Official U.S. Standards for Grain provide for an optional grade designation, commonly referred to as "or better." Upon request of the applicant, certify barley as U.S. No. 2 or better, U.S. No. 3 or better, etc. An "or better" grade designation cannot be applied to a U.S. No. 1 grade designation.

The optional grade designation for barley must include the name of the applicable subclass in the grade designation. When applicable, include special grade designations and dockage in the certification.

Example: U.S. No. 2 or better Six-rowed Barley

U.S. No. 3 or better Six-rowed Barley, Dockage 1.5%

2.7 BASIS OF DETERMINATION

Distinctly Low Quality. The determination of distinctly low quality is made on the basis of the lot as a whole at the time of sampling when a condition exists that may or may not appear in the representative sample and/or the sample as a whole.

Certain Quality Determinations. Each determination of rodent pellets, bird droppings, other animal filth, broken glass, castor beans, cockleburs, crotalaria seeds, dockage, garlic, live insect infestation, large stones, moisture, temperature, an unknown foreign substance(s), and a commonly recognized harmful or toxic substance(s) is made on the basis of the sample as a whole. When a condition exists that may not appear in the representative sample, the determination may be made on the basis of the lot as a whole at the time of sampling according to procedures prescribed in FGIS instructions.

All Other Determinations. Each determination of heat-damaged kernels, injured-by-heat kernels, and white or blue aleurone layers in Six-rowed barley is made on pearled, dockage-free barley. Other determinations not specifically provided for under the General Provisions are made on the basis of the grain when free from dockage, except the determination of odor is made on either the basis of the grain as a whole or the grain when free from dockage.

TABLE 2.4 – BASIS OF DETERMINATION

Lot as a Whole	Factors Determined Before the Removal of Dockage	Factors Determined After the Removal of Dockage	Factors Determined on a Pearled Portion After the Removal of Dockage
Distinctly Low Quality	Distinctly Low Quality	Blighted	Blue Aleurone Layers
Heating	Garlicky	Broken Kernels	Heat-Damaged Kernels
Infested	Heating	Class	Injured-by-Heat
Odor	Infested	Damaged Kernels	Injured-by-Sprout
	Kind of Grain	Ergot	White Aleurone Layers
	Moisture	Foreign Material	
	Odor	Injured-By-Frost	
	Sample Grade Criteria	Injured-By-Mold	
		Odor	
		Other Grains	
		Plump Barley	
		Skinned and Broken Kernels	
		Sound Barley	
		Smut	
		Stones	
		Subclass	
		Test Weight	
		Thin Barley	
		Wild Oats	

2.8 HEATING

Basis of Determination. Determine heating (HTG) on evidence obtained at the time of sampling or on the basis of the sample as a whole.

Barley developing a high temperature from excessive respiration is considered heating. Heating barley, in its final stages, will usually have a sour or musty odor. Do not confuse barley that is heating with barley that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

Certification. When applicable, show the term “Heating” on the work record and “Results" section of the certificate, and grade the barley “U.S. Sample Grade.”

2.9 ODOR

Basis of Determination. Determine odor on evidence obtained at the time of sampling or on the sample either before or after the removal of dockage.

TABLE 2.5 – ODOR CLASSIFICATION EXAMPLES

Musty	Sour	Commercially Objectionable Foreign Odors	
Ground Insect Moldy	Boot Fermenting Insect (acrid) Pigpen	Animal Hides Decaying Animal Fertilizer Fumigant Insecticide	Oil Products Skunk Smoke Strong Weed Vegetable Matter

Commercially Objectionable Foreign Odors (COFO) are odors, except smut and garlic odors, foreign to grain that render it unfit for normal commercial usage.

Fumigant, insecticide, or fungicide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of barley contains a fumigant, insecticide, or fungicide odor that prevents a determination as to whether any other odor(s) exists, apply the following guidelines:

a. Original Inspections. Allow the work portion to aerate in an open container for 4 hours, or less, if the odor dissipates in less time.

b. Reinspections, Appeal, and Board Appeal Inspections. Allow unworked file samples and new samples to aerate in an open container for 4 hours, or less, if the odor dissipates in less time. The 4-hour aeration requirement does not apply when the original work portion was aerated and retained as the final file.

Consider the sample as having a commercially objectionable foreign odor if the fumigant, insecticide, or fungicide odor persists based on the above criteria.

Final Determinations. The inspector is responsible for making the final determination for all odors. Whenever possible, use a consensus of experienced licensed inspectors on samples containing marginal odors. Under the consensus approach, if a clear majority (at least 2/3) of inspectors agree the sample contains a Musty, Sour, or COFO odor, grade the barley “U.S. Sample Grade”. The consensus approach is not required if the initial inspector does not detect an odor or a distinct odor is detected.

Certification. Grade barley containing a “distinct” musty, sour, or commercially objectionable foreign odor as “U.S. Sample Grade.” Record the words “Musty,” “Sour,” or “Commercially Objectionable Foreign Odor” on the work record and “Results” section of the certificate.

2.10 MOISTURE

Definition. *Water content in grain as determined by an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine moisture before the removal of dockage on a portion of approximately 650 grams.

The procedures for performing a moisture determination using a FGIS approved moisture instrument utilizing the proper calibrations are described in the Moisture Handbook and in Chapter 1, General Information.

For the class Barley, select the predominant type (i.e., Six- or Two-rowed) of barley in the mixture from the menu.

Certification. Record the percent of moisture on the work record and "Results" section of the certificate to the nearest tenth percent.

2.11 INFESTED BARLEY

Barley that is infested with live weevils (LW) or other live insects injurious to stored grain (OLI).

The presence of any LW or OLI found in the work sample indicates the probability of infestation and warns that the barley must be carefully examined to determine if it is infested. In such cases, examine the work sample and the file sample before reaching a conclusion as to whether or not the barley is infested. Do not examine the file sample if the work portion is insect free.

LW include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. OLI include grain beetles, grain moths, and larvae. To further define "other insect injurious to stored grain" refer to the Stored-Grain Insect Reference. Images of insects may also be viewed on the AMS website.

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, refer to Table 2.6 – Insect Infestation.

TABLE 2.6 – INSECT INFESTATION

Samples meeting or exceeding any one of these tolerances are infested: ***2 LW, or 1 LW + 5 OLI, or 10 OLI***		
1,000-gram representative sample[1] (+ file sample if needed)	**Lot as a Whole (Stationary)**	**Online Sample (In-Motion)[2]**
Submitted Samples Probed Lots D/T Sampled Land Carriers	Probed Lots (at time of sampling)	Railcars under the Cu-sum Subsamples for Sacked Grain Lots Components for Bargelots[3] Components for Shiplots[3]

[1] Examine work portion and file sample if necessary. Do not examine file sample if work portion is insect free.

[2] Minimum sampling rate is 500 grams per 2,000 bushels.

[3] Minimum component size is 10,000 bushels.

Key: LW = Live Weevil, OLI = Other Live Insects injurious to stored grain

Certification. When applicable, grade the barley "Infested" on the grade line of the certificate in accordance with Section 2.5, "Special Grades." Record the number of live weevils and/or other live insects injurious to stored grain on the work record and "Results" section of the certificate.

2.12 DISTINCTLY LOW QUALITY

Consider barley distinctly low quality when it is obviously of inferior quality and existing grade factors or guidelines do not accurately reflect the inferior condition.

Basis of Determination. Use all available information to determine whether the barley is of distinctly low quality (DLQ). This includes a general examination of the barley during sampling and an analysis of the obtained sample(s).

a. Diatomaceous Earth (DIAT). Barley suspected of containing DIAT is considered DLQ unless the applicant specifically requests an examination to verify the presence of DIAT. If the laboratory examination verifies that the barley contains DIAT, then the barley is not considered DLQ due to DIAT. For additional information regarding the testing of barley for diatomaceous earth, refer to Directive 9180.49, "Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel."

b. Flood Damaged Grain. Barley that is materially affected by flooding is considered DLQ and certified as "U.S. Sample Grade." In addition, official personnel must report identifiable lots that are DLQ to the district Food and Drug Administration (FDA) office as "actionable" in accordance with FGIS-PN-19-04, "Inspection of Flood Damaged Grain".

The determination of DLQ is based on the appearance and condition of the lot or sample as a whole. Evaluate barley affected by flooding on a portion of approximately 400 grams with the use of the ILP – All Grains/Graded Commodities - Inspection of Flood Damaged Grain. If a sample does not meet the requirements for DLQ, but the kernels are materially damaged (stained) by flooding, consider the kernels as damaged and count toward the total percentage of damaged kernels in the sample.

c. Large Animal Excreta (LGANX). Barley containing one or more large animal excreta (e.g., deer or elk pellet) is considered DLQ.

d. Large Debris. Barley containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris which are visible to the sampler but too large to enter the sampling device is considered DLQ.

e. Other Unusual Conditions. Barley that is obviously affected by other unusual conditions which adversely affect the quality of the barley and cannot be properly graded by use of the grading factors specified or defined in the standards is considered DLQ.

Certification. When applicable, show the factor DLQ and the reason(s) why on the work record and "Results" section of the certificate, and grade the barley "U.S. Sample Grade."

2.13 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine U.S. Sample Grade criteria, except stones, before the removal of dockage based on a work portion of 850 – 950 grams. Determine stones on a dockage-free portion.

Table 2.7 – U.S. Sample Grade Criteria shows the criteria and corresponding Visual Aids, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, or bulgur), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain must function as "unknown foreign substance (FSUB)."

Note: Dockage Weight must be subtracted from the original weight to calculate the percent of stones.

Original sample weight – weight of dockage
= dockage-free sample weight.
933g – 32 (32.48 rounded) = 901g dockage-free sample weight.

TABLE 2.7 – U.S. SAMPLE GRADE CRITERIA

Criteria	Visual Aids	Number/Weight[1]	
		Sample Basis	Lot Basis[2]
Any Numerical Grading Factor		Excess of limit for U.S. No. 5	N/A
Animal Filth	Animal Filth	10 or more	N/A
Castor Beans	Castor Bean	2 or more	N/A
Cockleburs	Cocklebur	8 or more	N/A
Crotalaria Seeds	Crotalaria	3 or more	N/A
Glass		2 or more	N/A
Odor		Presence	N/A
Stones[3]		8 or more or any number in excess of 0.2% by weight	N/A
Unknown Foreign Substances[4]	Fertilizer	4 or more	N/A
Heating		Presence	Presence
Large Debris*		N/A	2 or more
Other Unusual Conditions*		Presence	Presence

[1] Record count factors to the nearest whole number.
[2] The entire sample of a submitted sample is considered as the lot.
[3] Stones are based on sample after removal of dockage.
[4] Consider feed pellets and processed grain products as foreign material, not unknown foreign substance.
* For Distinctly Low Quality, refer to Section 2.12.

Certification. Grade barley "U.S. Sample Grade" when one or more of the limits in Table 2.7 – U.S. Sample Grade Criteria are observed. Record the factors (count factors to the nearest whole number) on the work record and "Results" section of the certificate.

2.14 GARLICKY BARLEY

Definition. *Barley that contains three or more green garlic bulblets, or an equivalent quantity of dry or partly dry bulblets in 500 grams of barley.*

Basis of Determination. Determine garlicky (GAR) before the removal of dockage on a work portion of 500 grams. (VRI – O.F. - 13.0 Green Garlic Bulbs (Whole) and O.F. - 13.1 Dry Garlic Bulbs (1/3rd))

Characteristics of Bulblets.

a. Green garlic bulblets are bulblets which have retained all of their husks intact.

b. Dry or partly dry garlic bulblets are bulblets which have lost all or part of their husks. Consider bulblets with cracked husks as dry.

c. Three dry or partly dry garlic bulblets are equal to one green bulblet.

Note: Garlic bulblets apply in the determinations of the "Garlicky" and also function as dockage or foreign material.

Wild onion, sometimes referred to as "crow garlic", is considered as garlic.

Certification. When applicable, grade the barley "Garlicky" on the grade line of the certificate in accordance with Section 2.5, "Special Grades." Record the number of garlic bulblets in whole numbers or in decimals to the nearest hundredths position (e.g., 1/3 = 0.33 or 2/3 = 0.67) on the work record and "Results" section of the certificate.

2.15 DOCKAGE

Definition. *All matter other than barley that can be removed from the original sample by use of an approved device according to procedures prescribed in FGIS instructions. Also, underdeveloped, shriveled, and small pieces of barley kernels removed in properly separating the material other than barley and that cannot be recovered by properly rescreening or recleaning.*

Basis of Determination. Determine dockage (DKG) on a portion of 850 - 950 grams.

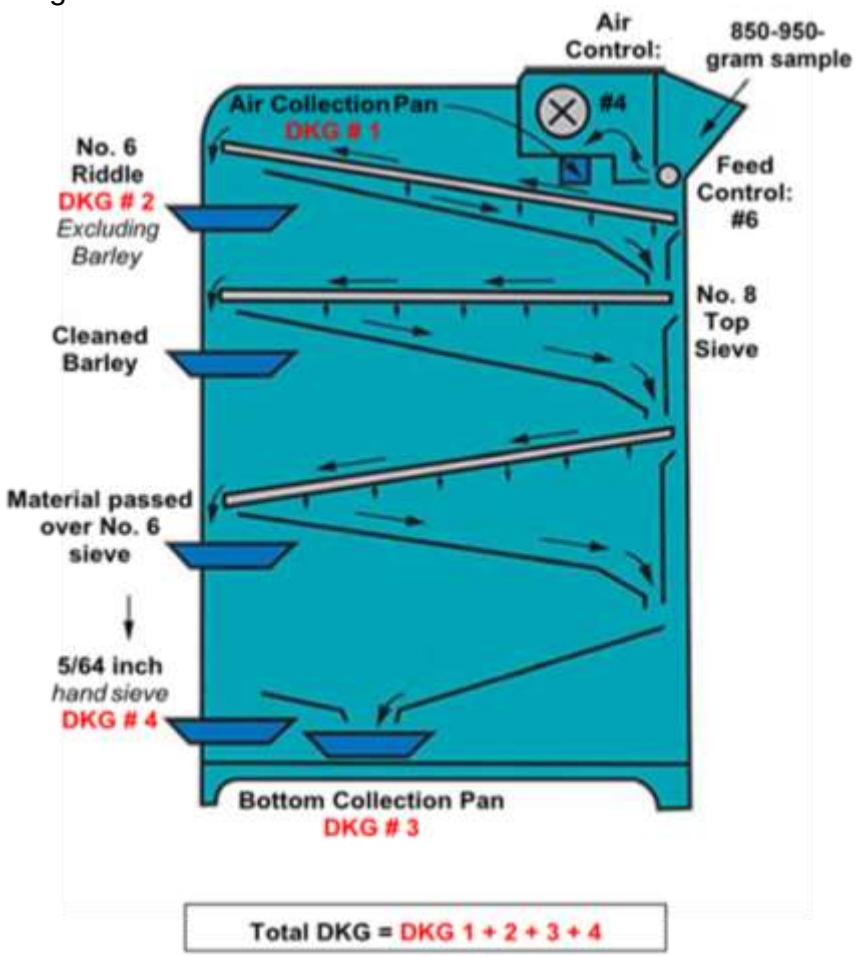

FIGURE 2.1 – PROCEDURE FOR DETERMINING DOCKAGE

Carter Dockage Tester (Mechanical Separation).

a. Set the air control to 4 and the feed control to 6.

b. Insert the No. 6 riddle in the riddle carriage.

c. Insert a No. 8 sieve in the top sieve carriage.

d. Insert a No. 6 sieve in the middle sieve carriage.

e. There is no sieve in the bottom sieve carriage.

f. Start the Carter Dockage Tester and pour sample into feed hopper.

g. Aspirated material in the air collection pan is dockage.

h. Material over the riddle, excluding barley, is dockage.

i. Material that passed through the No. 6 sieve is dockage (bottom collection pan).

j. Examine the material that passed over the No. 6 sieve to determine if it contains more than 0.1 percent of wild buckwheat, mustard seed, or similar seeds. (VRI – O.F. - 27.0 Wild Buckwheat and Similar Seeds) If a visual appraisal is not sufficient, make a determination on a portion of 50 grams. If so, rescreen this material with a 5/64 inch equilateral triangular hole sieve using the following procedure:

   (1) Place the material that passed over the No. 6 sieve on the upper edge of the 5/64 inch sieve.

   (2) Hold the sieve at a 10-20° angle and work the material down over the sieve with a gentle side-to-side motion.

   (3) Return barley and other material remaining on top of the 5/64 inch sieve to the dockage-free sample. The material passing through the hand sieve is dockage.

k. If the material that passed over the No. 6 sieve does not contain more than 0.1 percent of wild buckwheat, mustard seed, or similar seeds, return material to the dockage-free sample.

Certification. Report the percent of dockage on the work record in hundredths. Also, record the percent of dockage in the factor results section of the certificate application, but do not include this result in the “Results” section of the certificate. When the sample contains 0.50 percent or more dockage, record the percent of dockage on the grade line of the certificate in half and whole percent with fractions less than one-half percent disregarded.

Example: 0.50 to 0.99 percent is recorded as 0.5 percent.
1.00 to 1.49 percent is recorded as 1.0 percent.

2.16 TEST WEIGHT

Definition. *The weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine test weight (TW) on a dockage-free portion of sufficient quantity to overflow the kettle.

The procedures for performing a test weight determination are described in Chapter 1, General Information.

Certification. Record test weight results on the work record and "Results" section of the certificate in whole and half pounds. Disregard fractions of less than a half pound and round down to the nearest half pound. If requested, convert the pounds per bushel (lbs./bu) result to kilograms per hectoliter (kg/hl) using the formula lbs./bu x 1.287 = kg/hl, and record in the "Remarks" section in whole and tenths.

2.17 PROCESSING THE WORK SAMPLE

At this point, all tests required to be performed prior to the removal of dockage have been completed. Also, the sample has been examined for certain sample grade and special grade factors. Now the work sample is ready to be divided into fractional portions for other determinations required after the removal of dockage.

Chart 2.1 – Dividing the Work Sample and Table 2.8 – Approximate Analytical Portion Sizes illustrate how the sample is divided into fractional parts using an approved divider.

CHART 2.1 – DIVIDING THE WORK SAMPLE

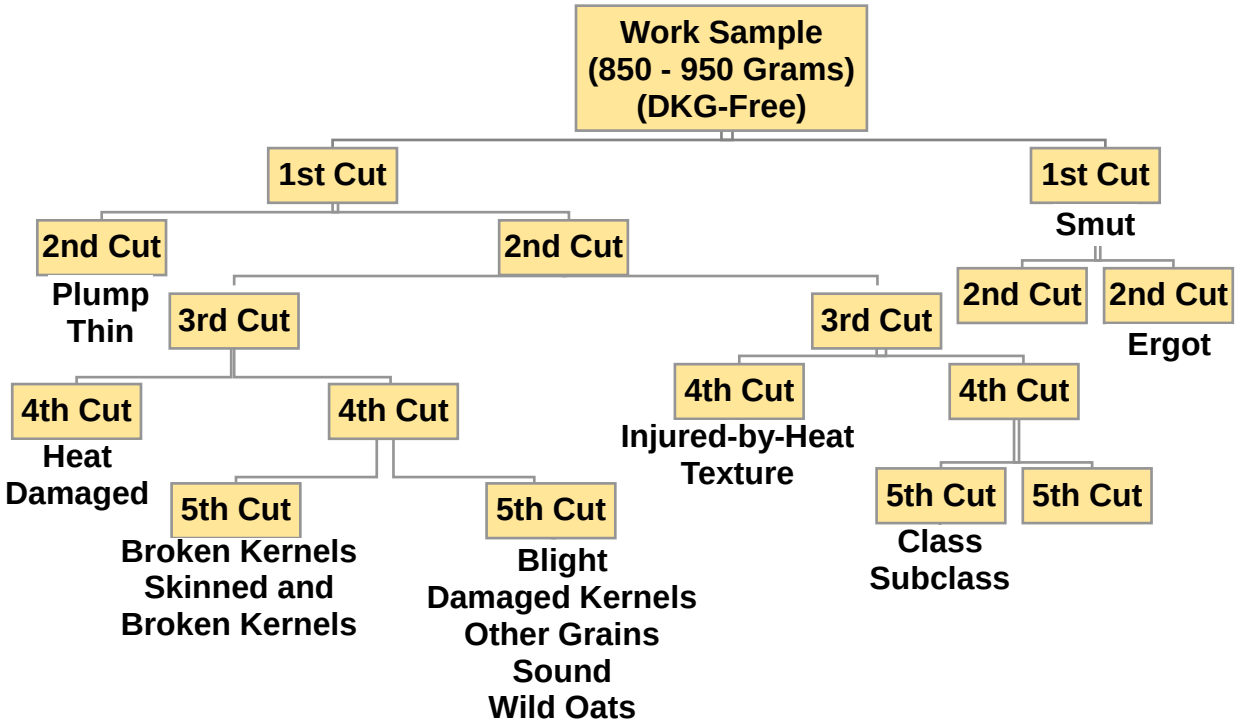

TABLE 2.8 – APPROXIMATE ANALYTICAL PORTION SIZES

Factors	Grams	Factors	Grams
Garlic Bulblets	500	Class and Subclass	25
Smutty	500	Damaged Kernels	25
Ergot	250	Foreign Material	25
Plump Barley	250	Injured-by-Frost Kernels	25
Thin Barley	250	Injured-by-Mold Kernels	25
Heat-Damaged Kernels	50	Kind of Grain	25
Injured-by-Heat Kernels	50	Other Grains	25
Kernel Texture	50	Skinned and Broken Kernels	25
Blighted	25	Sound Barley	25
Broken Kernels	25	Wild Oats	25

2.18 PLUMP BARLEY

Definition. *Barley that remains on top of a 6/64 x 3/4 slotted-hole sieve after sieving according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine plump (PL) on a dockage-free portion of 250 grams.

Determine plump upon request for any class of barley.

Mechanical Sieving Method.

a. Mount the 6/64 x ¾ slotted-hole sieve and a bottom pan on the mechanical sieve shaker.

b. Set the stroke counter for 30 strokes.

c. Place the portion in the center of the sieve and actuate the shaker.

d. Remove, clean the sieve, and empty the bottom pan. Return the material lodged in the perforations to the barley on top of the sieve.

e. Consider all material remaining on top of the sieve is plump barley.

Certification. Upon request, record the percent range (e.g., Below 50%, 50-55%, 56-60%, or 61-65%). Upon request, actual plump barley may additionally be certified to the nearest tenth percent in conjunction with the applicable range statement. Record plump on the work record and "Results" section of the certificate.

2.19 THIN BARLEY

Thin barley shall be defined for the appropriate class as follows:

a. *Malting Barley. Six-rowed Malting barley that passes through a 5/64 x 3/4 slotted-hole sieve and Two-rowed Malting barley which passes through a 5.5/64 x 3/4 slotted-hold sieve in accordance with procedures prescribed in GIPSAs instructions.*

b. *Barley. Six-rowed barley, Two-rowed barley, or Barley that passes through a 5/64 x 3/4 slotted-hole sieve in accordance with procedures prescribed in GIPSAs instructions.*

Basis of Determination. Determine thin (THIN) barley on a dockage-free portion of 250 grams.

Use the mechanical sieving method to determine thin barley. Return all material lodged in the perforations of the sieve to the barley remaining on top of the sieve. Consider all material passing thru the sieve as thin barley. The procedure for this method is described in Section 2.18, "Plump Barley."

Certification. Record the percent of thin barley on the work record and "Results" section of the certificate to the nearest tenth percent.

2.20 ERGOTY BARLEY

Definition. *Barley that contains more than 0.10 percent ergot.*

Basis of Determination. Determine ergoty (ERG) on a dockage-free portion of 250 grams.

Ergot is a hard, reddish-brown or black grain-like mass of certain parasitic fungi that replaces barley kernels. Ergot applies in the determination of the special grade "Ergoty" and also functions as foreign material. (VRI – O.F. - 12.0 Ergot)

Note: All cereal grains and grasses affected by ergot function as ergot in barley.

Certification. When applicable, grade the barley "Ergoty" on the grade line of the certificate in accordance with Section 2.5, "Special Grades." Record ergot to the nearest hundredth percent on the work record and "Results" section of the certificate.

2.21 SMUTTY BARLEY

Definition. *Barley that has kernels covered with smut spores to give a smutty appearance in mass, or which contains more than 0.20 percent smut balls.*

Basis of Determination. Determine smutty (SMUT) on a dockage-free portion of 500 grams.

Smut is a plant disease characterized by the appearance of smut balls or smut spores. Smut balls apply in the determination of the special grade "Smutty" but also function as foreign material. (VRI – O.F. - 22.0 Smut Balls)

Certification. When applicable, grade the barley "Smutty" on the grade line of the certificate in accordance with Section 2.5, "Special Grades." Record the percent of smut balls on the work record and "Results" section of the certificate to the nearest hundredth percent.

2.22 MALTING FACTORS

In addition to the grading factors listed in the grade and grade requirements tables (Section 2.3, "Grades and Grade Requirements"), other limits have been established for barley to qualify as Malting barley. Malting factors may also be determined on the class Barley upon request.

TABLE 2.9 – MALTING FACTORS

Subclass	Maximum limits of:					
	Frost Damage	Injured-by-Frost	Heat Damage	Injured-by-Heat	Mold Damage	Injured-by-Mold
Six-rowed Malting and Two-rowed Malting	0.4%	1.9%	0.1%	0.2%	0.4%	1.9%
Basis of Determination	25 g	25 g	50 g	50 g	25 g	25 g

a. Frost-Damaged and Injured-by-Frost Kernels.

Frost-Damaged Kernels. Kernels, pieces of barley kernels, other grains, and wild oats that are badly shrunken and distinctly discolored black or brown by frost. (VRI – B - 3.1 Frost Damage)

Injured-by-Frost Kernels. Kernels and pieces of barley kernels that are distinctly indented, immature or shrunken in appearance or that are light green in color as a result of frost before maturity. (VRI – B - 3.0 Injured-by-Frost)

Basis of Determination. Determine frost damage and injured-by-frost on a dockage-free portion of 25 grams.

(1) Frost-Damaged Kernel Limits.

(a) The class Malting barley may contain no more than 0.4 percent of frost damaged kernels.

(b) Frost-damaged kernels are scored as damaged kernels and against sound barley limits.

(2) Injured-by-Frost Kernel Limits.

(a) The class Malting barley may contain no more than 1.9 percent of injured-by frost kernels.

(b) Injured-by-frost kernels are not considered as damaged and are not scored against sound barley.

b. Heat-Damaged and Injured-by-Heat Kernels.

Heat-Damaged Kernels. Kernels, pieces of barley kernels, other grains, and wild oats that are materially discolored and damaged-by-heat. (VRI – B - 5.1 Heat Damage)

Injured-by-Heat Kernels. Kernels, pieces of barley kernels, other grains, and wild oats that are slightly discolored as a result of heat. (VRI – B - 5.0 Injured-by-Heat)

Basis of Determination. Determine injured-by-heat kernels and heat-damaged kernels on a dockage-free portion of 50 grams.

For the general operating procedures of a barley pearler, refer to Chapter 1, General Information.

(1) Determining Injured-by-Heat Kernels.

(a) Pour 50 grams of dockage-free barley into the barley pearler.

(b) Set the pearler timer for a "1/3 pearl."

(c) After pearling, reweigh and then examine the kernels for injured-by-heat.

(d) The class Malting barley may contain no more than 0.2 percent of injured-by-heat kernels.

(2) Determining Heat-Damaged Kernels.

(a) Pour 50 grams of dockage-free barley into the barley pearler.

(b) Set the pearler timer for a "full standardized pearl."

(c) After pearling, reweigh and then examine the kernels for heat damage.

(d) The class Malting barley may contain no more than 0.1 percent of heat damaged kernels.

Note: When determining heat-damaged or injured-by-heat barley, if inspectors cannot tell whether the affected kernel is blue or white aleurone layer, use the White Aleurone Barley kernel VRI.

c. Mold-Damaged and Injured-by-Mold Kernels.

Mold-Damaged Kernels. Kernels, pieces of barley kernels, other grains, and wild oats that are weathered and contain considerable evidence of mold.

Mold-damaged kernels are characterized by black or grayish spots or blotches on one or both sides of the kernel. (VRI – B - 1.1 Mold Damage)

Injured-by-Mold Kernels. Kernels, pieces of barley kernels containing slight evidence of mold.

Injured-by-mold kernels are characterized by mold spores and have a weathered appearance. (VRI - B - 7.0 Injured-by-Mold)

Basis of Determination. Determine mold-damaged kernels and injured-by-mold kernels on a dockage-free portion of 25 grams.

(1) Mold-Damaged Kernel Limits.

(a) Malting barley may contain no more than 0.4 percent of mold-damaged kernels.

(b) Mold-damaged barley are scored as damaged kernels and against sound barley limits.

(2) Injured-by-Mold Kernel Limits.

(a) Malting barley may contain no more than 1.9 percent of injured-by-mold kernels.

(b) Injured-by-mold kernels are not considered as damaged and are not scored against sound barley.

Certification. When barley does not meet the requirements for malting because it exceeds the limits for malting factors, record the factor(s) that exceeded malting limits on the work record and "Results" section of the certificate to the nearest tenth percent.

2.23 BLIGHTED BARLEY

Definition. *Barley that contains more than 4.0 percent of fungus-damaged and/or mold-damaged kernels.*

Basis of Determination. Determine blighted barley on a dockage-free portion of 25 grams. (VRI – B - 1.0 Blight Damage)

Certification. When applicable, grade the barley "Blighted" on the grade line of the certificate in accordance with Section 2.5, "Special Grades." Record the percent of blight kernels on the work record and "Results" section of the certificate to the nearest tenth percent.

2.24 DAMAGED KERNELS

Definition. *Kernels, pieces of barley kernels, other grains, and wild oats that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-damaged, heat-damaged, injured-by-heat, insect-bored, mold-damaged, sprout-damaged, or otherwise materially damaged.*

Basis of Determination. Determine damaged kernels (DKT) on a dockage-free portion of 25 grams.

The factor damaged kernels is a grade determining factor in all subclasses of barley. Damaged kernels are counted against sound barley.

In general, consider barley, other grains, or wild oats to be damaged for inspection and grading purposes only when the damage is distinctly apparent and of such character as to be recognized as damaged for commercial purposes.

TYPES OF BARLEY DAMAGE.

Blight-Damaged Kernels. Kernels and pieces of barley kernels which are covered by at least one-third or more of blight. Blight discolorations should not be confused with badly stained, weathered, or water-stained kernels. Designate barley containing more than 4.0 percent of blight damaged kernels as "Blighted" (Section 2.23, "Blighted Barley"). (VRI – B - 1.0 Blight Damage)

Frost-Damaged Kernels. Kernels and pieces of barley kernels, other grains, and wild oats that are badly shrunken and/or distinctly discolored black, brown, or green by frost. (VRI – B - 3.1 Frost Damage)

Germ-Damaged Kernels. Kernels and pieces of barley kernels, other grains, and wild oats that have dead or discolored germ ends. Germ-damaged kernels are kernels and pieces of barley kernels in which the germ is discolored by heat or mold as a result of respiration. This includes barley injured-by-heat. (VRI – B - 4.0 Germ Damage (Discolored and/or Mold))

Note: After other damages are determined and removed on the 25-gram portion, germ damage can be determined by pearling the portion for approximately two seconds, which does not affect the assessment and dramatically reduces the analytical time. Reweigh the pearled portion before determining germ damage.

Heat-Damaged Kernels. Kernels and pieces of barley kernels, other grains, and wild oats that are materially discolored and damaged by heat. The determination for heat-damaged kernels is made on a 50-gram pearled portion. For procedures for determining heat-damaged kernels, refer to Section 2.22, "Malting Factors." (VRI – B - 5.1 Heat Damage)

Note: When determining heat-damaged or injured-by-heat barley, if inspectors cannot tell whether the affected kernel is blue or white aleurone layer, use the White Aleurone Barley kernel VRI.

Malt-Damaged Kernels. Kernels and pieces of barley kernels which have undergone the malting process and show any degree of sprout.

Mold-Damaged Kernels. Kernels and pieces of barley kernels, other grains, and wild oats that are weathered and contain considerable evidence of mold. Mold-damaged kernels are characterized by black or grayish spots or blotches on one or both sides of the kernel. Designate barley that contains more than 4.0 percent of blight damaged kernels as "Blighted" (Section 2.23, "Blighted Barley"). (VRI – B - 1.1 Mold Damage)

Mold-like Substance. Whole kernels of barley which are 50 percent or more covered and pieces of kernels which are discolored and covered with a mold-like substance.

Sprout-Damaged Kernels. Kernels and pieces of barley kernels, other grains, and wild oats which have sprouted or which have swelling over the germ and after examination show sprout. Kernels in which the sprout has broken off and is left as a socket are counted as sprout-damaged. (VRI – B - 8.0 Sprout Damage)

Weevil or Insect-Bored. Kernels and pieces of barley kernels, other grains, and wild oats which have been bored or tunneled by insects. (VRI – B - 6.0 Insect-Bored)

Certification. Record the percent of damaged kernels on the work record and "Results" section of the certificate to the nearest tenth percent. If the percent damaged kernels is less than the percent heat, the percent damaged kernels must be adjusted to equal the percent heat.

2.25 FOREIGN MATERIAL

Definition. *All matter other than barley, other grains, and wild oats that remains in the sample after the removal of dockage.*

Basis of Determination. Determine foreign material (FM) on a dockage-free portion of 25 grams.

Certification. Record the percent of foreign material on the work record and "Results" section of the certificate to the nearest tenth percent.

2.26 OTHER GRAINS

Definition. *Black barley, corn, cultivated buckwheat, einkorn, emmer, flaxseed, guar, hull-less barley, nongrain sorghum, oats, Polish wheat, popcorn, poulard wheat, rice, rye, safflower, sorghum, soybeans, spelt, sunflower seed, sweet corn, triticale, and wheat.*

Additionally, canola, oat groats, and hull-less oats are also considered as other grains.

Basis of Determination. Determine other grains (OG) on a dockage-free portion of 25 grams.

Other grains are a grade determining factor in the subclasses Six-rowed Malting barley and Two-rowed Malting barley. Other grains are deducted from the percent of sound barley in all subclasses of barley.

Note: Score damaged other grains against damaged kernels and other grains but only once against sound barley.

Certification. When applicable, record the percent of other grains on the work record and "Results" section of the certificate to the nearest tenth percent.

2.27 WILD OATS

Definition. *Seeds of Avena fatua L. and A. sterilis L.*

Basis of Determination. Determine wild oats (WO) on a dockage-free portion of 25 grams.

Wild oats are usually identified by their slender kernels with twisted awns (so called "sucker mouths") and basal hairs or bristles on the germ end of the kernel.

Wild oats are a grade determining factor in the subclasses Six-rowed Malting barley and Two-rowed Malting barley. Wild oats are deducted from the percentage of sound barley in all subclasses of barley. (VRI – O.F. - 28.0 Wild Oats)

Certification. When applicable, record the percent of wild oats on the work record and "Results" section of the certificate to the nearest tenth percent.

2.28 SOUND BARLEY

Definition. *Kernels and pieces of barley kernels that are not damaged.*

Basis of Determination. Determine sound barley (SBLY) on a dockage-free portion of 25 grams.

Sound barley includes:

a. Skinned and broken kernels of barley which are not damaged;

b. Broken kernels which are not damaged;

c. Green immature kernels of barley not otherwise damaged;

d. Kernels which are considered injured-by-frost and/or injured-by-mold.

Sound barley does not include damaged kernels of barley and material other than barley.

The sum of the percent of damaged kernels, foreign material, other grains, and wild oats subtracted from 100 percent equals the percent of sound barley.

Certification. Record the percent of sound barley on the work record and "Results" section of the certificate to the nearest tenth percent.

2.29 SKINNED AND BROKEN KERNELS

Definition. *Barley kernels that have one-third or more of the hull removed, or that the hull is loose or missing over the germ, or broken kernels, or whole kernels that have a part or all of the germ missing.*

Basis of Determination. Determine skinned and broken kernels (SKBN) on a dockage-free portion of 25 grams.

Skinned and broken kernels is a grade determining factor in the subclasses Six-rowed Malting barley and Two-rowed Malting barley.
(VRI – (B) O.F. - 2.1 Skinned and Broken)

Certification. In the subclasses Six-rowed Malting barley, Two-rowed Malting barley, or when barley does not meet the requirements for malting because it exceeds the limit for skinned and broken kernels, record the percent of skinned and broken kernels on the work record and "Results" section of the certificate to the nearest tenth percent.

2.30 BROKEN KERNELS

Definition. *Barley with more than 1/4 of the kernel removed.*

Basis of Determination. Determine broken kernels (BN) on a dockage-free portion of 25 grams.

Broken kernels are a grade determining factor in the class Barley.

Certification. When applicable, record the percent of broken kernels on the work record and "Results" section of the certificate to the nearest tenth percent.

2.31 CLASS AND SUBCLASS

Barley is divided into two classes: (a) Malting barley (MB) and (b) Barley (BLY). Each class is divided into subclasses as follows:

a. *Malting barley is divided into the following two subclasses:*

(1) *Six-rowed Malting Barley. Barley that has a minimum of 95.0 percent of a six-rowed suitable malting type that contains not more than 1.9 percent injured-by-frost kernels, 0.4 percent frost-damaged kernels, 0.2 percent injured-by-heat kernels, 0.1 percent heat-damaged kernels 1.9 percent injured-by-mold kernels, and 0.4 percent mold-damaged kernels. Six-rowed Malting barley must not be infested, blighted, ergoty, garlicky, or smutty as defined in § 810.107(b) and § 810.206.*

(2) *Two-rowed Malting Barley. Barley that has a minimum of 95.0 percent of a two-rowed suitable malting type that contains not more than 1.9 percent injured-by-frost kernels, 0.4 percent frost-damaged kernels, 0.2 percent injured-by-heat kernels, 0.1 percent heat-damaged kernels, 1.9 percent injured-by-mold kernels, and 0.4 percent mold-damaged kernels. Two-rowed Malting barley must not be infested, blighted, ergoty, garlicky, or smutty as defined in § 810.107(b) and § 810.206 of the regulations, as amended.*

b. *Barley. Any barley of six-rowed or two-rowed type. The class Barley is divided into the following three subclasses:*

(1) *Six-rowed Barley. Any Six-rowed barley that contains not more than 10.0 percent two-rowed varieties.*

(2) *Two-rowed Barley. Any Two-rowed barley with white hulls that contains not more than 10.0 percent six-rowed varieties.*

(3) *Barley. Any barley that does not meet the requirements for the subclasses Six-rowed barley or Two-rowed barley.*

Basis of Determination. Determine the class and subclass of barley by examining kernel and varietal characteristics on a dockage-free portion of 25 grams.

Two-rowed and Six-rowed Kernel Characteristics.

Two-rowed barley (TRB) is usually characterized by plump symmetrical kernels with tight creases straight down the center of the kernels. Two-rowed barley often has a slightly wrinkled skin that is generally thinner than the skin of Six-rowed barley. (VRI – (B) O.F. - 2.3 Two-rowed and Six-rowed)

Six-rowed barley (SRB) is usually characterized by long, irregularly shaped kernels. The germs and creases in most Six-rowed barley kernels are twisted with the crease flaring open at the end of the kernel. Some kernels, however, have germs and creases which are straight. (VRI – (B) O.F. - 2.3 Two-rowed and Six-rowed)

The above characteristics vary somewhat with growing conditions but, as a whole serve as an index of the differences between Two-rowed and Six-rowed barley.

Suitable Malting Type/Subclass.

The subclass Six-rowed Malting barley (SRMB) may contain no more than 3.0 percent of other subclasses in grades U.S. Nos. 1 and 2, and no more than 5.0 percent of other subclasses in grades U.S. No. 3 and 4.

The subclass Two-rowed Malting barley (TRMB) may contain no more than 3.0 percent of other subclasses in grades U.S. Nos. 1 and 2, and no more than 5.0 percent of other subclasses grades U.S. No. 3 and 4.

Applicants for service may request barley be graded under the Malting Barley Standards (Table 2.1 – Grades and Grade Requirements for Six-Rowed Malting Barley and Table 2.2 – Grades and Grade Requirements for Two-Rowed Malting Barley) or the Barley standards (Table 2.3 – Grades and Grade Requirements for Barley). If not requested, grade barley under the class Barley.

Certification. For the subclasses Six-rowed Malting barley and Two-rowed Malting barley, record the percent of suitable malting type on the work record and "Results" section of the certificate to the nearest tenth percent.

2.32 OFFICIAL CRITERIA

Official criteria factors are determined only upon request and do not affect the grade designation.

a. Kernel Texture. As of August 1, 2018, kernel texture is no longer a grading factor for Six-rowed Malting barley. Upon the applicant's request, make a determination of white and blue aleurone layers in the class Malting barley as an official criteria factor.

Basis of Determination. Determine kernel texture on a dockage-free portion of 50 grams.

(1) Pour the 50-gram portion into the pearler.

(2) Set the timer for a "1/3 pearl" and turn pearler on.

(3) After pearling, reweigh and then examine the kernels for texture.

Do not consider foreign material, other grains, or wild oats when determining kernels with white or blue aleurone layers.

Note: Any amount of blue on the kernel after the "1/3 pearl" is considered blue aleurone barley when determining kernel texture.

Certification. Upon request, record the percent of kernels with white and blue aleurone layers on the work record and "Results" section of the certificate to the nearest tenth percent.

b. Injured-by-sprout. Injured-by-sprout is an official criteria factor that is determined only upon request and does not affect the grade designation. The factor injured-by-sprout is not considered as a grading factor and is provided for informational purposes only. Therefore, it is not included in total damaged kernels or scored against sound barley determinations.

Basis of Determination. Perform the injured-by-sprout (IBS) analysis on the basis of a representative portion of approximately 55 grams (dockage-free) of barley that has been pearled with a standardized pearler. Standardized pearlers must be used in this procedure in order to achieve the appropriate amount of hull removal.

If a pearler has already been approved for official use, it is not necessary to re-standardize it. However, it is necessary to establish the injured-by-sprout pearling time for that particular pearler.

Determining Injured-by-Sprout Pearling Time.

(1) To calculate injured-by-sprout pearling time, multiply the standardized "full pearl" time by 1/5.

Example: If the established standardized pearling time for a particular FGIS-approved pearler is 90 seconds, the corresponding injured-by-sprout pearling time is calculated at 18 seconds (90 x 1/5).

Note: Actual injured-by-sprout pearling time may deviate by ± 1 second. Using the example above, the acceptable injured-by-sprout pearling time is between 17 and 19 seconds.

(2) Record the injured-by-sprout pearling time on or near the pearler for quick reference.

Determining Injured-by-Sprout Kernels.

(1) Pour 55 grams of dockage-free barley into the barley pearler.

(2) Set the pearler timer for a "1/5 pearl."

(3) After pearling, examine the kernels for injured-by-sprout. From the pearled portion, consider kernels meeting the following definition as injured-by-sprout.

Whole or broken kernels which contain a sprout or sprout socket or whole and broken kernels with ⅔ or more of the embryo (germ) missing. Do not include broken kernels in which the germ area has broken off and the remaining kernel is less than ⅔ of a whole kernel. (VRI – (B) O.F. - 2.4 Injured-by-Sprout)

(4) Determine the percent of injured-by-sprout kernels by weighing the injured-by-sprout kernels and dividing by the weight of the original (unpearled) analytical portion.

Certification. Upon request, record the percent of injured-by-sprout kernels on the work record and "Results" section of the certificate to the nearest tenth percent.

CHAPTER 3:
CANOLA

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3.1 GENERAL ORDER OF PROCEDURES

The breakdown and inspection for Canola are listed below in the following chapter according to its general order. The order of procedure may slightly vary depending on the quality of the canola and the tests requested. More information is available on the Agricultural Marketing Service Website (AMS), in the U.S. Standards for Canola, and the Board of Appeals and Review (BAR) Questions and Answers.

The inspection process provides various factor information used to determine grade and to provide further information on the condition or quality of canola. Each section of this chapter provides details on recording factor information. If requested by the applicant for inspection, additional information may be provided (e.g., an exact count on stones in addition to the percent by weight or a percent for a specific type of damage). Furthermore, applicants may request the percent of erucic acid, the amount of glucosinolates, and the percent of oil.

3.2 DEFINITION OF CANOLA

Definition. *Seeds of the genus Brassica from which the oil shall contain less than 2 percent erucic acid in its fatty acid profile and the solid component shall contain less than 30.0 micromoles of any one or any mixture of 3-butenyl glucosinolate, 4-pentenyl glucosinolate, 2-hydroxy-3-butenyl, or 2-hydroxy-4-pentenyl glucosinolate, per gram of air-dried, oil free solid. Before the removal of dockage, the seed shall contain not more than 10.0 percent of other grains for which standards have been established under the United States Grain Standards Act.*

Other grains for which standards have been established are barley, corn, flaxseed, oats, rye, sorghum, soybeans, sunflower seed, triticale, and wheat.

Rapeseed is a complex crop including not one but three botanical species, *Brassica napus* L., *B. campestris* L., and *B. juncea* L. Moreover, the botanical classification has become even more complicated due to the genetic altering of these species to create new varieties with varying levels of erucic acid and glucosinolates.

Currently, there are rapeseed varieties with levels of high erucic acid and low glucosinolates (HEAR/LG), high erucic acid and high glucosinolates (HEAR/HG), low erucic acid and high glucosinolates (LEAR/HG), and low erucic acid and low glucosinolates (LEAR/LG). Some specific types of LEAR/LG varieties are known as canola.

Basis of Determination. Conduct a visual appraisal and glucosinolate analysis (if necessary) to determine if the sample meets the definition of canola. A glucosinolate analysis is mandatory for all export shipments, regardless of carrier type, and is optional (requested by the applicant for service or deemed necessary by the inspector grading the sample) for domestic lots and submitted samples.

a. Visual Appraisal. Analyze the sample as a whole. If further visual analysis is needed, use 25 grams before the removal of dockage. To aid in seed identification, use photographs and reference samples provided by the FGIS Board of Appeals and Review.

b. Glucosinolates (GLUC). Screen samples to determine whether the seed contains less than 30 micromoles of glucosinolates. Use a 300-gram dockage-free sample for this analysis. For more information, refer to Section 3.21, "Glucosinolates."

   Applicants may request that the glucosinolate content be quantitatively determined using a gas chromatography (GC) method at the FGIS Technology and Science Division (TSD). Details are provided in Section 3.22, "Official Criteria." The GC analysis is independent of the grade. Final grading of the sample *should not* be delayed pending the GC result.

c. Erucic Acid (ERC). The definition of canola also includes a maximum limit on erucic acid. A quick, reliable erucic acid test, suitable for grading purposes, is not available. FGIS will randomly select market samples of canola for verification testing.

   Applicants may request analysis for erucic acid content at the TSD. Details are provided in Section 3.22, "Official Criteria." This analysis is independent of the grade. Final grading of the sample *should not* be delayed pending the erucic acid result.

Certification. Grade the seed as canola if it meets the canola definition as described above. If the seed does not meet the definition of canola (e.g., high glucosinolate or erucic acid levels or more than 10.0 percent of other grains), examine it further to determine if it is:

a. Another grain for which standards have been established; or

b. Not Standardized Grain (NSG). No further analysis is necessary on a sample designated as NSG unless a specific factor test is requested.

If the sample is not tested for erucic acid content, use the statement "Erucic acid content not determined." in the "Remarks" section of the official certificate.

Certification details are provided in Section 3.21, "Glucosinolates," and Section 3.22, "Official Criteria," for those instances when an applicant requests quantitative analyses for glucosinolates and/or erucic acid.

3.3 GRADES AND GRADE REQUIREMENTS

There are no classes or subclasses in canola. Canola is divided into three numerical grades and U.S. Sample Grade. Special grades emphasize qualities or conditions affecting the value and are added to and made a part of the grade designation. Special grades do not affect the numerical or sample grade designation.

TABLE 3.1 – GRADES AND GRADE REQUIREMENTS FOR CANOLA

Grade	Maximum Limits of -							
	Damaged Kernels			Conspicuous Admixture				Inconspicuous Admixture (percent)
	Heat Damaged (percent)	Distinctly Green (percent)	Total (percent)	Ergot (percent)	Sclerotinia (percent)	Stones (percent)	Total (percent)	
U.S. No. 1	0.1	2.0	3.0	0.05	0.05	0.05	1.0	5.0
U.S. No. 2	0.5	6.0	10.0	0.05	0.10	0.05	1.5	5.0
U.S. No. 3	2.0	20.0	20.0	0.05	0.15	0.05	2.0	5.0

U.S. Sample Grade is Canola that:

a. Does not meet the requirements for grades U.S. No. 1, 2, 3; or

b. Contains 1 or more pieces of glass, 2 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), or 4 ormore pieces of animal filth; or

c. Has a musty, sour, or commercially objectionable foreign odor; or

d. Is heating or otherwise of distinctly low quality.

3.4 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in Table 3.1 – Grades and Grade Requirements for Canola. Use the following guidelines when assigning grades:

a. The letters "U.S.";

b. The abbreviation "No." and the number of the grade or the words "Sample Grade";

c. The words "or better" when applicable;

d. The word "Canola";

e. The applicable special grade(s) in alphabetical order;

f. The word "Dockage" and the percentage thereof.

3.5 SPECIAL GRADES

Special grades draw attention to unusual conditions in the grain and are made part of the grade designation. The special grades and special grade requirements for canola are shown in the United States Standards for Canola. Details for determining special grades are included in referenced sections. Definitions and examples of the designations for special grades in canola are:

a. Garlicky Canola. Canola that contains more than two green garlic bulblets or an equivalent quantity of dry or partly dry bulblets in approximately a 500-gram portion. (Section 3.11)

Example: U.S. No. 2 Canola, Garlicky, Dockage 7.5%

b. Infested Canola. Canola that is infested with live weevils or other live insects injurious to stored grain. (Section 3.12)

Example: U.S. No. 2 Canola, Infested

3.6 OPTIONAL GRADE DESIGNATION

The Official U.S. Standards for Grain provide for an optional grade designation, commonly referred to as "or better." Upon the request of an applicant, certify canola as U.S. No. 2 or better or U.S. No. 3 or better. An "or better" grade designation cannot be applied to a U.S. No. 1 grade designation.

Example: U.S. No. 3 or better Canola

3.7 BASIS OF DETERMINATION

Distinctly Low Quality. The determination of distinctly low quality is made on the basis of the lot as a whole at the time of sampling when a condition exists that may or may not appear in the representative sample and/or the sample as a whole.

Certain Quality Determinations. Each determination of rodent pellets, bird droppings, other animal filth, broken glass, castor beans, cockleburs, crotalaria seeds, dockage, garlic, live insect infestation, large stones, moisture, temperature, an unknown foreign substance(s), and a commonly recognized harmful or toxic substance(s) is made on the basis of the sample as a whole. When a condition exists that may not appear in the representative sample, the determination may be made on the basis of the lot as a whole at the time of sampling according to procedures prescribed in FGIS instructions.

All Other Determinations. Each determination of conspicuous admixture, ergot, sclerotinia, stones, damaged kernels, heat-damaged kernels, distinctly green kernels, and inconspicuous admixture is made on the basis of the sample when free from dockage.

Other determinations not specifically provided for under the General Provisions are made on the basis of the sample as a whole, except the determination of odor is made on either the basis of the sample as a whole or the sample when free from dockage. The content of glucosinolates and erucic acid is determined on the basis of the sample according to procedures prescribed in FGIS instructions.

TABLE 3.2 – BASIS OF DETERMINATION

Lot as a Whole	Factors Determined Before the Removal of Dockage	Factors Determined After the Removal of Machine Separated Dockage	Factors Determined After the Removal of Machine Separated Dockage and Conspicuous Admixture
Distinctly Low Quality	Distinctly Low Quality	Conspicuous Admixture	Damaged Kernels (Total)
Heating	Garlicky	Ergot	Distinctly Green Kernels
Infested	Heating	Erucic Acid Content	Heat-Damaged Kernels
Odor	Infested	Glucosinolates	Inconspicuous Admixture
	Kind of Grain	Odor	Odor
	Moisture	Oil	
	Odor	Sclerotinia	
	Sample Grade Criteria	Stones	

3.8 HEATING

Basis of Determination. Determine heating (HTG) on evidence obtained at the time of sampling or on the basis of the sample as a whole.

Canola developing a high temperature from excessive respiration is considered heating. Heating canola, in its final stages, will usually have a sour or musty odor. Do not confuse canola that is heating with canola that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

Certification. When applicable, show the term “Heating” on the work record and “Results” section of the certificate, and grade the canola “U.S. Sample Grade.”

3.9 ODOR

Basis of Determination. Determine odor on evidence obtained at the time of sampling or on the sample either before or after the removal of dockage.

TABLE 3.3 – ODOR CLASSIFICATION EXAMPLES

Musty	Sour	Commercially Objectionable Foreign Odors	
Ground Insect Moldy	Boot Fermenting Insect (acrid) Pigpen Smoke[1]	Animal Hides Decaying Animal Fertilizer Fumigant Insecticide	Oil Products Skunk Smoke Strong Weed Vegetable Matter
[1] Smoke odors are considered sour only in canola, flaxseed, soybeans, and sunflower seed.			

Odors from Heat-Damaged Canola. When heat-damaged kernels are present, canola gives off an odor very similar to smoke. Canola containing a "smoke" odor is considered as having a "sour" odor unless evidence of a fire-burnt material is present in the lot or the original sample. If evidence of a fire-burnt material is present in the lot or the sample, the smoke odor is considered a commercially objectionable foreign odor.

Commercially objectionable foreign odors (COFO) are odors foreign to grain that render it unfit for normal commercial usage.

Fumigant, insecticide, or fungicide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of canola contains a fumigant, insecticide, or fungicide odor that prevents a determination as to whether any other odor(s) exists, apply the following guidelines:

a. Original Inspections. Allow the work portion to aerate in an open container for 4 hours, or less, if the odor dissipates in less time.

b. Reinspections, Appeal, and Board Appeal Inspections. Allow unworked file samples and new samples to aerate in an open container for 4 hours, or less, if the odor dissipates in less time. The 4-hour aeration requirement does not apply when the original work portion was aerated and retained as the final file.

Consider the sample as having a commercially objectionable foreign odor if the fumigant, insecticide, or fungicide odor persists based on the above criteria.

Final Determination. The inspector is responsible for making the final determination for all odors. Whenever possible, use a consensus of experienced licensed inspectors on samples containing marginal odors. Under the consensus approach, if a clear majority (at least 2/3) of inspectors agree the sample contains a Musty, Sour, or COFO odor, grade the canola "U.S. Sample Grade." The consensus approach is not required if the initial inspector does not detect an odor or a distinct odor is detected.

Certification. Grade canola containing a "*distinct"* musty, sour, or commercially objectionable foreign odor as "U.S. Sample Grade." Record the words "Musty," "Sour," or "Commercially Objectionable Foreign Odor" on the work record and "Results" section of the certificate.

3.10 MOISTURE

Definition. *Water content in grain as determined by an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine moisture before the removal of dockage on a portion of approximately 500 grams.

The procedures for performing a moisture determination using a FGIS approved moisture instrument utilizing the proper calibrations are described in the Moisture Handbook and in Chapter 1, General Information.

Certification. Record the percent of moisture on the work record and "Results" section of the certificate to the nearest tenth percent.

3.11 GARLICKY CANOLA

Definition. *Canola that contains more than two green garlic bulblets or an equivalent quantity of dry or partly dry bulblets in approximately a 500-gram portion.*

Basis of Determination. Determine garlicky (GAR) before the removal of dockage on a work portion of 500 grams. (VRI – O.F. - 13.0 Green Garlic Bulbs (Whole) and O.F. - 13.1 Dry Garlic Bulbs (1/3rd))

Characteristics of Bulblets.

a. Green garlic bulblets are bulblets which have retained all of their husks intact.

b. Dry or partly dry garlic bulblets are bulblets which have lost all or part of their husks. Consider bulblets with cracked husks as dry.

c. Three dry or partly dry garlic bulblets are equal to one green bulblet.

Note: Garlic bulblets apply in the determination of "Garlicky" but also function as foreign material.

Wild onion, sometimes referred to as "crow garlic", is considered as garlic.

Certification. When applicable, grade the canola "Garlicky" on the grade line of the certificate in accordance with Section 3.5, "Special Grades." Record the number of garlic bulblets in whole numbers or in decimals to the nearest hundredths position (e.g., 1/3 = 0.33 or 2/3 = 0.67) on the work record and "Results" section of the certificate.

3.12 INFESTED CANOLA

Canola that is infested with live weevils (LW) or other live insects injurious to stored grain (OLI).

The presence of any LW or OLI found in the work sample indicates the probability of infestation and warns that the canola must be carefully examined to determine if it is infested. In such cases, examine the work sample and the file sample before reaching a conclusion as to whether or not the canola is infested. Do not examine the file sample if the work portion is insect free.

LW include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. OLI include grain beetles, grain moths, and larvae. To further define "other insect injurious to stored grain" refer to the Stored-Grain Insect Reference. Images of insects may also be viewed on the AMS website.

Basis of Determination. Determine infestation on the lot as a whole and/or before the removal of dockage on 500 grams. For insect tolerances, refer to Table 3.4 – Insect Infestation.

TABLE 3.4 – INSECT INFESTATION

Samples meeting or exceeding any one of these tolerances are infested: ***2 LW, or 1 LW + 5 OLI, or 10 OLI***		
1,000-gram representative sample[1] (+ file sample if needed)	**Lot as a Whole (Stationary)**	**Online Sample (In-Motion)[2]**
Submitted Samples Probed Lots D/T Sampled Land Carriers	Probed Lots (at time of sampling)	Railcars under the Cu-sum Subsamples for Sacked Grain Lots Components for Bargelots[3] Components for Shiplots[3]

[1] Examine work portion and file sample if necessary. Do not examine file sample if work portion is insect free.

[2] Minimum sampling rate is 500 grams per 2,000 bushels.

[3] Minimum component size is 10,000 bushels.

Key: LW = Live Weevil, OLI = Other Live Insects injurious to stored grain

Certification. When applicable, grade the canola "Infested" on the grade line of the certificate in accordance with Section 3.5, "Special Grades." Record the number of live weevils and/or other live insects injurious to stored grain on the work record and "Results" section of the certificate.

3.13 DISTINCTLY LOW QUALITY

Consider canola distinctly low quality when it is obviously of inferior quality and the existing grade factors or guidelines do not accurately reflect the inferior condition.

Basis of Determination. Use all available information to determine whether the canola is of distinctly low quality (DLQ). This includes a general examination of the canola during sampling and an analysis of the obtained sample(s).

a. Diatomaceous Earth (DIAT). Canola suspected of containing DIAT is considered DLQ unless the applicant specifically requests an examination to verify the presence of DIAT. If the laboratory examination verifies that the canola contains DIAT, then the canola is not considered DLQ due to DIAT. For additional information regarding the testing of canola for diatomaceous earth, refer to Directive 9180.49, "Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel."

b. Flood Damaged Grain. Canola that is materially affected by flooding is considered DLQ and certified as "U.S. Sample Grade". In addition, official personnel must report identifiable lots that are DLQ to the district Food and Drug Administration (FDA) office as "actionable" in accordance with FGIS-PN-19-04, "Inspection of Flood Damaged Grain".

   The determination of DLQ is based on the appearance and condition of the lot or sample as a whole. Evaluate canola affected by flooding on a portion of approximately 400 grams with the use of the ILP – All Grains/Graded Commodities - Inspection of Flood Damaged Grain. If a sample does not meet the requirements for DLQ, but the kernels are materially damaged (stained) by flooding, consider the kernels as damaged and count toward the total percentage of damaged kernels in the sample.

c. Large Animal Excreta (LGANX). Canola containing one or more large animal excreta (e.g., deer or elk pellet) is considered DLQ.

d. Large Debris. Canola containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris which are visible to the sampler but are too large to enter the sampling device is considered DLQ.

e. Other Unusual Conditions. Canola that is obviously affected by other unusual conditions which adversely affect the quality of the canola and cannot be properly graded by use of the grading factors specified or defined in the standards is considered DLQ.

Certification. When applicable, show the factor DLQ and the reason(s) why on the work record and "Results" section of the certificate, and grade the canola "U.S. Sample Grade."

3.14 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine U.S. Sample Grade criteria, except for stones, before the removal of dockage based on a work portion of 500 grams.

Table 3.5 – U.S. Sample Grade Criteria shows the criteria and corresponding Visual Aids, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, or bulgur), or feed pellets in grain as foreign material not "unknown foreign substance." Unidentifiable materials or material unrelated to grain must function as "unknown foreign substance (FSUB)."

TABLE 3.5 – U.S. SAMPLE GRADE CRITERIA

Criteria	Visual Aids	Number/Weight[1]	
		Sample Basis	Lot Basis[2]
Any Numerical Grading Factor		Excess of limit for U.S. No. 3	N/A
Animal Filth	Animal Filth	4 or more	N/A
Glass		1 or more	N/A
Odor		Presence	N/A
Unknown Foreign Substances[3]	Fertilizer	2 or more	N/A
Heating		Presence	Presence
Large Debris*		N/A	2 or more
Other Unusual Conditions*		Presence	Presence

[1] Record count factors to the nearest whole number.

[2] The entire sample of a submitted sample is considered as the lot.

[3] Consider feed pellets and processed grain products as foreign material, not unknown foreign substance.

* For Distinctly Low Quality, refer to Section 3.13.

Certification. Grade canola "U.S. Sample Grade" when one or more of the limits in Table 3.5 – U.S. Sample Grade Criteria are observed. Record the factors (count factors to the nearest whole number) on the work record and "Results" section of the certificate.

3.15 DOCKAGE AND CONSPICUOUS ADMIXTURE

a. Dockage (DKG).

a. All material removed by aspiration;

b. Coarse material, except threshed and sprouted kernels of canola, that passed over the riddle; and

c. Material that passed through the Number 4 sieve, except for small whole and broken pieces of canola which are reclaimed.

b. Conspicuous Admixture (CADM). All matter other than canola, including but not limited to bedstraw, ergot, pennycrest, sclerotinia, and stones, which is conspicuous and readily distinguishable from canola and which remains in the sample after the removal of machine separated dockage which, if necessary, includes any dockage removed by the use of an appropriate hand sieve(s).

The adjusted percentage of conspicuous admixture is added to the percentage of machine separated dockage in the calculation of total dockage (refer to the example at the end of this section).

Basis of Determination. Determine dockage in canola on 250 grams cut from the original sample.

Procedure. The procedure for determining conspicuous admixture and dockage is performed in two steps: machine cleaning (Carter Dockage Tester and mechanical shaker) and handpicking.

Note: Canola contains a high oil content and may gum sieves and other equipment. Care should be taken to clean all equipment. Mild soapy water and/or Alconox lab detergent have been found to be effective for cleaning the equipment.

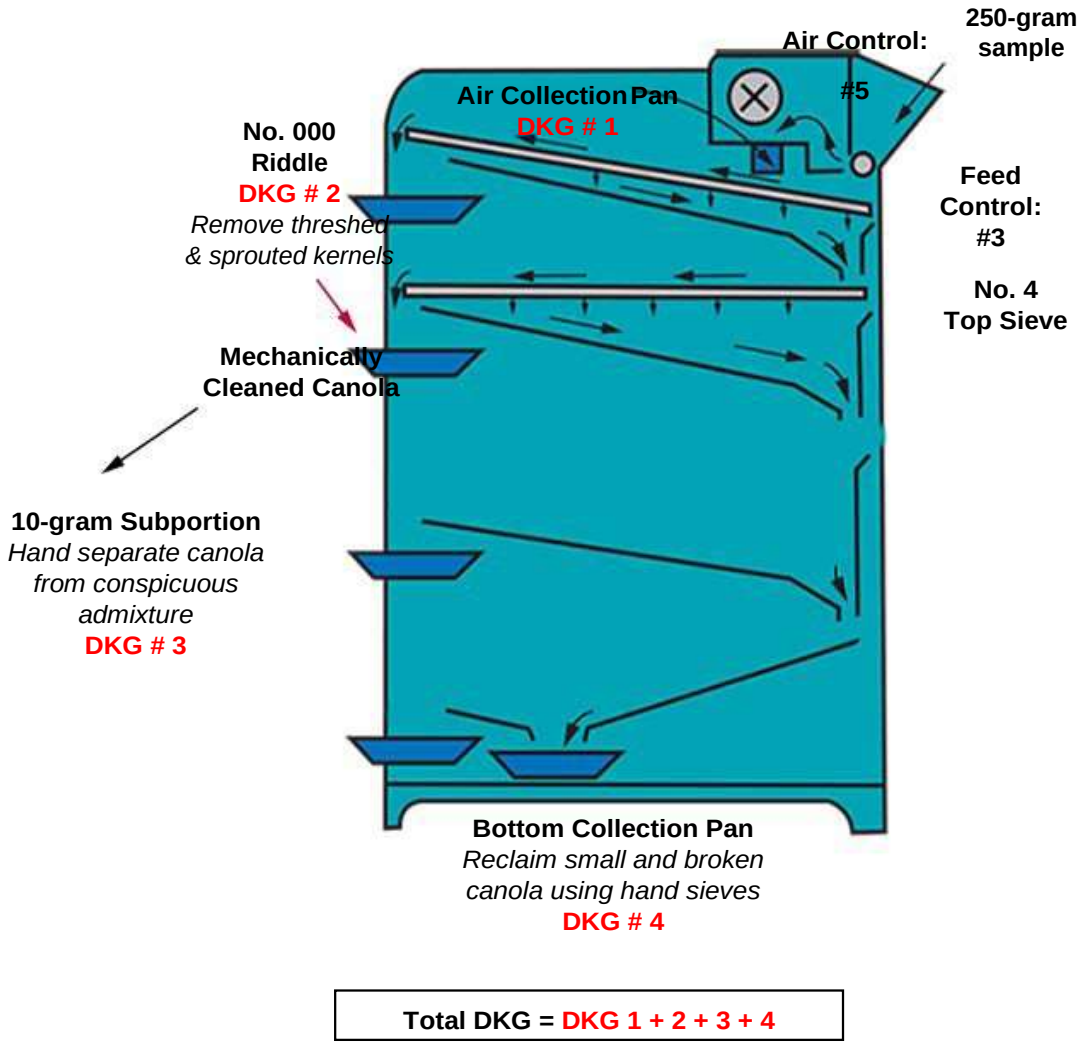

FIGURE 3.1 – PROCEDURE FOR DETERMINING DOCKAGE

Carter Dockage Tester (Mechanical Separation).

a. Set the air control to 5 and the feed control to 3

b. Insert the No. 000 riddle in the riddle carriage.

c. Insert a No. 4 sieve in the top sieve carriage.

d. There is no sieve in the middle or bottom sieve carriages.

e. Start the Carter Dockage Tester and pour sample into feed hopper.

f. Return any kernels that are caught in the riddle to the cleaned portion.

g. Return threshed and separated canola from material over the riddle and add to cleaned canola.

Reclaim Seed.

a. Sieve Sizes. Use sieves which achieve maximum cleanout of weed seeds and similar foreign material with a minimum loss of canola.

(1) Material Over No. 4 Sieve. Visually examine the material that passed over the No. 4 sieve. If the sample contains wheat, buckwheat, weed seeds, or similar foreign material, use a round-hole sieve (5/64, 5.5/64, 6/64, 6.5/64, or 7/64 inch (or larger) as an aid to separate the material from the canola. Return the canola passing through and remaining on top of the round-hole sieve to the clean sample.

(2) Material Through No. 4 Sieve. Use the .035 x 15/32-inch slotted sieve to reclaim material through the No. 4 sieve. (Upon request, a .028 x 15/32 or .0395 x 15/32-inch slotted-hole sieve may be used. When a requested sieve is used, record the sieve size in the "Remarks" section of the certificate.) Return the material remaining on the slotted-hole sieve(s) and in the perforations to the clean sample and *all material* passing through the slotted-hole sieve to the dockage.

Note: Handpicking the material passing through the slotted-hole sieve is not required.

b. Sieve the material (30 strokes) that passed through the No. 4 sieve.

c. Determine dockage/clean canola.

Handpick (Conspicuous Admixture).

a. Combine the two mechanically cleaned portions.

b. Cut down the cleaned sample to a portion of not less than 10 grams.

c. Handpick the 10-gram portion for conspicuous admixture.

d. As part of conspicuous admixture, handpick ergot, sclerotinia, and stones (Section 3.16)

Final Calculation. Dockage now consists of all mechanically separated dockage (including any handsieved dockage if applicable) *and* conspicuous admixture (which is equivalent to handpicked dockage).

Calculating Dockage. All mechanically separated dockage (MDKG) (as removed by the Carter Dockage Tester, mechanical shaker, and hand sieves) is calculated on the basis of the sample as a whole. The percent of CADM (handpicked dockage), which is determined on the basis of the weight in grams of the portion used for the hand separation, must be multiplied by the fractional proportion of canola remaining after the removal of the MDKG.

Example: Dockage Calculation

Original sample weight	250 grams
Weight of mechanically separated dockage	24.70 grams
Weigh of handpicked portion	10.24 grams
Weight of handpicked dockage (conspicuous admixture)	0.20 grams

a. **(Weight of Dockage ÷ original sample weight) x 100**
= percent mechanically separated dockage.
(24.70g ÷ 250g) x 100 = 9.88% mechanically separated dockage.

b. **(100 percent - percent mechanically separated dockage) ÷ 100**
= change of base factor.
(100% - 9.88%) ÷ 100 = 0.90 change of base factor.

c. **(Weight of handpicked separation, including ergot, sclerotinia, stones, and any other conspicuous admixture ÷ weight of handpicked sample) x 100**
= percent conspicuous admixture.
(0.20g ÷ 10.24g) x 100 = 1.95% conspicuous admixture.

d. **Percent conspicuous admixture x change of base factor**
= percent conspicuous admixture (adjusted)[1].
1.95 x 0.90 = 1.75% conspicuous admixture (adjusted).

e. **Percent conspicuous admixture (adjusted) + percent mechanically separated dockage**
= dockage (total).
1.75% + 9.88% = 11.63% dockage (total)
(add in hundredths) (rounded to 11.6%).

Certification. Record the word "Dockage" and the percent to the nearest tenth percent on the work record and grade line of the certificate. Also, record the percent of dockage in the factor results section of the certificate application, but do not include this result in the “Results” section of the certificate. Record the adjusted percent of conspicuous admixture to the nearest tenth percent on the work record and “Results” section of the certificate.

[1] Record the adjusted percentage of conspicuous admixture on the certificate.

3.16 ERGOT, SCLEROTINIA, AND STONES

Ergot. Hard, reddish-brown or black grain-like mass of certain parasitic fungi that replaces the kernels of certain grains. (VRI – O.F. - 12.0 Ergot)

Sclerotinia. Dark-colored black resting bodies of the fungi *Sclerotinia* and *Claviceps*. (VRI – O.F. - 32.0 Sclerotia)

Stones. Stones are concreted earthy or mineral matter and other substances of similar hardness that do not disintegrate in water.

Basis of Determination. Make the determination for ergot, sclerotinia and stones on the handpicked 10-gram portion used in the determination of conspicuous admixture after the removal of the machine separated dockage.

Calculate the percent of ergot, sclerotinia, and stones as follows:

Example: Ergot, Sclerotinia, and Stones Calculation

Weight of handpicked portion	10.24 grams
Weight of ergot	0.02 grams
Weight of sclerotinia	0.29 grams
Weight of stones	0.13 grams
Change of base factor	0.90

a. **(Weight of ergot ÷ weight of handpicked sample) x 100 = percent of ergot.**
(0.02g ÷ 10.24g) x 100 = 0.20% ergot.

Percent of ergot x change of base factor = percent of ergot (adjusted).
0.20 x 0.90 = 0.18% ergot (adjusted).

b. **(Weight of sclerotinia ÷ weight of handpicked sample) x 100 = percent of sclerotinia.**
(0.03g ÷ 10.24g) x 100 = 0.29% sclerotinia.

Percent of sclerotinia x change of base factor = percent of sclerotinia (adjusted).
0.29 x 0.90 = 0.26% sclerotinia (adjusted).

c. **(Weight of stones ÷ weight of handpicked sample) x 100 = percent of stones.**
(0.13g ÷ 10.24g) x 100 = 1.27% stones.

Percent of stones x change of base factor = percent of stones (adjusted).
1.27 x 0.90 = 1.14% stones (adjusted).

Certification. Record the percent of ergot, sclerotinia, and stones on the work record and "Results" section of the certificate to the nearest hundredth percent.

3.17 TEST WEIGHT

Definition. *The weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device according to procedures prescribed in FGIS instructions.*

Note: This factor is not provided for under the United States Standards for Canola but may be determined upon request.

Basis of Determination. Determine test weight (TW) after the removal of dockage on a representative portion of approximately 850 grams.

Note: Test weight may be performed before the removal of dockage on a representative portion of approximately 750 grams.

The procedures for performing a test weight determination are described in Chapter 1, General Information.

Certification. Record test weight results on the work record and "Results" section of the certificate to the nearest tenth of a pound. If requested, convert the pounds per bushel (lbs./bu) result to kilograms per hectoliter (kg/hl) using the following formula: lbs./bu x 1.287 = kg/hl and record in the "Remarks" section in whole and tenths.

3.18 PROCESSING THE WORK SAMPLE

At this point, all tests required to be performed prior to the removal of dockage have been completed. Also, the sample has been examined for certain sample grade and special grade factors. Now the work sample is ready to be divided into fractional portions for other determinations required after the removal of machine separated dockage.

Chart 3.1 – Dividing the Work Sample and Table 3.6 – Approximate Analytical Portion Sizes illustrate how the sample is divided into fractional parts using an approved divider.

CHART 3.1 – DIVIDING THE WORK SAMPLE

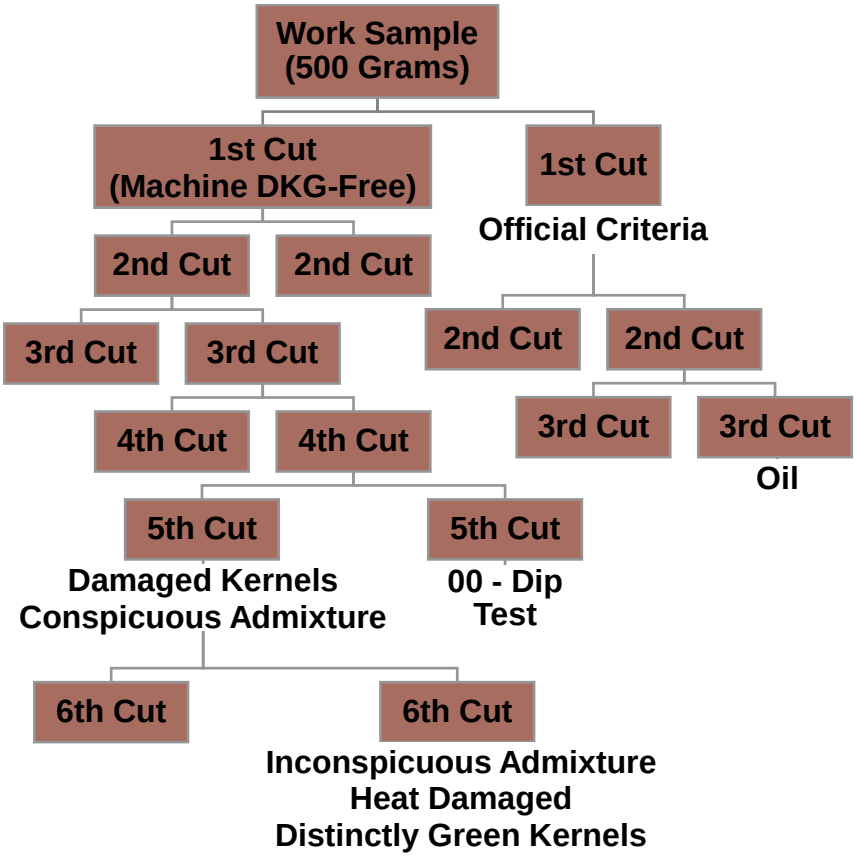

TABLE 3.6 – APPROXIMATE ANALYTICAL PORTION SIZES

Factors	Grams
Damaged Kernels	10
Heat-Damaged Kernels	5
Distinctly Green Kernels	5
Inconspicuous Admixture	5

3.19 DAMAGED KERNELS

Definition. *Canola and pieces of canola that are heat-damaged, sprout-damaged, mold-damaged, distinctly green-damaged, frost-damaged, rimed-damaged, or otherwise materially damaged.*

Basis of Determination. Determine the amount of damaged kernels (DKT) on a representative portion cut from the work sample after the removal of dockage and conspicuous admixture. Use the portion which was used for picking dockage and conspicuous admixture. This portion must be reweighed.

In general, consider canola to be damaged for inspection and grading purposes only when the damage is distinctly apparent and of such character as to be recognized as damaged for commercial purposes. Insect-bored kernels are not considered damaged.

TYPES OF CANOLA DAMAGE.

Distinctly Green Kernels. Canola and pieces of canola which, after being crushed, exhibit a distinctly green color. (VRI – Canola - 1.0 Distinctly Green)

Heat-Damaged Kernels. Canola and pieces of canola which, after being crushed, exhibit that they are discolored and damaged-by-heat. (VRI – Canola - 2.0 Heat Damage)

Procedure. The steps for determining the various damages are as follows:

a. Handpick the 10-gram portion (clean of dockage and conspicuous admixture) for distinctly shrunken or shriveled kernels (frost-damaged), kernels discolored by mold, rimed kernels (kernels that are completely covered with a whitish coloration), sprouted kernels, excessively weathered kernels, and any other kernels of canola that are distinctly damaged. These kernels are other-damaged kernels. (VRI – Canola - 3.0 Other Damage and Canola - 4.0 Sprout Damage)

b. Cut down the balance of the 10-gram portion to 5 grams.

c. Sprinkle the 5-gram portion across the damage seed counter to fill the 100-hole board (must be repeated five times) or once for the 500-hole board.

d. After each filling (total of 5 fillings when using the 100-hole board) and before crushing, tape and observe for inconspicuous admixture.[1]

[1] For more information, refer to Section 3.20, "Inconspicuous Admixture."

e. With a roller, crush the canola, examine the rows, and count the number of heat-damaged kernels, distinctly green kernels, and seeds that are obviously not canola, (inconspicuous admixture).

f. After the strip (all 5 strips when using the 100-hole board) has been crushed and kernels counted, calculate the percent of each type of damage.

Determine all percentages of damage, except for distinctly green and heat-damaged kernels, upon the basis of weight. Determine the percent of distinctly green and heat-damaged kernels on the basis of count.

Calculation. To calculate damaged kernels total, add the percent of distinctly green, heat-damaged, and other-damaged kernels of canola.

Example: Damaged Kernels Calculation

Weight of representative portion	10.04 grams
Weight of other-damaged kernels	0.10 grams
Number of non-canola kernels	10
Number of heat-damaged kernels	25
Number of distinctly green kernels	12

a. **(Weight of other-damaged kernels ÷ weight of representative portion) x 100**
= percent other-damaged kernels.
0.10g ÷ 10.04g = 0.0099 x 100 = 0.99% other-damaged kernels.

b. **500 - number of non-canola kernels**
= number of canola kernels.
500 - 10 = 490 canola kernels.

c. **(Number of heat-damaged kernels ÷ number of canola kernels) x 100**
= percent heat-damaged kernels.
25 kernels ÷ 490 kernels = 0.0510 x 100 = 5.10% heat-damaged kernels.

d. **(Number of distinctly green kernels ÷ number of canola kernels) x 100**
= percent distinctly green kernels.
12 kernels ÷ 490 kernels = 0.0244 x 100 = 2.44% distinctly green.

e. **Percent other-damaged kernels + percent heat-damaged kernels + percent distinctly green kernels**
= percent damaged kernels (total).
0.99% + 5.10% + 2.44% = 8.53% damaged kernels
(add in hundredths) (round to 8.5%).

Certification. Record the percent of heat-damaged kernels, distinctly green kernels, and damaged kernels (total) on the work record and “Results” section of the certificate to the nearest tenth percent.

3.20 INCONSPICUOUS ADMIXTUE

Definition. *Any seed which is difficult to distinguish from canola. This includes, but is not limited to, common wild mustard (Brassica kaber and B. juncea), domestic brown mustard (Brassica juncea), yellow mustard (B. hirta), and seed other than the mustard group.*

Basis of Determination. Make the determination for inconspicuous admixture (IADM) on the 5-gram portion used in the determination for heat-damaged and distinctly green kernels.

Prior to crushing, mark any seeds suspected of not being canola and observe with a dissecting scope or magnifying glass. Use the reference samples and photographs as an aid in identification.

Note: It is extremely important for inspectors to rely on a dissecting scope or a magnifying glass and the crushed strips for identification of IADM.

All electrical units must have a seal of approval from Underwriters Laboratory (U/L) or a similar testing laboratory.

Any seeds suspected of not being canola should be marked to be confirmed after crushing. After crushing, canola tends to be a golden yellow while crushed wild mustard is pale yellow to white and cow cockle is white. Lambs quarters also function as inconspicuous admixture.

Calculate the percent of inconspicuous admixture on the basis of count.

Example: 10 kernels ÷ 500 kernels = 0.02 x 100
= 2.0% inconspicuous admixture.

Certification. Record the percent of inconspicuous admixture on the work record and “Results” section of the certificate to the nearest tenth percent.

3.21 GLUCOSINOLATES

Testing for glucosinolates (GLUC) is accomplished through a screening process using a 00-Dip-Test developed at the Institute for Plant Breeding, University of Gottingen, Germany. This is a relatively quick process that can be conducted at the time of grading.

Basis of Determination. A glucosinolate analysis using the 00-Dip-Test is performed after the removal of machine-separated dockage on a portion of 15 grams.

Note: The following information on reagents, equipment, and procedure refer only to the 00-Dip-Test.

Reagents.

a. Distilled water.

b. Glucose.

c. Cellulose powder.

d. Clinistix reagent strips (Miles Inc.; 2844P).

Equipment.

a. Coffee mill or equivalent (e.g., Moulinex electric coffee, spice, and nut grinder).

b. Five-ounce paper cups.

c. Whatman No. 2 fluted filter paper (12.5 cm) or coffee filters (specific type of paper is not critical).

d. Stopwatch or equivalent.

e. Graduated cylinder (100 ml; plastic).

f. Small paint brush (1 inch or 2.54 cm bristles).

g. One powder funnel (stainless steel or plastic; 3 inch or 7.62 cm).

h. Teflon stirring rod (3/16 x 6 inch or 0.48 x 15.24 cm).

i. Scoopula.

j. Balance capable of weighing to the nearest 0.01g.

Precautions.

a. Store the Clinistix reagent strips in a closed container, out of direct sun, and at room temperature (60 to 85ºF).

b. Do not remove the test strip from its container until a sample is ready for testing.

c. Record on each new bottle the date that the bottle is first opened. Do not use the strips in a bottle beyond 6 months after the date the bottle was first opened or beyond the expiration date.

d. Before using any test strip from a freshly opened bottle, check the activity of one strip from that bottle with a 2 percent glucose solution. Thereafter, check the activity of the test strips in that bottle weekly (refer to (b) above).

e. After a sample has been tested for glucosinolates with a Clinistix strip, flush the sample down the drain and dispose the strip and paper cup in the trash.

Procedure for Screening Canola Samples for Glucosinolate Levels.

a. Remove any stones, straws, and other grain remaining in the 15-gram subsample.

b. Weigh 7.0 grams of the subsample into a labeled, tared paper cup. Transfer the sample from the cup to the grinding chamber of the coffee grinder.

Note: If the moisture content of the sample is 12 percent or more, add 0.7 grams of cellulose powder to the sample.

c. Grind the sample in two, 15-second bursts. Invert and shake the grinder gently between grinding bursts.

d. Use a powder funnel to transfer the ground sample from the grinder to the paper cup. Use a brush to aid in transferring the sample and for cleaning out the grinder.

e. Add 70 ml of distilled water (68 to 82ºF) to the sample in the cup. Stir the mixture vigorously for 30 seconds. Wait 4 minutes and then stir the mixture for 10 seconds.

f. Place a fluted filter into the cup. Wait a few seconds, and then dip a Clinistix reagent strip into the solution inside the filter paper for 2 seconds. Remove the test strip. Wait 20 seconds for the color to develop. Match the color of the test strip to the appropriate portion of the color chart on the test strip bottle.

Note: The color comparison must be made within 1 minute after the test strip is removed from the test mixture because the color fades rapidly with time.

g. A Clinistix strip color which is lighter than the medium color on the color chart indicates that the glucosinolate content of that sample is less than 30 micromoles per gram of defatted sample. Such samples are certified as canola (refer to the Certification sub-heading in this section).

A Clinistix strip color which is equal to or darker than the medium color on the color chart indicates that the glucosinolate content of that sample is approximately equal to or greater than 30 micromoles per gram of defatted sample. Such samples are certified as not standardized grain (refer to the Certification sub-heading in this section).

Procedure for Testing Clinistix Strips for Enzymatic Activity.

a. The activity of the Clinistix strips are estimated using a 2 percent glucose solution. Prepare the solution by placing 2.0 grams of glucose in a 100 ml volumetric flask. Fill the flask with distilled water to the 100 ml mark. Mix the solution by inverting the flask several times.

Note: The 2 percent glucose solution can be kept for 6 months when stored in a stoppered flask at 40ºF.

b. To test the activity of a test strip, place 2 mL of the glucose solution (68 to 82ºF) in a dish. Dip a test strip into the solution and hold for 2 seconds.

c. Remove the test strip and check the color after 20 seconds. A 2 percent glucose solution should turn the test strip a dark blue. If this is not the case, then the entire bottle of test strips should be discarded. A new bottle should be opened and tested for enzymatic activity.

If the glucose solution turns the test strip a dark blue, then the test strips in that bottle can be used for estimating glucosinolate content.

Certification. If the 00-Dip-Test indicates that the sample has a low level of glucosinolates, certify the sample as “Canola.” If the 00-Dip-Test indicates that the sample has a high level of glucosinolates, certify the sample as “Not Standardized Grain (NSG).”

3.22 OFFICIAL CRITERIA

a. Glucosinolate Analysis – Gas Chromatography (GC) Method. Glucosinolate analysis using the GC method is available at the FGIS Technology and Science Division (TSD) as a separate test, independent of grade. TSD will notify the local field office of the GC results which, in turn, will notify the official agency involved *or* issue a certificate depending on the level of service. The GC result is certified independent of the grade certificate.

If the GC results are equal to or greater than 30.0 micromoles, the applicant has the option of surrendering the outstanding grade certificate for corrections.

Official personnel must issue a "corrected certificate," labeling the seed as "Not Standardized Grain" rather than canola. Likewise, if the GC results are less than 30.0 micromoles and the previous result(s) (screening or GC) was equal to or greater than 30.0 micromoles, the applicant has the option of surrendering the outstanding grade certificate for corrections.

For review inspections (reinspection, appeal inspection, or Board appeal inspection), GC results supersede any previous results. The screening method does not supersede GC results. Review inspections involving factors/reasons other than the glucosinolate content do not require a re-analysis for glucosinolates. The previous results may be used for definition purposes.

If a review inspection is performed for grade and official personnel know, based on previous testing, that the glucosinolate content is equal to or greater than 30 micromoles, grade the review inspection "Not Standardized Grain" and cross reference the certificate that reported the high glucosinolate content.

Basis of Determination. A glucosinolate analysis using the GC method is performed after the removal of machine separated dockage on a portion of 300 grams. Only TSD can perform GC analysis. If GC analysis is requested, submit the portion to TSD at the FGIS Technical Center in Kansas City, Missouri:

USDA, AMS, FGIS
Technology and Science Division
10383 North Ambassador Drive
Kansas City, Missouri 64153-1394
Fax: (816) 891-7314
Tel: (816) 891-0437

(1) Include the following information with the sample: analysis required, sample ID, field office and/or official agency, and date mailed.

(2) Place the sample portion in a moisture-proof plastic bag (6-mil) and securely close or seal the bag. Place the sample and sample ticket inside a canvas mailing bag. Do not place the sample ticket inside the plastic bag in direct contact with the sample.

(3) Use a buff colored mailing tag to send samples. Indicate on the reverse of the mailing tag the analysis to be performed by the laboratory.

(4) Samples should be mailed at the expense of the field office or agency sending the sample. FGIS Business Reply Mail is not appropriate for this purpose.

Certification. Record the glucosinolate content on the “Results” section of the certificate to the nearest tenth of a micromole/gram.

Example: Glucosinolates 20.0.

b. Erucic Acid (ERC). The long-chain fatty acid, erucic acid (C22H43O2), is a component of canola/rapeseed and its oil. A high level of erucic acid is desired for the production of certain chemicals, industrial lubricants, fully hydrogenated rapeseed oil, and super glycerinated fully hydrogenated rapeseed oil. A low level is desired for the production of salad and vegetable oils, margarine, and shortening.

As stated in Section 3.2, “Definition of Canola,” an ERC test suitable for grading purposes does not exist. However, an analysis for ERC content is available at TSD as a separate test, independent of grade. TSD will notify the local field office of the test results which, in turn, will notify the official agency involved *or* will issue a certificate depending on the level of service. The ERC results are certified independent of the grade certificate.

If the ERC result is equal to or greater than 2.0 percent, the applicant has the option of surrendering the outstanding grade certificate for corrections.

Official personnel must issue a "corrected certificate" labeling the seed as "Not Standardized Grain" rather than canola.

If a review inspection is performed for grade and official personnel know, based on previous testing, that the ERC content is equal to or greater than 2.0 percent, grade the review inspection "Not Standardized Grain" and cross reference the certificate that reported the high erucic acid level.

Basis of Determination. If an analysis for erucic acid content is requested, submit a portion of 300 grams free of machine separated dockage to TSD in Kansas City, Missouri:

USDA, AMS, FGIS
Technology and Science Division
10383 North Ambassador Drive
Kansas City, Missouri 64153-1394
Fax: (816) 891-7314
Tel: (816) 891-0437

If an applicant requests both ERC and GC analysis for glucosinolates, submit a portion of 300 grams free of machine separated dockage to TSD. Refer to the sample preparation and mailing instructions given for glucosinolate analysis using the GC method.

Certification. Record the erucic acid content on the "Results" section of the certificate to the nearest tenth percent. Refer to general information above for further certification requirements.

Example: Erucic acid 1.2%.

c. Oil. Lipids are oils and fats that are liquid at room temperature.

Basis of Determination. If an analysis for oil content is requested, submit a portion of 100 grams free of machine separated dockage to TSD.

If an applicant requests an oil analysis and GC analysis for GLUC, submit a portion of 300 grams free of machine separated dockage to TSD. Refer to the sample preparation and mailing instructions given in Section 3.21, "Glucosinolates."

Certification. Certify the percent of oil to the nearest tenth percent.

Example: Oil 38.9%.

CHAPTER 4:
CORN

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4.1 GENERAL ORDER OF PROCEDURES

The breakdown and inspection for Corn are listed below in the following chapter according to its general order. The order of procedure may slightly vary depending on the quality of the corn and the tests requested. More information is available on the Agricultural Marketing Service Website (AMS), in the U.S. Standards for Corn, and the Board of Appeals and Review (BAR) Questions and Answers.

The inspection process provides various factor information used to determine grade and to provide further information on the condition or quality of corn. Each section of this chapter provides details on recording factor information. If requested by the applicant for inspection, additional information may be provided (e.g., an exact count on stones in addition to the percent by weight or a percent for a specific type of damage).

4.2 DEFINITION OF CORN

Definition. *Grain that consists of 50 percent or more of whole kernels of shelled dent corn and/or shelled flint corn (Zea mays L.) and not more than 10.0 percent of other grains for which standards have been established under the United States Grain Standards Act.*

Whole kernels are kernels with three-fourths or more of the kernel present. Other grains for which standards have been established are barley, canola, flaxseed, oats, rye, sorghum, soybeans, sunflower seed, triticale, and wheat.

Basis of Determination. Normally, a visual appraisal of the sample is sufficient to determine if it meets the definition of corn. However, if an analysis is necessary, make the determination before the removal of broken corn and foreign material on a portion of 250 grams.

If the sample does not meet the definition of corn, examine it further to determine if it is:

a. Another grain for which standards have been established; or

b. Not Standardized Grain (NSG). No further analysis is necessary on a sample designated as NSG unless a specific factor test is requested.

4.3 GRADES AND GRADE REQUIREMENTS

Corn is divided into three classes: Yellow corn, White corn, and Mixed corn. There are no subclasses in corn. Each class is divided into five numerical grades and U.S. Sample Grade. Special grades emphasize qualities or conditions affecting the value and are added to and made a part of the grade designation. Special grades do not affect the numerical or sample grade designation.

TABLE 4.1 – GRADES AND GRADE RERQUIREMENTS FOR CORN

Grade	Minimum Limits of -	Maximum Limits of -		
		Damaged Kernels		Broken Corn and Foreign Material (percent)
	Test Weight per bushel (pounds)	Heat-Damaged (percent)	Total (percent)	
U.S. No. 1	56.0	0.1	3.0	2.0
U.S. No. 2	54.0	0.2	5.0	3.0
U.S. No. 3	52.0	0.5	7.0	4.0
U.S. No. 4	49.0	1.0	10.0	5.0
U.S. No. 5	46.0	3.0	15.0	7.0

U.S. Sample Grade is corn that:

a. Does not meet the requirements for grades U.S. No.1, 2, 3, 4, or 5; or

b. Contains stones which have an aggregate weight in excess of 0.1 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria* spp.), 2 or more castor beans (*Ricinus communis* L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 8 or more cockleburs (*Xanthium* spp.) or similar seeds singly or in combination, or animal filth in excess of 0.20 percent in 1,000 grams; or

c. Has a musty, sour, or commercially objectionable foreign odor; or

d. Is heating or otherwise of distinctly low quality.

4.4 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in Table 4.1 – Grades and Grade Requirements for Corn. Use the following guidelines when assigning grades:

a. The letters "U.S.";

b. The abbreviation "No." and the number of the grade or the words "Sample Grade";

c. The words "or better" when applicable;

d. The class;

e. The special grade "Flint" when applicable;

f. The special grade “Flint and Dent” when applicable, along with the approximate percent of Flint corn; and

g. Other applicable special grade(s) in alphabetical order.

When certifying Mixed corn, record the name and percent of each class in the mixture in the “Results” section of the certificate to the nearest tenth percent.

4.5 SPECIAL GRADES

Special grades draw attention to unusual conditions in grain and are made part of the grade designation. The special grades and special grade requirements for corn are shown in the United States Standards for Corn. Details for determining special grades are included in referenced sections. Definitions and examples of the designations for special grades in corn are:

a. Flint Corn. Corn that consists of 95 percent or more of Flint corn. (Section 4.20)

Example: U.S. No. 3 Yellow Corn, Flint

b. Flint and Dent Corn. Corn that consists of a mixture of Flint and Dent corn containing more than 5.0 percent but less than 95 percent of Flint corn. (Section 4.20)

Example: U.S. No. 2 Yellow Corn, Flint and Dent, Flint Corn 35%

c. Infested Corn. Corn that is infested with live weevils or other live insects injurious to stored grain. (Section 4.12)

Example: U.S. No. 2 Yellow Corn, Infested

d. Waxy Corn. Corn that consists of 95 percent or more Waxy corn. (Section 4.21)

Example: U.S. No. 1 White Corn, Waxy

4.6 OPTIONAL GRADE DESIGNATION

The Official U.S. Standards for Grain provide for an optional grade designation, commonly referred to as "or better." Upon the request of an applicant, certify corn as U.S. No. 2 or better, U.S. No. 3 or better, etc. An "or better" grade designation cannot be applied to a U.S. No. 1 grade designation.

Example: U.S. No. 3 or better Yellow Corn

4.7 BASIS OF DETERMINATION

Distinctly Low Quality. *The determination of distinctly low quality is made on the basis of the lot as a whole at the time of sampling when a condition exists that may or may not appear in the representative sample and/or the sample as a whole.*

Certain Quality Determinations. *Each determination of rodent pellets, bird droppings, other animal filth, broken glass, castor beans, cockleburs, crotalaria seeds, dockage, garlic, live insect infestation, large stones, moisture, temperature, an unknown foreign substance(s), and a commonly recognized harmful or toxic substance(s) is made on the basis of the sample as a whole. When a condition exists that may not appear in the representative sample, the determination may be made on the basis of the lot as a whole at the time of sampling according to procedures prescribed in FGIS instructions.*

All Other Determinations. *Each determination of class, damaged kernels, heat-damaged kernels, waxy corn, flint corn, and flint and dent corn is made on the basis of the grain after the removal of the broken corn and foreign material. Other determinations not specifically provided for under the General Provisions are made on the basis of the grain as a whole, except the determination of odor is made on either the basis of the grain as a whole or the grain when free from broken corn and foreign material.*

TABLE 4.2 – BASIS OF DETERMINATION

Lot as a Whole	Factors Determined Before the RemovalofBroken Corn and Foreign Material	Factors Determined After the Removal of Broken Corn and Foreign Material
Distinctly Low Quality	Distinctly Low Quality	Class
Heating	Heating	Damaged Kernels
Infested	Infested	Flint corn
Odor	Kind of Grain	Flint and Dent corn
	Moisture	Heat-Damaged Kernels
	Odor	Odor
	Stones	Waxy
	Test Weight	
	Sample Grade Criteria	

4.8 HEATING

Basis of Determination. Determine heating (HTG) on evidence obtained at the time of sampling or on the basis of the sample as a whole.

Corn developing a high temperature from excessive respiration is considered heating. Heating corn, in its final stages, will usually have a sour or musty odor. Do not confuse corn that is heating with corn that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

Certification. When applicable, show the term "Heating" on the work record and "Results" section of the certificate, and grade the corn "U.S. Sample Grade."

4.9 ODOR

Basis of Determination. Determine odor on evidence obtained at the time of sampling or on the sample either before or after the removal of broken corn and foreign material.

TABLE 4.3 – ODOR CLASSIFICATION EXAMPLES

Musty	Sour	Commercially Objectionable Foreign Odors	
Ground Insect Moldy	Boot Fermenting Insect (acrid) Pigpen	Animal Hides Decaying Animal Fertilizer Fumigant Insecticide	Oil Products Skunk Smoke Strong Weed Vegetable Matter

Commercially Objectionable Foreign Odors (COFO) are odors foreign to grain that render it unfit for normal commercial usage.

Fumigant, insecticide, or fungicide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of corn contains a fumigant, insecticide, or fungicide odor that prevents a determination as to whether any other odor(s) exists, apply the following guidelines:

a. Original Inspections. Allow the work portion to aerate in an open container for 4 hours, or less, if the odor dissipates in less time.

b. Reinspections, Appeal, and Board Appeal Inspections. Allow unworked file samples and new samples to aerate in an open container for 4 hours, or less, if the odor dissipates in less time. The 4-hour aeration requirement does not apply when the original work portion was aerated and retained as the final file.

Consider the sample as having a commercially objectionable foreign odor if the fumigant, insecticide, or fungicide odor persists based on the above criteria.

Final Determination. The inspector is responsible for making the final determination for all odors. Whenever possible, use a consensus of experienced licensed inspectors on samples containing marginal odors. Under the consensus approach, if a clear majority (at least 2/3) of inspectors agree the sample contains a Musty, Sour, or COFO odor, grade the corn “U.S. Sample Grade”. The consensus approach is not required if the initial inspector does not detect an odor or a distinct odor is detected.

Certification. Grade corn containing a "*distinct*" musty, sour, or commercially objectionable foreign odor as “U.S. Sample Grade.” Record the words "Musty," "Sour," or "Commercially Objectionable Foreign Odor" on the work record and “Results” section of the certificate.

4.10 MOISTURE

Definition. *Water content in grain as determined by an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine moisture before the removal of broken corn and foreign material on a portion of approximately 650 grams.

The procedures for performing a moisture determination using a FGIS approved moisture instrument utilizing the proper calibrations are described in the Moisture Handbook and in Chapter 1, General Information.

Certification. Record the percent of moisture on the work record and “Results” section of the certificate to the nearest tenth percent.

4.11 TEST WEIGHT

Definition. *The weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine test weight (TW) before the removal of broken corn and foreign material on a portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination are described in Chapter 1, General Information.

Certification. Record test weight results on the work record and “Results” section of the certificate to the nearest tenth pound. If requested, convert the pounds per bushel (lb/bu) result to kilograms per hectoliter (kg/hl) using the following formula: lb/bu x 1.287 = kg/hl and record in the "Remarks" section in whole and tenths.

4.12 INFESTED CORN

Corn that is infested with live weevils (LW) or other live insects injurious to stored grain (OLI).

The presence of any LW or OLI found in the work sample indicates the probability of infestation and warns that the corn must be carefully examined to determine if it is infested. In such cases, examine the work sample and the file sample before reaching a conclusion as to whether or not the corn is infested. Do not examine the file sample if the work sample is insect free.

LW include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. OLI include grain beetles, grain moths, and larvae. To further define "other insect injurious to stored grain" refer to the Stored-Grain Insect Reference. Images of insects may also be viewed on the AMS website.

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, refer to Table 4.4 – Insect Infestation.

TABLE 4.4 – INSECT INFESTATION

Samples meeting or exceeding any one of these tolerances are infested: ***2 LW, or 1 LW + 5 OLI, or 10 OLI***		
1,000-gram representative sample[1] (+ file sample if needed)	**Lot as a Whole (Stationary)**	**Online Sample (In-Motion)[2]**
Submitted Samples Probed Lots D/T Sampled Land Carriers	Probed Lots (at time of sampling)	Railcars under the Cu-sum Subsamples for Sacked Grain Lots Components for Bargelots[3] Components for Shiplots[3]

[1] Examine work portion and file sample if necessary. Do not examine file sample if work portion is insect free.

[2] Minimum sampling rate is 500 grams per 2,000 bushels.

[3] Minimum component size is 10,000 bushels.

Key: LW = Live Weevil, OLI = Other Live Insects injurious to stored grain.

Certification. When applicable, grade the corn "Infested" on the grade line of the certificate in accordance with Section 4.5, "Special Grades." Record the number of live weevils and/or other live insects injurious to stored grain on the work record and "Results" section of the certificate.

4.13 DISTINCTLY LOW QUALITY

Consider corn distinctly low quality when it is obviously of inferior quality and existing grade factors or guidelines do not accurately reflect the inferior condition.

Basis of Determination. Use all available information to determine whether the corn is of distinctly low quality (DLQ). This includes a general examination of the corn during sampling and an analysis of the obtained sample(s).

a. Diatomaceous Earth (DIAT). Corn suspected of containing DIAT is considered DLQ unless the applicant specifically requests an examination to verify the presence of DIAT. If the laboratory examination verifies that the corn contains DIAT, then the corn is not considered DLQ due to DIAT. For additional information regarding the testing of corn for diatomaceous earth, refer to Directive 9180.49, "Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel."

b. Flood Damaged Grain. Corn that is materially affected by flooding is considered DLQ and certified as "U.S. Sample Grade." In addition, official personnel must report identifiable lots that are DLQ to the district Food and Drug Administration (FDA) office as "actionable" in accordance with FGIS-PN-19-04, "Inspection of Flood Damaged Grain".

   The determination of DLQ is based on the appearance and condition of the lot or sample as a whole. Evaluate corn affected by flooding on a portion of approximately 400 grams with the use of the ILP – All Grains/Graded Commodities - Inspection of Flood Damaged Grain. If a sample does not meet the requirements for DLQ, but the kernels are materially damaged (stained) by flooding, consider the kernels as damaged and count toward the total percentage of damaged kernels in the sample.

c. Large Animal Excreta (LGANX). Corn containing one or more large animal excreta (e.g., deer or elk pellet) is considered DLQ.

d. Large Debris. Corn containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris which are visible to the sampler but too large to enter the sampling device is considered DLQ.

e. Other Unusual Conditions. Corn that is obviously affected by other unusual conditions which adversely affect the quality of the corn and cannot be properly graded by use of the grading factors specified or defined in the standards is considered DLQ.

Certification. When applicable, show the factor DLQ and the reason(s) why on the work record and "Results" section of the certificate, and grade the corn "U.S. Sample Grade."

4.14 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine U.S. Sample Grade criteria before the removal of broken corn and foreign material (BCFM) based on a work portion of 1,000 – 1,050 grams.

Table 4.5 – U.S. Sample Grade Criteria shows the criteria and corresponding Visual Aids, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, or bulgur), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain must function as "unknown foreign substance (FSUB)."

TABLE 4.5 – U.S. SAMPLE GRADE CRITERIA

Criteria	Visual Aids	Number/Weight[1]	
		Sample Basis	Lot Basis[2]
Any Numerical Grading Factor		Excess of limit for U.S. No. 5	N/A
Animal Filth	Animal Filth	Excess of 0.20%	N/A
Castor Beans	Castor Bean	2 or more	N/A
Cockleburs	Cockleburs	8 or more	N/A
Crotalaria Seeds	Crotalaria	3 or more	N/A
Glass		2 or more	N/A
Odor		Presence	N/A
Stones		Excess of 0.1% by weight	N/A
Unknown Foreign Substances[3]	Fertilizer	4 or more	N/A
Heating		Presence	Presence
Large Debris*		N/A	2 or more
Other Unusual Conditions*		Presence	Presence

[1] Record count factors to the nearest whole number.
[2] The entire sample of a submitted sample is considered as the lot.
[3] Consider feed pellets and processed grain products as foreign material, not unknown foreign substance.
* For Distinctly Low Quality, refer to Section 4.13.

Certification. Grade corn as "U.S. Sample Grade" when one or more of the limits in Table 4.5 – U.S. Sample Grade Criteria are observed. Record the factors (count factors to the nearest whole number) on the work record and "Results" section of the certificate.

4.15 BROKEN CORN AND FOREIGN MATERIAL

Broken Corn. All matter that passes readily through a 12/64 round-hole sieve and over a 6/64 round-hole sieve according to procedures prescribed in FGIS instructions.

Foreign Material. All matter that passes readily through a 6/64 round-hole sieve and all matter other than corn that remains on top of the 12/64 round-hole sieve according to procedures prescribed in FGIS instructions.

Broken Corn and Foreign Material. All matter that passes readily through a 12/64 round-hole sieve and all matter other than corn that remains in the sieved sample after sieving according to procedures prescribed in FGIS instructions.

Basis of Determination. Determine Broken Corn and Foreign Material (BCFM) on a portion of 1,000 – 1,050 grams.

Procedure. The procedure for determining BCFM is performed in two steps: machine cleaning (Carter Dockage Tester) and handpicking.

To avoid repeating operations, check the BCFM for infestation and U.S. Sample Grade factors. (Section 4.12, “Infested Corn,” and Section 4.14, “U.S. Sample Grade Criteria.”) Live weevils, other live insects injurious to stored grain, and sample grade factors are considered foreign material but, when present in sufficient quantities, are also considered in the determination of U.S. Sample Grade and/or the special grade "Infested."

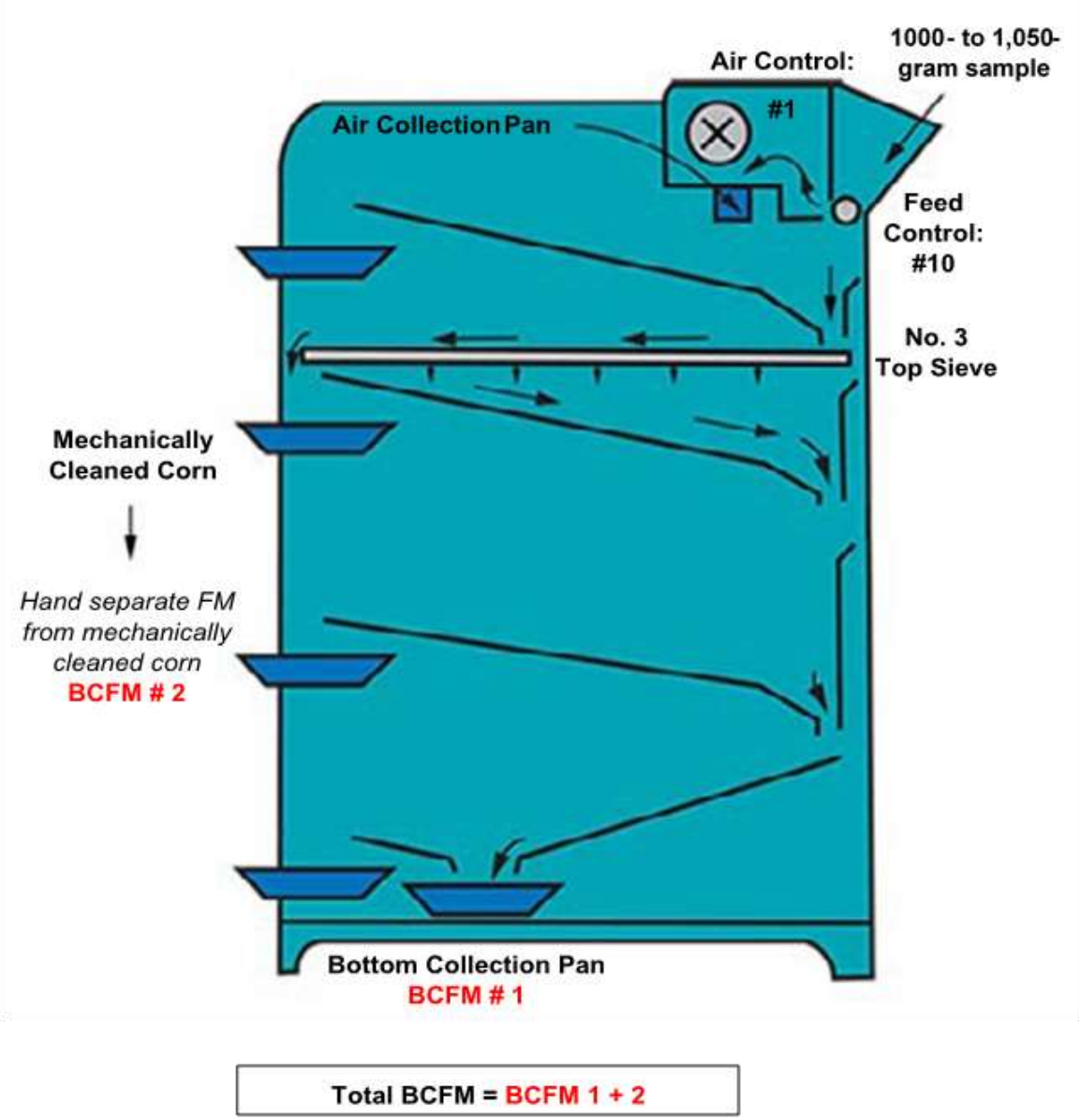

FIGURE 4.1 – PROCEDURE FOR DETERMINING BCFM

Carter Dockage Tester (Mechanical Separation).

a. Set the air control to 1 and the feed control to 10.

b. There is no riddle in the riddle carriage.

c. Insert the No. 3 sieve in the top sieve carriage.

d. There is no sieve in the middle and bottom sieve carriages.

e. Start the Carter Dockage Tester and pour sample into feed hopper.

Handpick (Foreign Material).

a. Remove all matter other than corn, including sweet corn, blue corn, and popcorn, from the mechanically cleaned portion.

b. Combine the mechanically separated and handpicked BCFM.

Certification. Record the percent of BCFM on the work record and "Results" section of the certificate to the nearest tenth percent.

Alternate Procedure. Upon request, use the following alternate procedure which allows for the separation of BC and FM.

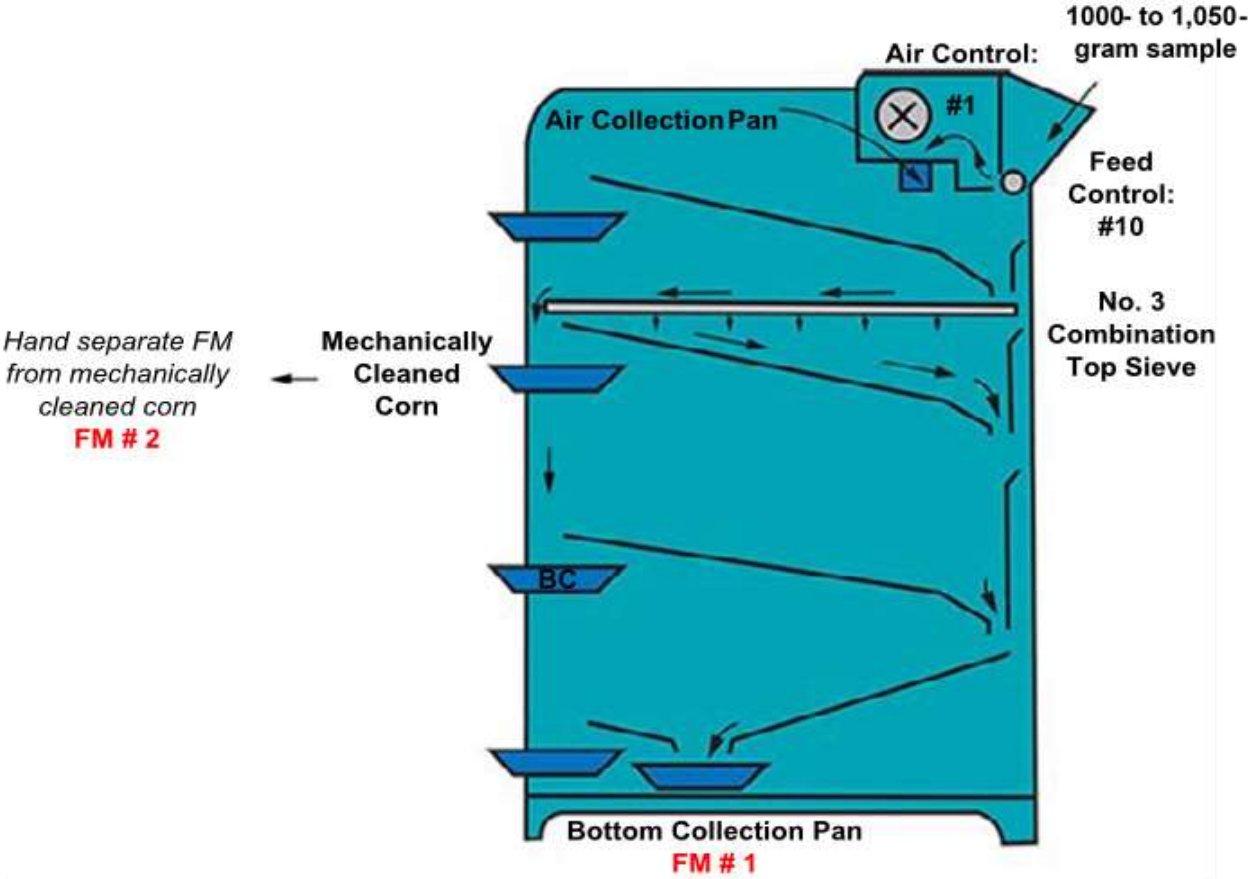

FIGURE 4.2 – ALTERNATE PROCEDURE FOR DETERMINING BC AND FM

Carter Dockage Tester (Mechanical Separation).

a. Set the air control to 1 and the feed control to 10.

b. There is no riddle in the riddle carriage.

c. Insert the combination 12/64-inch and 6/64-inch No. 3 sieve in the top sieve carriage.

d. There is no sieve in the middle and bottom sieve carriages.

e. Start the Carter Dockage Tester and pour sample into feed hopper.

f. BC consists of all material passing through the 12/64 inch sieve and over the 6/64 inch sieve (collected in the middle sieve collection pan).

g. FM consists of all material passing through the 6/64 inch sieve (collected in the bottom collection pan).

Handpick (Foreign Material).

a. Remove all matter other than corn, including sweet corn, blue corn, and popcorn, from the mechanically cleaned portion.

b. Combine the mechanically separated and handpicked FM from the mechanically cleaned portion.

Alternate Procedure for Determining BCFM (Hand Sieve Method). Official personnel have the option of manually hand-sieving or mechanically sieving (using a sizer shaker) the BCFM portion.

Follow the procedures listed below to separate the components BC and FM from machine (Carter Dockage Tester) separated BCFM.

Mechanically Sieving Method.

a. Mount a 6/64 round-hole sieve and a bottom pan on the mechanical sieve shaker.

b. Set the stroke counter to 5.

c. Remove the BCFM collection pan from the Carter Dockage Tester, pour the contents into the center of the sieve, and actuate the shaker.

d. Remove, clean the sieve, and empty the bottom pan. Return the material lodged in the perforations to the material on top of the sieve.

e. Consider the material in the bottom collection pan as foreign material.

f. Remove all matter other than corn, including sweet corn, blue corn, and popcorn from the mechanically (Carter Dockage Tester) cleaned portion and combine with the foreign material in step e above. This combination of mechanically separated FM and handpicked FM functions as foreign material.

g. Calculate the percentages of BC and FM separately.

Adjustment of Factors. In certain instances, when using the alternate procedure, the sum of BC and FM in corn, due to rounding, will not equal the percent of BCFM recorded on the certificate. When this occurs, it is necessary to adjust the component nearest a midpoint (e.g., 0.05, 0.15, 0.25, or 0.35) by adding or subtracting 0.1.

Example: BCFM Calculation

Original sample weight	1,012 grams
Weight of BC	38.34 grams
Weight of FM	2.64 grams
Weight of BCFM	40.98 grams

a. **Percent of Broken Corn.**
(38.34g ÷ 1,012g) x 100 = 3.78% BC (rounded 3.8%).

b. **Percent of Foreign Material.**
(2.64g ÷ 1,012g) x 100 = 0.26% FM (rounded 0.3%).

c. **Percent of Broken Corn and Foreign Material.**
(40.98g ÷ 1,012g) = 4.04% BCFM (rounded 4.0%).

Since the sum of the rounded BC and FM results (3.8% BC + 0.3% FM = 4.1%) does not equal the rounded BCFM results (4.0% BCFM), an adjustment of – 0.1 is needed. In this instance, the rounded result for FM (0.3%) is adjusted downward to 0.2% because the unrounded result (0.26%) is nearer to a midpoint (0.25) than the unrounded result for BC.

Certification. Record the percent of BC and the percent of FM separately on the work record and “Results” section of the certificate to the nearest tenth percent for non-export shipments and on the loading log or similar work record for export shipments. Record the total percent of BCFM on the work record and “Results” section of the certificate to the nearest tenth percent.

4.16 PROCESSING THE WORK SAMPLE

At this point, all tests required to be performed prior to the removal of BCFM have been completed and the percent of BCFM has been determined. Also, the sample has been examined for certain sample grade and special grade factors. Now the work sample is ready to be divided into fractional portions for other determinations required after the removal of BCFM.

Chart 4.1 – Dividing the Work Sample and Table 4.6 – Approximate Analytical Portion Sizes illustrate how the sample is divided into fractional parts using an approved divider.

CHART 4.1 – DIVIDING THE WORK SAMPLE

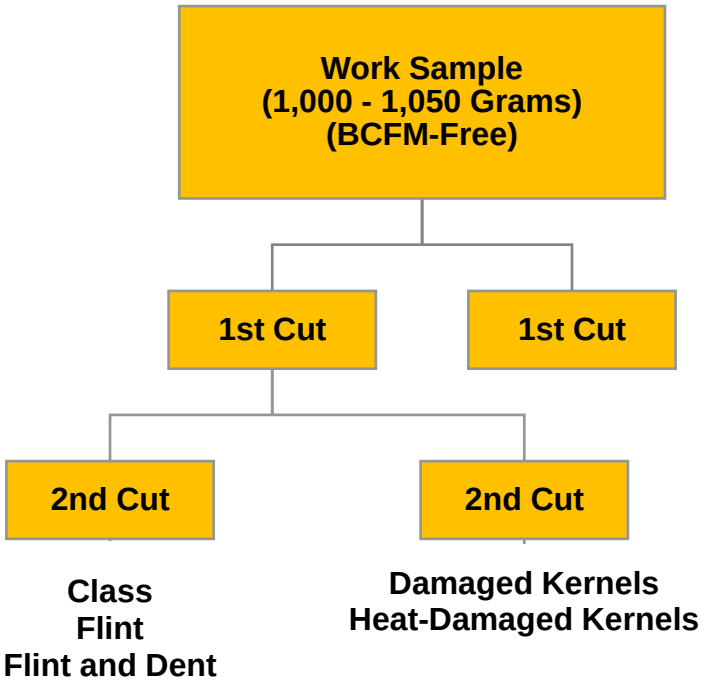

TABLE 4.6 – APPROXIMATE ANALYTICAL PORTION SIZES

Factors	Grams
Class	250
Damaged Kernels	250
Flint Corn	250
Flint and Dent Corn	250
Heat-Damaged Kernels	250

4.17 HEAT-DAMAGED KERNELS

Definition. *Kernels and pieces of corn kernels that are materially discolored and damaged-by-heat.*

Basis of Determination. Determine heat-damaged kernels on a BCFM-free portion of 250 grams.

It is acceptable to scrape the seedcoat on suspected heat-damaged kernels if the seedcoat is bleached and/or blistered making it hard to determine the color of the band extending out of the germ and around the sides and back of the kernel. (VRI – C - 5.0 Heat Damage (Drier), C - 5.1 Heat Damage (White), and C - 5.2 Heat Damage (Yellow))

Certification. Record the percent of heat-damaged kernels on the work record and in the "Results" section of the certificate to the nearest tenth percent.

4.18 DAMAGED KERNELS

Definition. *Kernels and pieces of corn kernels that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-damaged, heat-damaged, insect-bored, mold-damaged, sprout-damaged, or otherwise materially damaged.*

Basis of Determination. Determine damaged kernels (DKT) on a BCFM-free portion of 250 grams.

In general, consider corn to be damaged for inspection and grading purposes only when the damage is distinctly apparent and of such character as to be recognized as damaged for commercial purposes.

TYPES OF CORN DAMAGE.

Blue-Eye Mold. A germ infected with blue-eye mold, regardless of amount. If the mold is distinct, it is not necessary to open or scrape the kernel. When necessary, carefully lift the germ cover to avoid destroying the evidence of mold. (VRI – C - 1.0 Blue-Eye Mold Damage)

Do not confuse purple plumule with blue-eye mold. Purple plumule is not damage but is a genetic or varietal characteristic.
(VRI – C - 1.1 Purple Plumule (Not Damage))

Cob Rot. Cob rot is caused by a fungus that attacks weakened plants. It is detected by the presence of a distinct discoloration or rotting. Opening the kernel is not required to detect cob rot but may be necessary to determine the extent of other types of damage. (VRI – C - 2.0 Cob Rot Damage)

Drier-Damaged Kernels. Kernels and pieces of kernels which have a discolored, wrinkled, and blistered appearance; or which are puffed or swollen and slightly discolored and which often have damaged germs; or whose seed coats are slightly discolored and peeling off; or have already peeled off and which have a fractured or checked appearance resulting from external heat caused by artificial drying methods. Do not confuse drier damage with heat damage (drier). (VRI – C - 3.0 Drier Damage)

Germ-Damaged Kernels (Slight Discoloration by Respiration). Kernels and pieces of kernels damaged by respiration or heat but not materially discolored. In most cases, the germ covering will have to be removed, exposing the area around the plumule. The discoloration must extend into the meat of the germ to be considered damaged. (VRI – C - 4.0 Germ Damage)

Heat-Damaged Kernels. Kernels and pieces of kernels which are materially discolored and damaged-by-heat, with the dark discoloration extending out of the germ through the sides and into the back of the kernel. (VRI – C - 5.1 Heat Damage (White) and C - 5.2 Heat Damage (Yellow))

Heat-Damaged Kernels (Drier). Kernels and pieces of kernels which are puffed or swollen and materially discolored by external heat caused by artificial drying methods. (VRI – C - 5.0 Heat Damage (Drier))

Insect-Bored Kernels. Kernels and pieces of kernels with obvious insect-bored holes or which have tunneling, insect webbing, or insect refuse. Consider kernels partially eaten but entirely free from refuse, webbing, insects, or other forms of damage as sound. Do not cut open the kernel when making this determination. (VRI – C - 6.0 Insect Damage)

Mold-Damaged Kernels. Kernels and pieces of kernels infected with mold on exposed endosperm. When a kernel of corn has been broken exposing the starch, it becomes susceptible to mold. Check broken pieces carefully for mold. Mold is usually blue or green in color. (VRI – C - 7.0 Mold Damage) Do not confuse kernels that have dirt on them with kernels containing mold. (VRI – C - 7.1 Not Damage (Dirt))

Mold Damage (Pink Epicoccum). Kernels and pieces of kernels with germs infected with mold. (VRI – C - 7.2 Mold Damage (Pink Epicoccum))

Mold-like Substance. Whole kernels of corn which are 50 percent or more covered and pieces of kernels which are discolored and covered with a mold-like substance.

Silk-cut Kernels. Kernels and pieces of kernels with mold in silk cuts. Kernels with clean silk cuts and are otherwise sound are not considered damaged. (VRI – C - 8.0 Silk Cut)

Sprout-Damaged Kernels. Sprouted kernels or those showing evidence of a sprout. Anytime the sprout extends beyond the germ area, regardless of whether it actually breaks through the seedcoat or not, is considered damaged. (VRI – C - 9.0 Sprout Damage)

Surface Mold (Blight). Kernels and pieces of kernels which have mold caused by corn leaf blight on them which appears to be only on the surface but actually penetrates the seed coats. (VRI – C - 10.0 Surface Mold (Blight))

Surface Mold (More Than Slight). Kernels and pieces of kernels which contain surface mold in any area or combination of areas equal to or greater than shown on the visual aid. (VRI – C - 11.0 Surface Mold (More Than Slight))

Certification. Record the percent of damaged kernels on the work record and "Results" section of the certificate to the nearest tenth percent.

4.19 CLASS

Corn is divided into the following classes:

a. *Yellow Corn. Corn that is yellow-kerneled and contains not more than 5.0 percent of corn of other colors. Yellow kernels of corn with a slight tinge of red are considered Yellow corn.*

The term "yellow kernels of corn with a slight tinge of red" includes kernels which are yellow and/or light red in color and kernels which are yellow and dark red in color provided the dark red color covers less than 50 percent of the kernel. Yellow and red kernels in which the dark red color covers 50 percent or more of the kernel are considered "Corn of Other Colors." (VRI – (C) O.F. - 7.5 Corn of Other Colors)

b. *White Corn. Corn that is white-kerneled and contains not more than 2.0 percent of corn of other colors. White kernels of corn with a slight tinge of light straw or pink color are considered White corn.*

White corn with a slight tinge of light straw applies to all White corn, except corn found to be Waxy. For the specification pertinent to Waxy corn, refer to Section 4.21, "Waxy Corn."

The term "white kernels of corn with a slight tinge of light straw or pink color" includes kernels which are white and/or light straw or light pink in color and kernels which are white and pink in color provided the pink color covers less than 50 percent of the kernel. White and pink kernels in which the pink color covers 50 percent or more of the kernel are considered "Corn of Other Colors." (VRI – (C) O.F. - 7.1 Mixed Corn (More Than Slight Tinge-Straw) and (C) O.F. - 7.7 Mixed Corn (More Than Slight Tinge-Pink))

c. *Mixed Corn. Corn that does not meet the color requirements for either of the classes Yellow corn or White corn and includes white-capped Yellow corn.* (VRI – (C) O.F. - 7.2 Mixed Corn (White-Capped Yellow Corn))

Note: When determining the class of corn, consider "Enogen Corn," "Indian Corn," and "Purple Corn" as "Corn of Other Colors" if the amount is 50 percent or less of the sample. If the sample contains more than 50 percent, it is considered "Not Standardized Grain (NSG)." Consider Blue Corn as Foreign Material.

White Corn is considered Corn of Other Colors (OCOL) in Yellow Corn and vice versa.

Basis of Determination. Determine the class by the color characteristics of the kernels. When an analysis for class is necessary, use a 250-gram portion of BCFM-free corn.

Certification. Record the percent of corn of other colors on the work record and "Results" section of the certificate to the nearest tenth percent. For Mixed corn, record each percent of the mixture on the work record and "Results" section of the certificate to the nearest tenth percent.

4.20 FLINT CORN AND FLINT AND DENT CORN

Flint Corn. Corn that consists of 95 percent or more of Flint corn.

Flint and Dent Corn. Corn that consists of a mixture of Flint and Dent corn containing more than 5.0 percent but less than 95 percent of Flint corn.

A kernel of Flint corn normally has a rounded crown and is usually smaller than a dent kernel.

A kernel of Dent corn is normally characterized by a distinct depression or dent in the crown of the kernel.

In mixtures of Flint and Dent corn, there is frequently a difference in the color of the two types. The shape of the kernel, the size, the texture, and the color characteristics are used in making a determination in mixtures of Flint and Dent corn.

Basis of Determination. Determine the special grades Flint, Flint and Dent on the characteristics of the kernels in the sample. When an analysis is necessary, use a BCFM-free portion of 250 grams. (VRI – (C) O.F. - 7.3 Flint and Dent Corn)

Certification. When applicable, grade the corn "Flint" or "Flint and Dent" on the grade line of the certificate in accordance with Section 4.5, "Special Grades." Record the percent of Flint corn on the work record and "Results" section of the certificate to the nearest whole percent.

4.21 WAXY CORN

Definition. *Corn that consists of 95 percent or more waxy corn, according to procedures prescribed in FGIS instructions.*

Basis of Determination. When corn appears to contain 95 percent or more waxy kernels, determine by examining exactly 100 kernels cut out of a BCFM-free portion of 35 grams.

When determining class for a sample of corn designated Waxy, apply the following guidelines:

For the special grade Waxy, the requirement of white kernels of corn with a slight tinge of light straw is not applicable; however, kernels which are "slightly yellow" are considered as corn of other colors. All other color requirements remain in effect for all classes of Waxy corn. (VRI – (C) O.F. - 7.8 Slightly Yellow in (White Waxy) Corn)

Procedure for Testing Waxy Kernels of Corn. For required materials and equipment, refer to Chapter 1, General Information.

a. Pour 30 ml of the iodine stock solution into a spray bottle and dilute it with 30 ml of distilled water.

b. Cut each of the whole kernels lengthwise (tip to crown) or across the top exposing the starch in the endosperm. Place one-half of each kernel into a petri dish and discard the other half.

c. Carefully spray (do not soak) all the cut kernels with the iodine solution.

Caution: **Wear safety equipment. Spray iodine solution only in a well-ventilated area or within the working area of a laboratory hood. To prevent staining tables and surrounding areas, place the petri dish on a covered surface before spraying.**

d. Approximately 1 to 3 minutes after spraying, the starch of the waxy corn kernels will turn a red or reddish-brown color. The starch of non-waxy kernels will turn a blue or violet color. Consider samples with 95 kernels (95 percent) turning red or reddish-brown color as Waxy corn. (VRI – (C) O.F. - 7.9 Waxy and (C) O.F. - 7.91 Non-Waxy)

Certification. When applicable, grade the corn "Waxy" on the grade line of the certificate in accordance with Section 4.5, “Special Grades.” Record the percent of waxy on the work record and “Results” section of the certificate to the nearest whole percent.

4.22 OFFICIAL CRITERIA

Official criteria factors are determined only upon request and do not affect the grade designation.

a. Stress Crack Analysis.

Note: When stress crack analysis is requested for shiplots and unit trains, testing will be performed on a sublot basis. In addition to (but not in lieu of) sublot analysis, testing on a composite basis may also be performed upon applicant request. When stress crack analysis is requested for containers, the analysis may be done on individual containers or on a composite basis, with a limit of 20 containers per composite.

Basis of Determination. Stress crack analysis is determined on the basis of a predetermined number of whole kernels. Do not include kernels that are broken, chipped, or cracked (i.e., a ruptured seed coat), or which otherwise limit the ability to identify stress cracks (e.g., waxy or discolored kernels). Use a divider to obtain the appropriate analytical portion size based on the requested service. Removal of broken corn and foreign material prior to obtaining the analytical portion may facilitate whole kernel selection.

(1) For *total* stress crack analysis percent, obtain approximately 25 grams to select 50 whole kernels. Multiply the number of stressed kernels by 2 before reporting.

(2) For *single, double, and multiple* stress crack analysis percent, obtain approximately 50 grams to select 100 whole kernels. Record number of stressed kernels as obtained.

Note: The above portion sizes are the minimum required. Upon request, larger portion sizes are permitted. If a larger portion size is used, adjust test results as appropriate before reporting.

(3) Upon request, separate and count the number of kernels in the three stress crack categories: single, double, and multiple stress cracks. Visually inspect whole kernels on a light board for internal narrow cracks in the endosperm as follows:

(a) Place kernels on the light board with germ side down. Visually inspect each kernel for stress cracks and separate stressed kernels. (Visual Aid: Stress Cracks)

(b) Turn remaining kernels germ side up. Visually inspect each kernel for stress cracks and separate stressed kernels.

(c) Count the total number of stressed kernels.

Certification. Record the percent of total stress cracks or the percent of single, double, and multiple stress cracks on the work record and “Results” section of the certificate to the nearest whole percent.

b. Presence of Waxy Kernels. This procedure is applicable only for determining the presence of Waxy corn and does not replace the procedure for determining the special grade "Waxy."

Basis of Determination. A representative portion of at least 35 grams of corn on the basis of the sample as a whole.

Testing Procedure. For Iodine test materials, refer to Chapter 1, General information.

(1) Pour 30 ml of the iodine stock solution into a spray bottle and dilute it with 30 ml of distilled water.

(2) Coarse grind the 35-gram sample.

Note: A Romer Mill – Model 2A, Bunn Grinder, or equivalent, must be used to coarsely grind samples. The grinder must be adjusted so that 80 percent or more of the sample remains on top of an 8/64 round-hole sieve and that all kernels are broken open to expose the endosperm.

(3) Carefully spray (do not soak) the entire sample with the iodine solution. If an 8/64 sieve was used to separate the broken kernels from the fine material, then spray only the material that remains on top of the sieve.

Caution: Wear safety equipment. Spray iodine solution only in a well-ventilated area or within the working area of a laboratory hood.

(4) Shortly after spraying the kernels (approximately 1 to 3 minutes), the starch of Waxy corn kernels will turn a red or reddish-brown color. The starch of nonwaxy kernels will turn a blue or violet color. (VRI – (C) O.F. - 7.9 Waxy and (C) O.F. - 7.91 Non-Waxy)

(5) Analyze the sprayed kernels to determine if any Waxy kernels are present. If a single kernel is determined to be "Waxy", consider the sample as positive for the presence of Waxy corn, otherwise, the sample is negative for Waxy kernels.

Certification. Record the presence of Waxy Kernels on the work record and in the "Remarks" section of the certificate using the certification application as follows:

(1) When results are positive, enter the factor result of "Yes" in the factor results field and in the factor remarks field state:

"*This sample contains Waxy Kernels of corn*."

(2) When results are negative, enter the factor result of "No" in the factor results field and in the factor remarks field state:

"*This sample does not contain Waxy Kernels of corn*."

Note: Only the factor remarks will be visible on the certificate.

CHAPTER 5:
FLAXSEED

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5.1 GENERAL ORDER OF PROCEDURES

The breakdown and inspection for Flaxseed are listed below in the following chapter according to its general order. The order of procedure may slightly vary depending on the quality of the flaxseed and the tests requested. More information is available on the Agricultural Marketing Service Website (AMS), in the U.S. Standards for Flaxseed, and the Board of Appeals and Review (BAR) Questions and Answers.

The inspection process provides various factor information used to determine grade and to provide further information on the condition or quality of flaxseed. Each section of this chapter provides details on recording factor information. If requested by the applicant for inspection, additional information may be provided (e.g., an exact count on stones in addition to the percent by weight or a percent for a specific type of damage).

5.2 DEFINITION OF FLAXSEED

Definition. *Grain, that before the removal of dockage, consists of 50 percent or more of common flaxseed (Linum usitatissimum L.) and not more than 20 percent of other grains for which standards have been established under the United States Grain Standards Act and which, after the removal of dockage, contains 50 percent or more of whole flaxseed.*

Whole kernels are kernels with three-fourths or more of the kernel present. Other grains for which standards have been established are barley, canola, corn, oats, rye, sorghum, soybeans, sunflower seed, triticale, and wheat.

Basis of Determination. Normally, a visual appraisal of the sample is sufficient to determine if it meets the definition for flaxseed. However, if an analysis is necessary, make the determination before the removal of dockage on a representative portion of 25 grams.

If the sample does not meet the definition of flaxseed, examine it further to determine if it is:

a. Another grain for which standards have been established; or

b. Not Standardized Grain (NSG). No further analysis is necessary on a sample designated as NSG unless a specific factor test is requested.

5.3 GRADES AND GRADE REQUIREMENTS

There are no classes, subclasses, or special grades in flaxseed. Flaxseed is divided into two numerical grades and U.S. Sample Grade.

TABLE 5.1 – GRADES AND GRADE REQUIREMENTS FOR FLAXSEED

Grade	Minimum Limits of -	Maximum Limits of -	
	Test Weight per bushel (pounds)	Heat-Damaged Kernels (percent)	Damaged Kernels Total (percent)
U.S. No. 1	49.0	0.2	10.0
U.S. No. 2	47.0	0.5	15.0

U.S. Sample Grade is flaxseed that:

a. Does not meet the requirements for grades U.S. No. 1, or 2; or

b. Contains 8 or more stones which have an aggregate weight in excess of 0.2 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria* spp.), 2 or more castor beans (*Ricinus communis* L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 10 or more rodent pellets, bird droppings, or equivalent quantity of other animal filth per 1 1/8 to 1 ¼ quarts of flaxseed, or

c. Has a musty, sour, or commercially objectionable foreign odor (except smut or garlic); or

d. Is heating or otherwise of distinctly low quality.

5.4 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in Table 5.1 – Grades and Grade Requirements. Use the following guidelines when assigning grades:

a. The letters "U.S.";

b. The abbreviation "No." and the number of the grade or the words "Sample Grade";

c. The words "or better" when applicable;

d. The word "Flaxseed";

e. The word "Dockage" when applicable, and the percentage thereof.

5.5 OPTIONAL GRADE DESIGNATION

The Official U.S. Standards for Grain provide for an optional grade designation, commonly referred to as "or better." Upon the request of an applicant, certify flaxseed as U.S. No. 2 or better or U.S. Sample Grade or better. An "or better" grade designation cannot be applied to a U.S. No. 1 grade designation.

Example: U.S. No. 2 or better Flaxseed, Dockage 1.0%

5.6 BASIS OF DETERMINATION

Distinctly Low Quality. The determination of distinctly low quality is made on the basis of the lot as a whole at the time of sampling when a condition exists that may or may not appear in the representative sample and/or the sample as a whole.

Certain Quality Determinations. Each determination of rodent pellets, bird droppings, other animal filth, broken glass, castor beans, cockleburs, crotalaria seeds, dockage, garlic, live insect infestation, large stones, moisture, temperature, an unknown foreign substance(s), and a commonly recognized harmful or toxic substance(s) is made on the basis of the sample as a whole. When a condition exists that may not appear in the representative sample, the determination may be made on the basis of the lot as a whole at the time of sampling according to procedures prescribed in FGIS instructions.

All Other Determinations. Other determinations not specifically provided for under the General Provisions are made on the basis of the grain when free from dockage, except the determination of odor is made on either the basis of the grain as a whole or the grain when free from dockage.

TABLE 5.2 – BASIS OF DETERMINATION

Lot as a Whole	Factors Determined Before the Removal of Dockage	Factors Determined After the Removal of Mechanically Separated Dockage
Distinctly Low Quality	Distinctly Low Quality	Damaged Kernels
Heating	Heating	Handpicked Dockage
Odor	Kind of Grain	Heat-Damaged Kernels
	Moisture	Odor
	Odor	Stones
	Sample Grade Criteria	Test Weight

5.7 HEATING

Basis of Determination. Determine heating (HTG) on evidence obtained at the time of sampling or on the basis of the sample as a whole.

Flaxseed developing high temperature from excessive respiration is considered heating. Heating flaxseed, in its final stages, will usually have a sour or musty odor. Do not confuse flaxseed that is heating with flaxseed that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

Certification. When applicable, show the term "Heating" on the work record and "Results" section of the certificate, and grade the flaxseed "U.S. Sample Grade."

5.8 ODOR

Basis of Determination. Determine odor on evidence obtained at the time of sampling or on the sample either before or after the removal of dockage.

TABLE 5.3 – ODOR CLASSIFICATION EXAMPLES

Musty	Sour	Commercially Objectionable Foreign Odors	
Ground	Boot	Animal Hides	Oil Products
Insect	Fermenting	Decaying Animal	Skunk
Moldy	Insect (acrid)	Fertilizer	Smoke
	Pigpen	Fumigant	Strong Weed
	Smoke[1]	Insecticide	Vegetable Matter
[1] Smoke odors are considered sour only in canola, flaxseed, soybeans, and sunflower seed.			

Odors from Heat-Damaged Flaxseed. When heat-damaged kernels are present, flaxseed gives off an odor very similar to smoke. Flaxseed containing a "smoke" odor is considered as having a "sour" odor unless evidence of a fire-burnt material is present in the lot or the original sample. If evidence of a fire-burnt material is present in the lot or the sample, the smoke odor is considered a commercially objectionable foreign odor.

Commercially Objectionable Foreign Odors (COFO) are odors foreign to grain that render it unfit for normal commercial usage.

Fumigant, insecticide, or fungicide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of flaxseed contains a fumigant, insecticide, or fungicide odor that prevents a determination as to whether any other odor(s) exists, apply the following guidelines:

a. Original Inspections. Allow the work portion to aerate in an open container for 4 hours, or less, if the odor dissipates in less time.

b. Reinspections, Appeal, and Board Appeal Inspections. Allow unworked file samples and new samples to aerate in an open container for 4 hours, or less, if the odor dissipates in less time. The 4-hour aeration requirement does not apply when the original work portion was aerated and retained as the final file.

Consider the sample as having a commercially objectionable foreign odor if the fumigant, insecticide, or fungicide odor persists based on the above criteria.

Final Determination. The inspector is responsible for making the final determination for all odors. Whenever possible, use a consensus of experienced licensed inspectors on samples containing marginal odors. Under the consensus approach, if a clear majority (at least 2/3) of inspectors agree the sample contains a Musty, Sour, or COFO odor, grade the flaxseed “U.S. Sample Grade”. The consensus approach is not required if the initial inspector does not detect an odor or a distinct odor is detected.

Certification. Grade flaxseed containing a "*distinct*" musty, sour, or commercially objectionable foreign odor as “U.S. Sample Grade.” Record the words "Musty," "Sour," or "Commercially Objectionable Foreign Odor" on the work record and “Results” section of the certificate.

5.9 MOISTURE

Definition. *Water content in grain as determined by an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine moisture before the removal of dockage on a portion of approximately 650 grams.

The procedures for performing a moisture determination using a FGIS approved moisture instrument utilizing the proper calibrations are described in the Moisture Handbook and in Chapter 1, General Information.

Certification. Record the percent of moisture on the work record and “Results” section of the certificate to the nearest tenth percent.

5.10 DISTINCTLY LOW QUALITY

Consider flaxseed distinctly low quality when it is obviously of inferior quality and the existing grade factors or guidelines do not properly reflect the inferior condition.

Basis of Determination. Use all available information to determine whether the flaxseed is of distinctly low quality (DLQ). This includes a general examination of the flaxseed during sampling and an analysis of the obtained sample(s).

a. Diatomaceous Earth (DIAT). Flaxseed suspected of containing DIAT is considered DLQ unless the applicant specifically requests an examination to verify the presence of DIAT. If the laboratory examination verifies that the flaxseed contains DIAT, then the flaxseed is not considered DLQ due to DIAT. For additional information regarding the testing of flaxseed for diatomaceous earth, refer to Directive 9180.49, "Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel."

b. Flood Damaged Grain. Flaxseed that is materially affected by flooding is considered DLQ and certified as "U.S. Sample Grade". In addition, official personnel must report identifiable lots that are DLQ to the district Food and Drug Administration (FDA) office as "actionable" in accordance with FGIS-PN-19-04, "Inspection of Flood Damaged Grain".

   The determination of DLQ is based on the appearance and condition of the lot or sample as a whole. Evaluate flaxseed affected by flooding on a portion of approximately 400 grams with the use of the ILP – All Grains/Graded Commodities - Inspection of Flood Damaged Grain. If a sample does not meet the requirements for DLQ, but the kernels are materially damaged (stained) by flooding, consider the kernels as damaged and count toward the total percentage of damaged kernels in the sample.

c. Large Animal Excreta (LGANX). Flaxseed containing one or more large animal excreta (e.g., deer or elk pellet) is considered DLQ.

d. Large Debris. Flaxseed containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris which are visible to the sampler but are too large to enter the sampling device is considered DLQ.

e. Other Unusual Conditions. Flaxseed that is obviously affected by other unusual conditions which adversely affect the quality of the flaxseed and cannot be properly graded by use of the grading factors specified or defined in the standards is considered DLQ.

Certification. When applicable, show the factor DLQ and the reason(s) why on the work record and "Results" section of the certificate, and grade the flaxseed "U.S. Sample Grade."

5.11 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine U.S. Sample Grade criteria, except for stones, before the removal of dockage based on a work portion of 1,000 – 1,050 grams.

Table 5.4 – U.S. Sample Grade Criteria shows the criteria and corresponding Visual Aids, tolerance limits, and the appropriate basis of determination. Determine stones on a dockage-free portion. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, or bulgur), or feed pellets in grain as dockage. Unidentifiable materials or material unrelated to grain must function as "unknown foreign substance (FSUB)."

Note: Mechanical Dockage Weight must be subtracted from the original weight to calculate the percent of stones.

Original sample weight – weight of mechanically separated dockage = dockage-free sample weight.
1028g – 15 (14.82 rounded) = 1013g dockage-free sample weight.

TABLE 5.4 – U.S. SAMPLE GRADE CRITERIA

Criteria	Visual Aids	Number/Weight[1]	
		Sample Basis	Lot Basis[2]
Any Numerical Grading Factor		Excess of limit for U.S. No. 2	N/A
Animal Filth	Animal Filth	10 or more	N/A
Castor Beans	Castor Bean	2 or more	N/A
Crotalaria Seeds	Crotalaria	3 or more	N/A
Glass		2 or more	N/A
Odor		Presence	N/A
Stones[3]		8 or more and in excess of 0.2% by weight	N/A
Unknown Foreign Substances[4]	Fertilizer	4 or more	N/A
Heating		Presence	Presence
Large Debris*		N/A	2 or more
Other Unusual Conditions*		Presence	Presence

[1] Record count factors to the nearest whole number.
[2] The entire sample of a submitted sample is considered as the lot.
[3] Stones are based on sample after removal of mechanical dockage.
[4] Consider feed pellets and processed grain products as foreign material, not unknown foreign substance.
* For Distinctly Low Quality, refer to Section 5.10.

Certification. Grade flaxseed "U.S. Sample Grade" when one or more of the limits in Table 5.4 – U.S. Sample Grade Criteria are observed. Record the factors (count factors to the nearest whole number) on the work record and "Results" section of the certificate.

5.12 DOCKAGE

Definition. *All matter other than flaxseed that can be removed from the original sample by use of an approved device according to procedures prescribed in FGIS instructions. Also, underdeveloped, shriveled, and small pieces of flaxseed kernels removed in properly separating the material other than flaxseed and that cannot be recovered by properly rescreening or recleaning.*

Basis of Determination. Determine dockage (DKG) on a portion of 1,000 - 1,050 grams of the original sample.

Carter Dockage Tester (Mechanical Separation).

a. Set air control to 3.5 and the feed control to 4.

b. Insert the No. 000 riddle in the riddle carriage.

c. Insert a No. 4 sieve in the top sieve carriage.

d. Insert a No. 2 sieve in the middle sieve carriage.

e. Insert a No. 7 sieve in the bottom sieve carriage.

f. Start the Carter Dockage Tester and pour sample into feed hopper.

g. If matted lumps of flaxseed clog or kick over the riddle, remove the riddle and the No. 4 sieve and proceed with the dockage determination.

h. If the material that passes over the No. 4 sieve contains lumps of flaxseed that cannot be reclaimed, add this portion to the mechanically cleaned flaxseed.

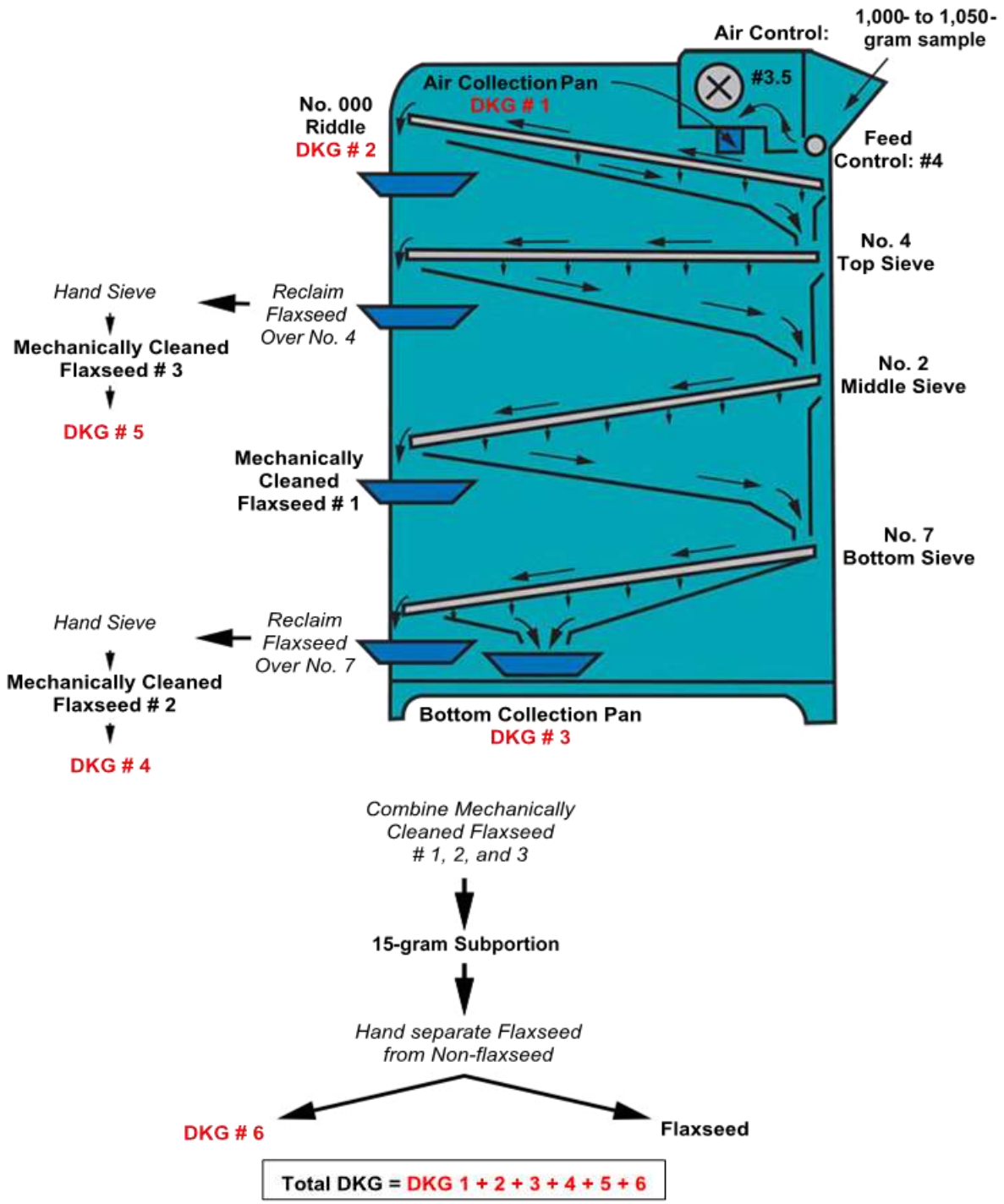

FIGURE 5.1 – PROCEDURE FOR DETERMINING DOCKAGE

Reclaim Seed.

a. Using an approved hand sieve, reclaim the flaxseed passing over the No. 4 sieve.

(1) When the material contains large-sized flaxseed, sieve (30 strokes) with a 0.064 x 3/8 inch (1.626 x 9.525 millimeters (mm)) sieve.

(2) When the material contains small-sized flaxseed, sieve (30 strokes) with a 3/64 x 3/8 inch (2.241 x 9.525 mm) or a 3/64 x 11/32 inch (2.241 x 8.732 mm) sieve.

b. Using an approved hand sieve, reclaim the flaxseed passing over the No. 7 sieve. Sieve (30 strokes) with a 3/64 x 3/8-inch (2.241 x 9.525 mm) or a 3/64 x 11/32-inch (2.241 x 8.732 mm) sieve.

Handpick.

a. Combine the three mechanically cleaned portions.

b. Cut down the cleaned sample to a portion of 15 grams.

c. Handpick the 15-gram portion for material other than flaxseed.

Note: Matted kernels of flaxseed are considered flaxseed even though portions of flax bolls adhere to the matted kernels. The test weight determination should be made (Section 5.13, "Test Weight") before determining handpicked dockage.

Calculating Dockage. Obtain the percent of dockage by adding the percent of mechanically separated dockage to the percent of handpicked dockage in hundredths (disregard thousandths).

Example: Dockage Calculation

Original sample weight	1,000 grams
Weight of mechanically separated dockage	68.0 grams
Weight of handpicked portion	15.30 grams
Weight of handpicked dockage	0.55 grams

a. **(Weight of mechanically separated dockage ÷ original sample weight) x 100**
= percent of mechanically separated dockage.
(68.00g ÷ 1,000g) x 100 = 6.80% mechanical dockage.

b. **(100 percent - percent of mechanically separated dockage) ÷ 100**
= change of base factor.
(100% - 6.80%) ÷ 100 = 0.93 change of base factor.

c. **(Weight of handpicked dockage ÷ weight of handpicked portion) x 100**
= percent of handpicked dockage.
(0.55g ÷ 15.30g) x 100 = 3.59% handpicked dockage.

d. **Percent of handpicked dockage x change of base factor**
= percent of handpicked dockage (adjusted).
3.59 x 0.93 = 3.33% handpicked dockage (adjusted).

e. **Percent of mechanically separated dockage + percent of handpicked dockage (adjusted)**
= percent of dockage.
6.80% + 3.33% = 10.13% dockage (total).

Certification. Report the percent of dockage on the work record in hundredths. Also, record the percent of dockage in the factor results section of the certificate application, but do not include this result in the "Results" section of the certificate. When the sample contains 1 percent or more dockage, record the word "Dockage" and the percent of dockage on the grade line of the certificate in whole percent with a fraction of a percent disregarded.

Example: 1.00 to 1.99 percent is recorded as 1.0 percent.
2.00 to 2.99 percent is recorded as 2.0 percent.

5.13 TEST WEIGHT

Definition. *The weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine test weight (TW) on a dockage-free portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination are described in Chapter 1, General Information.

Certification. Record test weight results on the work record and "Results" section of the certificate in whole and half pounds. Disregard fractions of a half-pound. If requested, convert the pounds per bushel (lbs./bu) result to kilograms per hectoliter (kg/hl) using the following formula: lbs./bu x 1.287 = kg/hl and record in the "Remarks" section in whole and tenths.

5.14 PROCESSING THE WORK SAMPLE

At this point, all tests required to be performed prior to the removal of dockage have been completed and the percent of dockage has been determined. Also, determinations for moisture and test weight have been performed and the sample has been examined for certain sample grade factors. Now the work sample is ready to be divided into fractional portions for other determinations required after the removal of dockage.

Chart 5.1 – Dividing the Work Sample and Table 5.5 – Approximate Analytical Portion Sizes illustrate how the sample is divided into fractional parts using an approved divider.

CHART 5.1 – DIVIDING THE WORK SAMPLE

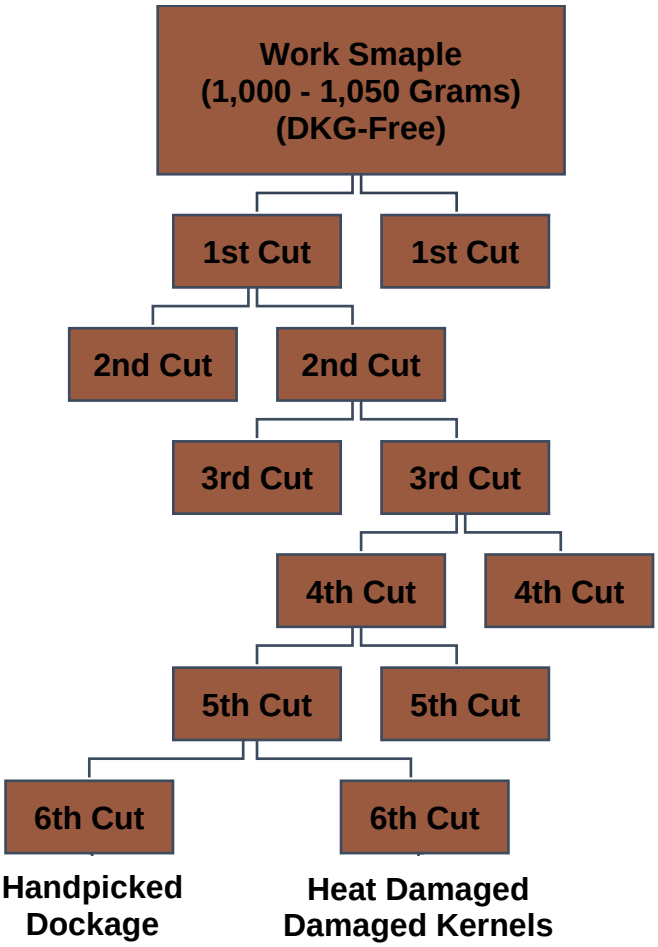

TABLE 5.5 – APPROXIMATE ANALYTICAL PORTION SIZES

Factors	Grams
Damaged Kernels	15
Heat-Damaged Kernels	15
Kind of Grain	25

5.15 DAMAGED KERNELS

Definition. *Kernels and pieces of flaxseed kernels that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-damaged, heat-damaged, insect-bored, mold-damaged, sprout-damaged, or otherwise materially damaged.*

Basis of Determination. Determine damaged kernels (DKT) on a mechanically cleaned portion of 15 grams.

In general, consider flaxseed to be damaged for inspection and grading purposes only when the damage is distinctly apparent and of such character as to be recognized as damaged for commercial purposes.

TYPES OF FLAXSEED DAMAGE.

Damaged Kernels. Damaged flaxseed is usually characterized by a distinct discoloration, such as white, dark brown, or black discolorations caused by disease or by a moldy, scabby, or a dead appearance. Very thin whitish, paper like seeds of flaxseed, commonly known as "fly's wings" or "bee's wings" that have empty hulls are considered as damaged. (VRI – F - 1.0 Damaged Flaxseed (Bee's Wings))

Damaged-By-Heat Kernels. Flaxseed and pieces of flaxseed which are damaged as a result of heat, but which are not materially discolored. Cross section the kernels to determine the extent of damage. (VRI – F - 2.0 Damaged-By-Heat)

Heat-Damaged Kernels. Kernels materially discolored and damaged-by-heat. Cross section the kernels to determine the extent of damage. (VRI – F - 3.0 Heat Damage)

Immature, green kernels of flaxseed which are otherwise sound are *not* considered damaged.

Mold-like Substance. Whole kernels of flaxseed which are 50 percent or more covered and pieces of kernels which are discolored and covered with a mold-like substance.

Certification. Record the percent of damaged kernels on the work record and "Results" section of the certificate to the nearest tenth percent.

5.16 HEAT-DAMAGED KERNELS

Definition. *Kernels and pieces of flaxseed kernels that are materially discolored and damaged-by-heat.*

Basis of Determination. Determine heat-damaged kernels on a mechanically cleaned portion of 15 grams. (VRI – F - 3.0 Heat Damage)

Certification. Record the percent of heat-damaged kernels on the work record and "Results" section of the certificate to the nearest tenth percent.

CHAPTER 6:
MIXED GRAIN

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6.1 GENERAL ORDER OF PROCEDURES

The breakdown and inspection for Mixed Grain are listed below in the following chapter according to its general order. The order of procedure may slightly vary depending on the quality of the mixed grain and the tests requested. More information is available on the Agricultural Marketing Service Website (AMS), in the U.S. Standards for Mixed Grain, and the Board of Appeals and Review (BAR) Questions and Answers.

The inspection process provides various factor information used to determine grade and to provide further information on the condition or quality of mixed grain. Each section of this chapter provides details on recording factor information. If requested by the applicant for inspection, additional information may be provided (e.g., an exact count on stones in addition to the percent by weight or a percent for a specific type of damage).

6.2 DEFINITION OF MIXED GRAIN

Definition. *Any mixture of grains for which standards have been established under the United States Grain Standards Act, provided that such mixture does not come within the requirements of any of the standards for such grains; and that such mixture consists of 50 percent or more of whole kernels of grain and/or whole and broken soybeans which will not pass through a 5/64 triangular-hole sieve and/or whole flaxseed that passes through such a sieve after sieving according to procedures prescribed in FGIS instructions.*

Whole kernels are kernels with three-fourths or more of the kernel present. Other grains for which standards have been established are barley, canola, corn, flaxseed, oats, rye, sorghum, soybeans, sunflower seed, triticale, and wheat.

Basis of Determination. Determine mixed grain on a representative portion of the original sample. When corn predominates in the mixture, analyze a portion of 250 grams. When soybeans or sunflower seed predominate in the mixture, analyze a portion of 125 grams. For all other mixtures, analyze a portion of 50 grams.

Determine if the representative portion contains:

a. A mixture of grains for which standards have been established.

b. Less than 50 percent of material, except flaxseed, that passes through a 5/64 triangular-hole sieve.

If the sample does not meet the definition of mixed grain, examine it further to determine if it is:

a. Another grain for which standards have been established; or

b. Not Standardized Grain (NSG). No further analysis is necessary on a sample designated as NSG unless a specific factor test is requested.

6.3 GRADES AND GRADE REQUIREMENTS

There are no classes or subclasses in mixed grain. Mixed Grain is divided into one numerical grade and U.S. Sample Grade. Special grades emphasize qualities or conditions affecting the value and are added to and made a part of the grade designation. Special grades do not affect the mixed grain or sample grade designation.

TABLE 6.1 – GRADES AND GRADE REQUIREMENTS FOR MIXED GRAIN

Grade	Maximum Limits of -		
	Moisture (percent)	Damaged Kernels Total (percent)	Heat-Damaged Kernels (percent)
U.S. Mixed Grain	16.0	15.0	3.0

U.S. Sample Grade is mixed grain that:

a. Does not meet the requirements for the grade U.S. Mixed Grain; or

b. Contains 8 or more stones which have an aggregate weight in excess of 0.2 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria* spp.), 2 or more castor beans (*Ricinus communis* L.), 8 or more cockleburs (*Xanthium* spp.) or similar seeds singly or in combination, 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 10 or more pieces of rodent pellets, bird droppings, or an equivalent quantity of other animal filth in 1-1/8 to 1-1/4quarts of grain; or

c. Has a musty, sour, or commercially objectionable foreign odor (except for smut or garlic); or

d. Is heating or otherwise of distinctly low quality.

6.4 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in Table 6.1 – Grades and Grade Requirements for Mixed Grain. Use the following guidelines when assigning grades:

On the Grade Line.

a. The letters "U.S.";

b. The words "Mixed Grain" or "Sample Grade Mixed Grain";

c. The words “or better” when applicable;

d. The applicable special grade(s) in alphabetical order.

In the “Results” Section.

a. The name and approximate percentage of each kind of grain which constitutes 10.0 percent or more of the mixture in their order of predominance.

b. When applicable, the words "Other grains" followed by the combined percent of those kinds of grains, each of which is present in a quantity less than 10.0 percent are shown next.

c. When applicable, the words "Foreign material and fines" together with the percent are shown last.

6.5 SPECIAL GRADES

Special grades draw attention to unusual conditions in grain and are made part of the grade designation. The special grades and special grade requirements for mixed grain are shown in the United States Standards for Mixed Grain. Details for determining special grades are included in referenced sections. Definitions and examples of the designations for special grades in mixed grain are:

a. Blighted Mixed Grain. Mixed grain in which barley predominates and that contains more than 4.0 percent of fungus-damaged and/or mold-damaged barley kernels. (Section 6.19)

Example: U.S. Mixed Grain, Blighted

In “Results” section: Barley 48%, Oats 40%, Other Grains 12%

b. Ergoty Mixed Grain.

(1) Mixed grain in which rye or wheat predominates and that contains more than 0.30 percent ergot, or

(2) Any other mixed grain that contains more than 0.10 percent ergot. (Section 6.17)

Example: U.S. Mixed Grain, Ergoty

In “Results” section: Corn 54%, Other Grains 46%, Foreign Material and Fines 7%

c. Garlicky Mixed Grain.

(1) Mixed grain in which wheat, rye, or triticale predominates and that contains 2 or more green garlic bulblets, or an equivalent quantity of dry or partly dry bulblets in 1,000 grams of mixed grain.

(2) Any other mixed grain that contains 4 or more green garlic bulblets, or an equivalent quantity of dry or partly dry bulblets in 500 grams of mixed grain. (Section 6.12)

Example: U.S. Mixed Grain, Garlicky

In "Results" section: Corn 52%, Soybeans 48%
Foreign Material and Fines 16%

d. Infested Mixed Grain. Mixed grain that is infested with live weevils or other live insects injurious to stored grain. (Section 6.13)

Example: U.S. Mixed Grain, Infested

In "Results" section: Wheat 71%, Rye 29%,
Foreign Material and Fines 1%

e. Smutty Mixed Grain.

(1) Mixed grain in which rye, triticale, or wheat predominates and that contains 15 or more average size smut balls, or an equivalent quantity of smut spores in 250 grams of mixed grain, or

(2) Any other mixed grain that has the kernels covered with smut spores to give a smutty appearance in mass or that contains more than 0.2 percent smut balls. (Section 6.18)

Example: U.S. Mixed Grain, Smutty

In "Results" section: Wheat 46%, Barley 44%,
Other Grains 10%

f. Treated Mixed Grain. Mixed grain that has been scoured, limed, washed, sulfured, or treated in such a manner that its true quality is not reflected by the grade designation U.S. Mixed Grain or U.S. Sample Grade Mixed Grain. (Section 6.14)

Example: U.S. Sample Grade Mixed Grain, Treated (Limed)

In "Results" section: Wheat 48%, Oats 42%,
Other Grains 10%

6.6 OPTIONAL GRADE DESIGNATION

The Official U.S. Standards for Grain provide for an optional grade designation, commonly referred to as "or better." Upon the request of an applicant, certify mixed grain as U.S. Sample Grade "or better."

Example: U.S. Sample Grade or better Mixed Grain

In "Results" section: Corn 81%, Other Grains 19%,
Foreign Material and Fines 1%

6.7 BASIS OF DETERMINATION

Distinctly Low Quality. *The determination of distinctly low quality is made on the basis of the lot as a whole at the time of sampling when a condition exists that may or may not appear in the representative sample and/or the sample as a whole.*

Certain Quality Determinations. *Each determination of rodent pellets, bird droppings, other animal filth, broken glass, castor beans, cockleburs, crotalaria seeds, dockage, garlic, live insect infestation, large stones, moisture, temperature, an unknown foreign substance(s), and a commonly recognized harmful or toxic substance(s) is made on the basis of the sample as a whole. When a condition exists that may not appear in the representative sample, the determination may be made on the basis of the lot as a whole at the time of sampling according to procedures prescribed in FGIS instructions.*

All Other Determinations. *Each determination of damaged and heat-damaged kernels, and the percentage of each kind of grain in the mixture is made on the basis of the sample after removal of foreign material and fines. Other determinations not specifically provided for under the General Provisions are made on the basis of the grain as a whole, except the determination of odor is made on either the basis of the grain as a whole or the grain when free from foreign material and fines.*

6.8 HEATING

Basis of Determination. Determine heating (HTG) on evidence obtained at the time of sampling or on the basis of the sample as a whole.

Mixed grain developing a high temperature from excessive respiration is considered heating. Heating mixed grain, in its final stages, will usually have a sour or musty odor. Do not confuse mixed grain that is heating with mixed grain that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

Certification. When applicable, show the term “Heating” on the work record and “Results” section of the certificate, and grade the mixed grain “U.S. Sample Grade.”

6.9 ODOR

Basis of Determination. Determine odor on evidence obtained at the time of sampling or on the sample either before or after the removal of foreign material and fines.

TABLE 6.2 – ODOR CLASSIFICATION EXAMPLES

Musty	Sour	Commercially Objectionable Foreign Odors	
Ground	Boot	Animal Hides	Oil Products
Insect	Fermenting	Decaying Animal	Skunk
Moldy	Insect (acrid)	Fertilizer	Smoke
	Pigpen	Fumigant	Strong Weed
		Insecticide	Vegetable Matter

Commercially objectionable foreign odors (COFO) are odors, except smut and garlic odors, foreign to grain that render it unfit for normal commercial usage.

Fumigant, insecticide, or fungicide odors are considered as commercially objectionable foreign odors if they linger and do not dissipate. When a sample of mixed grain contains a fumigant, insecticide, or fungicide odor that prevents a determination as to whether any other odor(s) exists, apply the following guidelines:

a. Original Inspections. Allow the work portion to aerate in an open container for 4 hours, or less, if the odor dissipates in less time.

b. Reinspections, Appeal, and Board Appeal Inspections. Allow unworked file samples and new samples to aerate in an open container for 4 hours, or less, if the odor dissipates in less time. The 4-hour aeration requirement does not apply when the original work portion was aerated and retained as the final file.

Consider the sample as having a commercially objectionable foreign odor if the fumigant, insecticide, or fungicide odor persists based on the above criteria.

Final Determinations. The inspector is responsible for making the final determination for all odors. Whenever possible, use a consensus of experienced licensed inspectors on samples containing marginal odors. Under the consensus approach, if a clear majority (at least 2/3) of inspectors agree the sample contains a Musty, Sour, or COFO odor, grade the mixed grain “U.S. Sample Grade”. The consensus approach is not required if the initial inspector does not detect an odor or a distinct odor is detected.

Certification. Grade mixed grain containing a *"distinct"* musty, sour, or commercially objectionable foreign odor as “U.S. Sample Grade.” Record the words "Musty," "Sour," or "Commercially Objectionable Foreign Odor" on the work record and “Results” section of the certificate.

6.10 MOISTURE

Definition. *Water content in grain as determined by an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine moisture before the removal of foreign material and fines on a representative portion of the original sample.

To determine the appropriate sample portion size and calibration for determining moisture content, refer to the moisture testing requirements for the grain that predominates in the mixture.

The procedures for performing a moisture determination using a FGIS approved moisture instrument utilizing the proper calibrations are described in the Moisture Handbook and in Chapter 1, General Information.

Certification. Record the percent of moisture on the work record and "Results" section of the certificate to the nearest tenth percent. If the moisture results exceed 16.0 percent, grade the mixed grain "U.S. Sample Grade."

6.11 TEST WEIGHT

Definition. *The weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine test weight (TW) before the removal of foreign material and fines on a portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination are described in Chapter 1, General Information.

Certification. Record test weight results on the work record and "Results" section of the certificate in whole and half pounds. If requested, convert the pounds per bushel (lbs./bu) result to kilograms per hectoliter (kg/hl).

a. For mixtures where *wheat (other than Durum) is the predominant grain*, use the following formula: (lbs./bu x 1.292) + 1.419 = kg/hl.

b. For mixtures where *wheat is the predominant grain and Durum is the predominant wheat class* use the following formula: (lbs./bu x 1.292) + 0.630= kg/hl.

c. For mixtures where *other grains are predominant* use the following formula: lbs./bu x 1.287 = kg/hl.

Record the kg/hl result in the "Remarks" section in whole and tenths.

6.12 GARLICKY MIXED GRAIN

a. *Mixed grain in which wheat, rye, or triticale predominates and that contains 2 or more green garlic bulblets or an equivalent quantity of dry or partly dry bulblets in 1,000 grams of mixed grain; or*

b. *Any other mixed grain that contains 4 or more green garlic bulblets, or an equivalent quantity of dry or partly dry bulblets, in 500 grams of mixed grain.*

Basis of Determination. Determine garlicky (GAR) before the removal of foreign material and fines on a portion of 1,000 grams when wheat, rye, or triticale predominate in the mixture. For all other mixtures, determine garlicky on a portion of 500 grams of the original sample. (VRI – O.F. - 13.0 Green Garlic Bulbs (Whole) and O.F. - 13.1 Dry Garlic Bulbs (1/3rd))

Characteristics of Bulblets.

a. Green garlic bulblets are bulblets which have retained all of their husks intact.

b. Dry or partially dry garlic bulblets are bulblets which have lost all or part of their husks. Consider bulblets with cracked husks as dry.

c. Three dry or partly dry garlic bulblets are equal to one green bulblet.

Note: Garlic bulblets apply in the determination of "Garlicky" but also function as foreign material and fines.

Wild onion, sometimes referred to as “crow garlic”, is considered as garlic.

Certification. When applicable, grade the mixed grain "Garlicky" on the grade line of the certificate in accordance with Section 6.5, “Special Grades.” Record the number of garlic bulblets in whole numbers or in decimals to the nearest hundredths position (e.g., 1/3 = 0.33 or 2/3 = 0.67) on the work record and “Results” section of the certificate.

6.13 INFESTED MIXED GRAIN

Mixed grain that is infested with live weevils (LW) or other live insects injurious to stored grain (OLI).

The presence of any LW or OLI found in the work sample indicates the probability of infestation and warns that the mixed grain must be carefully examined to determine if it is infested. In such cases, examine the work sample and the file sample before reaching a conclusion as to whether or not the mixed grain is infested. Do not examine the file sample if the work portion is insect free.

LW include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. OLI include grain beetles, grain moths, and larvae. To further define "other insect injurious to stored grain" refer to the Stored-Grain Insect Reference. Images of insects may also be viewed on the AMS website.

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, refer to Table 6.3 – Insect Infestation.

TABLE 6.3 – INSECT INFESTATION

Samples meeting or exceeding any one of these tolerances are infested: ***2 LW, or 1 LW + 5 OLI, or 10 OLI***		
1,000-gram representative sample[1] (+ file sample if needed)	**Lot as a Whole (Stationary)**	**Online Sample (In-Motion)[2]**
Submitted Samples Probed Lots D/T Sampled Land Carriers	Probed Lots (at time of sampling)	Railcars under the Cu-sum Subsamples for Sacked Grain Lots Components for Bargelots[3] Components for Shiplots[3]

[1] Examine work portion and file sample if necessary. Do not examine file sample if work portion is insect free.

[2] Minimum sampling rate is 500 grams per 2,000 bushels.

[3] Minimum component size is 10,000 bushels.

Key: LW = Live Weevil, OLI = Other Live Insects injurious to stored grain

Certification. When applicable, grade the mixed grain "Infested" on the grade line of the certificate in accordance with Section 6.5, "Special Grades." Record the number of live weevils and/or other live insects injurious to stored grain on the work record and "Results" section of the certificate.

6.14 TREATED MIXED GRAIN

Definition. *Mixed grain that has been scoured, limed, washed, sulfured, or treated in such a manner that its true quality is not reflected by the grade designation U.S. Mixed Grain or U.S. Sample Grade Mixed Grain.*

Basis of Determination. Determine treated (TRET) on a portion of 1,000 - 1,050 grams.

Certification. When applicable, grade the mixed grain "Treated" along with the type of treatment(s) on the grade line of the certificate in accordance with Section 6.5, "Special Grades."

6.15 DISTINCTLY LOW QUALITY

Consider mixed grain distinctly low quality when it is obviously of inferior quality and existing grade factors or guidelines do not accurately reflect the inferior condition.

Basis of Determination. Use all available information to determine whether the mixed grain is of distinctly low quality (DLQ). This includes a general examination of the mixed grain during sampling and an analysis of the obtained sample(s).

a. Diatomaceous Earth (DIAT). Mixed grain suspected of containing DIAT is considered DLQ unless the applicant specifically requests an examination to verify the presence of DIAT. If the laboratory examination verifies that the mixed grain contains DIAT, then the mixed grain is not considered DLQ due to DIAT. For additional information regarding the testing of mixed grain for diatomaceous earth, refer to Directive 9180.49, "Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel."

b. Flood Damaged Grain. Mixed grain that is materially affected by flooding is considered DLQ and certified as "U.S. Sample Grade." In addition, official personnel must report identifiable lots that are DLQ to the district Food and Drug Administration (FDA) office as "actionable" in accordance with FGIS-PN-19-04, "Inspection of Flood Damaged Grain".

   The determination of DLQ is based on the appearance and condition of the lot or sample as a whole. Evaluate mixed grain affected by flooding on a portion of approximately 400 grams with the use of the ILP – All Grains/Graded Commodities - Inspection of Flood Damaged Grain. If a sample does not meet the requirements for DLQ, but the kernels are materially damaged (stained) by flooding, consider the kernels as damaged and count toward the total percentage of damaged kernels in the sample.

c. Large Animal Excreta (LGANX). Mixed grain containing one or more large animal excreta (e.g., deer or elk pellet) is considered DLQ.

d. Large Debris. Mixed grain containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris which are visible to the sampler but too large to enter the sampling device is considered DLQ.

e. Other Unusual Conditions. Mixed grain that is obviously affected by other unusual conditions which adversely affect the quality of the mixed grain and cannot be properly graded by use of the grading factors specified or defined in the standards is considered DLQ.

Certification. When applicable, show the factor DLQ and the reason(s) why on the work record and "Results" section of the certificate, and grade the mixed grain "U.S. Sample Grade."

6.16 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine U.S. Sample Grade criteria before the removal of foreign material and fines based on a work portion of 1,000 - 1,050 grams.

Table 6.4 – U.S. Sample Grade Criteria shows the criteria and corresponding Visual Aids, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, or bulgur), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain must function as "unknown foreign substance (FSUB)."

TABLE 6.4 – U.S. SAMPLE GRADE CRITERIA

Criteria	Visual Aids	Number/Weight[1]	
		Sample Basis	Lot Basis[2]
Any Numerical Grading Factor		Excess of limit for U.S. Mixed Grain	N/A
Animal Filth	Animal Filth	10 or more	N/A
Castor Beans	Castor Bean	2 or more	
Cockleburs	Cocklebur	8 or more	
Crotalaria Seeds	Crotalaria	3 or more	
Glass		2 or more	N/A
Odor		Presence	N/A
Stones		8 or more and in excess of 0.2% by weight	
Unknown Foreign Substances[3]	Fertilizer	4 or more	N/A
Heating		Presence	Presence
Large Debris*		N/A	2 or more
Other Unusual Conditions*		Presence	Presence

[1] Record count factors to the nearest whole number.
[2] The entire sample of a submitted sample is considered as the lot.
[3] Consider feed pellets and processed grain products as foreign material, not unknown foreign substance.
* For Distinctly Low Quality, refer to Section 6.15.

Certification. Grade mixed grain “U.S. Sample Grade” when one or more of the limits in Table 6.4 – U.S. Sample Grade Criteria are observed. Record the factors (count factors to the nearest whole number) on the work record and “Results” section of the certificate.

6.17 ERGOTY MIXED GRAIN

a. *Mixed grain in which rye or wheat predominate and that contains more than 0.30 percent ergot, or*

b. *Any other mixed grain that contains more than 0.10 percent ergot.*

Basis of Determination. Determine ergoty (ERG) before the removal of foreign material and fines on a portion of 250 grams.

Ergot is a hard, reddish-brown or black grain like mass of certain parasitic fungi that replaces kernels. Ergot applies in the determination of the special grade "Ergoty" and also functions as foreign material and fines. (VRI – O.F. - 12.0 Ergot)

Certification. When applicable, grade the mixed grain "Ergoty" on the grade line of the certificate in accordance with Section 6.5, “Special Grades.” Record ergot to the nearest hundredth percent on the work record and “Results” section of the certificate.

6.18 SMUTTY MIXED GRAIN

a. *Mixed grain in which rye, triticale, or wheat predominate, and that contains 15 or more average size smut balls, or an equivalent quantity of smut spores in 250 grams of mixed grain; or*

b. *Any other mixed grain that has the kernels covered with smut spores to give a smutty appearance in mass, or that contains more than 0.2 percent smut balls.*

Basis of Determination. Determine smutty (SMUT) before the removal of foreign material and fines on a portion of 250 grams.

Smut is a plant disease characterized by the appearance of smut balls or smut spores. Smut balls apply in the determination of the special grade "Smutty" and also functions as foreign material and fines. (VRI – O.F. - 22.0 Smut Balls)

When wheat, rye, or triticale predominate in the mixture, determine smutty in accordance with the instructions for the applicable grain.

When corn, flaxseed, or soybeans predominates in the mixture, and other grains are present, follow the instructions for the grain next in predominance.

Certification. When applicable, grade the mixed grain "Smutty" on the grade line of the certificate in accordance with Section 6.5, “Special Grades.” Record smut balls in whole numbers or to the nearest tenth percent on the work record and “Results” section of the certificate.

6.19 BLIGHTED MIXED GRAIN

Definition. *Mixed grain in which barley predominates and that contains more than 4.0 percent of fungus-damaged and/or mold-damaged barley kernels.*

Basis of Determination. Determine blighted before the removal of foreign material and fines on a portion of 30 grams.

Blight Characteristics. Blighted kernels in mixed grain apply only to barley. For more information, refer to the barley chapter of this handbook for the interpretation and VRI – B - 1.0 Blight Damage.

Certification. When applicable, grade the mixed grain "Blighted" on the grade line of the certificate in accordance with Section 6.5, “Special Grades.” Record blight to the nearest tenth percent on the work record and “Results” section of the certificate.

6.20 PROCESSING THE WORK SAMPLE

At this point, all tests required to be performed prior to the removal of foreign material and fines have been completed. Also, the sample has been examined for certain sample grade and special grade factors. Now the work sample is ready to be divided into fractional portions for other determinations required after the removal of foreign material and fines.

6.21 KINDS OF GRAIN, FOREIGN MATERIAL AND FINES, DAMAGED KERNELS, AND HEAT-DAMAGED KERNELS

Foreign Material and Fines. All matter other than whole flaxseed that passes through a 5/64 triangular-hole sieve, and all matter other than grains for which standards have been established under the Act, that remains in the sieved sample.

Damaged Kernels. Kernels and pieces of grain kernels for which standards have been established under the Act that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-damaged, heat-damaged, insect-bored, mold-damaged, sprout-damaged, or otherwise materially damaged.

Heat-damaged Kernels. Kernels and pieces of grain kernels for which standards have been established under the Act that are materially discolored and damaged by heat.

The interpretation for damaged kernels and heat-damaged kernels are consistent with the interpretations specified in the respective chapters of this handbook.

Basis of Determination. Determine the percent of foreign material and fines on the basis of the sample as a whole. For mixtures where corn or soybeans predominate, determine the percent of foreign material and fines on the basis of 250 or 125 grams, respectively. For all other mixtures, use a portion of 50 grams.

Damaged and heat-damaged kernels and the percent of each kind of grain in the mixture is determined on the basis of the sample after the removal of foreign material and fines. Determine the percent of damaged kernels (DKT) and heat-damaged kernels on the basis of the established portion size for the predominating grain (e.g., corn 250 grams or wheat 15 grams).

The practical application of these determinations involves the following steps:

a. Sieve the appropriate portion. For mixtures where corn or soybeans predominate, sieve the analysis portion 10 times. For all other mixtures, sieve the portion 5 times. If the portion contains canola/rapeseed, stack the 5/64 triangular-hole sieve on top of the 0.035 x 15/32 slotted sieve and sieve. Suspect canola seeds must be tested for glucosinolate levels using the 00-Dip-Test.

b. Examine the material that passed through the 5/64 triangular-hole sieve and remove all flaxseed kernels. When using stacked sieves, examine the material passing through the 5/64 triangular-hole sieve and remaining on top of the 0.035 x 15/32 slotted sieve. The material remaining between the two sieves should be mainly canola/rapeseed/flaxseed. It must, however, be handpicked for other material.

c. Examine the material remaining on top of the 5/64 triangular-hole sieve or the 0.035 x 15/32 slotted sieve (if canola is present) and remove all material other than grain for which standards have been established and add it to the material that passed through the sieve. Consider unthreshed or unhulled kernels of grain for which standards have been established as foreign material and fines.

d. Obtain 7 grams of suspect canola seeds for glucosinolate testing using the 00-Dip-Test as described in the canola chapter of this handbook. Depending on the amount of canola/rapeseed/flaxseed present, multiple sievings may be necessary to obtain the necessary 7 grams. If, after multiple sievings, sufficient sample is not available for testing, consider the suspect seeds as foreign material.

   If the 00-Dip-Test indicates that the suspected canola is canola, calculate the percent of canola. If the 00-Dip-Test indicates that the suspected canola is not canola, the material is considered foreign material and fines (refer to steps e and f).

e. Calculate the percent of foreign material and fines. Foreign material and fines consist of the material, other than canola and flaxseed, that passed through the 5/64 triangular-hole sieve and all material other than grain that remained on top of the 5/64 triangular-hole sieve.

f. Determine the percent of each grain comprising the mixture and the amount of damaged kernels. When calculating these percentages, be sure to adjust the weight of the original portion to compensate for the removal of foreign material and fines.

Example: Foreign Material and Damage Calculation

Weight of representative sample (wheat predominates)	58.00 grams
Weight of foreign material and fines	0.68 grams
Weight of wheat	40.55 grams
Weight of rye	16.77 grams
Weight of damaged kernels (includes heat-damaged kernels)	2.55 grams
Weight of heat-damaged kernels	1.40 grams
Weight of portion used to determine damaged kernels (wheat requires a portion of 15 grams	16.20 grams

a. **Percent of foreign material and fines.**
(0.68g ÷ 58.00g) x 100 = 1.17% (rounded to 1.0%).

b. **Weight of portion used to calculate the percent of grains and heat-damaged kernels**.
(58.00g – 0.68g (rounded to 1.0 for subtraction) = 57.00 grams.

c. **Percent of wheat**.
(40.55g ÷ 57.00g) x 100 = 71.14% (rounded to 71.0%).

d. **Percent of rye**.
(16.77g ÷ 57.00g) x 100 = 29.42% (rounded to 29.0%).

e. **Percent of heat-damaged kernels**.
(1.40g ÷ 57.00g) x 100 = 2.45% (rounded to 2.5%).

f. **Percent of damaged kernels**.
(2.55g ÷ 16.20g) x 100 = 15.74% (rounded to 15.7%).

Certification. Record foreign material and fines and each kind of grain to the nearest whole percent and record damaged kernels and heat-damaged kernels the nearest tenth percent on the work record and “Results” section of the certificate.

CHAPTER 7:
OATS

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7.1 GENERAL ORDER OF PROCEDURES

The breakdown and inspection for Oats are listed below in the following chapter according to its general order. The order of procedure may slightly vary depending on the quality of the oats and the tests requested. More information is available on the Agricultural Marketing Service Website (AMS), in the U.S. Standards for Oats, and the Board of Appeals and Review (BAR) Questions and Answers.

The inspection process provides various factor information used to determine grade and to provide further information on the condition or quality of oats. Each section of this chapter provides details on recording factor information. If requested by the applicant for inspection, additional information may be provided (e.g., an exact count on stones in addition to the percent by weight or a percent for a specific type of damage).

7.2 DEFINITION OF OATS

Definition. *Grain that consists of 50 percent or more of oats (Avena sativa L. and A. Byzantina C. Koch) and may contain, singularly or in combination, no more than 25 percent of wild oats and other grains for which standards have been established under the United States Grain Standards Act.*

Note: A sample of Oat Groats may also be inspected under the U.S. Standards for Oats, but Hulless Oats are not.

Other grains for which standards have been established are barley, canola, corn, flaxseed, rye, sorghum, soybeans, sunflower seed, triticale, and wheat.

Basis of Determination. Normally, a visual appraisal of the sample is sufficient to determine if it meets the definition of oats. However, if an analysis is necessary, make the determination on a portion of 30 grams.

If the sample does not meet the definition of oats, examine it further to determine if it is:

a. Another grain for which standards have been established; or

b. Not Standardized Grain (NSG). No further analysis is necessary on a sample designated as NSG unless a specific factor test is requested.

7.3 GRADES AND GRADE REQUIREMENTS

There are no classes or subclasses in oats. Oats are divided into four numerical grades and U.S. Sample Grade. Special grades emphasize qualities or conditions affecting the value and are added to and made a part of the grade designation. Special grades do not affect the numerical or sample grade designation.

TABLE 7.1 – GRADES AND GRADE REQUIREMENTS FOR OATS

Grade	Minimum Limits of -		Maximum Limits of -		
	Test Weight per bushel (pounds)	Sound Oats (percent)	Heat-Damaged Kernels (percent)	Foreign Material (percent)	Wild Oats (percent)
U.S. No. 1	36.0	97.0	0.1	2.0	2.0
U.S. No. 2	33.0	94.0	0.3	3.0	3.0
U.S. No. 3[1]	30.0	90.0	1.0	4.0	5.0
U.S. No. 4[2]	27.0	80.0	3.0	5.0	10.0

U.S. Sample Grade are oats that:

a. Do not meet the requirements for grades U.S. No.1, 2, 3, or 4; or

b. Contains 8 or more stones which have an aggregate weight in excess of 0.2 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria* spp.), 2 or more castor beans (*Ricinus communis* L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 8 or more cockleburs (*Xanthium* spp.) or similar seeds singly or in combination, 10 or more rodent pellets, bird droppings, or an equivalent quantity of other animal filth per 1-1/8 to 1-1/4. quarts of oats; or

c. Have a musty, sour, or commercially objectionable foreign odor (except smut or garlic odor); or

d. Are heating or otherwise of distinctly low quality.

[1] Oats that are slightly weathered shall be graded not higher than U.S. No. 3.

[2] Oats that are badly stained or materially weathered shall be graded not higher than U.S. No. 4.

7.4 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in Table 7.1 – Grades and Grade Requirements. Use the following guidelines when assigning grades:

a. The letters "U.S.";

b. The abbreviation "No." and the number of the grade or the words "Sample Grade";

c. The words "or better" when applicable;

d. The applicable special grade(s) in alphabetical order;

e. The word "Oats";

f. The applicable special grade(s) in alphabetical order.

7.5 SPECIAL GRADES

Special grades draw attention to unusual conditions in grain and are made part of the grade designation. The special grades and special grade requirements for oats are shown in the United States Standards for Oats. Details for determining special grades are included in referenced sections. Definitions and examples of the designations for special grades in oats are:

a. Bleached Oats. Oats that in whole or in part, have been treated with sulfurous acid or any other bleaching agent. (Section 7.13)

Example: U.S. No. 2 Oats, Bleached

b. Bright Oats. Oats, except bleached oats, that are of good natural color. (Section 7.12)

Example: U.S. No. 1 Bright Oats

c. Ergoty Oats. Oats that contain more than 0.10 percent ergot. (Section 7.21)

Example: U.S. No. 3 Oats, Ergoty

d. Extra-Heavy Oats. Oats that have a test weight per bushel of 40 pounds or more. (Section 7.11)

Example: U.S. No. 1 Extra-Heavy Oats

e. Garlicky Oats. Oats that contain 4 or more green garlic bulblets or an equivalent quantity of dry or partly dry bulblets (12) in 500 grams. (Section 7.19)

Example: U.S. No. 2 Oats, Garlicky

f. Heavy Oats. Oats that have a test weight per bushel of 38 pounds or more but less than 40 pounds. (Section 7.11)

Example: U.S. No. 2 Heavy Oats

g. Infested Oats. Oats that are infested with live weevils or other insects injurious to stored grain. (Section 7.14)

Example: U.S. No. 2 Oats, Infested

h. Smutty Oats. Oats that have kernels covered with smut spores to give a smutty appearance in mass or that contain more than 0.2 percent of smut balls. (Section 7.20)

Example: U.S. No. 2 Oats, Smutty

i. Thin Oats. Oats that contain more than 20.0 percent of oats and other matter, except fine seeds, that pass through a 0.064 x 3/8 oblong-hole sieve but remain on top of a 5/64 triangular-hole sieve after sieving according to procedures prescribed in FGIS instructions. (Section 7.17)

Example: U.S. No. 3 Oats, Thin

7.6 OPTIONAL GRADE DESIGNATION

The Official U.S. Standards for Grain provide for an optional grade designation, commonly referred to as "or better." Upon the request of an applicant, certify oats as U.S. No. 2 or better, U.S. No. 3 or better, etc. An "or better" grade designation cannot be applied to a U.S. No. 1 grade designation.

Example: U.S. No. 2 or better Oats
U.S. Sample Grade or better Oats

7.7 BASIS OF DETERMINATION

Distinctly Low Quality. The determination of distinctly low quality is made on the basis of the lot as a whole at the time of sampling when a condition exists that may or may not appear in the representative sample and/or the sample as a whole.

Certain Quality Determinations. Each determination of rodent pellets, bird droppings, other animal filth, broken glass, castor beans, cockleburs, crotalaria seeds, dockage, garlic, live insect infestation, large stones, moisture, temperature, an unknown foreign substance(s), and a commonly recognized harmful or toxic substance(s) is made on the basis of the sample as a whole. When a condition exists that may not appear in the representative sample, the determination may be made on the basis of the lot as a whole at the time of sampling according to procedures prescribed in FGIS instructions.

All Other Determinations. Other determinations not specifically provided for under the General Provisions are made on the basis of the grain as a whole.

TABLE 7.2 – BASIS OF DETERMINATION

Lot as a Whole	Factors Determined Before the Removal of Coarse Foreign Material and Other Grains	Factors Determined After the Removal of Coarse Foreign Material and Other Grains
Distinctly low quality	Bleached Oats	Heat-Damaged Kernels
Heating	Distinctly Low Quality	Odor
Infested	Ergot	Other Damaged Kernels
Odor	Garlicky	Other Grains
	General Appearance	Sound Oats
	Heating	Wild Oats
	Infested	
	Kind of Grain	
	Moisture	
	Odor	
	Smut	
	Stones	
	Test Weight	
	Thin Oats	
	Sample Grade Criteria	

7.8 HEATING

Basis of Determination. Determine heating (HTG) on evidence obtained at the time of sampling or on the basis of the sample as a whole.

Oats developing a high temperature from excessive respiration are considered heating. Heating oats, in its final stages, will usually have a sour or musty odor. Do not confuse oats that are heating with oats that are warm and moist because of storage in bins, railcars, or other containers during hot weather.

Certification. When applicable, show the term “Heating” on the work record and “Results” section of the certificate, and grade the oats “U.S. Sample Grade.”

7.9 ODOR

Basis of Determination. Determine odor on evidence obtained at the time of sampling or on the sample either before or after the removal of foreign material.

TABLE 7.3 – ODOR CLASSIFICATION EXAMPLES

Musty	Sour	Commercially Objectionable Foreign Odors	
Ground Insect Moldy	Boot Fermenting Insect (acrid) Pigpen	Animal Hides Decaying Animal Fertilizer Fumigant Insecticide	Oil Products Skunk Smoke Strong Weed Vegetable Matter

Commercially objectionable foreign odors (COFO) are odors, except smut and garlic odors, foreign to grain that render it unfit for normal commercial usage.

Fumigant, insecticide, or fungicide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of oats contains a fumigant, insecticide, or fungicide odor that prevents a determination as to whether any other odor(s) exists, apply the following guidelines:

a. Original Inspections. Allow the work portion to aerate in an open container for 4 hours, or less, if the odor dissipates in less time.

b. Reinspections, Appeal, and Board Appeal Inspections. Allow unworked file samples and new samples to aerate in an open container for 4 hours, or less, if the odor dissipates in less time. The 4-hour aeration requirement does not apply when the original work portion was aerated and retained as the final file.

Consider the sample as having a commercially objectionable foreign odor if the fumigant, insecticide, or fungicide odor persists based on the above criteria.

Final Determinations. The inspector is responsible for making the final determination for all odors. Whenever possible, use a consensus of experienced licensed inspectors on samples containing marginal odors. Under the consensus approach, if a clear majority (at least 2/3) of inspectors agree the sample contains a Musty, Sour, or COFO odor, grade the oats “U.S. Sample Grade”. The consensus approach is not required if the initial inspector does not detect an odor or a distinct odor is detected.

Certification. Grade oats containing a *"distinct"* musty, sour, or commercially objectionable foreign odor as “U.S. Sample Grade.” Record the words "Musty," "Sour," or "Commercially Objectionable Foreign Odor" on the work record and “Results” section of the certificate.

7.10 MOISTURE

Definition. *Water content in grain as determined by an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine moisture before the removal of foreign material on a portion of approximately 400 grams.

The procedures for performing a moisture determination using a FGIS approved moisture instrument utilizing the proper calibrations are described in the Moisture Handbook and in Chapter 1, General Information.

Certification. Record the percent of moisture on the work record and "Results" section of the certificate to the nearest tenth percent.

7.11 TEST WEIGHT

Definition. *The weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine test weight (TW) before the removal of foreign material on a portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination are described in Chapter 1, General Information.

The special grades in oats based on test weight are:

Extra-Heavy Oats. Oats that have a test weight per bushel of 40 pounds or more.

Heavy Oats. Oats that have a test weight per bushel of 38 pounds or more but less than 40 pounds.

Certification. When applicable, grade the oats "Extra Heavy" or "Heavy" on the grade line of the certificate in accordance with Section 7.5, "Special Grades." Record test weight results on the work record and "Results" section of the certificate in whole and half pounds If requested, convert the pounds per bushel (lbs./bu) result to kilograms per hectoliter (kg/hl) using the following formula: lbs./bu x 1.287 = kg/hl and record in the "Remarks" section in whole and tenths.

7.12 GENERAL APPEARANCE

Bright Oats. Oats, except bleached oats, that are of good natural color.

Slightly Weathered Oats. Oats that are slightly weathered shall be graded not higher than U.S. No. 3.

Badly Stained or Materially Weathered Oats. Oats that are badly stained or materially weathered shall be graded not higher than U.S. No. 4.

Basis of Determination. Determine general appearance on the sample as a whole.

Characteristics of Bright Oats. Bright (BRIT) oats are oats which have been ripened and harvested under favorable weather conditions and have a good natural color. Oats which do not have a good natural color usually appear dull and lifeless, or are stained, or green from immaturity. Do not consider a mixture of bright oats with any appreciable quantity of poorly colored oats as bright, but bright oats which contain smut masses or a light trace of smut spores on the kernels are considered bright.

Characteristics of Weathered Oats. The factors "Slightly Weathered," "Badly Stained," and "Materially Weathered" denote a discolored condition caused by adverse weather conditions.

a. Slightly-Weathered (SLW). In order for a sample of oats to be designated slightly weathered, (1) each individual kernel must have a slightly dusty, gray appearance on the brush end in sufficient amounts to give the entire sample a slightly weathered appearance or (2) the sample may contain severely weathered kernels in a sufficient number to give it a slightly weathered appearance. In either case, the oats are slightly weathered. (ILP – Oats - Slightly Weathered)

b. Badly Stained (BADS) or Materially Weathered (MWTH). When kernel discoloration due to weather has progressed to a point where many of the kernels are badly discolored and weathered, the oats are badly stained or materially weathered. (ILP – Oats - Materially Weathered)

In order to ensure a uniform application of the general appearance factors, follow the procedures outlined below:

a. Cut 350 grams of oats from the original sample.

b. Compare the appearance of the sample with the Interpretive Line Print (ILP).

c. Consider oats SLW, BADS, or MWTH when the sample is equal to or worse in appearance than the oats in the ILP.

Certification. When applicable, grade the oats “Bright” on the grade line of the certificate in accordance with Section 7.5, “Special Grades,” or record the words "Slightly Weathered," "Badly Stained," or "Materially Weathered" on the work record and “Results” section of the certificate. Oats that are slightly weathered must grade no higher than U.S. No. 3 and oats that are badly stained or materially weathered must grade no higher than U.S. No. 4.

7.13 BLEACHED OATS

Definition. *Oats that in whole or in part, have been treated with sulfurous acid or any other bleaching agent.*

Basis of Determination. Determine bleached (BLCH) on the general appearance and odor of the sample as a whole.

The odor of sulfur or any other bleaching agent is associated with bleached oats. When the odor or general appearance indicate that oats have been artificially bleached, either in whole or in part, the oats are "bleached."

Certification. When applicable, grade the oats “Bleached” on the grade line of the certificate in accordance with Section 7.5, “Special Grades.”

7.14 INFESTED OATS

Oats that are infested with live weevils (LW) or other live insects injurious to stored grain (OLI).

The presence of any LW or OLI found in the work sample indicates the probability of infestation and warns that the oats must be carefully examined to determine if they are infested. In such cases, examine the work sample and the file sample before reaching a conclusion as to whether or not the oats are infested. Do not examine the file sample if the work portion is insect free.

LW include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. OLI include grain beetles, grain moths, and larvae. To further define "other insect injurious to stored grain" refer to the Stored-Grain Insect Reference. Images of insects may also be viewed on the AMS website.

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, refer to Table 7.4 – Insect Infestation.

TABLE 7.4 – INSECT INFESTATION

Samples meeting or exceeding any one of these tolerances are infested: ***2 LW, or 1 LW + 5 OLI, or 10 OLI***		
1,000-gram representative sample[1] (+ file sample if needed)	**Lot as a Whole (Stationary)**	**Online Sample (In-Motion)[2]**
Submitted Samples Probed Lots D/T Sampled Land Carriers	Probed Lots (at time of sampling)	Railcars under the Cu-sum Subsamples for Sacked Grain Lots Components for Bargelots[3] Components for Shiplots[3]

[1] Examine work portion and file sample if necessary. Do not examine file sample if work portion is insect free.

[2] Minimum sampling rate is 500 grams per 2,000 bushels.

[3] Minimum component size is 10,000 bushels.

Key: LW = Live Weevil, OLI = Other Live Insects injurious to stored grain

Certification. When applicable, grade the oats "Infested" on the grade line of the certificate in accordance with Section 7.5, "Special Grades." Record the number of live weevils and/or other live insects injurious to stored grain on the work record and "Results" section of the certificate.

7.15 DISTINCTLY LOW QUALITY

Consider oats distinctly low quality when they are obviously of inferior quality and existing grade factors or guidelines do not accurately reflect the inferior condition.

Basis of Determination. Use all available information to determine whether the oats are of distinctly low quality (DLQ). This includes a general examination of the oats during sampling and an analysis of the obtained sample(s).

a. Diatomaceous Earth (DIAT). Oats suspected of containing DIAT are considered DLQ unless the applicant specifically requests an examination to verify the presence of DIAT. If the laboratory examination verifies that the oats contain DIAT, then the oats are not considered DLQ due to DIAT. For additional information regarding the testing of oats for diatomaceous earth, refer to Directive 9180.49, "Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel."

b. Flood Damaged Grain. Oats that are materially affected by flooding are considered DLQ and certified as "U.S. Sample Grade." In addition, official personnel must report identifiable lots that are DLQ to the district Food and Drug Administration (FDA) office as "actionable" in accordance with FGIS-PN-19-04, "Inspection of Flood Damaged Grain".

   The determination of DLQ is based on the appearance and condition of the lot or sample as a whole. Evaluate oats affected by flooding on a portion of approximately 400 grams with the use of the ILP – All Grains/Graded Commodities - Inspection of Flood Damaged Grain. If a sample does not meet the requirements for DLQ, but the kernels are materially damaged (stained) by flooding, consider the kernels as damaged and count toward the total percentage of damaged kernels in the sample.

c. Large Animal Excreta (LGANX). Oats containing one or more large animal excreta (e.g., deer or elk pellet) are considered DLQ.

d. Large Debris. Oats containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris which are visible to the sampler but too large to enter the sampling device are considered DLQ.

e. Other Unusual Conditions. Oats that are obviously affected by other unusual conditions which adversely affect the quality of the oats and cannot be properly graded by use of the grading factors specified or defined in the standards are considered DLQ.

Certification. When applicable, show the factor DLQ and the reason(s) why on the work record and "Results" section of the certificate, and grade the oats "U.S. Sample Grade."

7.16 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine U.S. Sample Grade criteria before the removal of coarse foreign material and other grains based on a work portion of 700 - 800 grams.

Table 7.5 – U.S. Sample Grade Criteria shows the criteria and corresponding Visual Aids, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, or bulgur), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain must function as "unknown foreign substance (FSUB)."

TABLE 7.5 – U.S. SAMPLE GRADE CRITERIA

Criteria	Visual Aids	Number/Weight[1]	
		Sample Basis	Lot Basis[2]
Any Numerical Grading Factor		Excess of limit for U.S. No. 4	N/A
Animal Filth	Animal Filth	10 or more	N/A
Castor Beans	Castor Bean	2 or more	N/A
Cockleburs	Cockleburs	8 or more	N/A
Crotalaria Seeds	Crotalaria	3 or more	N/A
Glass		2 or more	N/A
Odor		Presence	N/A
Stones		8 or more and in excess of 0.2% by weight	N/A
Unknown Foreign Substances[3]	Fertilizer	4 or more	N/A
Heating		Presence	Presence
Large Debris*		N/A	2 or more
Other Unusual Conditions*		Presence	Presence

[1] Record count factors to the nearest whole number.
[2] The entire sample of a submitted sample is considered as the lot.
[3] Consider feed pellets and processed grain products as foreign material, not unknown foreign substance.
* For Distinctly Low Quality, refer to Section 7.15.

Certification. Grade oats "U.S. Sample Grade" when one or more of the limits in Table 7.5 – U.S. Sample Grade Criteria are observed. Record the factors (count factors to the nearest whole number) on the work record and "Results" section of the certificate.

7.17 THIN OATS

Thin Oats. Oats that contain more than 20.0 percent of oats and other matter, except fine seeds, that pass through a 0.064 by 3/8 oblong-hole sieve but remain on top of a 5/64 triangular-hole sieve after sieving according to procedures prescribed in FGIS instructions.

Fine Seeds. All matter that passes through a 5/64 triangular-hole sieve after sieving according to procedures prescribed in FGIS instructions.

Basis of Determination. Determine thin (THIN) on a portion of 250 grams of the original sample. Separate the thin oats from the sample using the following method:

Mechanical Sieving Method:

a. Mount a 0.064 x 3/8-inch (1.626 x 9.525 mm) oblong-hole sieve and a bottom pan on the mechanical sieve shaker.

b. Set the stroke counter for 30 strokes.

c. Place one-third of the sample in the center of the sieve and actuate the shaker.

d. Remove, clean the sieve, and empty the bottom pan. Return the material lodged in the perforations to the oats on top of the sieve.

e. Repeat this operation on the remaining portions until entire sample has been sieved.

Sieve the material which passed through the 0.064 x 3/8-inch oblong-hole sieve over a 5/64 (1.984 mm) triangular-hole hand sieve (small buckwheat) to remove the fine seeds which may be present. Place the material that passed through the 0.064 x 3/8-inch oblong-hole sieve on the upper edge of the small buckwheat sieve. Hold the sieve at a 10 to 20-degree angle and work the material down over the sieve with a gentle side-to-side motion. The fine seeds and other material passing through the small buckwheat sieve are considered fine seeds.

The oats and other material that pass through the 0.064 x 3/8-inch oblong-hole sieve but remain on top of the 5/64-inch triangular-hole sieve are thin oats.

Certification. When applicable, grade the oats "Thin" on the grade line of the certificate in accordance with Section 7.5, “Special Grades.” Record the percent of thin on the work record and “Results” section of the certificate to the nearest tenth percent.

7.18 PROCESSING THE WORK SAMPLE

At this point, all test required to be performed prior to the removal of coarse foreign material have been completed. Also, the sample has been examined for certain sample grade and special grade factors. Now the work sample is ready to be divided into fractional portions for other determinations required after the removal of coarse foreign material.

Chart 7.1 – Dividing the Work Sample and Table 7.6 – Approximate Analytical Portion Sizes illustrate how the sample is divided into fractional parts using an approved divider.

CHART 7.1 – DIVIDING THE WORK SAMPLE

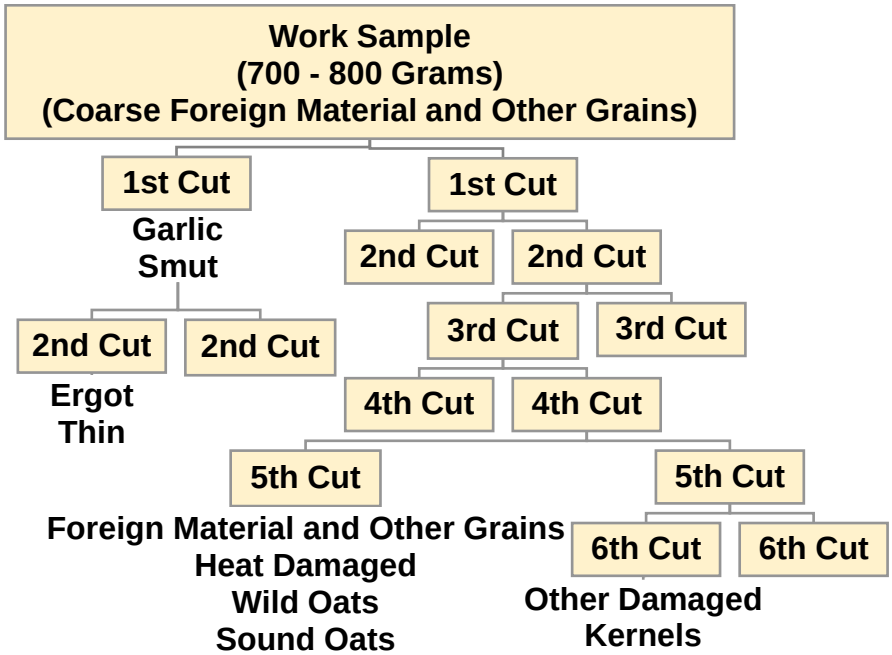


TABLE 7.6 – APPROXIMATE ANALYTICAL PORTION SIZES

Factors	Grams
Smut	500
Garlic	500
Ergot	250
Foreign Material and Other Grains	30
Heat-Damaged Kernels	30
Wild Oats	30
Other Damaged Kernels	15
Sound Oats	30

7.19 GARLICKY OATS

Definition. *Oats that contain four or more green garlic bulblets or an equivalent quantity of dry or partly dry bulblets in 500 grams of oats.*

Basis of Determination. Determine garlicky (GAR) on a portion of 500 grams of the original sample. (VRI – O.F. - 13.0 Green Garlic Bulbs (Whole) and O.F. - 13.1 Dry Garlic Bulbs (1/3rd))

Characteristics of Bulblets.

a. Green garlic bulblets are bulblets which have retained all of their husks intact.

b. Dry or partly dry garlic bulblets are bulblets which have lost all or part of their husks. Consider bulblets with cracked husks as dry.

c. Three dry or partly dry garlic bulblets are equal to one green bulblet.

Note: Garlic bulblets apply in the determination of "Garlicky" but also function as foreign material.

Wild onion, sometimes referred to as "crow garlic", is considered as garlic.

Certification. When applicable, grade the oats "Garlicky" on the grade line of the certificate in accordance with Section 7.5, "Special Grades." Record the number of garlic bulblets in whole numbers or in decimals to the nearest hundredths position (e.g., 1/3 = 0.33 or 2/3 = 0.67) on the work record and "Results" section of the certificate.

7.20 SMUTTY OATS

Definition. *Oats that have kernels covered with smut spores to give a smutty appearance in mass or that contain more than 0.2 percent of smut balls.*

Basis of Determination. Determine smutty (SMUT) on a portion of 500 grams of the original sample.

Smut is a plant disease characterized by the appearance of smut balls or smut spores. Smut balls apply in the determination of the special grade "Smutty" but also function as foreign material. (VRI – O.F. - 22.0 Smut Balls)

Certification. When applicable, grade the oats "Smutty" on the grade line of the certificate in accordance with Section 7.5, "Special Grades." Record the percent of smut balls on the work record and "Results" section of the certificate to the nearest tenth percent.

7.21 ERGOTY OATS

Definition. *Oats that contain more than 0.10 percent ergot.*

Basis of Determination. Determine ergoty (ERG) on a portion of 250 grams of the original sample.

Ergot is a hard, reddish-brown or black grain-like mass of certain parasitic fungi that replaces oat kernels. Ergot applies in the determination of the special grade "Ergoty" and also functions as foreign material. (VRI – O.F. - 12.0 Ergot)

Certification. When applicable, grade the oats "Ergoty" on the grade line of the certificate in accordance with Section 7.5, "Special Grades." Record ergot to the nearest hundredth percent on the work record and "Results" section of the certificate.

7.22 FOREIGN MATERIAL AND OTHER GRAINS

Foreign Material. All matter other than oats, wild oats, and other grains.

Consider oat clippings and detached oat hulls and pieces of detached hulls as foreign material. Also consider black oats as foreign material when found in white or red oats.

Other Grains. Barley, corn, cultivated buckwheat, einkorn, emmer, flaxseed, guar, hull-less barley, nongrain sorghum, Polish wheat, popcorn, poulard wheat, rice, rye, safflower, sorghum, soybeans, spelt, sunflower seed, sweet corn, triticale, and wheat.

Note: Consider heat-damaged other grains as heat-damaged only, not foreign material.

a. Coarse Foreign Material and Other Grains.

Basis of Determination. Determine coarse foreign material and coarse other grains on a work portion of 1-1/8 to 1-1/4 quarts. Coarse foreign material and coarse other grains consists of the following:

(1) Coarse Foreign Material.

(a) Cockleburs.

(b) Sticks if the following criteria are met:

1 Approximately 2.5 cm (1inch) or more in length.

2 Approximately 1.3 cm (1/2 inch) or more with a thickness of 0.4 cm (5/32 inch).

(c) Soybean pods (one-half pod or more).

(d) Other coarse foreign material may include but is not limited to corn cobs, large feed pellets, pieces of dirt, and edible beans.

(2) Coarse Other Grains.

(a) Whole kernels of corn and sweet corn with one-fourth or less of the kernel removed.

(b) Whole soybeans which are soybeans with one-fourth or less of the soybean removed.

(c) Sunflower seeds with the hulls intact.

Maintain individual separations for coarse foreign material and for coarse other grains.

b. Fine Foreign Material and Other Grains.

Basis of Determination. Determine fine foreign material and fine other grains after the removal of coarse foreign material and coarse other grains on a work portion of 30 grams.

(1) Fine Foreign Material.

(a) Star thistles, star burs, sandburs, morning glory, and kinghead seeds.

(b) Sticks not meeting the criteria for coarse foreign material.

(c) Soybean pods less than one-half the total pod.

(d) Any other material too small to function as coarse foreign material and other grains.

(2) Fine Other Grains.

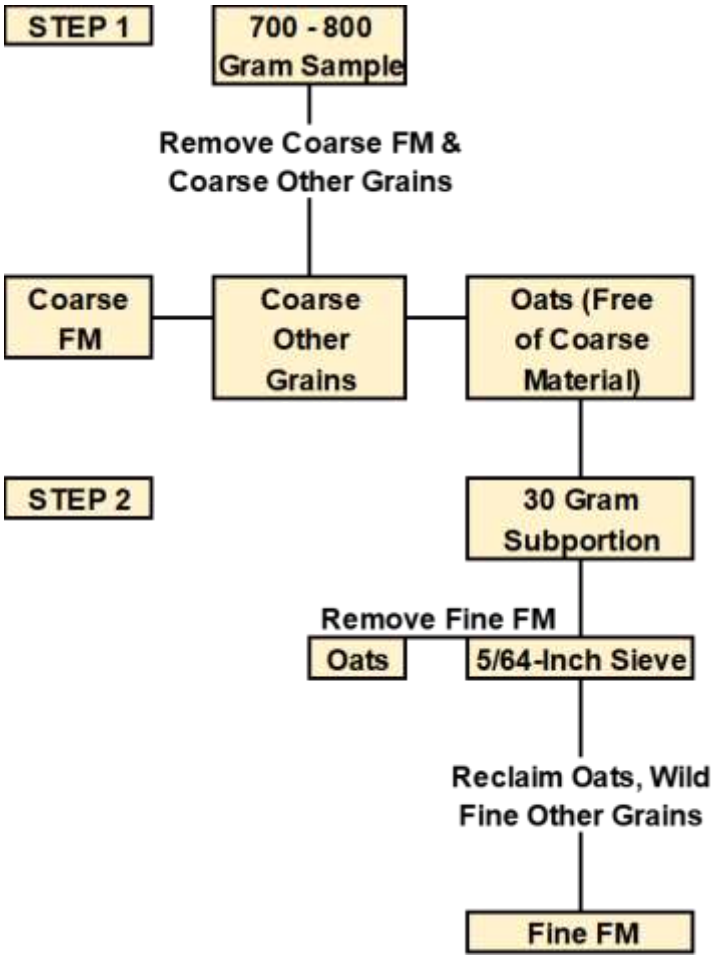
(a) Broken kernels of corn and sweet corn with more than one-fourth of the kernel removed.

(b) Broken soybeans with more than one-fourth of the soybean removed.

(c) Dehulled sunflower seeds.

(d) Other grains as defined in this section.

CHART 7.2 – PROCEDURE FOR DETERMINING FOREIGN MATERIAL AND OTHER GRAINS



Coarse Foreign Material and Coarse Other Grains.

a. Handpick the 700 to 800 gram work portion for coarse foreign material and coarse other grains.

b. Refer to the above definition for materials which constitute coarse foreign material and coarse other grains.

Fine Foreign Material and Fine Other Grains.

a. Cut down the cleaned sample to a portion of 30 grams.

b. Either:

(1) Handpick the 30-gram portion for fine foreign material and fine other grains; or

(2) Use, as an aid, a 5/64-inch (1.984 mm) triangular-hole sieve to remove the fine foreign material and fine other grains.

c. When using the sieve, gently slide the sample across the sieve then separate the oats, wild oats, and fine other grains from the material that passed through the sieve.

d. Remove all fine foreign material from the material remaining on top of the sieve.

e. Refer to the above definition for the material which constitute fine foreign material and fine other grains.

Calculate foreign material in oats by adding the percent of coarse foreign material to the percent of fine foreign material in hundredths (disregard thousandths) and round the sum to the nearest tenth percent.

Example: Foreign Material and Other Grains Calculation

Weight of representative sample	700 grams
Weight of coarse foreign material	5.00 grams
Weight of portion to be sieved	30.00 grams
Weight of fine foreign material	0.50 grams

a. **Percent of coarse foreign material.**
(5.00g ÷ 700g) x 100 = 0.71%.

b. **Percent of fine foreign material.**
(0.50g ÷ 30.00g) x 100 = 1.66%.

c. **Percent of foreign material.**
(0.71% + 1.66%) = 2.37% (rounded to 2.4%).

Calculate other grains in oats by adding the percent of coarse other grains to the percent of fine other grains (procedure similar to that given in the above example).

Certification. Record the percent of foreign material and other grains (both including coarse and fine) on work record and “Results” section of the certificate to the nearest tenth percent.

Upon applicant request, determine the percent of dehulled (DH) oat kernels and certify the results according to the procedures listed below:

a. From the 30-gram portion used to analyze fine foreign material and fine other grains, remove all oat kernels that are completely dehulled.

b. Calculate the percent of dehulled kernels.

c. Record the percent of dehulled oats on the work record and “Results” section of the certificate to the nearest tenth percent.

7.23 WILD OATS

Definition. *Seeds of Avena fatua L. and A. sterilis L.*

Basis of Determination. Determine wild oats (WO) after the removal of coarse foreign material and coarse other grains on a work portion of 30 grams.

Wild oats are usually identified by their slender kernels with twisted awns (so-called "sucker mouths") and basal hairs or bristles on the germ end of the kernel.

Wild oats function against sound oats. (VRI – O.F. - 28.0 Wild Oats)

Certification. Record the percent of wild oats on the work record and "Results" section of the certificate to the nearest tenth percent.

7.24 HEAT-DAMAGED KERNELS

Definition. *Kernels and pieces of oat kernels, other grains, and wild oats that are materially discolored and damaged-by-heat.*

a. Whole Corn and Soybeans.

Basis of Determination. Determine heat-damaged whole corn and soybeans on a work portion of 700 - 800 grams.

Whole corn and soybeans that show evidence of distinct discoloration and damage by heat are examined to determine if they are heat damaged. (VRI – C - 5.0 Heat Damage (Drier), C - 5.1 Heat Damage (White), C - 5.2 Heat Damage (Yellow), and SB - 5.0 Heat Damage (Materially Damaged/Heating))

b. Oats, Wild Oats, and Other Grains.

Basis of Determination. Determine heat-damaged kernels after the removal of coarse foreign material and coarse other grains on a work portion of 30 grams.

Kernels of oats and wild oats that show evidence of distinct discoloration and damage by heat are hulled to determine if they are heat-damaged. When the hulled kernels show a reddish discoloration extending out of the germ, the kernels are heat-damaged. (VRI – O - 3.0 Heat Damage)

Groats showing moldy, mold-like substance, sprouted, or dead germs but no reddish cast or discoloration function against sound cultivated oats but not as heat-damaged kernels.

Other grains that show evidence of distinct discoloration and damage by heat are examined to determine if they are heat-damaged.

Calculating Heat-Damaged Kernels. Calculate the percent of heat-damaged kernels by adding the percent of heat-damaged whole corn and soybeans to the percent of heat-damaged oats, wild oats, and other grains in hundredths (disregard thousandths) and round the sum to the nearest tenth percent.

Example: Heat-Damaged Kernels Calculation

Weight of representative sample	700 grams
Weight of heat-damaged corn and soybeans	3.00 grams
Weight of representative sample	30.00 grams
Weight of heat-damaged oats, wild oats, and other grains	0.30 grams

a. **Percent of heat-damaged whole corn and soybeans.**
(3.00g ÷ 700g) x 100 = 0.42%.

b. **Percent of heat-damaged oats, wild oats, and other grains.**
(0.30g ÷ 30.00g) x 100 – 1.00%.

c. **Percent of heat-damaged kernels.**
(0.42% + 1.00%) = 1.42% (rounded to 1.4%).

Certification. Record the percent of heat-damaged kernels on the work record and "Results" section of the certificate to the nearest tenth percent.

7.25 OTHER DAMAGED KERNELS

Other damaged kernels are kernels and pieces of oat kernels, *except heat-damaged kernels*, that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-damaged, insect-bored, mold-damaged, sprout-damaged, or otherwise materially damaged.

Heat-damaged kernels are not considered as part of other damaged kernels.

Basis of Determination. Determine other damaged kernels (ODK) after the removal of coarse foreign material and coarse other grains on a work portion of 15 grams.

In general, consider oats to be damaged for inspection and grading purposes only when the damage is distinctly apparent and of such character as to be recognized as damaged for commercial purposes.

Oat groats; hull-less oats; and green, immature kernels of oats that are not otherwise damaged are considered sound.

TYPES OF OAT DAMAGE.

Badly-Ground and/or Weather-Damaged Kernels. Kernels which are badly discolored by ground and/or weather conditions. (VRI – O - 1.0 Badly Ground and/or Weather Damage and O - 1.1 Weather Damaged (Stained))

Germ-Damaged Kernels (Sick and/or Mold). Kernels in which the germ is discolored or moldy as a result of respiration. The hull must be removed to determine the extent of germ damage. Kernels containing any amount of mold are considered damage. (VRI – O - 2.0 Germ Damage (Sick and/or Mold))

Insect-Bored Kernels. Kernels which have been bored or tunneled by insects are considered damaged and scored against sound. (VRI – O - 4.0 Insect Damage)

Sprout-Damaged Kernels. Kernels which have sprouted or which generally have a crack in the seed coat over the germ area are considered damaged and scored against sound. The hull must be removed to determine if the cracked seed coat indicates sprouting. Sprout sockets are considered damaged when sufficient evidence of sprouting has occurred. (VRI – O - 5.0 Sprout Damage)

Calculate the percent other damaged kernels in oats as follows:

Example: Other Damaged Kernels Calculation

Weight of representative portion	15.10 grams
Weight of other damaged kernels	0.11 grams

Percent of other damaged kernels.
(0.11g ÷ 15.10g) x 100 = 0.72% (rounded to 0.7%).

Certification. Record the percent of other damaged kernels on the work record to the nearest tenth percent.

7.26 SOUND OATS

Definition. *Kernels and pieces of oat kernels (except wild oats) that are not badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-damaged, heat-damaged, insect-bored, mold-damaged, sprout-damaged, or otherwise materially damaged.*

Basis of Determination. To determine the percent of sound oats (SO), separate all damaged oats and all matter other than cultivated oats from the work portion. The practical application of this determination involves:

a. Separation of coarse foreign material and whole kernels of corn and soybeans from the work sample (700 - 800 grams);

b. The separation of foreign material, other grains, heat-damaged kernels, and wild oats from a work portion of 30 grams; and

c. The separation of other damaged kernels from a work portion of 15 grams.

The added total percent of foreign material, other grains, heat-damaged kernels, other damaged kernels, and wild oats subtracted from 100 percent, equals the percent of sound oats.

Certification. Record the percent of sound oats on the work record and "Results" section of the certificate to the nearest tenth percent.

7.27 OFFICIAL CRITERIA

Official criteria factors are determined only upon request and do not affect the grade designation.

Seed sizing. The use of the 5/64 x 3/4 slotted-hole sieve to determine the percent of oats and other materials, except for fine seeds, that pass through the sieve.

Basis of Determination. Determine seed size on a portion of 250 grams of the original sample. Separate the seeds from the sample using the following method:

Mechanical Sieving Method.

a. Mount a 5/64 x 3/4 (1.984 x 19.050 millimeters (mm)) slotted-hole sieve and a bottom pan on the mechanical sieve shaker.

b. Set the stroke counter for 30 strokes.

c. Place the portion in the center of the sieve and actuate the shaker.

d. Remove, clean the sieve, and empty the bottom pan. Return the material lodged in the perforations to the oats on top of the sieve.

Sieve the material which passed through the 5/64 x ¾-inch slotted-hole sieve over a 5/64 (1.984 mm) triangular-hole hand sieve (small buckwheat) to remove the fine seeds which may be present. Place the material that passed through the 5/64 x ¾-inch slotted-hole sieve on the upper edge of the small buckwheat sieve. Hold the sieve at a 10 to 20-degree angle and work the material down over the sieve with a gentle side-to-side motion. The fine seeds and other material passing through the small buckwheat sieve are considered fine seeds.

Certification. Record the results of the sizing test to the nearest tenth percent on the work record and "Results" section of the certificate.

CHAPTER 8:
RYE

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8.1 GENERAL ORDER OF PROCEDURES

The breakdown and inspection for Rye are listed below in the following chapter according to its general order. The order of procedure may slightly vary depending on the quality of the rye and the tests requested. More information is available on the Agricultural Marketing Service Website (AMS), in the U.S. Standards for Rye, and the Board of Appeals and Review (BAR) Questions and Answers.

The inspection process provides various factor information used to determine grade and to provide further information on the condition or quality of rye. Each section of this chapter provides details on recording factor information. If requested by the applicant for inspection, additional information may be provided (e.g., an exact count on stones in addition to the percent by weight, a percent for a specific type of damage).

8.2 DEFINITION OF RYE

Definition. *Grain that, before the removal of dockage, consists of 50 percent or more of common rye (Secale cereale L.) and not more than 10 percent of other grains for which standards have been established under the United States Grain Standards Act and that, after the removal of dockage, contains 50 percent or more of whole rye.*

Whole kernels are kernels with three-fourths or more of the kernel present. Other grains for which standards have been established are barley, canola, corn, flaxseed, oats, sorghum, soybeans, sunflower seed, triticale, and wheat.

Basis of Determination. Normally, a visual appraisal of the sample is sufficient to determine if it meets the definition of rye. However, if an analysis is necessary, make the determination on a portion of 50 grams. Determine the percent of rye and other grains before the removal of dockage. Determine the percent of whole kernels after the removal of dockage.

If the sample does not meet the definition of rye, examine it further to determine if it is:

a. Another grain for which standards have been established; or

b. Not Standardized Grain (NSG). No further analysis is necessary on a sample designated as NSG unless a specific factor test is requested.

8.3 GRADES AND GRADE REQUIREMENTS

There are no classes or subclasses in rye. Rye is divided into four numerical grades and U.S. Sample Grade. Special grades emphasize qualities or conditions affecting the value and are added to and made a part of the grade designation. Special grades do not affect the numerical or sample grade designation.

TABLE 8.1 – GRADES AND GRADE REQUIREMENTS FOR RYE

Grade	Minimum Limits of -	Maximum Limits of -				
		Foreign Material		Damaged Kernels		
	Test Weight per bushel (pounds)	Foreign Matter Other Than Wheat (percent)	Total (percent)	Heat Damaged (percent)	Total (percent)	Thin Rye (percent)
U.S. No. 1	56.0	1.0	3.0	0.2	2.0	10.0
U.S. No. 2	54.0	2.0	6.0	0.2	4.0	15.0
U.S. No. 3	52.0	4.0	10.0	0.5	7.0	25.0
U.S. No. 4	49.0	6.0	10.0	3.0	15.0	–

U.S. Sample Grade is rye that:

a. Does not meet the requirements for grades U.S. No.1, 2, 3, or 4; or

b. Contains 8 or more stones or any number of stones which have an aggregate weight in excess of 0.2 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria spp*.), 2 or more castor beans (*Ricinus communis L*.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 2 or more rodent pellets, bird droppings, or an equivalent quantity of other animal filth per 1 1/8 to 1 1/4 quarts of rye; or

c. Has a musty, sour, or commercially objectionable foreign odor (except smut or garlic odor); or

d. Is heating or otherwise of distinctly low quality.

8.4 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in Table 8.1 – Grades and Grade Requirements. Use the following guidelines when assigning grades:

a. The letters "U.S.";

b. The abbreviation "No." and the number of the grade or the words "Sample Grade";

c. The words "or better" when applicable;

d. The special grade "Plump" when applicable;

e. The word "Rye";

f. The applicable special grade(s) in alphabetical order;

g. The word "Dockage" when applicable, and the percentage thereof.

8.5 SPECIAL GRADES

Special grades draw attention to unusual conditions in grain and are made part of the grade designation. The special grades and special grade requirements for rye are shown in the United States Standards for Rye. Details for determining special grades are included in referenced sections. Definitions and examples of the designations for special grades in rye are:

a. Ergoty Rye. Rye that contains more than 0.30 percent of ergot. (Section 8.19)

Example: U.S. No. 1 Rye, Ergoty, Dockage 2.0%

b. Garlicky Rye. Rye that contains in a 1,000-gram portion more than six green garlic bulblets or an equivalent quantity of dry or partly dry bulblets. (Section 8.11)

Example: U.S. No. 3 Rye, Garlicky

c. Infested Rye. Rye that is infested with live weevils or other insects injurious to stored grain. (Section 8.12)

Example: U.S. No. 1 Rye, Infested

d. Light Garlicky Rye. Rye that contains in a 1,000-gram portion two or more, but not more than six, green garlic bulblets or an equivalent quantity of dry or partly dry bulblets. (Section 8.11)

Example: U.S. No. 1 Rye, Light Garlicky

e. Light Smutty Rye. Rye that has an unmistakable odor of smut, or that contains in a 250-gram portion smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 14 smut balls but not in excess of a quantity equal to 30 smut balls of average size. (Section 8.20)

Example: U.S. No. 3 Rye, Light Smutty

f. Plump Rye. Rye that contains not more than 5.0 percent of rye and other matter that passes through a 0.064 X 3/8 oblong-hole sieve. (Section 8.18)

Example: U.S. No. 1 Plump Rye

g. Smutty Rye. Rye that contains in a 250-gram portion smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 30 smut balls of average size. (Section 8.20)

Example: U.S. No. 2 Rye, Smutty

8.6 OPTIONAL GRADE DESIGNATION

The Official U.S. Standards for Grain provide for an optional grade designation, commonly referred to as "or better." Upon the request of an applicant, certify rye as U.S. No. 2 or better, U.S. No. 3 or better, etc. An "or better" grade designation cannot be applied to a U.S. No. 1 grade designation.

Example: U.S. No. 3 or better Rye, Dockage 2.0%

8.7 BASIS OF DETERMINATION

Distinctly Low Quality. The determination of distinctly low quality is made on the basis of the lot as a whole at the time of sampling when a condition exists that may or may not appear in the representative sample and/or the sample as a whole.

Certain Quality Determinations. Each determination of rodent pellets, bird droppings, other animal filth, broken glass, castor beans, cockleburs, crotalaria seeds, dockage, garlic, live insect infestation, large stones, moisture, temperature, an unknown foreign substance(s), and a commonly recognized harmful or toxic substance(s) is made on the basis of the sample as a whole. When a condition exists that may not appear in the representative sample, the determination may be made on the basis of the lot as a whole at the time of sampling according to procedures prescribed in FGIS instructions.

All Other Determinations. Other determinations not specifically provided for under the General Provisions are made on the basis of the grain when free from dockage, except the determination of odor is made on either the basis of the grain as a whole or the grain when free from dockage.

TABLE 8.2 – BASIS OF DETERMINATION

Lot as a Whole	Factors Determined Before the Removal of Dockage	Factors Determined After the Removal of Dockage
Distinctly Low Quality	Distinctly Low Quality	Damaged Kernels
Heating	Garlicky	Ergot
Infested	Heating	Foreign Material
Odor	Infested	Heat-Damaged Kernels
	Kind of Grain	Kind of Grain
	Moisture	Odor
	Odor	Plump
	Odor (Smut)	Smut
	Sample Grade Criteria	Stones
		Test Weight
		Thin

8.8 HEATING

Basis of Determination. Determine heating (HTG) on evidence obtained at the time of sampling or on the basis of the sample as a whole.

Rye developing a high temperature from excessive respiration is considered heating. Heating rye, in its final stages, will usually have a sour or musty odor. Do not confuse rye that is heating with rye that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

Certification. When applicable, show the term “Heating” on the work record and “Results” section of the certificate, and grade the rye “U.S. Sample Grade.”

8.9 ODOR

Basis of Determination. Determine odor on evidence obtained at the time of sampling or on the sample either before or after the removal of dockage.

TABLE 8.3 – ODOR CLASSIFICATION EXAMPLES

Musty	Sour	Commercially Objectionable Foreign Odors	
Ground Insect Moldy	Boot Fermenting Insect (acrid) Pigpen	Animal Hides Decaying Animal Fertilizer Fumigant Insecticide	Oil Products Skunk Smoke Strong Weed Vegetable Matter

Commercially objectionable foreign odors (COFO) are odors, except smut and garlic odors, foreign to grain that render it unfit for normal commercial usage.

Fumigant, insecticide, or fungicide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of rye contains a fumigant, insecticide, or fungicide odor that prevents a determination as to whether any other odor(s) exists, apply the following guidelines:

a. Original Inspections. Allow the work portion to aerate in an open container for 4 hours, or less, if the odor dissipates in less time.

b. Reinspections, Appeal and Board Appeal Inspections. Allow unworked file samples and new samples to aerate in an open container for 4 hours, or less, if the odor dissipates in less time. The 4-hour aeration requirement does not apply when the original work portion was aerated and retained as the final file.

Consider the sample as having a commercially objectionable foreign odor if the fumigant, insecticide, or fungicide odor persists based on the above criteria.

Final Determination. The inspector is responsible for making the final determination for all odors. Whenever possible, use a consensus of experienced licensed inspectors on samples containing marginal odors. Under the consensus approach, if a clear majority (at least 2/3) of inspectors agree the sample contains a Musty, Sour, or COFO odor, grade the rye “U.S. Sample Grade”. The consensus approach is not required if the initial inspector does not detect an odor or a distinct odor is detected.

Certification. Grade rye containing a *"distinct"* musty, sour, or commercially objectionable foreign odor as “U.S. Sample Grade.” Record the words "Musty," "Sour," or "Commercially Objectionable Foreign Odor" on the work record and “Results” section of the certificate.

8.10 MOISTURE

Definition. *Water content in grain as determined by an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine moisture before the removal of dockage on a portion of approximately 650 grams.

The procedures for performing a moisture determination using a FGIS approved moisture instrument utilizing the proper calibrations are described in the Moisture Handbook and in Chapter 1, General Information.

Certification. Record the percent of moisture on the work record and "Results" section of the certificate to the nearest tenth percent.

8.11 LIGHT GARLICKY AND GARLICKY RYE

Light Garlicky. Rye that contains in a 1,000-gram portion two or more, but not more than six, green garlic bulblets or an equivalent quantity of dry or partly dry bulblets.

Garlicky. Rye that contains in a 1,000-gram portion more than six green garlic bulblets or an equivalent quantity of dry or partly dry bulblets.

Basis of Determination. Determine light garlicky (LGAR) and garlicky (GAR) before the removal of dockage on a portion of 1,000 grams. (VRI – O.F. - 13.0 Green Garlic Bulbs (Whole) and O.F. - 13.1 Dry Garlic Bulbs (1/3rd))

Characteristics of Bulblets.

a. Green garlic bulblets are bulblets which have retained all of their husks intact.

b. Dry or partly dry garlic bulblets are bulblets which have lost all or part of their husks. Consider bulblets with cracked husks as dry.

c. Three dry or partly dry garlic bulblets are equal to one green bulblet.

Note: Garlic bulblets apply in the determination of "Light Garlicky" and "Garlicky" but also function as dockage and foreign material.

Wild onion, sometimes referred to as "crow garlic", is considered as garlic.

Certification. When applicable, grade the rye "Light Garlicky" or "Garlicky" on the grade line of the certificate in accordance with Section 8.5, "Special Grades." Record the number of garlic bulblets in whole numbers or in decimals to the nearest hundredths position (e.g., 1/3 = 0.33 or 2/3 = 0.67) on the work record and "Results" section of the certificate.

8.12 INFESTED RYE

Rye that is infested with live weevils (LW) or other live insects injurious to stored grain (OLI).

The presence of any LW or OLI found in the work sample indicates the probability of infestation and warns that the rye must be carefully examined to determine if it is infested. In such cases, examine the work sample and file sample before reaching a conclusion as to whether or not the rye is infested. Do not examine the file sample if the work portion is insect free.

LW include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. OLI include grain beetles, grain moths, and larvae. To further define "other insect injurious to stored grain" refer to the Stored-Grain Insect Reference. Images of insects may also be viewed on the AMS website.

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, refer to Table 8.4 – Insect Infestation.

TABLE 8.4 – INSECT INFESTATION

Samples meeting or exceeding any one of these tolerances are infested: ***2 LW, or 1 LW + 1 OLI, or 2 OLI***		
1,000-gram representative sample[1] (+ file sample if needed)	**Lot as a Whole (Stationary)**	**Online Sample (In-Motion)[2]**
Submitted Samples Probed Lots D/T Sampled Land Carriers	Probed Lots (at time of sampling)	Railcars under the Cu-sum Subsamples for Sacked Grain Lots Components for Bargelots[3] Components for Shiplots[3]

[1] Examine work portion and file sample if necessary. Do not examine file sample if work portion is insect free.

[2] Minimum sampling rate is 500 grams per 2,000 bushels.

[3] Minimum component size is 10,000 bushels.

Key: LW = Live Weevil, OLI = Other Live Insects injurious to stored grain

Certification. When applicable, grade the rye "Infested" on the grade line of the certificate in accordance with Section 8.5, "Special Grades." Record the number of live weevils and/or other live insects injurious to stored grain on the work record and results section of the certificate.

8.13 DISTINCTLY LOW QUALITY

Consider rye distinctly low quality when it is obviously of inferior quality and existing grade factors or guidelines do not accurately reflect the inferior condition.

Basis of Determination. Use all available information to determine whether the rye is of distinctly low quality (DLQ). This includes a general examination of the rye during sampling and an analysis of the obtained sample(s).

a. Diatomaceous Earth (DIAT). Rye suspected of containing DIAT is considered DLQ unless the applicant specifically requests an examination to verify the presence of DIAT. If the laboratory examination verifies that the rye contains DIAT, then the rye is not considered DLQ due to DIAT. For additional information regarding the testing of rye for diatomaceous earth, refer to Directive 9180.49, "Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel."

b. Flood Damaged Grain. Rye that is materially affected by flooding is considered DLQ and certified as "U.S. Sample Grade." In addition, official personnel must report identifiable lots that are DLQ to the district Food and Drug Administration (FDA) office as "actionable" in accordance with FGIS-PN-19-04, "Inspection of Flood Damaged Grain".

   The determination of DLQ is based on the appearance and condition of the lot or sample as a whole. Evaluate rye affected by flooding on a portion of approximately 400 grams with the use of the ILP – All Grains/Graded Commodities - Inspection of Flood Damaged Grain. If a sample does not meet the requirements for DLQ, but the kernels are materially damaged (stained) by flooding, consider the kernels as damaged and count toward the total percentage of damaged kernels in the sample.

c. Large Animal Excreta (LGANX). Rye containing one or more large animal excreta (e.g., deer or elk pellet) is considered DLQ.

d. Large Debris. Rye containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris which are visible to the sampler but too large to enter the sampling device is considered DLQ.

e. Other Unusual Conditions. Rye that is obviously affected by other unusual conditions which adversely affect the quality of the rye and cannot be properly graded by use of the grading factors specified or defined in the standards is considered DLQ.

Certification. When applicable, show the factor DLQ and the reason(s) why on the work record and "Results" section of the certificate, and grade the rye "U.S. Sample Grade."

8.14 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine U.S. Sample Grade criteria, except for stones, before the removal of dockage based on a work portion of 1,000 - 1,050 grams. Determine stones on a dockage-free portion.

Table 8.5 – U.S. Sample Grade shows the criteria and corresponding Visual Aids, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, or bulgur), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain must function as "unknown foreign substance (FSUB)."

Note: Dockage Weight must be subtracted from the original weight to calculate the percent of stones.

Original sample weight – weight of dockage
= dockage-free sample weight.
1033g – 32 (32.48 rounded) = 1001g dockage-free sample weight.

TABLE 8.5 – U.S. SAMPLE GRADE CRITERIA

Criteria	Visual Aids	Number/Weight[1]	
		Sample Basis	Lot Basis[2]
Any Numerical Grading Factor		Excess of limit for U.S. No. 4	N/A
Animal Filth	Animal Filth	2 or more	N/A
Castor Beans	Castor Bean	2 or more	N/A
Crotalaria Seeds	Crotalaria	3 or more	N/A
Glass		2 or more	N/A
Odor		Presence	N/A
Stones[3]		8 or more or any number in excess of 0.2% by weight	N/A
Unknown Foreign Substances[4]	Fertilizer	4 or more	N/A
Heating		Presence	Presence
Large Debris*		N/A	2 or more
Other Unusual Conditions*		Presence	Presence

[1] Record count factors to the nearest whole number.
[2] The entire sample of a submitted sample is considered as the lot.
[3] Stones are based on sample after removal of dockage.
[4] Consider feed pellets and processed grain products as foreign material, not unknown foreign substance.
* For Distinctly Low Quality, refer to Section 8.13.

Certification. Grade rye "U.S. Sample Grade" when one or more of the limits in Table 8.5 – U.S. Sample Grade Criteria are observed. Record the factors (count factors to the nearest whole number) on the work record and "Results" section of the certificate.

8.15 DOCKAGE

Definition. *All matter other than rye that can be removed from the original sample by use of an approved device in accordance with procedures prescribed in FGIS instructions. Also, underdeveloped, shriveled, and small pieces of rye kernels removed in properly separating the material other than rye and that cannot be recovered by properly rescreening and recleaning.*

Basis of Determination. Determine dockage (DKG) on a portion of 1,000 – 1,050 grams of the original sample.

When performing the dockage determination, check the material that passes over the riddle for threshed and sprouted kernels of rye.

Threshed and sprouted kernels that pass over the riddle are not considered dockage. Return such kernels to the dockage-free sample. Threshed kernels of rye are kernels with either no glumes attached or not more than one glume attached.

Consider unthreshed kernels of rye that pass over the riddle as dockage. Unthreshed kernels are kernels with more than one glume attached. (VRI – O.F. - 30.0 Threshed and Unthreshed Kernels)

To avoid repeating operations, check the dockage for garlic bulblets, infestation, and U.S. Sample Grade factors (except stones). (Section 8.11, "Light Garlicky and Garlicky Rye;" Section 8.12, "Infested Rye;" and Section 8.14, "U.S. Sample Grade Criteria.")

Certification. Record the word "Dockage" and the percent to the nearest tenth percent on the work record and grade line of the certificate. Also, record the percent of dockage in the factor results section of the certificate application, but do not include this result in the "Results" section of the certificate. If the dockage is less than one-tenth percent, report as "Dockage 0.0%."

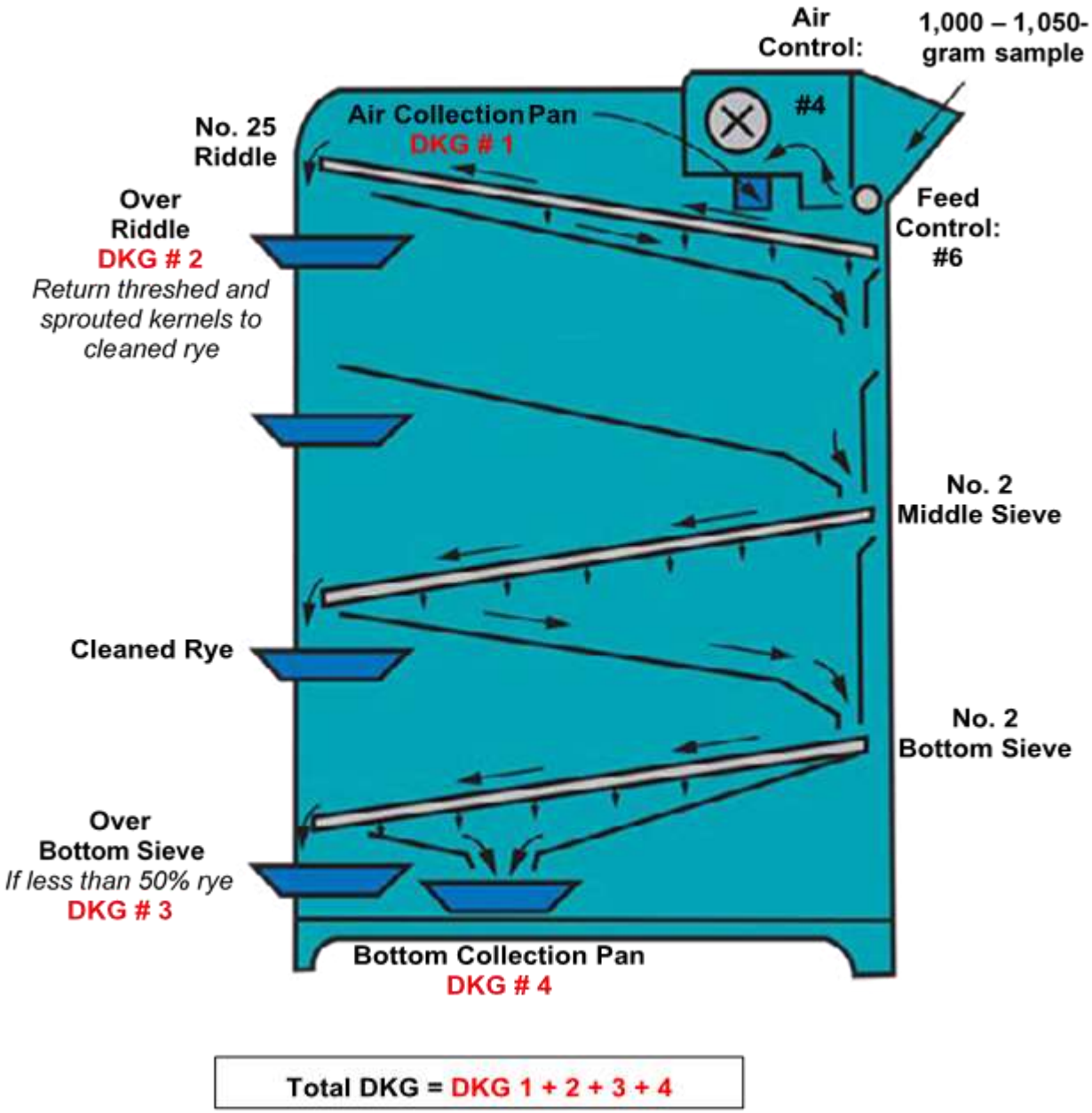

FIGURE 8.1 – PROCEDURE FOR DETERMINING DOCKAGE

Carter Dockage Tester (Mechanical Separation).

a. Set air control to 4 and the feed control to 6.

b. Insert the No. 25 riddle in the riddle carriage.

c. There is no sieve in the top sieve carriage.

d. Insert a No. 2 sieve in the middle and bottom sieve carriages.

e. Start Carter Dockage Tester and pour sample into feed hopper.

f. Aspirated material in the air collection pan is dockage.

g. Material over the riddle, except for threshed and sprouted kernels, is dockage.

h. Material that passed through the bottom sieve is dockage.

i. Material passing over the bottom sieve is dockage if it contains less than 50 percent by weight of rye. If 50 percent or more of triticale pass over the bottom sieve, return the material to the cleaned portion.

Additional Dockage Procedures. When rye contains wild buckwheat or similar seeds or flaxseed, determine dockage as follows:

a. Rye Containing Wild Buckwheat or Similar Seeds. If the sample appears to contain more than 0.5 percent of wild buckwheat, yellow or green foxtail, millet, wild mustard, or similar seeds, analyze a 50-gram portion cut from the original sample before the removal of dockage. (VRI – O.F. - 27.0 Wild Buckwheat and Similar Seeds) If the portion contains more than 0.5 percent of wild buckwheat or other similar sized seeds, proceed as follows:

(1) Set up the Carter Dockage Tester as follows:

(a) Set the air control to 4 and the feed control to 6;

(b) Insert a No. 25 riddle in the riddle carriage;

(c) There is no sieve in the top sieve carriage;

(d) Insert a No. 6 sieve in the middle sieve carriage;

(e) Insert a No. 2 sieve in the bottom sieve carriage.

(2) After removing the dockage, sieve approximately 50 grams of the material that *passed over* the No. 2 sieve (bottom sieve collection pan) by placing it on the upper edge of a 5/64 equilateral triangular hand sieve. Hold the sieve at a 10 to 20-degree angle and work the material down over the sieve with a gentle side-to-side motion.

(3) Repeat Step (2) above on additional 50-gram portions until all material in the bottom sieve collection pan has been sieved.

(4) If the material remaining on top of the sieve consists of 50 percent or more, by weight, of whole or broken kernels of rye, return it to the cleaned rye. Otherwise, add it to the dockage.

(5) Examine the material that passed through the hand sieve. If the material consists of 50 percent or more, by weight, of whole or broken kernels of rye, repeat the sieving process on 50-gram portions of all the material that passed through the hand sieve. *Do not* perform this hand sieving process *more than twice*.

(6) All material that passed through the hand sieve is dockage.

(7) Dockage will then consist of:

(a) The material removed by the aspirator (air collection pan);

(b) The coarse material, except for threshed and sprouted kernels of rye, that passed over the riddle (riddle collection pan);

(c) The material that passed through the No. 2 sieve (bottom collection pan);

(d) The material that passed through the hand sieve;

(e) The material that remained on the hand sieve when the material consists of less than 50 percent, by weight, of rye.

b. Rye Containing Canola, Flaxseed, or Rapeseed. If the sample appears to contain 0.3 percent or more of canola, flaxseed, or rapeseed, analyze a dockage-free portion of 50 grams. If the portion contains 0.3 percent or more of canola, flaxseed, or rapeseed, sieve the entire dockage-free sample. Use the appropriate sieve, a 5/64 triangular-hole sieve for removing canola/rapeseed, a 3/64-inch wide by 3/8-inch long or 3/64-inch wide by 11/32-inch long sieve for removing flaxseed as follows:

(1) Mechanical Sieving Method.

(a) Mount the sieve and a bottom pan on an approved mechanical sieve shaker.

(b) Set the stroke counter at 30 strokes.

(c) Place one-fourth of the dockage-free representative portion in the center of the sieve and actuate the shaker.

(d) Remove, clean the sieve, and empty the bottom pan. Return the material lodged in the perforations to the rye on top of the sieve.

(e) Repeat this operation on the remaining portions until entire sample has been sieved.

(2) If the material which passed through the sieve consists of less than 50 percent, by weight, of whole or broken kernels of rye, add it to the dockage. If it consists of 50 percent or more, by weight, of whole or broken kernels, recomposite it with the material remaining on top of the sieve.

(3) Dockage will then consist of:

(a) The material removed by the aspirator (air collection pan);

(b) The coarse material, except threshed and sprouted kernels, that passed over the riddle (riddle collection pan);

(c) The material that passed through the No. 2 sieve (bottom collection pan);

(d) The material which passed through the hand sieve if it consists of less than 50 percent, by weight, of whole and broken kernels of rye.

8.16 TEST WEIGHT

Definition. *The weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine test weight (TW) on a dockage-free portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination are described in Chapter 1, General Information.

Certification. Record test weight results on the work record and “Results” section of the certificate to the nearest tenth pound. If requested, convert the pounds per bushel (lbs./bu) result to kilograms per hectoliter (kg/hl) using the following formula: lbs./bu x 1.287 = kg/hl and record in the "Remarks" section in whole and tenths.

8.17 PROCESSING THE WORK SAMPLE

At this point, all test required to be performed prior to the removal of dockage have been completed. Also, the sample has been examined for certain sample grade and special grade factors. Now the work sample is ready to be divided into fractional portions for other determinations required after the removal of dockage.

Chart 8.1 – Dividing the Work Sample and Table 8.6 – Approximate Analytical Portion Sizes illustrate how the sample is divided into fractional parts using an approved divider.

CHART 8.1 – DIVIDING THE WORK SAMPLE

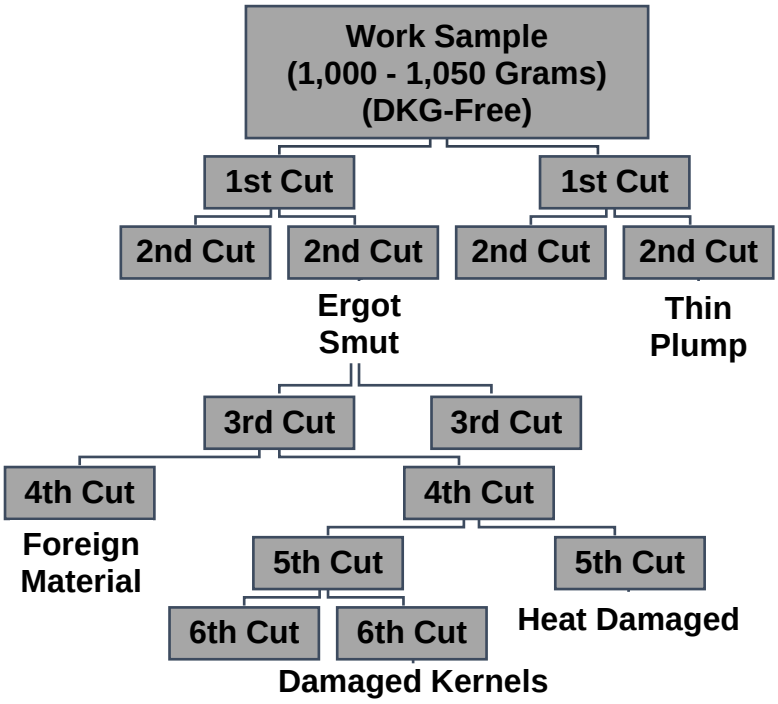

TABLE 8.6 – APPROXIMATE ANALYTICAL PORTION SIZES

Factors	Grams
Ergot	250
Plump	250
Smut	250
Thin	250
Foreign Material	50
Heat-Damaged Kernels	30
Damaged Kernels	15

8.18 THIN AND PLUMP RYE

Thin. Rye and other matter that passes through a 0.064 x 3/8 oblong-hole sieve after sieving according to procedures prescribed in FGIS instructions.

Plump. Rye that contains not more than 5.0 percent of rye and other matter that passes through a 0.064 X 3/8 oblong-hole sieve.

Basis of Determination. Determine thin (THIN) and plump (PL) on a dockage-free portion of 250 grams using the following method:

Mechanical Sieving Method.

a. Mount the 0.064 x 3/8-inch (1.626 x 9.525 mm) oblong-hole sieve and a bottom pan on the mechanical sieve shaker.

b. Set the stroke counter for 30 strokes.

c. Place the portion in the center of the sieve and actuate the shaker.

d. Remove, clean the sieve, and empty the bottom pan. Return the material lodged in the perforations to the rye on top of the sieve.

e. Consider all material passing through the sieve as thin rye. Consider all material remaining on top of the sieve as plump rye.

Certification. Record the percent of thin rye on the work record and "Results" section of the certificate to the nearest tenth percent. When applicable, grade the rye "Plump" on the grade line of the certificate in accordance with Section 8.5, "Special Grades."

8.19 ERGOTY RYE

Definition. *Rye that contains more than 0.30 percent of ergot.*

Basis of Determination. Determine ergoty (ERG) on a dockage-free portion of 250 grams.

Ergot is a hard, reddish-brown or black grain-like mass of certain parasitic fungi that replaces rye kernels. Ergot applies in the determination of "Ergoty" but also functions as foreign matter other than wheat. (VRI – O.F. - 12.0 Ergot)

Certification. When applicable, grade the rye "Ergoty" on the grade line of the certificate in accordance with Section 8.5, "Special Grades." Record ergot to the nearest hundredth percent on the work record and "Results" section of the certificate.

8.20 LIGHT SMUTTY AND SMUTTY RYE

Light Smutty. Rye that has an unmistakable odor of smut, or that contains in a 250-gram portion smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 14 smut balls but not in excess of a quantity equal to 30 smut balls of average size.

Smutty. Rye that contains in a 250-gram portion smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 30 smut balls of average size.

Basis of Determination. Determine light smutty (LSM) on the sample as a whole (odor only) or on a dockage-free portion of 250 grams. Determine smutty (SMUT) on a dockage-free portion of 250 grams.

Smut is a plant disease characterized by the appearance of smut balls or smut spores. Smut balls apply in the determination of the special grade "Light Smutty" or "Smutty" but also function as foreign matter other than wheat. (VRI – O.F. - 22.0 Smut Balls)

Certification. When applicable, grade the rye "Light Smutty," or "Smutty" on the grade line of the certificate in accordance with Section 8.5, "Special Grades." Record the odor (in the case of Light smutty) or number of smut balls on the work record and "Results" section of the certificate.

8.21 FOREIGN MATERIAL

Definition. *All matter other than rye that remains in the sample after the removal of dockage.*

Basis of Determination. Determine foreign material (FM) on a dockage-free portion of 50 grams.

In rye, the factor foreign material is divided into (a) foreign material (total) and (b) foreign material other than wheat.

a. Foreign Material (Total). Remove all matter other than rye from the representative portion and determine the percent of foreign material (total).

b. Foreign Material Other Than Wheat (FMOW). Remove the wheat from the total foreign material separation. The percent of FMOW is then based on the remaining foreign material after the removal of the wheat.

Certification. Record the percent of foreign material other than wheat and foreign material (total) on the work record and "Results" section of the certificate to the nearest tenth percent.

8.22 HEAT-DAMAGED KERNELS

Definition. *Kernels, pieces of rye kernels, and other grains that are materially discolored and damaged-by-heat.*

Basis of Determination. Determine heat-damaged kernels on a dockage-free portion of 30 grams. (VRI – W - 6.1 Heat Damage (Other Than Durum))

Certification. Record the percent of heat-damaged kernels on the work record and "Results" section of the certificate to the nearest tenth percent.

8.23 DAMAGED KERNELS

Definition. *Kernels, pieces of rye kernels, and other grains that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-damaged, heat-damaged, insect-bored, mold-damaged, sprout-damaged, or otherwise materially damaged.*

Basis of Determination. Determine damaged kernels (DKT) on a dockage-free portion of 15 grams.

In general, consider rye and other grains to be damaged for inspection and grading purposes only when the damage is distinctly apparent and of such character as to be recognized as damaged for commercial purposes.

TYPES OF RYE DAMAGE.

Black Tip Fungus. Kernels affected by black tip fungus to the extent that the fungus growth is on the germ and extends into the crease of the kernel. (VRI – W - 1.0 Black Tip Damage (Fungus))

Germ-Damaged Kernels (Sick and/or Mold). Kernels in which the germ is discolored or moldy as a result of respiration. The bran coat should be removed carefully because scraping too deeply could remove the damage. (VRI – RY - 1.0 Germ Damage (Sick and/or Mold))

Heat-Damaged Kernels. Kernels materially discolored and damaged-by-heat. Cross section the kernels to determine the extent of damage. Heat-damaged kernels are reddish-brown, mahogany, or creamy in cross-section. (VRI – W - 6.1 Heat Damage (Other Than Durum))

Insect-Bored Kernels. Kernels which have been bored or tunneled by insects. (VRI – RY - 4.0 Weevil or Insect-Bored)

Other Damaged Kernels. Kernels which have cracks, breaks, or "chews" which contain mold or fungus. (VRI – RY - 5.0 Other Damage)

Sprout-Damaged Kernels. Kernels that have the germ end broken open from germination and show sprout and kernels that have sprouted but which have the sprouts broken off. (VRI – RY - 3.0 Sprout Damage)

Kernels from which the germs have been chewed are considered sound kernels unless otherwise damaged. Do not confuse insect-chewed germs with sprout sockets. (VRI – RY - 3.2 A. Insect Chewed & B. Sprout Sockets)

At times, rye can present a ragged appearance, particularly after excessive handling. In many cases, the germ ends are slightly rubbed off, giving these kernels the appearance of having been sprouted. Close examination, however, usually indicates that the kernels have not sprouted but that the ends have merely been rubbed off through excessive handling. Such kernels, unless otherwise damaged, are considered sound. (VRI – RY - 3.1 Exposed Germ in Sound Rye (Not Sprout))

Certification. Record the percent of damaged kernels on the work record and "Results" section of the certificate to the nearest tenth percent. If the percent damaged kernels is less than the percent heat, the percent damaged kernels must be adjusted to equal the percent heat.

CHAPTER 9:
SORGHUM

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9.1 GENERAL ORDER OF PROCEDURES

The breakdown and inspection for Sorghum are listed below in the following chapter according to its general order. The order of procedure may slightly vary depending on the quality of the sorghum and the tests requested. More information is available on the Agricultural Marketing Service Website (AMS), in the U.S. Standards for Sorghum, and the Board of Appeals and Review (BAR) Questions and Answers.

The inspection process provides various factor information used to determine grade and to provide further information on the condition or quality of sorghum. Each section of this chapter provides details on recording factor information. If requested by the applicant for inspection, additional information may be provided (e.g., an exact count on stones in addition to the percent by weight or a percent for a specific type of damage).

9.2 DEFINITION OF SORGHUM

Definition. *Grain that, before the removal of dockage, consists of 50 percent or more of whole kernels of sorghum (Sorghum bicolor (L.) Moench) excluding nongrain sorghum and not more than 10.0 percent of other grains for which standards have been established under the United States Grain Standards Act.*

Whole kernels are kernels with three-fourths or more of the kernel present. Other grains for which standards have been established are barley, canola, corn, flaxseed, oats, rye, soybeans, sunflower seed, triticale, and wheat.

Basis of Determination. Normally, a visual appraisal of the sample is sufficient to determine if it meets the definition of sorghum. However, if an analysis is necessary, make the determination before the removal of dockage on a portion of 30 grams.

If the sample does not meet the definition of sorghum, examine it further to determine if it is:

a. Another grain for which standards have been established; or

b. Not Standardized Grain (NSG). No further analysis is necessary on a sample designated as NSG unless a specific factor test is requested.

9.3 GRADES AND GRADE REQUIREMENTS

Sorghum is divided into four classes: Sorghum, Tannin sorghum, White sorghum, and Mixed sorghum. There are no subclasses in sorghum. Each class is divided into four numerical grades and U.S. Sample Grade. Special grades emphasize qualities or conditions affecting the value and are added to and made a part of the grade designation. Special grades do not affect the numerical or sample grade designation.

TABLE 9.1 – GRADES AND GRADE REQUIREMENTS FOR SORGHUM

Grade	Minimum Limits of -	Maximum Limits of -			
		Damaged Kernels		Broken Kernels and Foreign Material	
	Test Weight per bushel (pounds)	Heat Damage (percent)	Total (percent)	Foreign material (part of total) (percent)	Total (percent)
U.S. No. 1	57.0	0.2	2.0	1.0	3.0
U.S. No. 2	55.0	0.5	5.0	2.0	6.0
U.S. No. 3[1]	53.0	1.0	10.0	3.0	8.0
U.S. No. 4	51.0	3.0	15.0	4.0	10.0

U.S. Sample Grade is sorghum that:

a. Does not meet the requirements for grades U.S. No.1, 2, 3, or 4; or

b. Contains 8 or more stones which have an aggregate weight in excess of 0.2 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria* spp.), 2 or more castor beans (*Ricinus communis* L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 8 or more cockleburs (*Xanthium* spp.) or similar seeds singly or in combination, 10 or more rodent pellets, bird droppings, or an equivalent quantity of other animal filth in 1,000 grams of sorghum, 11 or more pieces of other material from any combination of animal filth, castor beans, crotalaria seeds, glass, stones, unknown foreign substances, and cockleburs, or

c. Has a musty, sour, or commercially objectionable foreign odor (except smut odor); or

d. Is badly weathered, heating or otherwise of distinctly low quality.

[1] Sorghum which is distinctly discolored shall not grade any higher than U.S. No. 3.

9.4 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in Table 9.1 – Grades and Grade Requirements. Use the following guidelines when assigning grades:

a. The letters "U.S.";

b. The abbreviation "No." and the number of the grade or the words "Sample Grade";

c. The words "or better" when applicable;

d. The class;

e. The applicable special grade(s) in alphabetical order;

f. The word "Dockage" when applicable, and the percentage thereof.

When certifying Mixed sorghum, record the name and percent of each class in the mixture in the “Results” section of the certificate.

9.5 SPECIAL GRADES

Special grades draw attention to unusual conditions in grain and are made part of the grade designation. The special grades and special grade requirements for sorghum are shown in the United States Standards for Sorghum. Details for determining special grades are included in referenced sections. Definitions and examples of the designations for special grades in sorghum are:

a. Infested Sorghum. Sorghum that is infested with live weevils or other live insects injurious to stored grain. (Section 9.12)

Example: U.S. No. 2 Sorghum, Infested

b. Smutty Sorghum. Sorghum that has kernels covered with smut spores to give a smutty appearance in mass or contains 20 or more smut balls in 100 grams of sorghum. (Section 9.14)

Example: U.S. No. 3 Sorghum, Smutty

9.6 OPTIONAL GRADE DESIGNATION

The Official U.S. Standards for Grain provide for an optional grade designation, commonly referred to as "or better." Upon the request of an applicant, certify sorghum as U.S. No. 2 or better, U.S. No. 3 or better, etc. An "or better" grade designation cannot be applied to a U.S. No. 1 grade designation.

Example: U.S. No. 3 or better Sorghum

9.7 BASIS OF DETERMINATION

Distinctly Low Quality. The determination of distinctly low quality is made on the basis of the lot as a whole at the time of sampling when a condition exists that may or may not appear in the representative sample and/or the sample as a whole.

Certain Quality Determinations. Each determination of rodent pellets, bird droppings, other animal filth, broken glass, castor beans, cockleburs, crotalaria seeds, dockage, garlic, live insect infestation, large stones, moisture, temperature, an unknown foreign substance(s), and a commonly recognized harmful or toxic substance(s) is made on the basis of the sample as a whole. When a condition exists that may not appear in the representative sample, the determination may be made on the basis of the lot as a whole at the time of sampling according to procedures prescribed in FGIS instructions.

All Other Determinations. Each determination of broken kernels and foreign material is made on the basis of the grain when free from dockage. Each determination of class, damaged kernels, heat-damaged kernels, and stones is made on the basis of the grain when free from dockage and that portion of the broken kernels and foreign material that will pass through a 1.98 mm (5/64 inch) triangular-hole sieve. Other determinations not specifically provided for in the General Provisions are made on the basis of the grain as a whole except the determination of odor is made on either the basis of the grain as a whole or the grain when free from dockage, broken kernels, and foreign material removed by the 1.98 mm (5/64 inch) triangular-hole sieve.

TABLE 9.2 – BASIS OF DETERMINATION

Lot as a Whole	Factors Determined Before the Removal of Dockage	Factors Determined After the Removal of Dockage	Factors Determined After the Removal of Dockage, Broken Kernels, and Foreign Material Removed by the 5/64 Sieve
Distinctly Low Quality Heating Infested Odor	Distinctly Low Quality General Appearance Heating Infested Kind of Grain Moisture Odor Smut Test Weight Sample Grade Criteria	Broken Kernels and Foreign Material	Class Damaged Kernels Heat-Damaged Kernels Odor Stones

9.8 HEATING

Basis of Determination. Determine heating (HTG) on evidence obtained at the time of sampling or on the basis of the sample as a whole.

Sorghum developing a high temperature from excessive respiration is considered heating. Heating sorghum, in its final stages, will usually have a sour or musty odor. Do not confuse sorghum that is heating with sorghum that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

Certification. When applicable, show the term “Heating” on the work record and “Results” section of the certificate, and grade the sorghum “U.S. Sample Grade.”

9.9 ODOR

Basis of Determination. Determine odor on evidence obtained at the time of sampling or on the sample either before or after the removal of dockage, broken kernels, and foreign material.

TABLE 9.3 – ODOR CLASSIFICATION EXAMPLES

Musty	Sour	Commercially Objectionable Foreign Odors	
Ground Insect Moldy	Boot Fermenting Insect (acrid) Pigpen	Animal Hides Decaying Animal Fertilizer Fumigant Insecticide	Oil Products Skunk Smoke Strong Weed Vegetable Matter

Commercially objectionable foreign odors (COFO) are odors, except smut odor, foreign to grain that render it unfit for normal commercial usage.

Fumigant, insecticide, or fungicide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of sorghum contains a fumigant, insecticide, or fungicide odor that prevents a determination as to whether any other odor(s) exists, apply the following guidelines:

a. Original Inspections. Allow the work portion to aerate in an open container for 4 hours, or less, if the odor dissipates in less time.

b. Reinspections, Appeal, and Board Appeal Inspections. Allow unworked file samples and new samples to aerate in an open container for 4 hours, or less, if the odor dissipates in less time. The 4-hour aeration requirement does not apply when the original work portion was aerated and retained as the final file.

Consider the sample as having a commercially objectionable foreign odor if the fumigant, insecticide, or fungicide odor persists based on the above criteria.

Final Determinations. The inspector is responsible for making the final determination for all odors. Whenever possible, use a consensus of experienced licensed inspectors on samples containing marginal odors. Under the consensus approach, if a clear majority (at least 2/3) of inspectors agree the sample contains a Musty, Sour, or COFO odor, grade the sorghum "U.S. Sample Grade". The consensus approach is not required if the initial inspector does not detect an odor or a distinct odor is detected.

Certification. Grade sorghum containing a *"distinct"* musty, sour, or commercially objectionable foreign odor as "U.S. Sample Grade." Record the words "Musty," "Sour," or "Commercially Objectionable Foreign Odor" on the work record and "Results" section of the certificate.

9.10 MOISTURE

Definition. *Water content in grain as determined by an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine moisture before the removal of dockage on a portion of approximately 650 grams.

The procedures for performing a moisture determination using a FGIS approved moisture instrument utilizing the proper calibrations are described in the Moisture Handbook and in Chapter 1, General Information.

Certification. Record the percent of moisture on the work record and "Results" section of the certificate to the nearest tenth percent.

9.11 TEST WEIGHT

Definition. *The weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine test weight (TW) before the removal of dockage on a portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination are described in Chapter 1, General Information.

Certification. Record test weight results on the work record and "Results" section of the certificate to the nearest tenth pound. If requested, convert the pounds per bushel (lbs./bu) result to kilograms per hectoliter (kg/hl) using the following formula: lbs./bu x 1.287 = kg/hl and record in the "Remarks" section in whole and tenths.

9.12 INFESTED SORGHUM

Sorghum that is infested with live weevils (LW) or other live insects injurious to stored grain (OLI).

The presence of any LW or OLI found in the work sample indicates the probability of infestation and warns that the sorghum must be carefully examined to determine if it is infested. In such cases, examine the work sample and the file sample before reaching a conclusion as to whether or not the sorghum is infested. Do not examine the file sample if the work portion is insect free.

LW include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. OLI include grain beetles, grain moths, and larvae. To further define "other insect injurious to stored grain" refer to the Stored-Grain Insect Reference. Images of insects may also be viewed on the AMS website.

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, refer to Table 9.4 – Insect Infestation.

TABLE 9.4 – INSECT INFESTATION

Samples meeting or exceeding any one of these tolerances are infested: ***2 LW, or 1 LW + 5 OLI, or 10 OLI***		
1,000-gram representative sample[1] (+ file sample if needed)	**Lot as a Whole (Stationary)**	**Online Sample (In-Motion)[2]**
Submitted Samples Probed Lots D/T Sampled Land Carriers	Probed Lots (at time of sampling)	Railcars under the Cu-sum Subsamples for Sacked Grain Lots Components for Bargelots[3] Components for Shiplots[3]

[1] Examine work portion and file sample if necessary. Do not examine file sample if work portion is insect free.

[2] Minimum sampling rate is 500 grams per 2,000 bushels.

[3] Minimum component size is 10,000 bushels.

Key: LW = Live Weevil, OLI = Other Live Insects injurious to stored grain

Certification. When applicable, grade the sorghum "Infested" on the grade line of the certificate in accordance with Section 9.5, "Special Grades." Record the number of live weevils and/or other live insects injurious to stored grain on the work record and "Results" section of the certificate.

9.13 GENERAL APPEARANCE

Distinctly Discolored. Sorghum which is distinctly discolored shall not grade higher than U.S. No. 3.

Badly Weathered. Sorghum which is badly weathered shall be graded U.S. Sample Grade.

Basis of Determination. Determine general appearance on the sample as a whole.

Distinctly Discolored (DISC). Distinctly discolored sorghum that has been discolored by adverse weather conditions to a point where a sample has a slightly gray and/or blackened appearance. (ILP – Distinctly Discolored (Sorghum or Tannin Appearance), (Sorghum/Tannin & White Appearance Mixed), and (White Appearance))

Badly Weathered (BADW). Sorghum that has been discolored by adverse weather conditions to a point where many of the kernels are badly discolored. (ILP – Badly Weathered (Sorghum/Tannin Appearance), (Sorghum/Tannin & White Appearance Mixed), and (White Appearance))

In order to ensure a uniform application of the general appearance factors, follow the procedures outlined below:

a. Cut 400 grams of sorghum from the original sample.

b. Compare the appearance of the sample with the Interpretive Line Print (ILP).

c. Consider sorghum distinctly discolored or badly weathered when the sample is equal to or worse than the sorghum in the ILP.

Certification. When applicable, record the words “Distinctly Discolored” or “Badly Weathered” on the work record and “Results” section of the certificate. Sorghum that is distinctly discolored must grade no higher than U.S. No. 3 and sorghum that is badly weathered must grade no higher than U.S. Sample Grade.

9.14 SMUTTY SORGHUM

Definition. *Sorghum that has kernels covered with smut spores to give a smutty appearance in mass, or that contains 20 or more smut balls in 100 grams of sorghum.*

Basis of Determination. Determine smut spores before the removal of dockage on a portion of 1,000 – 1,050 grams. Determine smut balls before the removal of dockage on approximately 100 grams.

Smut is a plant disease characterized by the appearance of smut balls or smut spores. Smut balls apply in the determination of the special grade “Smutty” but also function as broken kernels, foreign material, and other grains. (VRI – O.F. - 22.0 Smut Balls)

Certification. When applicable, grade the sorghum "Smutty" on the grade line of the certificate in accordance with Section 9.5, “Special Grades.” Record the number of smut balls on the work record and “Results” section of the certificate.

9.15 DISTINCTLY LOW QUALITY

Consider sorghum distinctly low quality when it is obviously of inferior quality and existing grade factors or guidelines do not accurately reflect the inferior condition.

Basis of Determination. Use all available information to determine whether the sorghum is of distinctly low quality (DLQ). This includes a general examination of the sorghum during sampling and an analysis of the obtained sample(s).

a. Diatomaceous Earth (DIAT). Sorghum suspected of containing DIAT is considered DLQ unless the applicant specifically requests an examination to verify the presence of DIAT. If the laboratory examination verifies that the sorghum contains DIAT, then the sorghum is not considered DLQ due to DIAT. For additional information regarding the testing of sorghum for diatomaceous earth, refer to Directive 9180.49, "Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel."

b. Flood Damaged Grain. Sorghum that is materially affected by flooding is considered DLQ and certified as "U.S. Sample Grade." In addition, official personnel must report identifiable lots that are DLQ to the district Food and Drug Administration (FDA) office as "actionable" in accordance with FGIS-PN-19-04, "Inspection of Flood Damaged Grain".

   The determination of DLQ is based on the appearance and condition of the lot or sample as a whole. Evaluate sorghum affected by flooding on a portion of approximately 400 grams with the use of the ILP – All Grains/Graded Commodities - Inspection of Flood Damaged Grain. If a sample does not meet the requirements for DLQ, but the kernels are materially damaged (stained) by flooding, consider the kernels as damaged and count toward the total percentage of damaged kernels in the sample.

c. Large Animal Excreta (LGANX). Sorghum containing one or more large animal excreta (e.g., deer or elk pellet) is considered DLQ.

d. Large Debris. Sorghum containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris which are visible to the sampler but too large to enter the sampling device is considered DLQ.

e. Other Unusual Conditions. Sorghum that is obviously affected by other unusual conditions which adversely affect the quality of the sorghum and cannot be properly graded by use of the grading factors specified or defined in the standards is considered DLQ.

Certification. When applicable, show the factor DLQ and the reason(s) why on the work record and "Results" section of the certificate, and grade the sorghum "U.S. Sample Grade."

9.16 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine U.S. Sample Grade criteria, except for stones, before the removal of dockage based on a work portion of 1,000 – 1,050 grams. Determine stones on a dockage, broken kernel, and foreign material-free portion.

Table 9.5 – U.S. Sample Grade Criteria shows the criteria and corresponding Visual Aids, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, or bulgur), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain must function as "unknown foreign substance (FSUB)."

Note: Dockage and Broken Weight must be subtracted from the original weight to calculate the percent of stones.

Original sample weight – weight of dockage and weight of broken = dockage and broken free sample weight.

1033g – 33 (33.31 rounded) = 1001g dockage and broken free sample weight.

TABLE 9.5 – U.S. SAMPLE GRADE CRITERIA

Criteria	Visual Aids	Number/Weight[1]	
		Sample Basis	Lot Basis[2]
Any Numerical Grading Factor		Excess of limit for U.S. No. 4	N/A
Animal Filth	Animal Filth	10 or more	N/A
Castor Beans	Castor Bean	2 or more	N/A
Cockleburs	Cocklebur	8 or more	NA/
Crotalaria Seeds	Crotalaria	3 or more	N/A
Glass		2 or more	N/A
Odor		Presence	N/A
Stones[3]		8 or more in excess of 0.2% by weight	N/A
Unknown Foreign Substances[4]	Fertilizer	4 or more	N/A
Total[5]		11 or more	N/A
Badly Weathered		Appearance	Appearance
Heating		Presence	Presence
Large Debris*		N/A	2 or more
Other Unusual Conditions*		Presence	Presence

1 Record count factors to the nearest whole number.

2 The entire sample of a submitted sample is considered as the lot.

3 Stones are based on sample after removal of dockage and broken.

4 Consider feed pellets and processed grain products as foreign material, not unknown foreign substance.

5 Include any combination of animal filth, castor beans, crotalaria seeds, glass, stones, unknown foreign substances or cockleburs.

* For Distinctly Low Quality, refer to Section 9.15

Certification. Grade sorghum "U.S. Sample Grade" when one or more of the limits in Table 9.5 – U.S. Sample Grade Criteria are observed. Record the factors (count factors to the nearest whole number) on the work record and "Results" section of the certificate.

9.17 DOCKAGE

Definition. *All matter other than sorghum that can be removed from the original sample by use of an approved device according to procedures prescribed in FGIS instructions. Also, underdeveloped, shriveled, and small pieces of sorghum kernels removed in properly separating the material other than sorghum.*

Basis of Determination. Determine dockage (DKG) on a portion of 1,000 – 1,050 grams of the original sample.

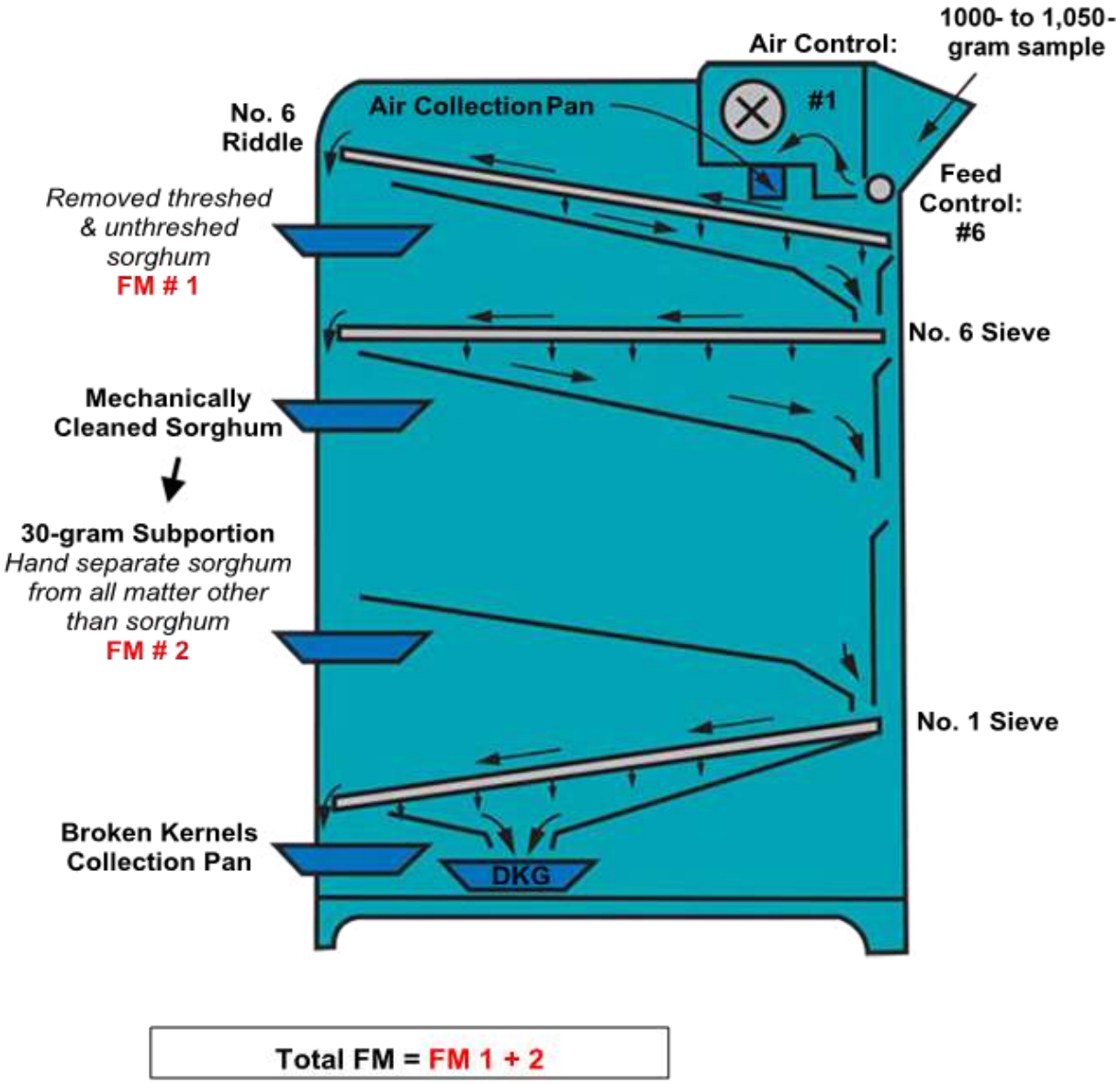

FIGURE 9.1 – PROCEDURE FOR DETERMINING DOCKAGE

Carter Dockage Tester (Mechanical Separation).

a. Set the air control to 1 and the feed control to 6.

b. Insert the No. 6 riddle in the riddle carriage.

c. Insert a No. 6 sieve in the top sieve carriage.

d. There is no sieve in the middle sieve carriage.

e. Insert a No. 1 sieve in the bottom sieve carriage.

f. Start the Carter Dockage Tester and pour sample into feed hopper.

g. Return sorghum kernels that may caught in the riddle to the cleaned portion.

h. Remove threshed, unthreshed and clumps of sorghum from material that passed over the riddle and add it the cleaned sorghum.

Handpick (Foreign Material).

a. From the mechanically cleaned sample, obtain approximately a 30-gram representative portion.

b. Handpick the 30-gram portion for matter other than sorghum.

Note: If a No. 6 riddle is not available, the coarse material is handpicked. A 12/64 (4.76 mm) round-hole hand sieve may be used as an aid when removing the coarse material.

Certification. Record the percent of dockage on the work record in hundredths. When the sample contains 1 percent or more dockage, record the word "Dockage" on the grade line of the certificate in whole percent with the fraction of a percent disregarded. Also, record the percent of dockage in the factor results section of the certificate application, but do not include this result in the “Results” section of the certificate. If the dockage is less than one percent, report as “Dockage 0.0%.”

Example: 1.00 to 1.99 percent is recorded as 1.0%.
2.00 to 2.99 percent is recorded as 2.0%.

9.18 BROKEN KERNELS AND FOREIGN MATERIAL

Broken Kernels and Foreign Material. The combination of broken kernels and foreign material as defined.

Broken Kernels. All matter which passes through a 5/64 triangular-hole sieve and over a 2.5/64 round-hole sieve according to procedures prescribed in FGIS instructions.

Foreign Material. All matter, except sorghum, which passes over the number 6 riddle and all matter other than sorghum that remains on top of the 5/64 triangular-hole sieve according to procedures prescribed in FGIS instructions.

Nongrain Sorghum. Seeds of broomcorn, Johnson-grass, Sorghum almum Parodi, and sudangrass; and seeds of Sorghum bicolor (L.) Moench that appear atypical of grain sorghum.

Characteristics of Nongrain Sorghum. Kernels of nongrain sorghum are small and have tightly clasped hulls that are shiny red, black, lemon yellow, or buff in color. Kernels of nongrain sorghum are very rarely white in color. Kernels of nongrain sorghum are usually more elongated than kernels of sorghum and range in size from a large mustard seed to a large cockle seed. (VRI – (S) O.F. - 16.0 Non-Grain Sorghum)

Unthreshed Kernels. Unthreshed kernels of sorghum are not considered as broken kernels and foreign material.

Unattached Hulls. Unattached hulls are considered as broken kernels and foreign material.

Unattached hulls with a sliver or more of a kernel inside are not considered as broken kernels and foreign material.

Basis of Determination. Broken kernels (BN) and foreign material (FM) are determined by:

a. Sieving 1,000 – 1,050 grams of dockage-free sorghum with a 1.98 mm (5/64) triangular-hole sieve (No. 6 sieve used in the Carter dockage tester); and

b. Handpicking a portion of 30 grams after removal of dockage and the mechanically separated broken kernels and foreign material.

Calculating Broken Kernels and Foreign Material. The mechanically separated broken kernels and foreign material (MSFM) used to make this calculation are in the bottom collection pan and the riddle collection pan. (Section 9.17, "Dockage") Obtain the total percent of broken kernels and foreign material by adding the percent of broken kernels, mechanically cleaned foreign material, and handpicked foreign material. When adding these portions, as shown in the following example, add the results in hundredths (disregard thousandths) and round the sum to the nearest tenth percent.

Example: Broken Kernels and Foreign Material Calculation

Original sample weight	1,007 grams
Dockage weight	3.81 grams
Mechanically separated broken kernels weight	54.11 grams
Foreign material removed by No. 6 riddle weight	4.33 grams
Handpicked portion weight	29.70 grams
Handpicked separation weight	0.37 grams

a. **(Weight of dockage ÷ weight of original sample) x 100**
= percent of dockage.
(3.81g ÷ 1,007g) x 100 = 0.37% dockage.

b. **Weight of original sample - weight of dockage**
= weight of dockage-free sample.
1,007g – 4g (3.8 rounded) = 1,003 dockage-free sample weight.

c. **(Weight of broken kernels ÷ weight of dockage-free sample) x 100**
= percent of broken kernels (BN).
(54.11g ÷ 1,003g) x 100 = 5.39% broken kernels.

d. **(Weight of foreign material (FM) removed by No. 6 riddle ÷ weight of dockage-free sample) x 100**
= percent of mechanically separated foreign material.
(4.33g ÷ 1,003g) x 100 = 0.43% mechanically separated FM.

e. **(Weight of handpicked FM (including other grains) ÷ weight of handpicked portion) x 100**
= percent of handpicked FM.
(0.37g ÷ 29.70g) x 100 = 1.24% handpicked FM.

f. **Percent of handpicked FM + percent of mechanically separated FM**
= total percent of FM.
(1.24% + 0.43%) = 1.67% total FM (rounded to 1.7%).

g. **Percent BN + total percent FM**
= total percent of broken kernels and foreign material (BNFM).
(5.39% + 1.67%) = 7.06% total broken kernels and foreign material (BNFM) (rounded to 7.1%).

Certification. Record the total percent of broken kernels and foreign material (g) and the percent of foreign material (f) on the work record and "Results" section of the certificate to the nearest tenth percent. Upon request, report the percent of broken kernels (c) on the certificate to the nearest tenth.

Adjustment of Factors. In certain instances, when reporting broken kernels and foreign material (BNFM) separately, the sum of BN and FM in sorghum, due to rounding, will not equal the percent of BNFM recorded on the certificate. When this occurs, it is necessary to adjust the component (BN or FM) nearest a midpoint (e.g., 0.05, 0.15, 0.25, or 0.35) by adding or subtracting 0.1.

9.19 PROCESSING THE WORK SAMPLE

At this point, all tests required to be performed prior to the removal of dockage have been completed and the percent of dockage has been determined. Also, the sample has been examined for certain sample grade and special grade factors. Now the work sample is ready to be divided into fractional portions for other determinations required after the removal of dockage, broken kernels, and foreign material.

Chart 9.1 – Dividing the Work Sample and Table 9.6 – Approximate Analytical Portion Sizes illustrate how the sample is divided into fractional parts using an approved divider.

CHART 9.1 – DIVIDING THE WORK SAMPLE

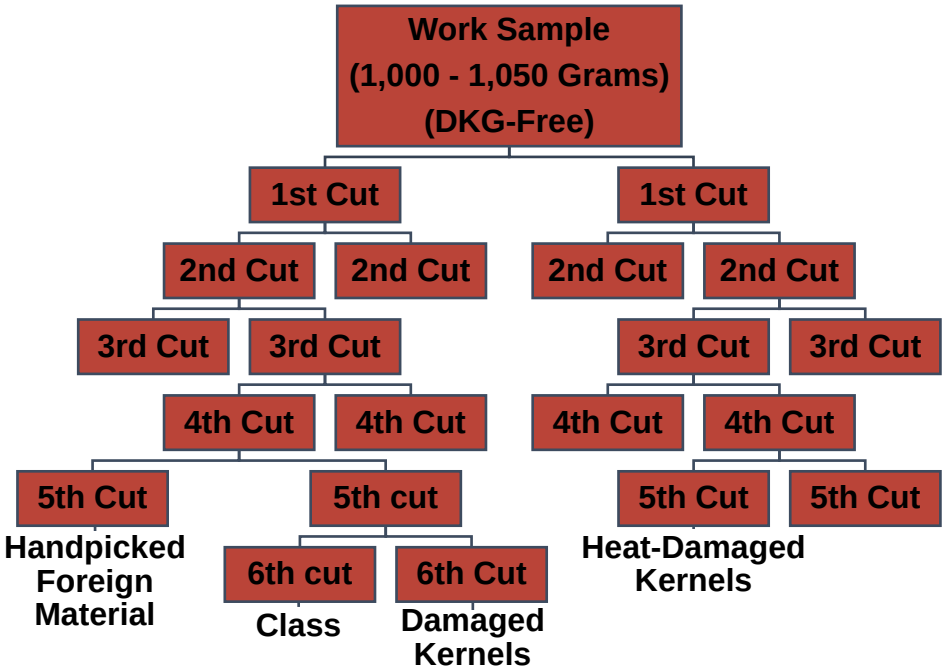

TABLE 9.6 – APPROXIMATE ANALYTICAL PORTION SIZES

Factors	Grams
Kind of Grain	30*
Heat-Damaged Kernels	30
Damaged Kernels	15
* Factor determined before the removal of dockage.	

9.20 HEAT-DAMAGED KERNELS

Definition. *Kernels, pieces of sorghum kernels, and other grains that are materially discolored and damaged-by-heat.*

Basis of Determination. Determine heat-damaged kernels after the removal of dockage, machine-separated broken kernels and foreign material on a portion of 30 grams. (VRI – S - 3.0 Heat Damage)

Procedure for Determining Heat-Damaged Kernels of Grain Removed by Riddle. The percent of heat-damaged kernels of corn and/or soybeans removed by the No. 6 riddle during the determination of dockage, broken kernels, and foreign material is added to the percent of heat-damaged kernels removed from the 30-gram portion. Calculate the percent of heat-damaged kernels of corn and/or soybeans on the basis of the weight of the sample after the removal of dockage and mechanically cleaned broken kernels and foreign material. (Section 9.17, "Dockage")

Certification. Record the percent of heat-damaged kernels on the work record and "Results" section of the certificate to the nearest tenth percent.

9.21 DAMAGED KERNELS

Definition. *Kernels, pieces of sorghum kernels, and other grains that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-damaged, heat-damaged, insect-bored, mold-damaged, sprout-damaged, or otherwise materially damaged.*

Basis of Determination. The determination of damaged kernels (DKT) is a two-step process.

a. Determine damaged kernels of other grains (e.g., corn or soybeans) removed by the No. 6 riddle on the basis of the mechanically cleaned sample portion (approximately 1,000 grams).

b. Determine damaged kernels on a portion of 15 grams after the removal of dockage and broken kernels, foreign material, and other grains removed by the 1.98 mm (5/64) triangular-hole sieve.

In general, consider sorghum to be damaged for inspection and grading purposes only when the damage is distinctly apparent and of such character as to be recognized as damaged for commercial purposes.

TYPES OF SORGHUM DAMAGE.

Germ-Damaged Kernels. Kernels and pieces of kernels of sorghum which, after bleaching, contain dark colored germs. Sorghum containing a germ damage or suspected of containing germ damage must be bleached. (VRI – S - 1.1 Germ Damage (Bleach Method))

Ground and/or Weather-Damaged Kernels. Kernels and pieces of kernels of sorghum which contain dark stains or discolorations and have a rough cake-like appearance. (VRI – S - 2.0 Ground and/or Weather Damage).

Heat-Damaged Kernels. Kernels and pieces of kernels of sorghum which are materially discolored and damaged-by-heat. Cross section the kernel to determine the extent of damage. (VRI – S - 3.0 Heat Damage)

Insect-Bored Kernels. Kernels and pieces of kernels of sorghum which have been bored or tunneled by insects. Consider pin holes in the germ area as damage, consider insect chewed kernels as sound. (VRI – S - 4.0 Insect-Bored Damage)

Mold-Damaged Kernels. Kernels and pieces of kernels of sorghum containing surface mold. Do not confuse mold with dark stains or discolorations caused by ground and/or weather conditions. (VRI – S - 5.0 Mold Damage)

Mold-Damaged Kernels (Internal Mold). Kernels and pieces of kernels of sorghum that contain mold which penetrates the seedcoat. Internal molds vary in color and are usually confined to the germ area. (VRI – S - 5.1 Mold Damage (Internal Mold))

Mold-like Substance. Whole kernels of sorghum which are 50 percent or more covered and pieces of kernels which are discolored and covered with a mold-like substance.

Purple Pigment Damaged Kernels. Kernels and pieces of kernels which are materially discolored by purple pigment. (VRI – S - 8.0 Purple Pigment Damage)

Sprout-Damaged Kernels. Kernels and pieces of kernels of sorghum in which the sprout definitely protrudes from the germ. (VRI – S - 6.0 Sprout Damage)

Kernels and pieces of kernels of sorghum which have a split over the germ area, but have no sprout protruding, are considered sound unless otherwise damaged. (VRI – S - 7.0 Split Germs (Sound Kernels))

Germ and Internal Mold Damage Determination. Use the S/J mixer method to determine germ-damage and when inspecting weathered sorghum (optional for non-weathered), internal mold damage. For equipment and materials, refer to Chapter 1, General Information.

New crop sorghum, in most cases, will not contain germ damage and will not have to be bleached, as it typically contains no germ damage and very little mold damage. However, improperly stored or sorghum which has been subjected to poor harvesting conditions is susceptible to these types of damage. In both instances, bleaching improves the efficiency and accuracy of the damage assessment by removing the protective bran and exposing distinctively discolored germs. After bleaching, sorghum germs containing internal mold will appear black; traditional “germ” damaged sorghum will appear dark brown in color.

Prior to bleaching, remove all types of damaged kernels, except sorghum germ and internal mold-damaged kernels, from the representative portion and calculate the percentage. The representative portion, less the other types of damaged kernels, can now be bleached.

After bleaching, reweigh the bleached portion, remove the germ and internal-damaged kernels, and calculate the percentage.

Bleach Procedure.

a. Place 15 grams (± 1.5 grams) of sorghum in the mixing jar. If the amount of "other damage" present in the original 15-gram portion reduces the weight of the sample to be bleached below 13.5 grams, an additional 15-gram portion must be analyzed for germ damage. It is not necessary to remove the other damage kernels from the second portion before bleaching.

b. Add 15 grams of potassium hydroxide (KOH) pellets.

c. Add 40 ml of bleach

d. Set stirring head on jar, place jar on mixer, and mix for 3 minutes.

e. Pour the sorghum from the mixing jar into the tea strainer and rinse with warm tap water to remove the KOH-bleach solution. Dispose of the used KOH-bleach solution in a hazardous waste container.

f. After rinsing, lightly tap the tea strainer against the edge of the sink to remove the excess water. Gently press the bottom of the tea strainer on a dry paper towel to remove any additional water.

g. Place the sorghum on the dryer sieve and dry for 1 – 1 1/2 minutes or until the kernels are not tacky when picked up with a pair of tweezers.

h. Remove the sorghum from the drying sieve and weigh. The kernels with germ or internal-damage should now be readily apparent. Germ area which appear dark brown in color function as “germ” damage; blackened germs will function as internal mold. Carefully lift any bran remaining over the germ area to examine for damage. Obvious other damaged kernels that were missed before bleaching can be taken after bleaching, if it is evident that they were damaged.

Any deviation from the previously described procedures may result in improperly bleached sorghum and could produce a hazardous condition. As such, observe the following precautions and safety procedures:

a. Safety equipment should be worn while the bleach operation is in progress and the lab area thoroughly cleaned once bleaching is complete.

b. Accidental spills should first be neutralized with vinegar before the liquid is wiped up.

c. Avoid mixing the chemicals used in a test with chemical reagents or waste solutions associated with other tests.

d. Store bleach in cool, dry place and replace any unused bleach at least every 3 months following the date of purchase.

Calculating Damaged Kernels. Calculate the percent of total damaged kernels by adding the percent of germ-damaged kernels, other damaged kernels, and damaged kernels of grain removed by the No. 6 riddle. Add the results, as shown in the following example, in hundredths (disregard thousandths) and round the sum to the nearest tenth percent.

Example: Damaged Kernels Calculation

Weight of mechanically cleaned sample	949 grams
Original weight of damaged portion	16.10 grams
Weight of other type damaged kernels	2.40 grams
Sample weight before bleaching	13.70 grams
Sample weight after bleaching	11.95 grams
Weight of germ damaged kernels	4.33 grams
Weight of damaged kernels of corn/soybeans removed by the No. 6 riddle	2.50 grams

a. **Weight of other type damaged kernels ÷ weight of sample before bleaching x 100**
= percent of other type damaged kernels.
(2.40g ÷ 16.10g) x 100 = 14.90% other type damaged kernels.

b. **100 percent - percent of other type damaged kernels ÷ 100**

= change of base factor.
(100% - 14.90%) ÷ 100 = 0.85 change of base factor.

c. **Weight of germ-damaged portion ÷ weight of damaged portion after bleaching x 100**
= percent of germ-damaged kernels.
(4.33g ÷ 11.95g) x 100 = 36.23% germ-damaged kernels.

d. **Percent of germ-damaged kernels x change of base factor**
= percent of germ-damaged kernels (adjusted).
36.23 x 0.85 = 30.79% germ-damaged kernels (adjusted).

e. **Weight of damaged kernels of corn/soybeans removed by No. 6 riddle ÷ weight of mechanically cleaned sample**
= percent of damaged corn/soybeans.
(2.50g ÷ 949g) x 100 = 0.26% damaged kernels of corn/soybeans.

f. **Percent of other damaged kernels + percent of germ-damaged kernels (adjusted) + percent of damaged corn/soybeans**
= percent of damaged kernels.
14.90% + 30.79% + 0.26% = 45.95%
(rounded to 46.0%) damaged kernels.

Certification. Record the percent of damaged kernels on the work record and "Results" section of the certificate to the nearest tenth percent. If the percent damaged kernels is less than the percent heat, the percent damaged kernels must be adjusted to equal the percent heat.

9.22 CLASS

Sorghum is divided into the following classes:

a. *Sorghum. Sorghum which lacks a pigmented testa (subcoat) and contains less than 98.0 percent White sorghum and not more than 3.0 percent Tannin sorghum. The pericarp color of this class may appear white, yellow, pink, orange, red, or bronze.*

b. *Tannin Sorghum. Sorghum which has a pigmented testa (subcoat) and contains not more than 10.0 percent of kernels without a pigmented testa.*

c. *White Sorghum. Sorghum which lacks a pigmented testa (subcoat) and contains not less than 98.0 percent kernels with a white pericarp, and contains not more than 2.0 percent of sorghum of other classes. This class includes sorghum containing spots that, singly or in combination, cover 25.0 percent or less of the kernel.*

d. *Mixed Sorghum. Sorghum which does not meet the requirements for any of the classes Sorghum, Tannin sorghum, or White sorghum.*

Pericarp. The pericarp is the outer layers of the sorghum grain and is fused to the seedcoat.

Basis of Determination. Determine the class of sorghum by the color characteristics of the pericarps and/or subcoats (testa) of the kernels. When an analysis for class is necessary, use the S/J mixer method to bleach a portion of 15 (15 ± 1.5) grams after the removal of dockage and machine-separated broken kernels and foreign material. For equipment and materials, refer to Chapter 1, General Information. (VRI – S - 9.0 Tannin Sorghum (Bleached) and (S) O.F. - 33.0 White Sorghum)

Bleach Procedure. Similarities in the bleaching methods used in the determination for sorghum germ damage and class determination allow inspectors to effectively use the germ damage portion to screen samples for class. If the bleached damage portion contains darkened kernels similar to those depicted in VRI – S - 9.0 Tannin Sorghum (Bleached), bleach a separate portion for classing purposes. Remove non-grain sorghum before bleaching for Tannin sorghum. The bleach method for class determination is identical to that listed in Section 9.21, “Damaged Kernels,” Germ Damage Determination, with the following exceptions:

a. Determine the percent of White sorghum (WHS) present in a mixture before bleaching due to the difficulty of distinguishing between White sorghum and Sorghum after bleaching. Recombine the sample before proceeding.

b. Use 5 grams of potassium hydroxide (KOH) pellets.

c. After bleaching, Sorghum and White sorghum kernels remain light in color; sorghum kernels with brown subcoat (testa) turn black.

Do not confuse field damaged Sorghum/White sorghum kernels with Tannin sorghum. Field damage may discolor/stain the kernel making it difficult to distinguish the bleached Tannin sorghum from the damaged Sorghum/White sorghum.

Do not confuse Tannin sorghum (TANS) having a bluish-white pericarp with damaged Sorghum/White kernels. When bleached, this type of Tannin sorghum is partially discolored similar to damaged Sorghum/White kernels. If necessary, quickly review an unbleached portion for the presence of kernels having pericarps with a bluish-white cast. If this type of sorghum is not present, consider the sorghum in question as Sorghum.

Sorghum with White Pericarps and Brown Subcoats. Sorghum of this type has a somewhat bluish-white appearance. To determine the presence or absence of brown subcoats with white pericarps, it may be necessary to scrape small areas of the pericarp.

Certification. For Mixed sorghum, record the name and percent of each class to the nearest tenth percent as individual factors on the work record and "Results" section of the certificate.

9.23 OFFICIAL CRITERIA

Official criteria factors are determined only upon request and do not affect the grade designation.

Ergot. A hard, reddish-brown or black grain-like mass of certain parasitic fungi that replaces sorghum and other grains. (VRI – O.F. - 12.0 Ergot)

Basis of Determination. Determine ergot before the removal of dockage on a work portion of approximately 1,000 – 1,050 grams.

Certification. Record the percent of ergot on the work record and "Results" section of the certificate to the nearest hundredth percent. Upon applicant request, use one of the following statements in the "Remarks" section of the certificate.

"Ergot (*Claviceps* spp.)."

"Does not exceed percent of sclerotia of the following species of sorghum ergot: *Claviceps Africana, C. sorghi, and C. sorghicola."*

CHAPTER 10:
SOYBEANS

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10.1 GENERAL ORDER OF PROCEDURES

The breakdown and inspection for Soybeans are listed below in the following chapter according to its general order. The order of procedure may slightly vary depending on the quality of the soybeans and the tests requested. More information is available on the Agricultural Marketing Service Website (AMS), in the U.S. Standards for Soybeans, and the Board of Appeals and Review (BAR) Questions and Answers.

The inspection process provides various factor information used to determine grade and to provide further information on the condition or quality of the soybeans. Each section of this chapter provides details on recording factor information. If requested by the applicant for inspection, additional information may be provided (e.g., an exact count on stones in addition to the percent by weight or a percent for a specific type of damage). Also, upon applicant request any non-grade determining factor may be omitted from the inspections process (e.g. test weight, moisture, protein, or oil).

10.2 DEFINITION OF SOYBEANS

Definition. *Grain that consists of 50 percent or more of whole or broken soybeans (Glycine max (L.) merr.) that will not pass through an 8/64 round-hole sieve and not more than 10.0 percent of other grains for which standards have been established under the United States Grain Standards Act.*

Whole soybeans are soybeans with three-fourths or more of the soybean present. Other grains for which standards have been established are barley, canola, corn, flaxseed, oats, rye, sorghum, sunflower seed, triticale, and wheat.

Basis of Determination. Normally, a visual appraisal of the sample is sufficient to determine if it meets the definition of soybeans. However, if an analysis is necessary, make the determination before the removal of foreign material on a portion of 125 grams.

If the sample does not meet the definition of soybeans, examine it further to determine if it is:

a. Another grain for which standards have been established; or

b. Not Standardized Grain (NSG). No further analysis is necessary on a sample designated as NSG unless a specific factor test is requested.

10.3 GRADES AND GRADE REQUIREMENTS

Soybeans are divided into two classes based on color: Yellow soybeans and Mixed soybeans. There are no subclasses. Each class is divided into four numerical grades and U.S. Sample Grade. Special grades emphasize qualities or conditions affecting the value and are added to and made a part of the grade designation. Special grades do not affect the numerical or sample grade designation.

TABLE 10.1 – GRADES AND GRADE REQUIREMENTS FOR SOYBEANS

Grade	Maximum Limits of -				
	Damaged Kernels		Foreign Material (percent)	Splits (percent)	Soybeans of other colors[1] (percent)
	Heat (part of total) (percent)	Total (percent)			
U.S. No. 1	0.2	2.0	1.0	10.0	1.0
U.S. No. 2	0.5	3.0	2.0	20.0	2.0
U.S. No. 3	1.0	5.0	3.0	30.0	5.0
U.S. No. 4	3.0	8.0	5.0	40.0	10.0

U.S. Sample Grade is soybeans that:

a. Do not meet the requirements for grades U.S. No.1, 2, 3, or 4; or

b. Contains 4 or more stones which have an aggregate weight in excess of 0.1 percent of the sample weight, 1 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria* spp.), 2 or more castor beans (*Ricinus communis* L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 10 or more rodent pellets, bird droppings, or an equivalent quantity of other animal filth in 1,000 grams of soybeans, or

c. Contain 11 or more animal filth, castor beans, crotalaria seeds, glass, stones, or unknown foreign substance(s) in any combination, or

d. Have a musty, sour, or commercially objectionable foreign odor (except garlic odor); or

e. Are heating or otherwise of distinctly low quality.

[1] Disregard for Mixed Soybeans

10.4 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in Table 10.1 – Grades and Grade Requirements for Soybeans. Use the following guidelines when assigning grades:

a. The letters "U.S.";

b. The abbreviation "No." and the number of the grade or the words "Sample Grade";

c. The words "or better," when applicable;

d. The name of the class;

e. The applicable special grades in alphabetical order.

For Mixed soybeans, record the percent of Yellow soybeans and soybeans of other colors to the nearest tenth percent on the work record and "Results" section of the certificate.

Example: U.S. No. 2 Yellow Soybeans
U.S. No. 3 Mixed Soybeans

In "Results" section: Yellow Soybeans 75.4%
Soybeans of other colors 24.6%

10.5 SPECIAL GRADES

Special grades draw attention to unusual conditions in the grain and are made part of the grade designation. The special grades and special grade requirements for all classes of soybeans are shown in the United States Standards for Soybeans. Details for determining special grades are included in referenced sections. Definitions and examples of the designations for special grades in soybeans are:

a. Garlicky Soybeans. Soybeans that contain five or more green garlic bulblets or an equivalent quantity of dry or partly dry bulblets in a 1,000-gram portion. (Section 10.12)

Example: U.S. No. 3 Yellow Soybeans, Garlicky

b. Infested Soybeans. Soybeans that are infested with live weevils or other insects injurious to stored grain. (Section 10.13)

Example: U.S. No. 2 Yellow Soybeans, Infested

c. Purple Mottled or Stained Soybeans. Soybeans that are discolored with pink or purple seed coats, dirt or a dirt-like substance, or pokeberry stains, as determined on a portion of 400 grams with the use of an FGIS Interpretive Line Print. (Section 10.14)

Example: U.S. No. 2 Yellow Soybeans, Purple Mottled or Stained.

10.6 OPTIONAL GRADE DESIGNATION

The Official U.S. Standards for Grain provide for an optional grade designation, commonly referred to as "or better." Upon the request of an applicant, certify soybeans as U.S. No. 2 or better, U.S. No. 3 or better, etc. An "or better" grade designation cannot be applied to a U.S. No. 1 grade designation.

Example: U.S. No. 3 or better Yellow Soybeans

10.7 BASIS OF DETERMINATION

Distinctly Low Quality. The determination of distinctly low quality is made on the basis of the lot as a whole at the time of sampling when a condition exists that may or may not appear in the representative sample and/or the sample as a whole.

Certain Quality Determinations. Each determination of rodent pellets, bird droppings, other animal filth, broken glass, castor beans, cockleburs, crotalaria seeds, dockage, garlic, live insect infestation, large stones, moisture, temperature, an unknown foreign substance(s), and a commonly recognized harmful or toxic substance(s) is made on the basis of the sample as a whole. When a condition exists that may not appear in the representative sample, the determination may be made on the basis of the lot as a whole at the time of sampling according to procedures prescribed in FGIS instructions.

All Other Determinations. Each determination of class, heat-damaged kernels, damaged kernels, splits, and soybeans of other colors is made on the basis of the grain when free from foreign material. Other determinations not specifically provided for under the General Provisions are made on the basis of the grain as a whole.

TABLE 10.2 – BASIS OF DETERMINATION

Lot as a Whole	Factors Determined Before the Removal of Foreign Material	Factors Determined After the Removal of Foreign Material
Distinctly Low Quality	Distinctly Low Quality	Heat-Damaged Kernels
Heating	Garlicky	Damaged Kernels
Infested	Heating	Odor
Odor	Infested	Soybeans of Other Colors
	Kind of Grain	Splits
	Moisture	
	Odor	
	Purple Mottled or Stained	
	Stones	
	Test Weight	
	Sample Grade Criteria	

10.8 HEATING

Basis of Determination. Determine heating (HTG) on evidence obtained at the time of sampling or on the basis of the sample as a whole.

Soybeans developing a high temperature from excessive respiration are considered heating. Heating soybeans, in its final stages, will usually have a sour or musty odor. Do not confuse soybeans that are heating with soybeans that are warm and moist because of storage in bins, railcars, or other containers during hot weather.

Certification. When applicable, show the term "Heating" on the work record and "Results" section of the certificate, and grade the soybeans "U.S. Sample Grade."

10.9 ODOR

Basis of Determination. Determine odor on evidence obtained at the time of sampling or on the sample either before or after the removal of foreign material.

TABLE 10.3 – ODOR CLASSIFICATION EXAMPLES

Musty	Sour	Commercially Objectionable Foreign Odors	
Ground	Boot	Animal Hides	Oil Products
Insect	Fermenting	Decaying Animal	Skunk
Moldy	Insect (acrid)	Fertilizer	Smoke
	Pigpen	Fumigant	Strong Weed
	Smoke[1]	Insecticide	Vegetable Matter

[1] Smoke odors are considered sour only in canola, flaxseed, soybeans, and sunflower seed.

Odors from Heat-Damaged Soybeans. When heat-damaged kernels are present, soybeans give off an odor very similar to smoke. Soybeans containing a "smoke" odor are considered as having a "sour" odor unless evidence of a fire-burnt material is present in the lot or the original sample. If evidence of a fire-burnt material is present in the lot or the sample, the smoke odor is considered a commercially objectionable foreign odor.

Commercially Objectionable Foreign Odors (COFO) are odors, except garlic odors, foreign to grain that render it unfit for normal commercial usage.

Fumigant, insecticide, or fungicide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of soybeans contains a fumigant, insecticide, or fungicide odor that prevents the determination of whether any other odor(s) exists, apply the following guidelines:

a. Original Inspections. Allow the work portion to aerate in an open container for 4 hours, or less, if the odor dissipates in less time.

b. Reinspections, Appeal and Board Appeal Inspections. Allow unworked file samples and new samples to aerate in an open container for 4 hours, or less, if the odor dissipates in less time. The 4-hour aeration requirement does not apply when the original work portion was aerated and retained as the final file.

Consider the sample as having a commercially objectionable foreign odor if the fumigant, insecticide, or fungicide odor persists based on the above criteria.

Final Determinations. The inspector is responsible for making the final determination for all odors. Whenever possible, use a consensus of experienced licensed inspectors on samples containing marginal odors. Under the consensus approach, if a clear majority (at least 2/3) of inspectors agree the sample contains a Musty, Sour, or COFO odor, grade the soybeans “U.S. Sample Grade”. The consensus approach is not required if the initial inspector does not detect an odor or a distinct odor is detected.

Certification. Grade soybeans containing a "*distinct*" musty, sour, or commercially objectionable foreign odor as “U.S. Sample Grade.” Record the words "Musty," "Sour," or "Commercially Objectionable Foreign Odor" on the work record and “Results” section of the certificate.

10.10 MOISTURE

Definition. *Water content in grain as determined by an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine moisture before the removal of foreign material on a portion of approximately 650 grams.

The procedures for performing a moisture determination using a FGIS approved moisture instrument utilizing the proper calibrations are described in the Moisture Handbook and in Chapter 1, General Information.

Certification. Record the percent of moisture on the work record and “Results” section of the certificate to the nearest tenth percent.

10.11 TEST WEIGHT

Definition. *The weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine test weight (TW) before the removal of foreign material on a portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination are described in Chapter 1, General Information.

Note: Unless an applicant specifically requests that TW determination not be performed, official personnel must perform TW analysis and certify the results as part of official grading services for all types (e.g. submitted samples, shiplots, lash barges, or unit trains) of inspection services.

Certification. Record test weight results on the work record and "Results" section of the certificate to the nearest tenth of a pound. If requested, convert the pounds per bushel (lbs./bu) result to kilograms per hectoliter (kg/hl) using the following formula: lbs./bu x 1.287 = kg/hl and record in the "Remarks" section in whole and tenths.

10.12 GARLICKY SOYBEANS

Definition. *Soybeans that contain five or more green garlic bulblets or an equivalent quantity of dry or partly dry bulblets in a 1,000-gram portion.*

Basis of Determination. Determine garlicky (GAR) before the removal of foreign material on a portion of 1,000 grams. (VRI – O.F. - 13.0 Green Garlic Bulbs (Whole) and O.F. - 13.1 Dry Garlic Bulbs (1/3rd))

Characteristics of Bulblets.

a. Green garlic bulblets are bulblets which have retained all of their husks intact.

b. Dry or partially dry garlic bulblets are bulblets which have lost all or part of their husks. Consider bulblets with cracked husks as dry.

c. Three dry or partly dry garlic bulblets are equal to one green bulblet.

Note: Garlic bulblets apply in the determination of "Garlicky" but also function as foreign material.

Wild onion, sometimes referred to as "crow garlic", is considered as garlic.

Certification. When applicable, grade the soybeans "Garlicky" on the grade line of the certificate in accordance with Section 10.5, "Special Grades." Record the number of garlic bulblets in whole numbers or in decimals to the nearest hundredths position (e.g., 1/3 = 0.33 or 2/3 = 0.67) on the work record and "Results" section of the certificate.

10.13 INFESTED SOYBEANS

Soybeans that are infested with live weevils (LW) or other live insects injurious to stored grain (OLI).

The presence of any LW or OLI indicates the probability of infestation and warns that the soybeans must be carefully examined to determine if they are infested. In such cases, examine the work sample and the file sample before reaching a conclusion as to whether or not the soybeans are infested. Do not examine the file sample if the work portion is insect free.

LW include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. OLI include grain beetles, grain moths, and larvae. To further define "other insect injurious to stored grain" refer to the Stored-Grain Insect Reference. Images of insects may also be viewed on the AMS website.

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, refer to Table 10.4 – Insect Infestation.

TABLE 10.4 – INSECT INFESTATION

Samples meeting or exceeding any one of these tolerances are infested: ***2 LW, or 1 LW + 5 OLI, or 10 OLI***		
1,000-gram representative sample[1] (+ file sample if needed)	**Lot as a Whole (Stationary)**	**Online Sample (In-Motion)[2]**
Submitted Samples Probed Lots D/T Sampled Land Carriers	Probed Lots (at time of sampling)	Railcars under the Cu-sum Subsamples for Sacked Grain Lots Components for Bargelots[3] Components for Shiplots[3]

[1] Examine work portion and file sample if necessary. Do not examine file sample if work portion is insect free.

[2] Minimum sampling rate is 500 grams per 2,000 bushels.

[3] Minimum component size is 10,000 bushels.

Key: LW = Live Weevil, OLI = Other Live Insects injurious to stored grain

Certification. When applicable, grade the soybeans "Infested" on the grade line of the certificate in accordance with Section 10.5, "Special Grades." Record the number of live weevils and/or other live insects injurious to stored grain on the work record and "Results" section of the certificate.

10.14 PURPLE MOTTLED OR STAINED

Definition. *Soybeans with pink or purple seed coats as determined on a portion of approximately 400 grams with the use of an FGIS Interpretive Line Print.*

Purple mottled or stained (PMS) is an appearance factor in soybeans and when sufficient amounts of discolored soybeans are found, the soybeans are considered purple mottled or stained.

Soybeans Discolored by the Growth of a Fungus. Soybeans discolored by a fungus have seed coats that are discolored pink or purple. This type of discoloration is caused by the growth of a fungus and may cover all or part of the kernel. Soybeans exhibiting this type of discoloration are considered purple mottled or stained. (ILP – Soybeans - Purple Mottled or Stained by Growth of a Fungus)

Soybeans Discolored by Dirt or a Dirt-Like Substance, Etc. This type of discoloration is caused by dirt or similar matter and includes nontoxic substances. Dirt, dirt-like substances, or other nontoxic substances are substances which can be readily removed by water. Soybeans exhibiting this type of discoloration are considered purple mottled or stained. (ILP – Soybeans - Purple Mottled or Stained by Dirt or Dirt-like Substances)

Soybeans Purple Mottled or Stained by Pokeberry Stain. Soybeans with seed coats discolored by pokeberry stain are considered purple mottled or stained. (ILP – Soybeans - Purple Mottle or Stained by Pokeberry Stain)

Basis of Determination. Determine general appearance on the sample as a whole.

In order to ensure a uniform application of the general appearance factors, follow the procedures outlined below:

a. Cut 400 grams of soybeans from the original sample.

b. Compare the appearance of the sample with the Interpretive Line Print (ILP).

c. Consider soybeans purple mottled or stained when the sample is equal to or worse in appearance than the soybeans in the ILP.

Certification. When applicable, grade the soybeans "Purple Mottled or Stained" on the grade line of the certificate in accordance with Section 10.5, “Special Grades.”

10.15 DISTINCTLY LOW QUALITY

Consider soybeans distinctly low quality when they are obviously of inferior quality and existing grade factors or guidelines do not accurately reflect the inferior condition.

Basis of Determination. Use all available information to determine whether the soybeans are of distinctly low quality (DLQ). This includes a general examination of the soybeans during sampling and an analysis of the obtained sample(s).

a. Diatomaceous Earth (DIAT). Soybeans suspected of containing DIAT are considered DLQ unless the applicant specifically requests an examination to verify the presence of DIAT. If the laboratory examination verifies that the soybeans contain DIAT, then the soybeans are not considered DLQ due to DIAT. For additional information regarding the testing of soybeans for diatomaceous earth, refer to Directive 9180.49, "Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel."

b. Flood Damaged Grain. Soybeans that are materially affected by flooding are considered DLQ and certified as "U.S. Sample Grade." In addition, official personnel must report identifiable lots that are DLQ to the district Food and Drug Administration (FDA) office as "actionable" in accordance with FGIS-PN-19-04, "Inspection of Flood Damaged Grain".

   The determination of DLQ is based on the appearance and condition of the lot or sample as a whole. Evaluate soybeans affected by flooding on a portion of approximately 400 grams with the use of the ILP – All Grains/Graded Commodities - Inspection of Flood Damaged Grain. If a sample does not meet the requirements for DLQ, but the kernels are materially damaged (stained) by flooding, consider the kernels as damaged and count toward the total percentage of damaged kernels in the sample.

c. Large Animal Excreta (LGANX). Soybeans containing one or more large animal excreta (e.g., deer or elk pellet) are considered DLQ.

d. Large Debris. Soybeans containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris which are visible to the sampler and too large to enter the sampling device are considered DLQ.

e. Other Unusual Conditions. Soybeans that are obviously affected by other unusual conditions which adversely affect the quality of the soybeans and cannot be properly graded by use of the grading factors specified or defined in the standards are considered DLQ.

Certification. When applicable, show the factor DLQ and the reason(s) why on the work record and "Results" section of the certificate, and grade the soybeans "U.S. Sample Grade."

10.16 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine U.S. Sample Grade criteria before the removal of foreign material based on a work portion of 1,000 - 1,050 grams.

Table 10.5 – U.S. Sample Grade Criteria shows the criteria and corresponding Visual Aids, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, or bulgur), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain must function as "unknown foreign substance (FSUB)."

Soybeans inoculated with a seed treatment which is toxic should not be confused with soybeans stained by pokeberry juice which is not toxic.

If it is difficult to visually determine soybeans stained by pokeberry juice from those stained by a seed treatment, the following procedures may be used:

a. Place discolored soybean kernels into a 100 x 15 mm petri dish.

b. Use an eyedropper to add enough hydrochloric acid (HCL) to cover the soybeans. Care should be taken not to get HCL in the eyes or on the skin.

c. If the soybeans are stained with pokeberry juice, the HCL solution (0.1 N) will remove the stain from the seed coat and the soybeans are not graded "U.S. Sample Grade." If the soybeans are stained with a toxic seed treatment, the HCL solution will not remove the stain from the seed coat and the soybeans are graded "U.S. Sample Grade."

TABLE 10.5 – U.S. SAMPLE GRADE CRITERIA

Criteria	Visual Aids	Number/Weight[1]	
		Sample Basis	Lot Basis[2]
Any Numerical Grading Factor		Excess of limit for U.S. No. 4	N/A
Animal Filth	Animal Filth	10 or more	N/A
Castor Beans	Castor Bean	2 or more	N/A
Crotalaria Seeds	Crotalaria	3 or more	N/A
Glass		1 or more	N/A
Odor		Presence	N/A
Stones		4 or more and in excess of 0.1% by weight	N/A
Unknown Foreign Substances[3]	Fertilizer	4 or more	N/A
Heating		Presence	Presence
Total Other Material[4]		11 or more	N/A
Large Debris*		N/A	2 or more
Other Unusual Conditions*		Presence	Presence

[1] Record count factors to the nearest whole number.

[2] The entire sample of a submitted sample is considered as the lot.

[3] Consider feed pellets and processed grain products as foreign material, not unknown foreign substance.

[4] Includes any combination of animal filth, castor beans, crotalaria seeds, glass, stones, and unknown foreign substances. The weight of stones is not applicable for total other material.

* For Distinctly Low Quality, refer to Section 10.15.

Certification. Grade soybeans "U.S. Sample Grade" when one or more of the limits in Table 10.5 – U.S. Sample Grade Criteria are observed. Record the factors (count factors to the nearest whole number) on the work record and "Results" section of the certificate.

10.17 FOREIGN MATERIAL

Definition. *All matter that passes through an 8/64 round-hole sieve and all matter other than soybeans remaining in the sieved sample after sieving according to procedures prescribed in FGIS instructions.*

a. Coarse Foreign Material. Coarse foreign material consists of the following:

(1) Whole kernels of corn. Whole kernels of corn are kernels with one-fourth or less of the kernel removed.

(2) Cockleburs.

(3) Sticks if the following criteria are met:

(a) Approximately 1 inch or more in length.

(b) Approximately 1/2 inch or more with a thickness of 5/32 of an inch (width of the largest soybean slotted sieve).

(4) Pods (one-half pod or more). If pods contain soybeans, remove the soybeans and return to sample.

(5) Other coarse foreign material may include but is not limited to corn cobs, large feed pellets, pieces of dirt or stones larger than soybeans, sweet corn, large sunflower seeds, and edible beans that are generally larger than soybeans.

b. Fine Foreign Material. Fine foreign material consists of the following:

(1) Broken kernels of corn with more than one-fourth of the kernel removed.

(2) Popcorn, sunflower seeds, yellow peas, nightshade berries, and edible beans that are generally equal to or smaller than soybeans.

(3) Star thistles, star burs, sandburs, morning glory, and kinghead seeds.

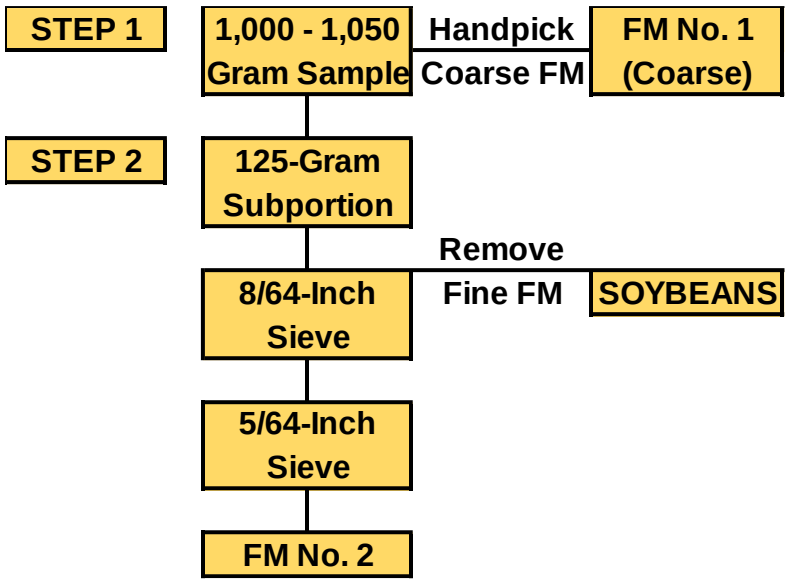
(4) Sticks and stones not meeting the criteria for coarse foreign material.

(5) Soybean pods less than one-half the total pod.

(6) Any other material too small to function as coarse foreign material including broken off soybean sprouts. Soybean hulls which are not removed by the 3.175 mm (8/64) round-hole sieve are not considered foreign material.

Basis of Determination. Determine foreign material by handpicking and sieving as follows:

CHART 10.1 – PROCEDURE FOR DETERMINING FOREIGN MATERIAL



Coarse Foreign Material.

Handpick the 1,000 – 1.050 gram portion for coarse foreign material. Refer to Section 10.17 for the definition of coarse foreign material.

Fine Foreign Material.

a. Cut down the cleaned sample (free of coarse foreign material) to a portion of 125 grams.

b. Using an approved shaker or hand sieve, sieve (5 strokes) the 125-gram portion with and 8/64" (3.175 mm) round-hole sieve.

c. Handpick the material other than soybeans from the material remaining on the 8/64" sieve and add it to the fine foreign material. Soybean hulls which remain on the 8/64" sieve are not considered foreign material.

Note: An 8/64 x 3/4 (3.175 x 19.050 mm) or 9/64 x 3/4 (3.572 x 19.050 mm) oblong-hole sieve, or 10/64 x 3/4 (3.969 x 19.050 mm) oblong-hole sieve may be mounted on top of the 8/64" round-hole sieve and used an aid in separating splits. Refer to Section 10.19, "Splits," for the determination of splits. When a sieve is used as an aid, the material remaining on top of the 8/64" round-hole sieve and the material remaining on top of the sieve used as an aid is analyzed for additional fine foreign material.

Calculating Foreign Material. Calculate foreign material in soybeans by adding the percent of coarse foreign material to the percent of fine foreign material in hundredths (disregard thousandths) and round the sum to the nearest tenth percent.

Example: Foreign Material Calculation

Weight of representative sample	1,025 grams
Weight of coarse foreign material	5.00 grams
Weight of portion to be sieved	125 grams
Weight of fine foreign material	1.60 grams

a. **Percent of coarse foreign material.**
(5.00g ÷ 1,025g) x 100 = 0.48%.

b. **Percent of fine foreign material.**
(1.60g ÷ 125g) x 100 = 1.28%.

c. **Percent of foreign material.**
(0.48% + 1.28%) = 1.76% (rounded to 1.8%)

Certification. Record the percent of foreign material on the work record and "Results" section of the certificate to the nearest tenth percent.

10.18 PROCESSING THE WORK SAMPLE

At this point, all tests required to be performed prior to the removal of foreign material have been completed and the percent of foreign material has been determined. Also, the sample has been examined for certain sample grade and special grade factors. Now the work sample is ready to be divided into fractional portions for other determinations required after the removal of the foreign material.

Chart 10.2 – Dividing the Work Sample and Table 10.6 – Approximate Analytical Portion Sizes illustrate how the sample is divided into fractional parts using an approved divider.

CHART 10.2 – DIVIDING THE WORK SAMPLE

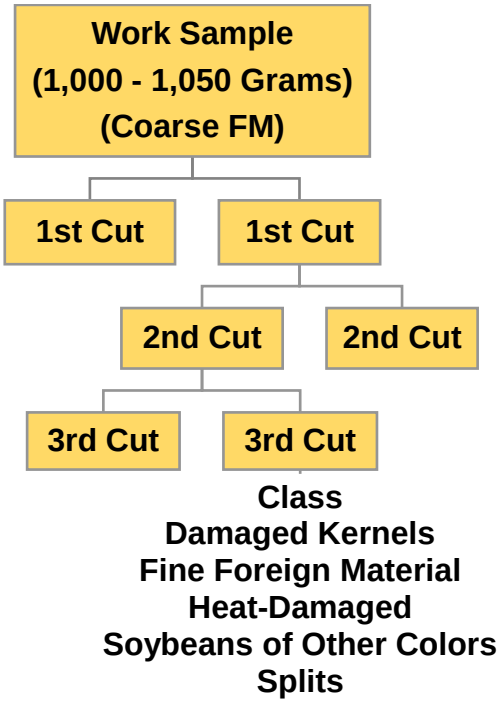


TABLE 10.6 – APPROXIMATE ANALYTICAL PORTION SIZES

Factors	Grams
Damaged Kernels	125
Foreign Material	125
Heat-Damaged Kernels	125
Kind of Grain[1]	125
Soybean of Other Colors	125
Splits	125

[1] Factor determined before the removal of foreign material.

10.19 SPLITS

Definition. *Soybeans with more than one-fourth of the bean removed and that are not damaged.*

Basis of Determination. Determine splits (SPL) on a portion of 125 grams after the removal of foreign material.

Note: A smaller portion size (approximately 60 grams) may be used for the analysis of splits when a sample contains approximately 50 percent or more of whole soybeans that pass through a 10/64 oblong-hole sieve.

Sieves Used to Facilitate the Splits Determination. An 8/64 x ¾ (3.175 x 19.050 mm) or 9/64 x ¾ (3.572 x 19.50 mm) oblong-hole or 10/64 x ¾ (3.969 x 19.50 mm) oblong-hole hand sieve may be used to separate splits. Use these sieves in conjunction with the 8/64-inch round-hole sieve used to determine foreign material.

All splits are not separated by sieving. Therefore, the material remaining on top of the sieve and the material that passed through the sieve have to be examined for splits.

Since splits are normally separated during the determination of foreign material, the weight of the foreign material must be subtracted from the weight of the representative portion before calculating the percent of splits.

Example: Splits Calculation

Weight of representative portion	125 grams
Weight of fine foreign material (material passing through the 8/64 round-hole sieve and all matter other than soybeans on top of the sieve)	2.40 grams
Weight of splits	10.60 grams

a. **Portion size used to calculate splits (adjusted).**
125g – 2.40g (rounded to 2) = 123 grams.

b. **Percent of splits.**
(10.60g ÷ 123g) x 100 = 8.61% (rounded to 8.6%).

Certification. Record the percent of splits on the work record and “Results” section of the certificate to the nearest tenth percent.

10.20 DAMAGED KERNELS

Definition. *Soybeans and pieces of soybeans that are badly ground-damaged, badly weathered-damaged, diseased, frost-damaged, germ-damaged, heat-damaged, insect-bored, mold-damaged, sprout-damaged, stinkbug-stung, or otherwise materially damaged. Stinkbug-stung kernels are considered damaged kernels at the rate of one-fourth of the actual percentage of the stung kernels.*

Basis of Determination. Determine damaged kernels (DKT) on a portion of 125 grams after the removal of foreign material.

Note: A smaller portion size (approximately 60 grams) may be used for the analysis of damaged kernels when a sample contains approximately 50 percent or more of whole soybeans that pass through a 10/64 oblong-hole sieve.

In general, consider soybeans to be damaged for inspection and grading purposes only when the damage is distinctly apparent and of such character as to be recognized as damaged for commercial purposes.

Cross section soybeans through the middle of the hilum. Cross section stinkbug soybeans through the suspected sting. Do not cross section lengthwise.

TYPES OF SOYBEAN DAMAGE.

Badly Ground and/or Weather-Damaged Kernels. Soybeans and pieces of soybeans in which the seed coats are discolored by ground or weather damage. The discoloration may be on one side or both sides. (VRI – SB - 1.0 Badly Ground and/or Weather Damage and SB - 1.1 Weather Damage (Gray/Black))

Damaged-By-Heat Kernels. Soybeans and pieces of soybeans which have been discolored and damaged-by-heat but not to the extent they are considered heat damaged. Cross section the whole soybean to determine the extent of the damage. Do not cross-section splits and pieces of soybeans. (VRI – SB - 2.0 Damaged-By-Heat)

Frost-Damaged Kernels (Waxy). Soybeans and pieces of soybeans which have a glassy, wax-like appearance. The color of affected soybeans may vary. Do not cross-section splits and pieces of soybeans. (VRI – SB - 3.2 Frost Damage (Waxy))

Green-Damaged. Soybeans and pieces of soybeans which are discolored green in the cross section. This is applicable to any variety of soybeans. Do not cross section splits and pieces of soybeans. (VRI – SB - 3.0 Green Damage)

Heat-Damaged Kernels. Soybeans and pieces of soybeans which are materially discolored and damaged-by-heat. Cross section the whole soybean to determine the extent of damage. Do not cross section splits and pieces of soybeans. (VRI – SB - 5.0 Heat Damage (Materially Damaged/Heating))

Note: Heat-damaged kernels are included in the total percent of other damaged kernels.

Immature Kernels (Wafers). Soybeans and pieces of soybeans which are immature and have a thin, flat, wrinkled, or wafer like appearance. Cross section soybeans and pieces of soybeans that are immature and have a thin, flat, wrinkled, or wafer-like appearance to determine if there is "meat" in the kernel. If there is "meat" in the kernel and the "meat" is not otherwise damaged, the wafers are sound. Wafered kernels without "meat" are considered damaged. (VRI – SB - 6.0 Immature (Wafer))

Insect-Bored Kernels. Soybeans and pieces of soybeans which bear evidence of boring or tunneling, indicating the possible inner presence of insects, insect webbing, or insect refuse. Kernels which have been partially eaten by insects or rodents but which are entirely free from refuse, webbing, insects, or other forms of damage are considered as sound kernels. Do not cut open the kernel when making this determination. (VRI – SB - 7.0 Insect-Bored Kernels)

Mold-Damaged Kernels.

a. Invaded-By-Mold. Soybeans that are discolored; elongated; misshapen; may have splits, cracks, or fissures in the seed coat and which contain a white to gray moldy growth. Soybeans and pieces of soybeans with mold on exposed areas (meat), regardless of amount, are considered damaged. (VRI – SB - 8.0 Mold Damage)

b. Surface Mold Growth. Soybeans with little or no apparent deterioration having a milky white or grayish crusty growth caused by downy mildew. Seedcoat is not discolored and contains no splits, cracks, or fissures. Soybeans that contain mildew on 50 percent or more of the seedcoat in sufficient concentration are considered damage. (VRI – SB - 8.0 Mold Damage)

c. Mold Damage (Pink). Soybeans and pieces of soybeans with a pink discoloration caused by fungal activity. The discoloration may appear on one or both sides. (VRI – SB - 8.1 Mold Damage (Pink))

   Cross sectioned soybeans that have a pinkish discoloration on the cotyledon extending around the entire perimeter with color intensity meeting VRI – SB - 8.1 Mold Damage (Pink) are considered damaged. If the color intensity is greater than shown, the extent of the discoloration around the perimeter may be prorated.

Sprout-Damaged Kernels. Soybeans and pieces of soybeans which are sprouted with the sprout protruding. Soybeans with broken off sprouts are considered sound unless otherwise damaged. (VRI – SB - 9.0 Sprout Damage)

Stinkbug Stung Kernels. Soybeans and pieces of soybeans which show an indentation or discoloration on the seed coat. Cross section kernels through the suspected sting to determine the extent of damage. Stinkbug stung kernels should not be confused with kernels that are damaged by weevils. (VRI – SB - 10.0 Stinkbug or Insect Stung Kernels)

Stinkbug stung kernels are considered damaged at the rate of one-fourth of the actual percent.

Calculating Damaged Kernels. Obtain the percent of total damaged kernels by adding the percent of other damaged kernels and stinkbug damaged kernels. Add the results, as shown in the following example, in hundredths (disregard thousandths) and round the sum to the nearest tenth percent.

Example: Damaged Kernels Calculation

Weight of representative portion (after removal of FM)	123 grams
Weight of other damaged kernels	1.60 grams
Weight of stinkbug damage	15.00 grams

a. **Percent of other damaged kernels.**
(1.60g ÷ 123g) x 100 = 1.30%.

b. **Percent of stinkbug damage.**
(15.00g ÷ 123g) x 100 ÷ 4 = 3.04%.

c. **Damaged kernels (total).**
(1.30% + 3.04%) = 4.34% (rounded to 4.3%).

Certification. Record the percent of damaged kernels on the work record and "Results" section of the certificate to the nearest tenth percent.

10.21 HEAT-DAMAGED KERNELS

Definition. *Soybeans and pieces of soybeans that are materially discolored and damaged-by-heat.*

Basis of Determination. Determine heat-damaged kernels on a portion of 125 grams after the removal of foreign material. (VRI – SB - 5.0 Heat Damage (Materially Damaged/Heating))

Note: Heat-damaged kernels are included in the total percent of other damaged kernels.

Certification. Record the percent of heat-damaged kernels on the work record and "Results" section of the certificate to the nearest tenth percent.

10.22 CLASS

Soybeans are divided into the following classes:

a. *Yellow Soybeans. Soybeans that have yellow or green seed coats and which in cross section, are yellow or have a yellow tinge, and may include not more than 10.0 percent of soybeans of other colors.*

b. *Mixed Soybeans. Soybeans that do not meet the requirements of the class Yellow soybeans.*

Basis of Determination. Determine class by the color characteristics of the kernels on a portion of 125 grams after the removal of foreign material.

Soybeans of Other Colors. Soybeans that have green, black, brown, or bicolored seed coats. Soybeans that have green seed coats will also be green in cross section. Bicolored soybeans will have seed coats of two colors, one of which is brown or black, and the brown or black color covers 50 percent of the seed coats. The hilum of a soybean is not considered a part of the seed coat for this determination. (VRI – SB - 12.0 Soybeans of Other Colors)

Soybeans of other colors (SBOC) is not a class of soybeans.

Soybeans with green seed coats that are yellow when cross sectioned are considered Yellow soybeans.

Yellow or Green soybeans with distinct black or brown pigmented streaks or splotches covering 50 percent or more of the seed coat are considered bicolored soybeans.

> The pioneer variety that has a smoky green color function as soybeans of other colors when found in yellow soybeans.

Black or Brown soybeans with distinct yellow or green pigmented streaks or splotches covering 50 percent or more of the seed coat are considered bicolored soybeans.

Certification. For Mixed soybeans, record the percent of Yellow soybeans and soybeans of other colors on the work record and “Results” section of the certificate to the nearest tenth percent.

When not a mixture, record the percent of "soybeans of other colors," on the work record and “Results” section of the certificate to the nearest tenth percent.

10.23 OFFICIAL CRITERIA

Official criteria factors are determined only on request and do not affect the grade designation.

a. Oil and/or Protein. An applicant may request analysis for oil, protein, or oil and protein content.

Basis of Determination. All oil and protein analyses must be performed in accordance with official procedures established by FGIS.

Certification. Record the percent of Oil and/or Protein on the work record and "Results" section of the certificate to the nearest tenth percent on a 13.0% moisture basis. For more information, refer to the NIRT Handbook and the Grain Inspection Handbook III, Inspection Procedures.

b. Sclerotinia Sclerotiorum. The fungus S*. sclerotiorum* causes a stem disease (stem rot) in soybeans which results in large black growths (sclerotinia) on the stem and pods. Seeds may occasionally become infected within diseased pods. If infected early, the seeds are flattened and badly shriveled and are sometimes replaced by sclerotinia. (VRI – O.F. - 32.0 Sclerotia)

Basis of Determination. Examine the work portion, 1,000 – 1,050 grams, for the presence of sclerotinia.

Certification. Record the percent of sclerotinia on the work record and "Results" section of the certificate to the nearest tenth percent.

c. Black Soybeans. Soybeans that have black seed coats.

Basis of Determination. Determine the percent of black soybeans on the color characteristics of the kernels on a 125-gram portion after the removal of FM.

Certification. Record the percent of black soybeans on the work record and "Results" section of the certificate to the nearest tenth percent.

d. Seed Sizing. Consists of a measurement of soybeans passing through or remaining on top of a sieve(s) size specified by the applicant for service.

Basis of Determination. Determine seed sizing on a portion of 125 grams, after the removal of foreign material, using the following method:

Mechanical Sieving Method.

a. Mount the sieve and the bottom pan on the mechanical sieve shaker.

b. Set the stroke counter to 20 strokes.

c. Put the representative portion in the center of the sieve and actuate the shaker.

d. All soybeans passing through or remaining on top of the sieve(s) will determine the percent of size fractions.

Example: Seed Sizing Calculation

Weight of representative portion	125 grams
Weight of foreign material	2.87 grams
Weight of material remaining on top sieve	50.0 grams
Weight of material passing through sieve	72.0 grams

a. **Portion size used to calculate size (adjusted).**
125g – 3g (2.9 rounded) = 122 grams.

b. **Percent remaining on top of sieve.**
(50g ÷ 122g) x 100 = 40.98% (rounded to 41.0%).

c. **Percent passing through sieve.**
(72g ÷ 122g) x 100 = 59.02% (rounded to 59.0%).

Certification. Record the percent of the size fractions, as requested by the applicant, on the work record and "Results" section of the certificate to the nearest tenth percent.

e. Seed Count. A measurement of the number of soybeans contained in a specified weight (i.e., number of soybeans per 1,000 grams or one pound).

Basis of Determination. Determine the count on a representative portion of 25 grams as illustrated below, after the removal of foreign material and non-whole soybeans (soybeans with more than one-fourth of the bean removed).

Example: Seed Count Calculation

Weight of representative portion	25.00 grams
Weight of foreign material	0.87 grams
Weight of non-whole soybeans	2.93 grams

a. **Weight of whole soybeans.**
25g – (0.87g + 2.93g) = 25 – 4 (rounded) = 21.00 grams.

b. **Average count per gram (Truncated – disregard thousands).**
(172 ÷ 21g) = 8.19 whole soybeans.

c. **Seed count per 1,000 grams.**
8.19 x 1,000 = 8,190 whole soybeans.

Certification. Record seed count on the work record and "Results" section of the certificate.

f. White Hilum. A test to determine the percent of whole soybeans with clear white hilum. Upon request, tests for other hilum colors (e.g., buff or brown) can be provided. (VRI – (SB)-O.F. - 36.0 White Hilum)

The percent of whole soybeans is also obtained using this criteria.

Basis of Determination. Determine the percent of clear white hilum on a portion of 125 grams after the removal of foreign material and non-whole soybeans (soybeans with more than one-fourth of the bean removed).

When performing a white hilum test, consider damaged whole soybeans but do not consider soybeans of other colors in the percent of whole soybeans with clean white hilum.

Example: White Hilum Calculation

Weight of representative portion	125 grams
Weight of foreign material	2.36 grams
Weight of non-whole soybeans	4.69 grams
Weight of non-clear white hilum	1.55 grams

a. **Weight of whole soybeans.**
125g – (2.36g + 4.69g rounded) = 125 – 7 = 118.0 grams.

b. **Weight of clear white hilum soybeans.**
118g – 2g (1.55g rounded) = 116.0 grams.

c. **Percent of whole soybeans.**
(118g ÷ 125g) x 100 = 94.40% (rounded to 94.4%).

d. **Percent of clear white hilum soybeans.**
(116g ÷ 118g) x 100 = 98.30% (rounded to 98.3%).

Certification. Record the percent of whole soybeans and the percent of clear white hilum soybeans on the work record and “Results” section of the certificate to the nearest tenth percent.

g. Cracked Seedcoats. Soybeans with cracked seedcoats must be whole (three-fourths or more of a whole soybean) sound soybeans which have readily discernable cracked seedcoats, have all or part of the seedcoat removed, or have growth stress cracks tight and next to the hilum.

Basis of Determination. Determine the percent of cracked seedcoats on a portion of 125 grams after the removal of foreign material and damaged kernels.

Example: Cracked Seedcoats Calculation

Weight of representative portion	125 grams
Weight of foreign material	3.85 grams
Weight of damaged soybeans	1.98 grams
Weight of split soybeans	17.90 grams
Weight of whole soybeans with cracked seedcoats	17.50 grams

a. **Weight of whole soybeans.**
125g – (3.85g + 1.98g + 17.90g) = 125 – 24 (rounded)
= 101.1 grams.

b. **Percent of whole soybeans with cracked seedcoats.**
(17.50g ÷ 101g) x 100 = 17.32% (rounded to 17.3%).

Certification. Record the percent of cracked seedcoats on the work record and "Results" section of the certificate to the nearest tenth percent.

h. Shriveled and Wrinkled Soybeans. Whole non-damaged soybeans with an atypical size and appearance that pass through a 10/64" x 3/4" oblong-hole sieve and remain on top of the 8/64" round-hole sieve. (VRI – SB - 13.0 Shriveled and Wrinkled)

Basis of Determination. Determine shriveled and wrinkled soybeans after the removal of foreign material on a representative portion of 125 grams.

Example: Shriveled and Wrinkled Soybeans Calculation

Weight of representative portion	125 grams
Weight of foreign material	2.57 grams
Weight of damaged soybeans	1.46 grams
Weight of split soybeans	15.00 grams
Weight of whole shriveled and wrinkled soybeans	24.88 grams

a. **Weight of whole soybeans that passed through a 10/64" x 3/4" oblong-hole sieve and remain on top of the 8/64" round-hole sieve.**
125g – (2.57g + 1.46g + 12.90g) = 125 – 17 (rounded)
= 108.0 grams.

b. **Percent of whole shriveled and wrinkled soybeans.**
(24.88g ÷ 108g) x 100 = 23.03% (rounded to 23.0%).

Certification. Record the percent of shriveled and wrinkled of the work record and "Results" section of the certificate to the nearest tenth percent.

CHAPTER 11:
SUNFLOWER SEED

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11.1 GENERAL ORDER OF PROCEDURES

The breakdown and inspection for Sunflower Seed are listed below in the following chapter according to its general order. The order of procedure may slightly vary depending on the quality of the sunflower seed and the tests requested. More information is available on the Agricultural Marketing Service Website (AMS), in the U.S. Standards for Sunflower Seed, and the Board of Appeals and Review (BAR) Questions and Answers.

The inspection process provides various factor information used to determine grade and to provide further information on the condition or quality of the sunflower seed. Each section of this chapter provides details on recording factor information. If requested by the applicant for inspection, additional information may be provided (e.g., an exact count on stones in addition to the percent by weight or a percent for a specific type of damage).

11.2 DEFINITION OF SUNFLOWER SEED

Definition. *Grain that, before the removal of foreign material, consists of 50.0 percent or more of cultivated sunflower seed (Helianthus annuus L.) and not more than 10.0 percent of other grains for which standards have been established under the United States Grain Standards Act.*

Whole seed includes seeds and broken seeds with kernels. Seeds that do not contain kernels are not considered as whole sunflower seeds.

Other grains for which standards have been established are barley, canola, corn, flaxseed, oats, rye, sorghum, soybeans, triticale, and wheat.

Cultivated Sunflower Seed. Sunflower seed grown for oil content. The term seed in this and other definitions related to sunflower seed refers to both the kernel and hull which is a fruit or achene.

Cultivated sunflower seed includes samples or lots comprised of mixtures of confectionery and oil type seeds or pure confectionery seed, provided the mixture or pure confectionery seed are presented for inspection as sunflower seed marketed for oil content.

Except for the definition of admixture (Section 11.19, “Official Criteria”), a hull does *not* constitute a sunflower seed.

According to the definition, a sunflower seed can be either the kernel with attached hull (the size of either is irrelevant as long as they are connected) or just the kernel.

The following definitions apply when identifying sunflower seed:

a. *Hull (Husk). The ovary wall of the sunflower seed.*

b. *Kernel. The interior contents of the sunflower seed that are surrounded by the hull.*

The terms "kernel" and "meat" are used synonymously.

Basis of Determination. Normally, a visual appraisal of the sample is sufficient to determine if it meets the definition of sunflower seed. However, if an analysis is necessary, make the determination before the removal of foreign material on a portion of 75 grams.

If the sample does not meet the definition of sunflower seed, examine it further to determine if it is:

a. Another grain for which standards have been established; or

b. Not Standardized Grain (NSG). No further analysis is necessary on a sample designated as NSG unless a specific factor test is requested.

11.3 GRADES AND GRADE REQUIREMENTS

There are no classes or subclasses in sunflower seed. Sunflower seed is divided into two U.S. numerical grades and U.S. Sample Grade. Special grades emphasize qualities or conditions affecting the value and are added to and made a part of the grade designation. Special grades do not affect the numerical or sample grade designation.

TABLE 11.1 – GRADES AND GRADE REQUIREMENTS FOR SUNFLOWER SEED

Grade	Minimum Limits of -	Maximum Limits of -		
	Test Weight per bushel (pounds)	Damaged Kernels		Dehulled Seed (percent)
		Heat Damage (percent)	Total (percent)	
U.S. No. 1	25.0	0.5	5.0	5.0
U.S. No. 2	25.0	1.0	10.0	5.0

U.S. Sample Grade is sunflower seed that:

a. Does not meet the requirements for grades U.S. No.1 or 2; or

b. Contains 8 or more stones which have an aggregate weight in excess of 0.20 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria* spp.), 2 or more castor beans (*Ricinus communis* L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 10 or more rodent pellets, bird droppings, or an equivalent quantity of other animal filth per 600 grams of sunflower seed; or

c. Has a musty, sour, or commercially objectionable foreign odor; or

d. Is heating or otherwise of distinctly low quality.

11.4 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in Table 11.1 – Grades and Grade Requirements for Sunflower Seed. Use the following guidelines when assigning grades:

a. The letters "U.S.";

b. The abbreviation "No." and the number of the grade or the words "Sample Grade";

c. The words "or better" when applicable;

d. The words "Sunflower Seed";

e. The special grade designation when applicable.

Example: U.S. Sample Grade Sunflower Seed

11.5 SPECIAL GRADES

Special grades draw attention to unusual conditions in the grain and are made part of the grade designation. The special grades and special grade requirements for sunflower seed are shown in the United States Standards for Sunflower Seed. Details for determining special grades are included in referenced sections. Definitions and examples of the designations for special grades in sunflower seed are:

Infested Sunflower Seed. Sunflower seed that is infested with live weevils or other insects injurious to stored grain. (Section 11.11)

Example: U.S. No. 1 Sunflower Seed, Infested

11.6 OPTIONAL GRADE DESIGNATION

The Official U.S. Standards for Grain provide for an optional grade designation, commonly referred to as "or better." Upon the request of an applicant, certify sunflower seed as U.S. No. 2 or better, U.S. No. 3 or better, etc. An "or better" grade designation cannot be applied to a U.S. No. 1 grade designation.

Example: U.S. No. 2 or better Sunflower Seed

11.7 BASIS OF DETERMINATION

Distinctly Low Quality. The determination of distinctly low quality is made on the basis of the lot as a whole at the time of sampling when a condition exists that may or may not appear in the representative sample and/or the sample as a whole.

Certain Quality Determinations. Each determination of rodent pellets, bird droppings, other animal filth, broken glass, castor beans, cockleburs, crotalaria seeds, dockage, garlic, live insect infestation, large stones, moisture, temperature, an unknown foreign substance(s), and a commonly recognized harmful or toxic substance(s) is made on the basis of the sample as a whole. When a condition exists that may not appear in the representative sample, the determination may be made on the basis of the lot as a whole at the time of sampling according to procedures prescribed in FGIS instructions.

All Other Determinations. Each determination of heat-damaged kernels, damaged kernels, test weight per bushel, and dehulled seed is made on the basis of the grain when free from foreign material. Other determinations not specifically provided for under the General Provisions are made on the basis of the grain as a whole, except the determination of odor is made on either the basis of the grain as a whole or the grain when free from foreign material.

TABLE 11.2 – BASIS OF DETERMINATION

Lot as a Whole	Factors Determined Before the Removal of Mech. Foreign Material	Factors Determined After the Removal of Mech. Foreign Material
Distinctly Low Quality	Admixture	Damaged kernels (Total)
Heating	Distinctly Low Quality	Dehulled Seed
Infested	Infested	Heat-Damaged Kernels
Odor	Moisture	Kind of Grain
	Odor	Odor
	Sample Grade Criteria	Test Weight

11.8 HEATING

Basis of Determination. Determine heating (HTG) on evidence obtained at the time of sampling or on the basis of the sample as a whole.

Sunflower seed developing a high temperature from excessive respiration is considered heating. Heating sunflower seed, in its final stages, will usually have a sour or musty odor. Do not confuse sunflower seed that is heating with sunflower seed that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

Certification. When applicable, show the term “Heating” on the work record and “Results” section of the certificate, and grade the sunflower seed “U.S. Sample Grade.”

11.9 ODOR

Basis of Determination. Determine odor on evidence obtained at the time of sampling or on the sample either before or after the removal of mechanically separated foreign material.

TABLE 11.3 – ODOR CLASSIFICATION EXAMPLES

Musty	Sour	Commercially Objectionable Foreign Odors	
Ground	Boot	Animal Hides	Oil Products
Insect	Fermenting	Decaying Animal	Skunk
Moldy	Insect (acrid)	Fertilizer	Smoke
	Pigpen	Fumigant	Strong Weed
	Smoke[1]	Insecticide	Vegetable Matter
[1] Smoke odors are considered sour only in canola, flaxseed, soybeans, and sunflower seed.			

Odors from Heat-Damaged Sunflower Seed. When heat-damaged kernels are present, sunflower seed gives off an odor very similar to smoke. Sunflower seed containing a “smoke” odor is considered as having a “sour” odor unless evidence of a fire-burnt material is present in the lot or the original sample. If evidence of a fire-burnt material is present in the lot or the sample, the smoke odor is considered a commercially objectionable foreign odor.

Note: Turpentine odors are considered OK in sunflower seed.

Commercially objectionable foreign odors (COFO) are odors that are entirely foreign to grain that render it unfit for normal commercial usage.

Fumigant, insecticide, or fungicide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of sunflower seed contains a fumigant, insecticide, or fungicide odor that prevents the determination as to whether any other odor(s) exists, apply the following guidelines:

a. Original Inspections. Allow the work portion to aerate in an open container for 4 hours, or less if the odor dissipates in less time.

b. Reinspections, Appeal and Board Appeal Inspections. Allow unworked file samples and new samples to aerate in an open container for 4 hours, or less, if the odor dissipates in less time. The 4-hour aeration requirement does not apply when the original work portion was aerated and retained as the final file.

Consider the sample as having a commercially objectionable foreign odor if the fumigant, insecticide, or fungicide odor persists based on the above criteria.

Final Determinations. The inspector is responsible for making the final determination for all odors. Whenever possible, use a consensus of experienced licensed inspectors on samples containing marginal odors. Under the consensus approach, if a clear majority (at least 2/3) of inspectors agree the sample contains a Musty, Sour, or COFO odor, grade the sunflower seed "U.S. Sample Grade". The consensus approach is not required if the initial inspector does not detect an odor or a distinct odor is detected.

Certification. Grade sunflower seed containing a *"distinct"* musty, sour, or commercially objectionable foreign odor as "U.S. Sample Grade." Record the words "Musty," "Sour," or "Commercially Objectionable Foreign Odor" on the work record and "Results" section of the certificate.

11.10 MOISTURE

Definition. *Water content in grain as determined by an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine moisture before the removal of foreign material on a portion of approximately 400 grams.

The procedures for performing a moisture determination using a FGIS approved moisture instrument utilizing the proper calibrations are described in the Moisture Handbook and in Chapter 1, General Information.

Certification. Record the percent of moisture on the work record and "Results" section of the certificate to the nearest tenth percent.

11.11 INFESTED SUNFLOWER SEED

Sunflower seed that is infested with live weevils (LW) or other live insects injurious to stored grain (OLI).

The presence of any LW or OLI found in the work sample indicates the probability of infestation and warns that the sunflower seed must be carefully examined to determine if it is infested. In such cases, examine the work sample and the file sample before reaching a conclusion as to whether or not the sunflower seed is infested. Do not examine the file sample if the work portion is insect free.

LW include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. OLI include grain beetles, grain moths, and larvae. To further define "other insect injurious to stored grain" refer to the Stored-Grain Insect Reference. Images of insects may also be viewed on the AMS website.

Larvae of the red or gray sunflower seed weevil (*Smicronyz* spp.) are small, white, legless grubs approximately 1/8 inch in size that wander among sunflower seeds. When disturbed, these larvae curl into a ball and remain motionless for minutes. They chew out from inside the sunflower seed and cannot reinfest the seed in storage. Consequently, lots containing sunflower seed weevil larvae are not considered infested. Sunflower seed weevil larvae are considered foreign material.

Basis of Determination. Determine infestation on the lot as a whole and/or sample as a whole. For insect tolerances, refer to Table 11.4 – Insect Infestation.

TABLE 11.4 – INSECT INFESTATION

Samples meeting or exceeding any one of these tolerances are infested: ***2 LW, or 1 LW + 5 OLI, or 10 OLI***		
1,000-gram representative sample[1] (+ file sample if needed)	**Lot as a Whole (Stationary)**	**Online Sample (In-Motion)[2]**
Submitted Samples Probed Lots D/T Sampled Land Carriers	Probed Lots (at time of sampling)	Railcars under the Cu-sum Subsamples for Sacked Grain Lots Components for Bargelots[3] Components for Shiplots[3]

[1] Examine work portion and file sample if necessary. Do not examine file sample if work portion is insect free.

[2] Minimum sampling rate is 500 grams per 2,000 bushels.

[3] Minimum component size is 10,000 bushels.

Key: LW = Live Weevil, OLI = Other Live Insects injurious to stored grain

Certification. When applicable, grade the sunflower seed "Infested" on the grade line of the certificate in accordance with Section 11.5, "Special Grades." Record the number of live weevils and/or other live insects injurious to stored grain on the work record and "Results" section of the certificate.

11.12 DISTINCTLY LOW QUALITY

Consider sunflower seed distinctly low quality when it is obviously of inferior quality and the existing grade factors or guidelines do not properly reflect the inferior condition.

Basis of Determination. Use all available information to determine whether the sunflower seed is of distinctly low quality (DLQ). This includes a general examination of the sunflower seed during sampling and an analysis of the obtained sample(s).

a. Diatomaceous Earth (DIAT). Sunflower seed suspected of containing DIAT is considered DLQ unless the applicant specifically requests an examination to verify the presence of DIAT. If the laboratory examination verifies that the sunflower seed contains DIAT, then the sunflower seed is not considered DLQ due to DIAT. For additional information regarding the testing of sunflower seed for diatomaceous earth, refer to Directive 9180.49, "Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel."

b. Flood Damaged Grain. Sunflower seed that is materially affected by flooding is considered DLQ and certified as "U.S. Sample Grade". In addition, official personnel must report identifiable lots that are DLQ to the district Food and Drug Administration (FDA) office as "actionable" in accordance with FGIS-PN-19-04, "Inspection of Flood Damaged Grain".

The determination of DLQ is based on the appearance and condition of the lot or sample as a whole. Evaluate sunflower seed affected by flooding on a portion of approximately 400 grams with the use of the ILP – All Grains/Graded Commodities - Inspection of Flood Damaged Grain. If a sample does not meet the requirements for DLQ, but the kernels are materially damaged (stained) by flooding, consider the kernels as damaged and count toward the total percentage of damaged kernels in the sample.

c. Large Animal Excreta (LGANX). Sunflower seed containing one or more large animal excreta (e.g., deer or elk pellet) is considered DLQ.

d. Large Debris. Sunflower seed containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris which are visible to the sampler but are too large to enter the sampling device is considered DLQ.

e. Other Unusual Conditions. Sunflower seed that is obviously affected by other unusual conditions which adversely affect the quality of the sunflower seed and cannot be properly graded by use of the grading factors specified or defined in the standards is considered DLQ.

Certification. When applicable, show the factor DLQ and the reason(s) why on the work record and "Results" section of the certificates, and grade the sunflower seed "U.S. Sample Grade."

11.13 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine U.S. Sample Grade criteria before the removal of foreign material based on a work portion of 600 grams.

Table 11.5 – U.S. Sample Grade Criteria shows the criteria and corresponding Visual Aids, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, or bulgur), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain must function as "unknown foreign substance (FSUB)."

TABLE 11.5 – U.S. SAMPLE GRADE CRITERIA

Criteria	Visual Aids	Number/Weight[1]	
		Sample Basis	Lot Basis[2]
Any Numerical Grading Factor		Excess of limit for U.S. No. 2	N/A
Animal Filth	Animal Filth	10 or more	N/A
Castor Beans	Castor Bean	2 or more	N/A
Crotalaria Seeds	Crotalaria	3 or more	N/A
Glass		2 or more	N/A
Odor		Presence	N/A
Stones		8 or more and in excess of 0.20% by weight	N/A
Unknown Foreign Substances[3]	Fertilizer	4 or more	N/A
Heating		Presence	Presence
Large Debris*		N/A	2 or more
Other Unusual Conditions*		Presence	Presence

[1] Record count factors to the nearest whole number.

[2] The entire sample of a submitted sample is considered as the lot.

[3] Consider feed pellets and processed grain products as foreign material, not unknown foreign substance.

* For Distinctly Low Quality, refer to Section 11.12.

Certification. Grade sunflower seed "U.S. Sample Grade" when one or more of the limits in Table 11.5 – U.S. Sample Grade Criteria are observed. Record the factors (count factors to the nearest whole number) on the work record and "Results" section of the certificate.

11.14 FOREIGN MATERIAL

Definition. *All matter other than whole sunflower seeds containing kernels that can be removed from the original sample by use of an approved device and by handpicking a portion of the sample according to procedures prescribed in FGIS instructions.*

The term "whole sunflower seed" as used in the definition of foreign material is synonymous with the description of a sunflower seed as given in Section 11.2, “Definition of Sunflower Seed.”

Whole seed includes seeds and broken seeds with kernels. Seeds that do not contain kernels are not considered as whole sunflower seeds.

Basis of Determination. Determine foreign material (FM) on 600 grams of the original sample. If the percentage of foreign material is requested, use the following procedures.

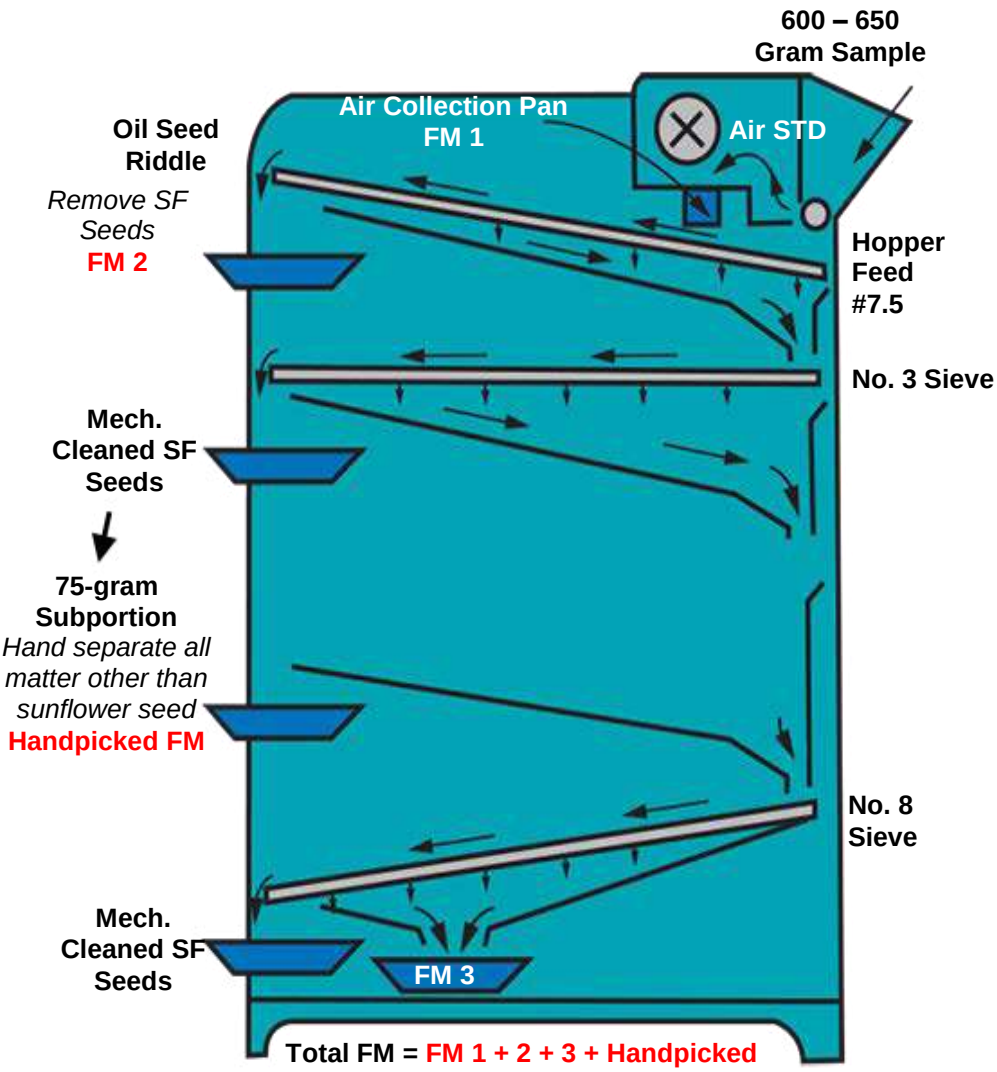

FIGURE 11.1 – PROCEDURE FOR DETERMINING FOREIGN MATERIAL

Carter Dockage Tester (Mechanical Separation).

a. Set the air at the standardized setting and the feed control to 7.5.

b. Insert the oilseed riddle in the riddle carriage.

c. Insert a No. 3 sieve in the top sieve carriage.

d. There is no sieve in the middle sieve carriage.

e. Insert a No. 8 sieve in the bottom sieve carriage.

f. Start the Carter Dockage Tester and pour the sample into the feed hopper.

g. Remove sunflower seeds from the material removed by the riddle and add to the cleaned sunflower seed.

h. *ALL* aspirated material in the air collection pan is foreign material.

i. Material that passed over the riddle, except for sunflower seeds, is foreign material.

j. Material in the bottom collection pan is foreign material.

Handpick (Foreign Material).

a. Combine the two mechanically cleaned portion.

b. Cut down the cleaned sample to a portion of 75 grams.

c. Handpick the 75-gram portion for foreign material (all matter other than sunflower seed referred in Section 11.2, "Definition of Sunflower Seed").

Calculating Foreign Material. Calculate the percent of foreign material by adding the percent of mechanically separated foreign material to the percent of handpicked foreign material using the following formula:

Example: Foreign Material Calculation

Original sample weight	650 grams
Weight of mechanically separated foreign material	50.00 grams
Weight of handpicked portion	75.20 grams
Weight of handpicked foreign material	0.45 grams

a. **(Weight of mechanically separated foreign material ÷ original sample weight) x 100**
= percent of mechanically separated foreign material.
(50.00g ÷ 650g) x 100 = 7.69% mechanically separated foreign material.

b. **(100 percent - percent of mechanically separated foreign material) ÷ 100**
= change of base factor.
(100% - 7.69%) ÷ 100 = 0.92 change of base factor.

c. **(Weight of handpicked foreign material ÷ weight of handpicked portion) x 100**
= percent of handpicked foreign material.
(0.45g ÷ 75.20g) x 100 = 0.59% handpicked foreign material.

d. **(Percent of handpicked foreign material) x change of base factor**
= percent of handpicked foreign material (adjusted).
0.59 x 0.92 = 0.54% (adjusted).

e. **Percent of mechanically separated foreign material + adjusted percent of handpicked foreign material**
= percent of foreign material.
7.69% + 0.54% = 8.23% foreign material (certified as 8.0%).

Ranges of sunflower seed foreign material are certified as follows:

0.25 to 0.74 as 0.5 percent, 0.75 to 1.24 as 1.0 percent, etc.

Certification. Record the percent of foreign material on the work record to the nearest hundredth percent. Record the percent of foreign material in the "Results" section of the certificate to the nearest half percent.

11.15 TEST WEIGHT

Definition. *The weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine test weight (TW) after the removal of mechanically separated foreign material on a portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination and available services are described in Chapter 1, General Information.

Certification. Record test weight results on the work record and "Results" section of the certificate in whole and half pounds. Disregard fractions of a half-pound. If requested, convert the pounds per bushel (lbs./bu) result to kilograms per hectoliter (kg/hl) using the following formula: lbs./bu x 1.287 = kg/hl and record in the "Remarks" section in whole and tenths.

11.16 PROCESSING THE WORK SAMPLE

At this point, all tests required to be performed prior to the removal of foreign material have been completed. Also, the sample has been examined for certain sample grade and special grade factors. Now the work sample is ready to be divided into fractional portions for other determinations required after the removal of foreign material.

Chart 11.1 – Dividing the Work Sample and Table 11.6 – Approximate Analytical Portion Sizes illustrate how the sample is divided into fractional parts using an approved divider.

CHART 11.1 – DIVIDING THE WORK SAMPLE

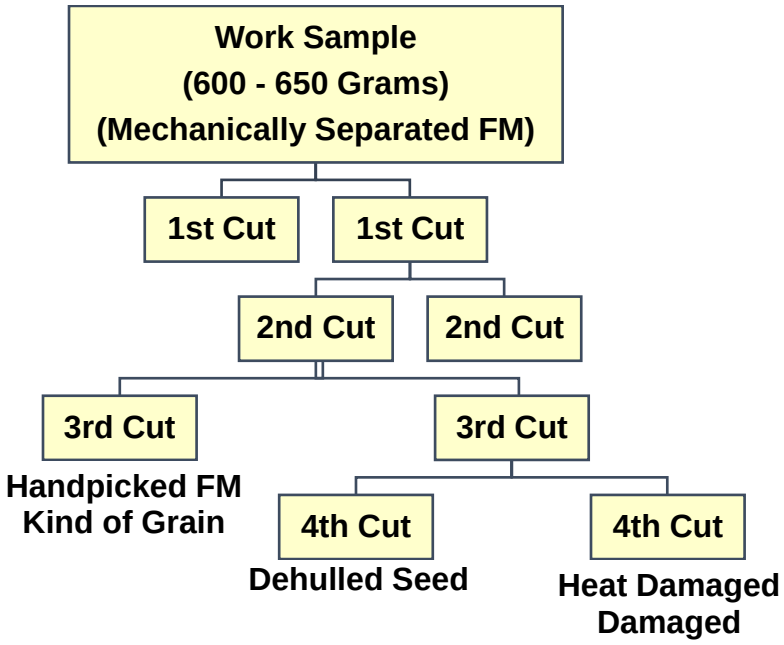

TABLE 11.6 – APPROXIMATE ANALYTICAL PORTION SIZES

Factors	Grams
Admixture	60
Damaged Kernels (Total)	30
Dehulled Seed	30
Handpicked Foreign Material	75
Heat-Damaged Kernels	30
Kind of Grain	75

11.17 DEHULLED SEED

Definition. *Sunflower seed that has the hull completely removed from the sunflower kernel.*

Basis of Determination. Determine dehulled (DH) seed after the removal of mechanically separated foreign material on a portion of 30 grams.

Certification. Record the percent of dehulled seed on the work record and "Results" section of the certificate to the nearest tenth percent.

11.18 DAMAGED KERNELS

Damaged Sunflower Seed. Seed and pieces of sunflower seed that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, heat-damaged, mold-damaged, sprout-damaged, or otherwise materially damaged.

Heat-Damaged Sunflower Seed. Seed and pieces of sunflower seed that are materially discolored and damaged-by-heat.

Basis of Determination. Determine damaged kernels (DKT) after the removal of mechanically separated foreign material on a portion of 30 grams (± 1.5 grams).

In general, consider sunflower seed to be damaged for inspection and grading purposes only when the damage is distinctly apparent and of such character as to be recognized as damaged for commercial purposes. Insect-bored kernels are not considered damaged.

TYPES OF SUNFLOWER SEED DAMAGE.

Damaged-By-Heat. Seed and pieces of seed which are slightly discolored as a result of heating. (VRI – SS - 1.0 Damaged-By-Heat)

Green-Damaged. Seed and pieces of seed which are discolored green and meets or exceeds required intensity on both sides of the kernel. Green damaged kernels would be included in otherwise materially damaged. (VRI – SB - 3.0 Green Damage)

Heat-Damaged. Seed and pieces of seed which have been materially discolored and damaged-by-heat are considered as heat-damaged and are included in the total percent for damaged sunflower seed. Seeds damaged-by-heat, either by external heat or as a result of excessive respiration, usually have a dull, dead appearance and are discolored brown or black. (VRI – SS - 2.0 Heat Damage)

Mold-Damaged. Sunflower seeds containing surface mold on one or both sides. (VRI – SS - 3.0 Surface Mold)

Sprout-Damaged. Seed and pieces of seed which have sprouted and the sprout extends out of the hull. The sprout must be hooking around the seed for dehulled seeds.

Method of Determination.

a. After the removal of mechanically separated foreign material, examine a 30-gram (± 1.5 grams) portion and remove all damaged seed except damaged-by-heat and heat-damaged seeds.

b. Calculate the percent for the damaged seed removed.

c. Pour the remainder of the 30-gram portion into the barley pearler. For pearler operation procedures, refer to Chapter 1, General Information.

d. Set the timer for a standardized pearl (after pearling and aspiration, the pearled sample should weigh 14 to 16 grams). If outside this range, reset the timer and pearl another portion. If the hulls are not removed from the kernels, remove the remaining hulls by hand.

e. Remove the hulls from the pearled portion using the S/J system aspirator.

f. Weigh the pearled portion.

g. Separate the damaged-by-heat and heat-damaged kernels from the sound kernels.

Calculating Total Damaged Kernels. Calculate the percent of damaged kernels by adding the percent of other damaged kernels, damaged-by-heat kernels, and heat-damaged kernels. Add the results, as shown in the following example, in hundredths (disregard thousandths) and round the sum to the nearest tenth percent.

Example: Damaged Kernels Calculation

Weight of representative portion (after removal of Mech. FM)	30.58 grams
Weight of other damaged kernels	0.60 grams
Weight f pearled portion	15.78 grams
Weight of heat-damaged kernels	0.16 grams
Weight of damaged-by-heat kernels	1.50 grams

a. **(Weight of other damaged kernels ÷ weight of representative portion after the removal of mechanically separated FM) x 100**
= percent of other damaged kernels.
(0.60g ÷ 30.58g) x 100 = 1.96% other damaged kernels.

b. **(100 percent - percent of other damaged kernels) ÷ 100**
= change of base factor.
(100% - 1.96%) ÷ 100 = 0.98 change of base factor.

c. **(Weight of heat-damaged kernels ÷ weight of pearled portion) x 100**
= percent of heat-damaged kernels.
(0.16g ÷ 15.78g) x 100 = 1.01% heat-damaged kernels.

d. **Percent of heat-damaged kernels x change of base factor**
= percent of heat-damaged kernels (adjusted).
1.01% x 0.98 = 0.98% heat-damaged kernels (adjusted).

e. **(Weight of damaged-by-heat kernels ÷ weight of pearled portion) x 100**
= percent of damaged-by-heat kernels.
(1.50g ÷ 15.78g) x 100 = 9.50% damaged-by-heat kernels.

f. **Percent of damaged-by-heat kernels x change of base factor**
= percent of damaged-by-heat kernels (adjusted).
9.50 x 0.98 = 9.31% damaged-by-heat kernels (adjusted).

g. **Percent of other damaged kernels + percent of heat-damaged kernels (adjusted) + percent of damaged-by-heat kernels (adjusted)**
= percent of damaged kernels.
1.96% + 0.98% + 9.31% = 12.25% damaged kernels (rounded to 12.3%).

Certification. Record the percent of damaged and heat-damaged sunflower seed on the work record and “Results” section of the certificate to the nearest tenth percent.

11.19 OFFICIAL CRITERIA

Official criteria factors are determined only on request and do not affect the grade designation.

a. Admixture (ADM). Admixture consists of all material other than sunflower seed which can be removed from a test portion by handsieving and handpicking. Consider empty hulls and parts of seed as sunflower seed.

The major difference between admixture and foreign material is that hulls and pieces of hulls are not included in admixture. Consequently, the percent admixture will usually be lower than the percent foreign material.

Basis of Determination. Determine admixture on a portion of 60 grams before the removal of mechanically separated foreign material.

Method of Determination. Determine admixture as follows:

(1) Place the 60-gram portion on the upper edge of a 5/64 equilateral triangular hand sieve.

(2) Hold the sieve at a 10 to 20-degree angle and gently work the material down over the sieve with a side-to-side motion.

(3) After sieving, handpick all material other than sunflower seed from the material remaining *on top* of the hand sieve and *add* it to the material that *passed through* the hand sieve.

(4) Admixture consists of all material *passing through* the sieve and all material other than sunflower seed *handpicked* from the material remaining on top of the sieve.

Certification. Record the percent of admixture on the work record and “Results” section of the certificate to the nearest tenth percent.

b. Oil Content. The procedure for determining and certifying oil content is described in the Nuclear Magnetic Resonance (NMR) Handbook.

CHAPTER 12:
TRITICALE

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12.1 GENERAL ORDER OF PROCEDURES

The breakdown and inspection for Triticale are listed below in the following chapter according to its general order. The order of procedure may slightly vary depending on the quality of the triticale and the tests requested. More information is available on the Agricultural Marketing Service Website (AMS), in the U.S. Standards for Triticale, and the Board of Appeals and Review (BAR) Questions and Answers.

The inspection process provides various factor information used to determine grade and to provide further information on the condition or quality of triticale. Each section of this chapter provides details on recording factor information. If requested by the applicant for inspection, additional information may be provided (e.g., an exact count on stones in addition to the percent by weight or a percent for a specific type of damage).

12.2 DEFINITION OF TRITICALE

Definition. *Grain that, before the removal of dockage, consists of 50 percent or more of triticale (X. Triticosecale Wittmack) and not more than 10 percent of other grains for which standards have been established under the United States Grain Standards Act and that, after the removal of dockage, contains 50 percent or more of whole kernels of triticale.*

Whole kernels are kernels with three-fourths or more of the kernel present. Other grains for which standards have been established are barley, canola, corn, flaxseed, oats, rye, sorghum, soybeans, sunflower seed, and wheat.

Basis of Determination. Normally, a visual appraisal of the sample is sufficient to determine if it meets the definition of triticale. However, if an analysis is necessary, make the determination on a portion of 50 grams. Determine the percent of triticale and other grains before the removal of dockage. Determine the percent of whole kernels after the removal of dockage.

If the sample does not meet the definition of triticale, examine it further to determine if it is:

a. Another grain for which standards have been established; or

b. Not Standardized Grain (NSG). No further analysis is necessary on a sample designated as NSG unless a specific factor test is requested.

12.3 GRADES AND GRADE REQUIREMENTS

There are no classes or subclasses in triticale. Triticale is divided into four numerical grades and U.S. Sample Grade. Special grades emphasize qualities or conditions affecting the value and are added to and made a part of the grade designation. Special grades do not affect the numerical or sample grade designation.

TABLE 12.1 – GRADES AND GRADE REQUIREMENTS FOR TRITICALE

Grade	Minimum Limits of -	Maximum Limits of -					
		Damaged Kernels		Foreign Material			
	Test Weight per bushel (pounds)	Heat Damaged (percent)	Total[1] (percent)	Material Other Than Wheat or Rye (percent)	Total[2] (percent)	Shrunken and Broken Kernels (percent)	Defects[3] (percent)
U.S. No. 1	48.0	0.2	2.0	1.0	2.0	5.0	5.0
U.S. No. 2	45.0	0.2	4.0	2.0	4.0	8.0	8.0
U.S. No. 3	43.0	0.5	8.0	3.0	7.0	12.0	12.0
U.S. No. 4	41.0	3.0	15.0	4.0	10.0	20.0	20.0

U.S. Sample Grade is triticale that:

a. Does not meet the requirements for grades U.S. No.1, 2, 3, or 4; or

b. Contains 8 or more stones or any number of stones which have an aggregate weight in excess of 0.2 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria* spp.), 2 or more castor beans (*Ricinus communis* L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 2 or more rodent pellets, bird droppings, or an equivalent quantity of other animal filth per 1 1/8 to 1 1/4 quarts of triticale; or

c. Has a musty, sour, or commercially objectionable foreign odor (except smut or garlic odor); or

d. Is heating or otherwise of distinctly low quality.

[1] Includes heat-damaged kernels

[2] Includes material other than wheat or rye.

[3] Defects include damaged kernels (total), foreign material (total), and shrunken and broken kernels. The sum of these three factors may not exceed the limit for defects for each numerical grade.

12.4 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in Table 12.1 – Grades and Grade Requirements for Triticale. Use the following guidelines when assigning grades:

a. The letters "U.S.";

b. The abbreviation "No." and the number of the grade or the words "Sample Grade";

c. The words "or better" when applicable;

d. The word "Triticale";

e. The applicable special grade(s) in alphabetical order;

f. The word "Dockage" and the percentage thereof.

12.5 SPECIAL GRADES

Special grades draw attention to unusual conditions in grain and are made part of the grade designation. The special grades and special grade requirements for triticale are shown in the United States Standards for Triticale. Details for determining special grades are included in referenced sections. Definitions and examples of the designations for special grades in triticale are:

a. Ergoty Triticale. Triticale that contains more than 0.10 percent of ergot. (Section 12.19)

Example: U.S. No. 2 Triticale, Ergoty

b. Garlicky Triticale. Triticale that contains in a 1,000-gram portion more than six green garlic bulblets or an equivalent quantity of dry or partly dry bulblets. (Section 12.11)

Example: U.S. No. 3 Triticale, Garlicky

c. Infested Triticale. Triticale that is infested with live weevils or other live insects injurious to stored grain. (Section 12.12)

Example: U.S. No. 2 Triticale, Infested

d. Light Garlicky Triticale. Triticale that contains in a 1,000-gram portion two or more, but not more than six, green garlic bulblets or an equivalent quantity of dry or partly dry bulblets. (Section 12.11)

Example: U.S. No. 2 Triticale, Light Garlicky

e. Light Smutty Triticale. Triticale that has an unmistakable odor of smut, or that contains in a 250-gram portion smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 14 smut balls, but not in excess of a quantity equal to 30 smut balls of average size. (Section 12.20)

Example: U.S. No. 1 Triticale, Light Smutty, Dockage 1.0%

f. Smutty Triticale. Triticale that contains in a 250-gram portion smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 30 smut balls of average size. (Section 12.20)

Example: U.S. No. 2 Triticale, Smutty

12.6 OPTIONAL GRADE DESIGNATION

The Official U.S. Standards for Grain provide for an optional grade designation, commonly referred to as "or better." Upon the request of an applicant, certify triticale as U.S. No. 2 or better, U.S. No. 3 or better, etc. An "or better" grade designation cannot be applied to a U.S. No. 1 grade designation.

Example: U.S. No. 3 or better Triticale

12.7 BASIS OF DETERMINATION

Distinctly Low Quality. The determination of distinctly low quality is made on the basis of the lot as a whole at the time of sampling when a condition exists that may or may not appear in the representative sample and/or the sample as a whole.

Certain Quality Determinations. Each determination of rodent pellets, bird droppings, other animal filth, broken glass, castor beans, cockleburs, crotalaria seeds, dockage, garlic, live insect infestation, large stones, moisture, temperature, an unknown foreign substance(s), and a commonly recognized harmful or toxic substance(s) is made on the basis of the sample as a whole. When a condition exists that may not appear in the representative sample, the determination may be made on the basis of the lot as a whole at the time of sampling according to procedures prescribed in FGIS instructions.

All Other Determinations. Each determination of heat-damaged kernels, damaged kernels, material other than wheat or rye, and foreign material (total) is made on the basis of the grain when free from dockage and shrunken and broken kernels. Other determinations not specifically provided for under the General Provisions are made on the basis of the grain when free from dockage, except the determination of odor, is made on either the basis of the grain as a whole or the grain when free from dockage.

TABLE 12.2 – BASIS OF DETERMINATION

Lot as a Whole	Factors Determined Before the Removal of Dockage	Factors Determined After the Removal of Dockage	Factors Determined After the Removal of Dockage and Shrunken and Broken Kernels
Distinctly Low Quality	Distinctly Low Quality	Ergot	Damaged Kernels
Heating	Garlicky	Kind of Grain	Foreign Material
Infested	Heating	Odor	Heat-Damaged Kernels
Odor	Infested	Shrunken and	
	Kind of Grain	Broken Kernels	
	Moisture	Smut	
	Odor	Stones	
	Odor (Smut)	Test Weight	
	Sample Grade Criteria		

12.8 HEATING

Basis of Determination. Determine heating (HTG) on evidence obtained at the time of sampling or on the basis of the sample as a whole.

Triticale developing a high temperature from excessive respiration is considered heating. Heating triticale, in its final stages, will usually have a sour or musty odor. Do not confuse triticale that is heating with triticale that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

Certification. When applicable, show the term “Heating” on the work record and “Results” section of the certificate, and grade the triticale “U.S. Sample Grade.”

12.9 ODOR

Basis of Determination. Determine odor on evidence obtained at the time of sampling or on the sample either before or after the removal of dockage.

TABLE 12.3 – ODOR CLASSIFICATION EXAMPLES

Musty	Sour	Commercially Objectionable Foreign Odors	
Ground	Boot	Animal Hides	Oil Products
Insect	Fermenting	Decaying Animal	Skunk
Moldy	Insect (acrid)	Fertilizer	Smoke
	Pigpen	Fumigant	Strong Weed
		Insecticide	Vegetable Matter

Commercially objectionable foreign odors (COFO) are odors, except smut and garlic odors, foreign to grain that render it unfit for normal commercial usage.

Fumigant, insecticide, or fungicide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of triticale contains a fumigant, insecticide, or fungicide odor that prevents a determination as to whether any other odor(s) exists, apply the following guidelines:

a. Original Inspections. Allow the work portion to aerate in an open container for 4 hours, or less, if the odor dissipates in less time.

b. Reinspections, Appeal and Board Appeal Inspections. Allow unworked file samples and new samples to aerate in an open container for 4 hours, or less, if the odor dissipates in less time. The 4-hour aeration requirement does not apply when the original work portion was aerated and retained as the final file.

Consider the sample as having a commercially objectionable foreign odor if the fumigant, insecticide, or fungicide odor persists based on the above criteria.

Final Determination. The inspector is responsible for making the final determination for all odors. Whenever possible, use a consensus of experienced licensed inspectors on samples containing marginal odors. Under the consensus approach, if a clear majority (at least 2/3) of inspectors agree the sample contains a Musty, Sour, or COFO odor, grade the triticale “U.S. Sample Grade”. The consensus approach is not required if the initial inspector does not detect an odor or a distinct odor is detected.

Certification. Grade triticale containing a *"distinct"* musty, sour, or commercially objectionable foreign odor as “U.S. Sample Grade.” Record the words "Musty," "Sour," or "Commercially Objectionable Foreign Odor" on the work record and “Results” section of the certificate.

12.10 MOISTURE

Definition. *Water content in grain as determined by an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine moisture before the removal of dockage on a portion of approximately 650 grams.

The procedures for performing a moisture determination using a FGIS approved moisture instrument utilizing the proper calibrations are described in the Moisture Handbook and in Chapter 1, General Information.

Certification. Record the percent of moisture on the work record and results section of the certificate to the nearest tenth percent.

12.11 LIGHT GARLICKY AND GARLICKY TRITICALE

Light Garlicky. Triticale that contains in a 1,000-gram portion two or more, but not more than six, green garlic bulblets or an equivalent quantity of dry or partly dry bulblets.

Garlicky. Triticale that contains in a 1,000-gram portion more than six green garlic bulblets or an equivalent quantity of dry or partly dry bulblets.

Basis of Determination. Determine light garlicky (LGAR) and garlicky (GAR) before the removal of dockage on a portion of 1,000 grams. (VRI – O.F. - 13.0 Green Garlic Bulbs (Whole) and O.F. - 13.1 Dry Garlic Bulbs (1/3rd))

Characteristics of Bulblets.

a. Green garlic bulblets are bulblets which have retained all of their husks intact.

b. Dry or partly dry garlic bulblets are bulblets which have lost all or part of their husks. Consider bulblets with cracked husks as dry.

c. Three dry or partly dry garlic bulblets are equal to one green bulblet.

Note: Garlic bulblets apply in the determination of "Light Garlicky" and "Garlicky" but also function as dockage and foreign material.

Wild onion, sometimes referred to as "crow garlic", is considered as garlic.

Certification. When applicable, grade the triticale "Light Garlicky" or "Garlicky" on the grade line of the certificate in accordance with Section 12.5, "Special Grades." Record the number of garlic bulblets in whole number or in decimals to the hundredths position (e.g., 1/3 = .0.33 or 2/3 = 0.67) on the work record and "Results" section of the certificate.

12.12 INFESTED TRITICALE

Triticale that is infested with live weevils (LW) or other live insects injurious to stored grain (OLI).

The presence of any LW or OLI found in the work sample indicates the probability of infestation and warns that the triticale must be carefully examined to determine if it is infested. In such cases, examine the work sample and the file sample before reaching a conclusion as to whether or not the triticale is infested. Do not examine the file sample if the work portion is insect free.

LW include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. OLI include grain beetles, grain moths, and larvae. To further define "other insect injurious to stored grain" refer to the Stored-Grain Insect Reference. Images of insects may also be viewed on the AMS website.

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, refer to Table 12.4 – Insect Infestation.

TABLE 12.4 – INSECT INFESTATION

Samples meeting or exceeding any one of these tolerances are infested: ***2 LW, or 1 LW + 1 OLI, or 2 OLI***		
1,000-gram representative sample[1] (+ file sample if needed)	**Lot as a Whole (Stationary)**	**Online Sample (In-Motion)[2]**
Submitted Samples Probed Lots D/T Sampled Land Carriers	Probed Lots (at time of sampling)	Railcars under the Cu-sum Subsamples for Sacked Grain Lots Components for Bargelots[3] Components for Shiplots[3]

[1] Examine work portion and file sample if necessary. Do not examine file sample if work portion is insect free.

[2] Minimum sampling rate is 500 grams per 2,000 bushels.

[3] Minimum component size is 10,000 bushels.

Key: LW = Live Weevil, OLI = Other Live Insects injurious to stored grain

Certification. When applicable, grade the triticale "Infested" on the grade line of the certificate in accordance with Section 12.5, "Special Grades." Record the number of live weevils and/or other live insects injurious to stored grain on the work record and "Results" section of the certificate.

12.13 DISTINCTLY LOW QUALITY

Consider triticale distinctly low quality when it is obviously of inferior quality and existing grade factors or guidelines do not accurately reflect the inferior condition.

Basis of Determination. Use all available information to determine whether the triticale is of distinctly low quality (DLQ). This includes a general examination of the triticale during sampling and an analysis of the obtained sample(s).

a. Diatomaceous Earth (DIAT). Triticale suspected of containing DIAT is considered DLQ unless the applicant specifically requests an examination to verify the presence of DIAT. If the laboratory examination verifies that the triticale contains DIAT, then the triticale is not considered DLQ due to DIAT. For additional information regarding the testing of triticale for diatomaceous earth, refer to Directive 9180.49, "Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel."

b. Flood Damaged Grain. Triticale that is materially affected by flooding is considered DLQ and certified as "U.S. Sample Grade." In addition, official personnel must report identifiable lots that are DLQ to the district Food and Drug Administration (FDA) office as "actionable" in accordance with FGIS-PN-19-04, "Inspection of Flood Damaged Grain".

   The determination of DLQ is based on the appearance and condition of the lot or sample as a whole. Evaluate triticale affected by flooding on a portion of approximately 400 grams with the use of the ILP – All Grains/Graded Commodities - Inspection of Flood Damaged Grain. If a sample does not meet the requirements for DLQ, but the kernels are materially damaged (stained) by flooding, consider the kernels as damaged and count toward the total percentage of damaged kernels in the sample.

c. Large Animal Excreta (LGANX). Triticale containing one or more large animal excreta (e.g., deer or elk pellet) is considered DLQ.

d. Large Debris. Triticale containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris which are visible to the sampler but too large to enter the sampling device is considered DLQ.

e. Other Unusual Conditions. Triticale that is obviously affected by other unusual conditions which adversely affect the quality of the triticale and cannot be properly graded by use of the grading factors specified or defined in the standards is considered DLQ.

Certification. When applicable, show the factor DLQ and the reason(s) why on the work record and "Results" section of the certificate, and grade the triticale "U.S. Sample Grade."

12.14 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine U.S. Sample Grade criteria, except for stones, before the removal of dockage based on a work portion of 1,000 - 1,050 grams. Determine stones on a dockage-free portion.

Table 12.5 – U.S. Sample Grade Criteria shows the criteria and corresponding Visual Aids, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, or bulgur), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain must function as "unknown foreign substance (FSUB)."

Note: Dockage Weight must be subtracted from the original weight to calculate the percent of stones.

Original sample weight – weight of dockage
= dockage-free sample weight.
1033g – 32 (32.48 rounded) = 1001g dockage-free sample weight.

TABLE 12.5 – U.S. SAMPLE GRADE CRITERIA

Criteria	Visual Aids	Number/Weight[1]	
		Sample Basis	Lot Basis[2]
Any Numerical Grading Factor		Excess of limit for U.S. No. 4	N/A
Animal Filth	Animal Filth	2 or more	N/A
Castor Beans	Castor Bean	2 or more	N/A
Crotalaria Seeds	Crotalaria	3 or more	N/A
Glass		2 or more	N/A
Odor		Presence	N/A
Stones[3]		8 or more or any number in excess of 0.2% by weight	N/A
Unknown Foreign Substances[4]	Fertilizer	4 or more	N/A
Heating		Presence	Presence
Large Debris*		N/A	2 or more
Other Unusual Conditions*		Presence	Presence

[1] Record count factors to the nearest whole number.
[2] The entire sample of a submitted sample is considered as the lot.
[3] Stones are based on sample after removal of dockage.
[4] Consider feed pellets and processed grain products as foreign material, not unknown foreign substance.
* For Distinctly Low Quality, refer to Section 12.13.

Certification. Grade triticale "U.S. Sample Grade" when one or more of the limits in Table 12.5 – U.S. Sample Grade Criteria are observed. Record the factors (count factors to the nearest whole number) on the work record and "Results" section of the certificate.

12.15 DOCKAGE

Definition. *All matter other than triticale that can be removed from the original sample by use of an approved device according to procedures prescribed in FGIS instructions. Also, underdeveloped, shriveled, and small pieces of triticale kernels removed in properly separating the material other than triticale and that cannot be recovered by properly rescreening or recleaning.*

Basis of Determination. Determine dockage (DKG) on a portion of 1,000 – 1,050 grams of the original sample.

When performing the dockage determination, check the material that passes over the riddle for threshed and sprouted kernels of triticale.

Threshed and sprouted kernels that pass over the riddle are not considered dockage. Return such kernels to the dockage-free sample. Threshed kernels of triticale are kernels with either no glumes attached or not more than one glume attached.

Consider unthreshed kernels of triticale that pass over the riddle as dockage. Unthreshed kernels are kernels with more than one glume attached. (VRI – O.F. - 30.0 Threshed and Unthreshed Kernels)

To avoid repeating operations, check the dockage for garlic bulblets, infestation, and U.S. Sample Grade factors (except stones). (Section 12.11, "Light Garlicky and Garlicky Triticale;" Section 12.12, "Infested Triticale;" and Section 12.14, "U.S. Sample Grade Criteria.")

Certification. Record the percent of dockage on the work record in hundredths. Also, record the percent of dockage in the factor results section of the certificate application, but do not include this result in the "Results" section of the certificate. Record the word "Dockage" and the percent on the grade line of the certificate in whole and half percent with a fraction less than one-half percent disregarded.

Example: 0.50 to 0.99 percent record as 0.5%.
1.00 to 1.49 percent record as 1.0%.

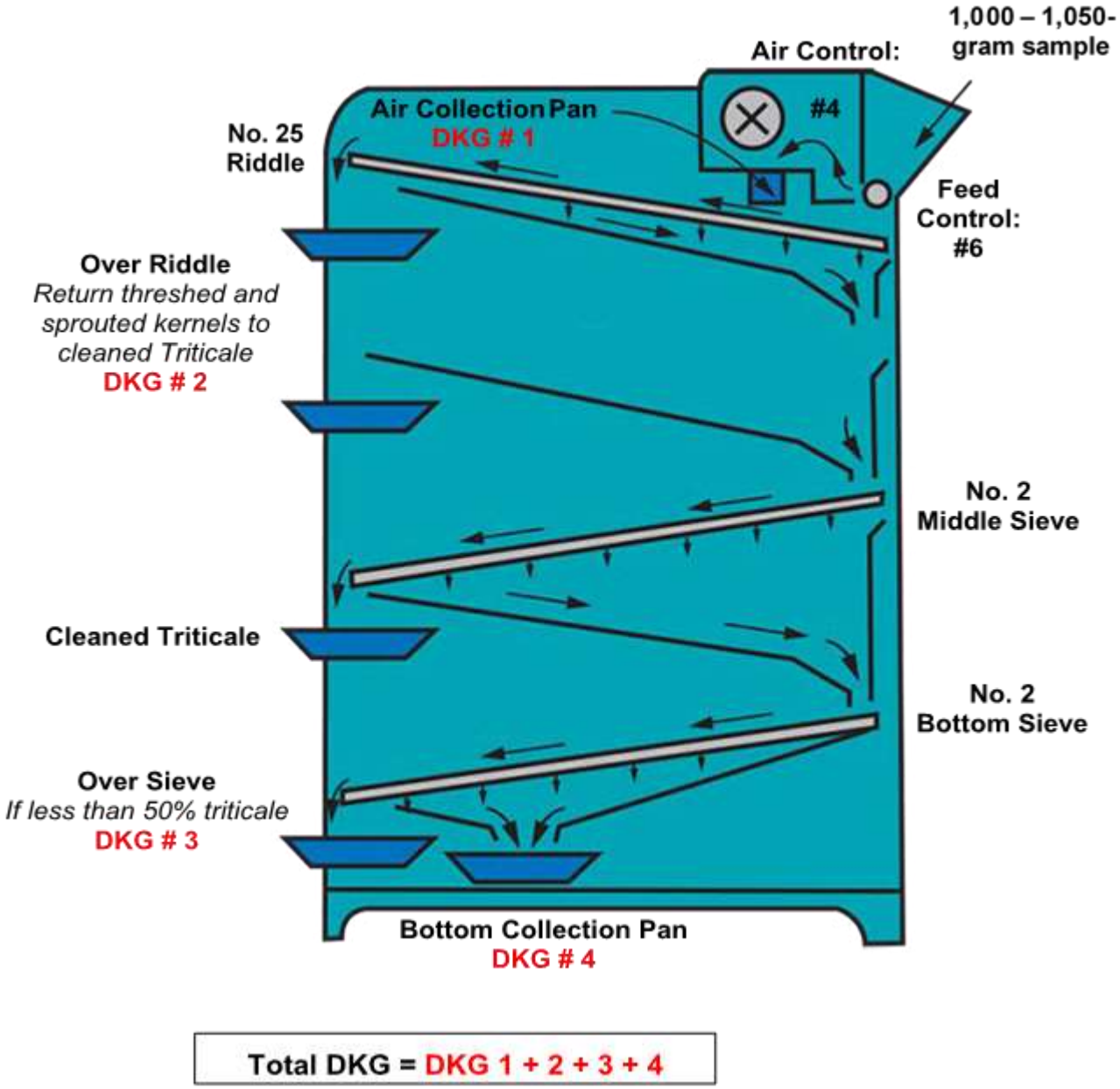

FIGURE 12.1 – PROCEDURE FOR DETERMINING DOCKAGE

Carter Dockage Tester (Mechanical Separation).

a. Set air control to 4 and the feed control to 6.

b. Insert the No. 25 riddle in the riddle carriage.

c. There is no sieve in the top sieve carriage.

d. Insert a No. 2 sieve in the middle and bottom sieve carriages.

e. Start Carter Dockage Tester and pour sample into feed hopper.

f. Aspirated material in the air collection pan is dockage.

g. Material over the riddle, except for threshed and sprouted kernels, is dockage.

h. Material that passed through the bottom sieve is dockage.

i. Material passing over the bottom sieve is dockage if it contains less than 50 percent by weight of triticale. If 50 percent or more of triticale pass over the bottom sieve, return the material to the cleaned portion.

Additional Dockage Procedures. When triticale contains wild buckwheat or similar seeds, chess or similar seeds, or flaxseed, determine dockage as follows:

a. Triticale Containing Wild Buckwheat or Similar Seeds. If the sample appears to contain more than 0.5 percent of wild buckwheat, yellow or green foxtail, millet, wild mustard, or similar seeds, analyze a 50-gram portion cut from the original sample before the removal of dockage. (VRI – O.F. - 27.0 Wild Buckwheat and Similar Seeds) If the portion contains more than 0.5 percent of wild buckwheat or similar sized seeds, proceed as follows:

(1) Set up the Carter Dockage Tester as follows:

(a) Set the air control to 4 and the feed control to 6;

(b) Insert a No. 25 riddle in the riddle carriage;

(c) There is no sieve in the top sieve carriage;

(d) Insert a No. 8 sieve in the middle sieve carriage; and

(e) Insert a No. 2 sieve in the bottom sieve carriage.

(2) After removing the dockage, sieve approximately 50 grams of the material that *passed over* the No. 2 sieve (bottom sieve collection pan) by placing it on the upper edge of a 5/64 equilateral triangular hand sieve. Hold the sieve at a 10 to 20-degree angle and work the material down over the sieve with a gentle side-to-side motion.

(3) Repeat "Step 2" above on additional 50-gram portions until all material in the bottom sieve collection pan has been sieved.

(4) If the material remaining on top of the hand sieve consists of 50 percent or more, by weight, of whole or broken kernels of triticale, return it to the cleaned triticale. Otherwise, add it to the dockage.

(5) Examine the material that passed through the hand sieve. If the material consists of 50 percent or more, by weight, of whole or broken kernels of triticale, repeat the hand sieving process on 50-gram portions of all the material that passed through the hand sieve. *Do not* perform this hand sieving process *more than twice*.

(6) All material that passed through the hand sieve is dockage.

(7) Dockage will then consist of:

(a) The material removed by the aspirator (air collection pan);

(b) The coarse material, except for threshed and sprouted kernels of triticale, that passed over the riddle (riddle collection pan);

(c) The material that passed through the No. 2 sieve (bottom collection pan);

(d) The material that passed through the hand sieve;

(e) The material that remained on the hand sieve when the material consists of less than 50 percent, by weight, of triticale.

b. Triticale Containing Chess or Similar Seeds. If the sample appears to contain more than 0.5 percent of chess or similar seeds, analyze a 50-gram portion cut from the original sample before the removal of dockage. (VRI – O.F. - 4.0 Chess) If the portion contains more than 0.5 percent of chess or similar seeds, proceed as follows:

(1) Set up the Carter Dockage Tester as follows:

(a) Set the air control to 4 and the feed control to 6;

(b) Insert a No. 25 plastic riddle in the riddle carriage;

(c) Insert a No. 9 combination large chess swaged-hole sieve in the top sieve carriage;

(d) There is no sieve in the middle sieve carriage;

(e) Insert a No. 2 sieve in the bottom sieve carriage.

(2) When the triticale has cleared the No. 9 sieve, clean the sieve by sliding it in and out of the carriage several times while the machine is operating. *Do not* collect material until the sieve has been cleaned.

(3) Examine the triticale that passed over the No. 9 sieve (top collection pan). If it contains more than 0.5 percent of chess or similar seeds, repeat the operation one more time.

(4) Examine the material that passed over the No. 2 sieve (bottom sieve collection pan). This material may be reduced in size to a representative portion of not less than 8 grams for analysis. If it consists of 50 percent or more, by weight, of whole or broken kernels of triticale, recomposite the entire sample and determine dockage using the normal dockage procedures.

(5) When the material that passed over the No. 2 sieve consists of less than 50 percent of whole or broken kernels of triticale, dockage will consist of:

(a) The material removed by the aspirator (air collection pan);

(b) The coarse material, except threshed and sprouted kernels, that passed over the riddle (riddle collection pan);

(c) The material that passed through the No. 2 sieve (bottom collection pan);

(d) The material that passed over the No. 2 sieve (bottom sieve collection pan).

c. Triticale Containing Canola, Flaxseed, or Rapeseed. If the sample appears to contain 0.3 percent or more of canola, flaxseed, or rapeseed, analyze a dockage-free portion of 50 grams. If the portion contains 0.3 percent or more of canola, flaxseed, or rapeseed, sieve the entire dockage-free sample. Use the appropriate sieve, a 5/64 triangular-hole sieve for removing canola/rapeseed, a 3/64-inch wide by 3/8-inch long or 3/64-inch wide by 11/32-inch long sieve for removing flaxseed as follows:

(1) Mechanical Sieving Method.

(a) Mount the sieve and a bottom pan on an approved mechanical sieve shaker.

(b) Set the stroke counter at 30 strokes.

(c) Place one-fourth of the dockage-free representative portion in the center of the sieve and actuate the shaker.

(d) Remove, clean the sieve, and empty the bottom pan. Return the material lodged in the perforations to the triticale on top of the sieve.

(e) Repeat this operation on the remaining portions until entire sample has been sieved.

(2) If the material which passed through the sieve consists of less than 50 percent, by weight, of whole or broken kernels of triticale, add it to the dockage. If it consists of 50 percent or more, by weight, of whole or broken kernels, recomposite it with the material remaining on top of the sieve.

(3) Dockage will then consist of:

(a) The material removed by the aspirator (air collection pan);

(b) The coarse material, except threshed and sprouted kernels, that passed over the riddle (riddle collection pan);

(c) The material that passed through the No. 2 sieve (bottom collection pan); and

(d) The material which passed through the hand sieve if it consists of less than 50 percent, by weight, of whole and broken kernels of triticale.

12.16 TEST WEIGHT

Definition. *The weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine test weight (TW) on a dockage-free portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination are described in Chapter 1, General Information.

Certification. Record test weight results on the work record and “Results” section of the certificate to the nearest tenth pound. If requested, convert the pounds per bushel (lbs./bu) result to kilograms per hectoliter (kg/hl) using the following formula: lbs./bu x 1.287 = kg/hl and record in the “Remarks” section in whole and tenths.

12.17 PROCESSING THE WORK SAMPLE

At this point, all tests required to be performed prior to the removal of dockage have been completed. Also, the sample has been examined for certain sample grade and special grade factors. Now the work sample is ready to be divided into fractional portions for other determinations required after the removal of dockage.

Chart 12.1 – Dividing the Work Sample and Table 12.6 – Approximate Analytical Portion Sizes illustrate how the sample is divided into fractional parts using an approved divider.

CHART 12.1 – DIVIDING THE WORK SAMPLE

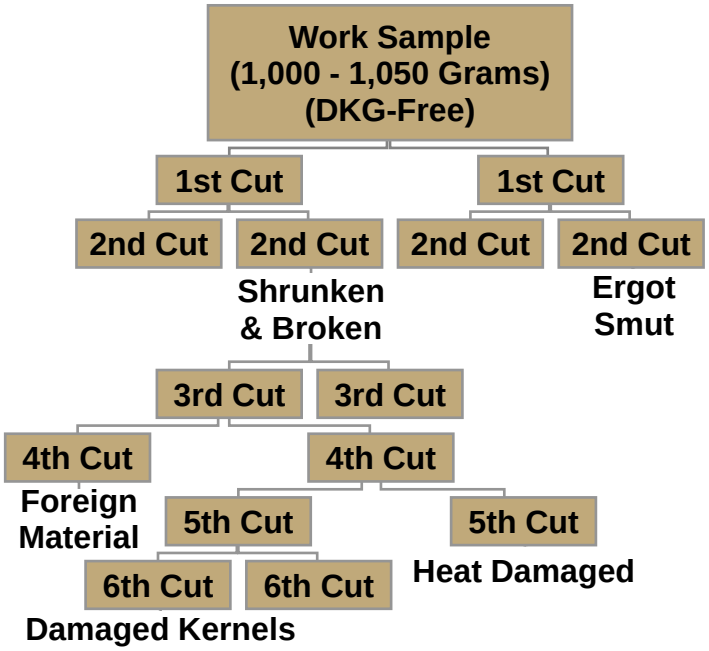

TABLE 12.6 – APPROXIMATE ANALYTICAL PORTION SIZES

Factors	Grams
Ergot	250
Smut	250
Shrunken and Broken Kernels	250
Foreign Material	50
Heat-Damaged Kernels	30
Damaged Kernels	15

12.18 SHRUNKEN AND BROKEN KERNELS

Definition. *All matter that passes through a 0.064 X 3/8 oblong-hole sieve after sieving according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine shrunken and broken kernels (SHBN) on a dockage-free portion of 250 grams using the following method:

Mechanical Sieving Method.

a. Mount the 0.064 x 3/8 (1.626 x 9.525 mm) oblong-hole sieve and a bottom pan on the mechanical sieve shaker.

b. Set the stroke counter for 30 strokes.

c. Place the portion in the center of the sieve and actuate the shaker.

d. Remove, clean the sieve, and empty the bottom pan. Return the material lodged in the perforations to the triticale on top of the sieve.

e. All material passing through the sieve is considered shrunken and broken kernels.

Certification. Record the percent of shrunken and broken kernels on the work record and “Results” section of the certificate to the nearest tenth percent.

12.19 ERGOTY TRITICALE

Definition. *Triticale that contains more than 0.10 percent of ergot.*

Basis of Determination. Determine ergoty (ERG) on a dockage-free portion of 250 grams except when the percent of ergot has been requested to be shown on the certificate. When the percent is requested, make the determination on a dockage-free portion of approximately 1,000 grams.

Ergot is a hard, reddish-brown or black grain-like mass of certain parasitic fungi that replaces triticale kernels. Ergot applies in the determination of “Ergoty” but also functions as foreign material. (VRI – O.F. - 12.0 Ergot)

Certification. When applicable, grade the triticale "Ergoty" on the grade line of the certificate in accordance with Section 12.5, “Special Grades.” Record ergot to the nearest hundredth percent on the work record and “Results” section of the certificate.

12.20 LIGHT SMUTTY AND SMUTTY TRITICALE

Light Smutty. Triticale that has an unmistakable odor of smut, or that contains in a 250-gram portion smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 14 smut balls but not in excess of a quantity equal to 30 smut balls of average size.

Smutty. Triticale that contains in a 250-gram portion smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 30 smut balls of average size.

Basis of Determination. Determine light smutty (LSM) on the sample as a whole (odor only) or on a dockage-free portion of 250 grams. Determine smutty (SMUT) on a dockage-free portion of 250 grams.

Smut is a plant disease characterized by the appearance of smut balls or smut spores. Smut balls apply in the determination of the special grade "Smutty" but also function as foreign material. (VRI – O.F. - 22.0 Smut Balls)

Certification. When applicable, grade the triticale "Light Smutty" or "Smutty" on the grade line of the certificate in accordance with Section 12.5, "Special Grades." Record the odor (in the case of Light Smutty) or the number of smut balls on the work record and "Results" section of the certificate.

12.21 FOREIGN MATERIAL

Definition. *All matter other than triticale.*

Basis of Determination. Determine foreign material (FM) on a dockage-free and shrunken and broken-free portion of 50 grams.

In triticale, foreign material is subdivided into (a) foreign material (total) and (b) foreign material other than wheat or rye.

a. Foreign Material (Total). Remove all matter other than triticale from the representative portion and determine the percent of foreign material (total).

b. Foreign Material Other Than Wheat or Rye (FMWR). Remove the wheat and rye from the total foreign material separation. The percent of FMWR is then based on the remaining FM after the removal of wheat and rye.

Glumes are considered FM and are removed from the kernels of triticale.

Certification. Record the percent of foreign material other than wheat or rye and the percent of foreign material (total) on the work record and "Results" section of the certificate to the nearest tenth percent.

12.22 HEAT-DAMAGED KERNELS

Definition. *Kernels, pieces of triticale kernels, and other grains that are materially discolored and damaged-by-heat.*

Basis of Determination. Determine heat-damaged kernels on a dockage-free and shrunken and broken-free portion of 30 grams. (VRI – W - 6.1 Heat Damage (Other Than Durum))

Certification. Record the percent of heat-damaged kernels on the work record and "Results" section of the certificate to the nearest tenth percent.

12.23 DAMAGED KERNELS

Definition. *Kernels, pieces of triticale kernels, and other grains that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-damaged, heat-damaged, insect-bored, mold-damaged, sprout-damaged, or otherwise materially damaged.*

Basis of Determination. Determine damaged kernels (DKT) on a dockage-free and shrunken and broken-free portion of 15 grams.

In general, consider triticale and other grains to be damaged for inspection and grading purposes only when the damage is distinctly apparent and of such character as to be recognized as damaged for commercial purposes.

TYPES OF TRITICALE DAMAGE.

Black Tip Fungus. Kernels affected by black tip fungus to the extent that the fungus growth is on the germ and extends into the crease of the kernel. (VRI – W - 1.0 Black Tip Damage (Fungus))

Germ-Damaged Kernels (Mold). Kernels which contain mold in the germ. The bran coat covering the germ should be removed carefully; scraping the bran coat too deep could remove the mold. (VRI – W - 4.1 Mold Damage)

Germ-Damaged Kernels (Sick). Kernels damaged as a result of heat but are not materially discolored. Sick kernels should be scraped very carefully to avoid the loss of discoloration or "popping" or removal of the germ. (VRI – W - 4.0 Germ Damage)

Green Damage (Immature). Kernels which are intense green (immature) on both sides and without any yellow appearance. (VRI – W - 5.0 Green Damage (Immature))

Heat-Damaged Kernels. Kernels materially discolored and damaged-by-heat. Cross section the kernels to determine the extent of damage. (VRI – W - 6.1 Heat Damage (Other Than Durum))

Insect-Bored Kernels. Kernels that have been bored or tunneled by insects. (VRI – W - 9.0 Weevil or Insect-Bored)

Kernels which have been chewed are considered sound kernels unless otherwise damaged. Do not confuse insect-chewed germs with sprout sockets. (VRI – W - 9.1 Insect Chewed Wheat (Not Damaged))

Mold-like Substance. Whole kernels of triticale which are 50 percent or more covered and pieces of kernels which are discolored and covered with a mold-like substance, which includes but not limited to gibberella.

Other Damaged Kernels. Kernels which have cracks, breaks, or "chews" which contain mold or fungus. (VRI – W - 7.0 Other Damage (Mold))

Sprout-Damaged Kernels. Kernels with the germ end broken open from germination and show sprout and kernels that have sprouted but the sprouts have broken off. (VRI – W - 8.0 Sprout Damage)

Certification. Record the percent of damaged kernels on the work record and "Results" section of the certificate to the nearest tenth percent. If the percent damaged kernels is less than the percent heat, the percent damaged kernels must be adjusted to equal the percent heat.

12.24 DEFECTS

Definition. *Damaged kernels, foreign material, and shrunken and broken kernels. The sum of these three factors may not exceed the limit for the factor "defects" for each numerical grade.*

Basis of Determination. Determine defects (DEF) on the sum of damaged kernels, foreign material, and shrunken and broken kernels.

A percent of defects cannot be shown when only one or two of the factors defined as defects have been determined. However, when one or two factors are determined and their sum would change the numerical grade, or come close to changing the grade, determine the other factor and record the percent of defects.

Certification. Record the percent of defects on the work record and "Results" section of the certificate to the nearest tenth percent.

CHAPTER 13:
WHEAT

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13.1 GENERAL ORDER OF PROCEDURES

The breakdown and inspection for Wheat are listed below in the following chapter according to its general order. The order of procedure may slightly vary depending on the quality of the wheat and the tests requested. More information is available on the Agricultural Marketing Service Website (AMS), in the U.S. Standards for Wheat, and the Board of Appeals and Review (BAR) Questions and Answers.

The inspection process provides various factor information used to determine grade and to provide further information on the condition or quality of wheat. Each section of this chapter provides details on recording factor information. If requested by the applicant for inspection, additional information may be provided (e.g., an exact count on stones in addition to the percent by weight or a percent for a specific type of damage).

13.2 DEFINITION OF WHEAT

Definition. *Grain that, before the removal of dockage, consists of 50 percent or more common wheat (Triticum aestivum L.), Club wheat (T. compactum Host.), and Durum wheat (T. durum Desf.) and not more than 10 percent of other grains for which standards have been established under the United States Grain Standards Act and that, after the removal of dockage, contains 50 percent or more of whole kernels of one or more of these wheats.*

Whole kernels are kernels with three-fourths or more of the kernel present. Other grains for which standards have been established are barley, canola, corn, flaxseed, oats, rye, sorghum, soybeans, sunflower seed, and triticale.

Basis of Determination. Normally, a visual appraisal of the sample is sufficient to determine if it meets the definition of wheat. However, if an analysis is necessary, make the determination on a portion of 50 grams. Determine the percent of wheat and other grains before the removal of dockage. Determine the percent of whole kernels after the removal of dockage.

If the sample does not meet the definition of wheat, examine it further to determine if it is:

a. Another grain for which standards have been established; or

b. Not Standardized Grain (NSG). No further analysis is necessary on a sample designated as NSG unless a specific factor test is requested.

13.3 GRADES AND GRADE REQUIREMENTS

Wheat is divided into eight classes: Durum wheat, Hard Red Spring wheat, Hard Red Winter wheat, Soft Red Winter wheat, Hard White wheat, Soft White wheat, Unclassed wheat, and Mixed wheat. Hard Red Spring wheat, Durum wheat, and Soft White wheat are divided into subclasses.

Each class and subclass are divided into five numerical grades and U.S. Sample Grade. Special grades emphasize qualities or conditions affecting the value and are added to and made a part of the grade designation. Special grades do not affect the numerical or sample grade designation.

TABLE 13.1 – GRADES AND GRADE REQUIREMENTS FOR WHEAT

Grade	Minimum Limits of -		Maximum Limits of -						
	Test Weight per bushel		Damaged Kernels		Foreign Material (percent)	Shrunken and Broken Kernels (percent)	Defects[1] (percent)	Wheat of Other Classes[2]	
	Hard Red Spring Wheat or White Club	All Other Classes and Subclasses (pounds)	Heat Damage (percent)	Total (percent)				Contrasting Classes (percent)	Total[3] (percent)
U.S. No 1	58.0	60.0	0.2	2.0	0.4	3.0	3.0	1.0	3.0
U.S. No. 2	57.0	58.0	0.2	4.0	0.7	5.0	5.0	2.0	5.0
U.S. No. 3	55.0	56.0	0.5	7.0	1.3	8.0	8.0	3.0	10.0
U.S. No. 4	53.0	54.0	1.0	10.0	3.0	12.0	12.0	10.0	10.0
U.S. No. 5	50.0	51.0	3.0	15.0	5.0	20.0	20.0	10.0	10.0

U.S. Sample Grade is wheat that:

a. Does not meet the requirements for grades U.S. No.1, 2, 3, 4, or 5; or

b. Contains 4 or more stones or any number of stones which have an aggregate weight in excess of 0.1 percent of the sample weight, 1 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria* spp.), 2 or more castor beans (*Ricinus communis* L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 2 or more rodent pellets, bird droppings, or an equivalent quantity of other animal filth per 1,000 grams of wheat; or

c. Contains 5 or more animal filth, castor beans, crotalaria seeds, glass, stones, or unknown foreign substance(s) in any combination; or

d. Has a musty, sour, or commercially objectionable foreign odor (except smut or garlic odor); or

e. Is heating or otherwise of distinctly low quality; or

f. Contains more than 31 insect-damaged kernels in 100 grams.

[1] Defects include damaged kernels (total), foreign material, and shrunken and broken kernels. The sum of these three factors may not exceed the limit for defects for each numerical grade.

[2] Unclassed wheat of any grade may contain no more than 10.0 percent of wheat of other classes.

[3] Includes contrasting classes.

Grade Mixed wheat according to the U.S. numerical and U.S. Sample Grade requirements of the predominating class in the mixture. Wheat of other classes and contrasting classes are not applicable to Mixed wheat.

13.4 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in Table 13.1 – Grades and Grade Requirements for Wheat. Use the following guidelines when assigning grades:

a. The letters "U.S.";

b. The abbreviation "No." and the number of the grade or the words "Sample Grade";

c. The words "or better" when applicable;

d. The name of the class or subclass;

e. The applicable special grade in alphabetical order, except for treated wheat.

   The grade designation for treated wheat includes, following the class or subclass and any special grade designations, the word "Treated" followed by a statement indicating the kind of treatment (e.g., Scoured, Limed, Washed, Sulfured), and the word "Dockage" and the percentage thereof.

f. The word “Dockage” and the percentage thereof.

13.5 SPECIAL GRADES

Special grades draw attention to unusual conditions in grain and are made part of the grade designation. The special grades and special grade requirements for wheat are shown in the United States Standards for Wheat. Details for determining special grades are included in referenced sections. Definitions and examples of the designations for special grades in wheat are:

a. Ergoty Wheat. Wheat that contains more than 0.05 percent of ergot. (Section 13.19)

   Example: U.S. No. 2 Dark Northern Spring Wheat, Ergoty, Dockage 0.1%

b. Garlicky Wheat. Wheat that contains in a 1,000-gram portion more than two green garlic bulblets or an equivalent quantity of dry or partly dry bulblets. (Section 13.11)

   Example: U.S. No. 2 Soft Red Winter Wheat, Garlicky, Dockage 0.9%

c. Infested Wheat. Wheat that is infested with live weevils or other live insects injurious to stored grain. (Section 13.12)

   Example: U.S. No. 2 Hard Red Winter Wheat, Infested, Dockage 0.0%

d. Light Smutty Wheat. Wheat that has an unmistakable odor of smut or which contains, in a 250-gram portion, smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 5 smut balls, but not in excess of a quantity equal to 30 smut balls of average size. (Section 13.21)

Example: U.S. No. 3 Hard Red Winter Wheat, Light Smutty, Dockage 1.7%

e. Smutty Wheat. Wheat that contains in a 250-gram portion, smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 30 smut balls of average size. (Section 13.21)

Example: U.S. No. 3 Northern Spring Wheat, Smutty, Dockage 0.5%

f. Treated Wheat. Wheat that has been scoured, limed, washed, sulfured, or treated in such a manner that the true quality is not reflected by either the numerical grades or the U.S. Sample Grade designation alone. (Section 13.20)

Example: U.S. No. 1 Amber Durum Wheat, Treated (Limed), Dockage 0.2%

13.6 OPTIONAL GRADE DESIGNATION

The Official U.S. Standards for Grain provide for an optional grade designation, commonly referred to as "or better." Upon the request of an applicant, certify wheat as U.S. No. 2 or better, U.S. No. 3 or better, etc. An "or better" grade designation cannot be applied to a U.S. No. 1 grade designation.

Example: U.S. No. 2 or better Hard Red Winter Wheat, Dockage 0.2%

13.7 BASIS OF DETERMINATION

Distinctly Low Quality. The determination of distinctly low quality is made on the basis of the lot as a whole at the time of sampling when a condition exists that may or may not appear in the representative sample and/or the sample as a whole.

Certain Quality Determinations. Each determination of rodent pellets, bird droppings, other animal filth, broken glass, castor beans, cockleburs, crotalaria seeds, dockage, garlic, live insect infestation, large stones, moisture, temperature, an unknown foreign substance(s), and a commonly recognized harmful or toxic substance(s) is made on the basis of the sample as a whole. When a condition exists that may not appear in the representative sample, the determination may be made on the basis of the lot as a whole at the time of sampling according to procedures prescribed in FGIS instructions.

<u>All Other Determinations</u>. Each determination of heat-damaged kernels, damaged kernels, foreign material, wheat of other classes, contrasting classes, and subclasses is made on the basis of the grain when free from dockage and shrunken and broken kernels. Other determinations not specifically provided for under the General Provisions are made on the basis of the grain when free from dockage, except the determination of odor is made on either the basis of the grain as a whole or the grain when free from dockage.

TABLE 13.2 – BASIS OF DETERMINATION

Lot as a Whole	Factors Determined Before the Removal of Dockage	Factors Determined After the Removal of Dockage	Factors Determined After the Removal of Dockage and Shrunken and Broken Kernels
Distinctly Low Quality	Distinctly Low Quality	Ergot	Class
Heating	Garlicky	Kind of Grain	Contrasting Classes
Infested	Heating	Odor	Damaged Kernels
Odor	Infested	Protein	Foreign Material
	Kind of Grain	Shrunken and Broken Kernels	Heat-Damaged Kernels
	Moisture	Smut	Subclass
	Odor	Stones	Wheat of Other Classes
	Odor (Smut)	Test Weight	
	Sample Grade Criteria	Treated	

13.8 HEATING

Basis of Determination. Determine heating (HTG) on evidence obtained at the time of sampling or on the basis of the sample as a whole.

Wheat developing a high temperature from excessive respiration is considered heating. Heating wheat, in its final stages, will usually have a sour or musty odor. Do not confuse wheat that is heating with wheat that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

Certification. When applicable, show the term “Heating” on the work record and “Results” section of the certificate, and grade the wheat “U.S. Sample Grade.”

13.9 ODOR

Basis of Determination. Determine odor on evidence obtained at the time of sampling or on the sample either before or after the removal of dockage.

TABLE 13.3 – ODOR CLASSIFICATION EXAMPLES

Musty	Sour	Commercially Objectionable Foreign Odors	
Ground Insect Moldy	Boot Fermenting Insect (acrid) Pigpen	Animal Hides Decaying Animal Fertilizer Fumigant Insecticide	Oil Products Skunk Smoke Strong Weed Vegetable Matter

Commercially objectionable foreign odors (COFO) are odors, except smut and garlic odors, foreign to grain that render it unfit for normal commercial usage.

Fumigant, insecticide, or fungicide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of wheat contains a fumigant, insecticide, or fungicide odor that prevents a determination as to whether any other odor(s) exists, apply the following guidelines:

a. Original Inspections. Allow the work portion to aerate in an open container for 4 hours, or less, if the odor dissipates in less time.

b. Reinspections, Appeal and Board Appeal Inspections. Allow unworked file samples and new samples to aerate in an open container for 4 hours, or less, if the odor dissipates in less time. The 4-hour aeration requirement does not apply when the original work portion was aerated and retained as the final file.

Consider the sample as having a commercially objectionable foreign odor if the fumigant, insecticide, or fungicide odor persists based on the above criteria.

Final Determination. The inspector is responsible for making the final determination for all odors. Whenever possible, use a consensus of experienced licensed inspectors on samples containing marginal odors. Under the consensus approach, if a clear majority (at least 2/3) of inspectors agree the sample contains a Musty, Sour, or COFO odor, grade the wheat “U.S. Sample Grade”. The consensus approach is not required if the initial inspector does not detect an odor or a distinct odor is detected.

Certification. Grade wheat containing a *"distinct"* musty, sour, or commercially objectionable foreign odor as “U.S. Sample Grade.” Record the words "Musty," "Sour," or "Commercially Objectionable Foreign Odor" on the work record and “Results” section of the certificate.

13.10 MOISTURE

Definition. *Water content in grain as determined by an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine moisture before the removal of dockage on a portion of approximately 650 grams.

The procedures for performing a moisture determination using a FGIS approved moisture instrument utilizing the proper calibrations are described in the Moisture Handbook and in Chapter 1, General Information.

Certification. Record the percent of moisture on the work record and "Results" section of the certificate to the nearest tenth percent.

13.11 GARLICKY WHEAT

Definition. *Wheat that contains in a 1,000-gram portion more than two green garlic bulblets or an equivalent quantity of dry or partly dry bulblets.*

Basis of Determination. Determine garlicky (GAR) before the removal of dockage on a portion of 1,000 grams except in those cases where the garlic bulblet count is in excess of 10 green bulblets. When garlic bulblets are in excess of 10 green bulblets, use a portion of 250 grams. After determining the count of bulblets on the 250-gram portion, multiply the count by 4 to obtain the equivalent number of bulblets in 1,000 grams. (VRI – O.F. - 13.0 Green Garlic Bulbs (Whole) and O.F. - 13.1 Dry Garlic Bulbs (1/3rd))

Characteristics of Bulblets.

a. Green garlic bulblets are bulblets which have retained all of their husks intact.

b. Dry or partly dry garlic bulblets are bulblets which have lost all or part of their husks. Consider bulblets with cracked husks as dry.

c. Three dry or partly dry garlic bulblets are equal to one green bulblet.

Note: Garlic bulblets apply in the determination "Garlicky" but also function as dockage and foreign material.

Wild onion, sometimes referred to as "crow garlic", is considered as garlic.

Certification. When applicable, grade the wheat "Garlicky" on the grade line of the certificate in accordance with Section 13.5, "Special Grades." Record the number of garlic bulblets in whole numbers or in decimals to the nearest hundredths position (e.g., 1/3 = 0.33 or 2/3 = 0.67) on the work record and "Results" section of the certificate.

13.12 INFESTED WHEAT

Wheat that is infested with live weevils (LW) or other live insects injurious to stored grain (OLI).

The presence of any LW or OLI found in the work sample indicates the probability of infestation and warns that the wheat must be carefully examined to determine if it is infested. In such cases, examine the work and file sample before reaching a conclusion as to whether or not the wheat is infested. Do not examine the file sample if the work portion is insect free.

LW include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. OLI include grain beetles, grain moths, and larvae. To further define "other insect injurious to stored grain" refer to the Stored-Grain Insect Reference. Images of insects may also be viewed on the AMS website.

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, refer to Table 13.4 – Insect Infestation.

TABLE 13.4 – INSECT INFESTATION

Samples meeting or exceeding any one of these tolerances are infested: ***2 LW, or 1 LW + 1 OLI, or 2 OLI***		
1,000-gram representative sample[1] (+ file sample if needed)	**Lot as a Whole (Stationary)**	**Online Sample (In-Motion)[2]**
Submitted Samples Probed Lots D/T Sampled Land Carriers	Probed Lots (at time of sampling)	Railcars under the Cu-sum Subsamples for Sacked Grain Lots Components for Bargelots[3] Components for Shiplots[3]

[1] Examine work portion and file sample if necessary. Do not examine file sample if work portion is insect free.

[2] Minimum sampling rate is 500 grams per 2,000 bushels.

[3] Minimum component size is 10,000 bushels.

Key: LW = Live Weevil, OLI = Other Live Insects injurious to stored grain

Certification. When applicable, grade the wheat "Infested" on the grade line of the certificate in accordance with Section 13.5, "Special Grades." Record the number of live weevils and/or other live insects injurious to stored grain on the work record and "Results" section of the certificate.

13.13 DISTINCTLY LOW QUALITY

Consider wheat distinctly low quality when it is obviously of inferior quality and the existing grade factors or guidelines do not accurately reflect the inferior condition.

Basis of Determination. Use all available information to determine whether the wheat is of distinctly low quality (DLQ). This includes a general examination of the wheat during sampling and an analysis of the obtained sample(s).

a. Diatomaceous Earth (DIAT). Wheat suspected of containing DIAT is considered DLQ unless the applicant specifically requests an examination to verify the presence of DIAT. If the laboratory examination verifies that the wheat contains DIAT, then the wheat is not considered DLQ due to DIAT. For additional information regarding the testing of wheat for diatomaceous earth, refer to Directive 9180.49, "Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel."

b. Flood Damaged Grain. Wheat that is materially affected by flooding is considered DLQ and certified as "U.S. Sample Grade." In addition, official personnel must report identifiable lots that are DLQ to the district Food and Drug Administration (FDA) office as "actionable" in accordance with FGIS-PN-19-04, "Inspection of Flood Damaged Grain".

   The determination of DLQ is based on the appearance and condition of the lot or sample as a whole. Evaluate wheat affected by flooding on a portion of approximately 400 grams with the use of the ILP – All Grains/Graded Commodities - Inspection of Flood Damaged Grain. If a sample does not meet the requirements for DLQ, but the kernels are materially damaged (stained) by flooding, consider the kernels as damaged and count toward the total percentage of damaged kernels in the sample.

c. Large Animal Excreta (LGANX). Wheat containing one or more large animal excreta (e.g., deer or elk pellet) is considered DLQ.

d. Large Debris. Wheat containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris which are visible to the sampler but too large to enter the sampling device is considered DLQ.

e. Other Unusual Conditions. Wheat that is obviously affected by other unusual conditions which adversely affect the quality of the wheat and cannot be properly graded by use of the grading factors specified or defined in the standards is considered DLQ.

Certification. When applicable, show the factor DLQ and the reason(s) why on the work record and "Results" section of the certificate, and grade the wheat "U.S. Sample Grade."

13.14 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine U.S. Sample Grade criteria, except stones, before the removal of dockage based on a work portion of 1,000 – 1,050 grams. Determine stones on a dockage-free portion.

Table 13.5 – U.S. Sample Grade Criteria shows the criteria and corresponding Visual Aids, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, or bulgur), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain must function as "unknown foreign substance (FSUB)." Kernels of wheat discolored by treatment with a fungicide or similar substance (Pink wheat) are considered as being discolored by an unknown foreign substance.

Note: Dockage Weight must be subtracted from the original weight to calculate the percent of stones and/or ergot.

Original sample weight – weight of dockage
= dockage-free sample weight.
1033g – 32 (32.48 rounded) = 1001g dockage-free sample weight.

TABLE 13.5 – U.S. SAMPLE GRADE CRITERIA

Criteria	Visual Aids	Number/Weight[1]	
		Sample Basis	Lot Basis[2]
Any Numerical Grading Factor		Excess of limit except WOCL for U.S. No. 5	N/A
Animal Filth	Animal Filth	2 or more	N/A
Castor Beans	Castor Bean	2 or more	N/A
Crotalaria Seeds	Crotalaria	3 or more	N/A
Glass		1 or more	N/A
Insect-Damaged Kernels		32 or more	
Odor		Presence	N/A
Stones[3]		4 or more or any number in excess of 0.1% by weight	N/A
Unknown Foreign Substances[4 5]	Fertilizer	4 or more	N/A
Heating		Presence	Presence
Total other material[6]		5 or more	N/A
Large Animal Excreta*		Presence	Presence
Large Debris*		N/A	2 or more
Other Unusual Conditions*		Presence	Presence

1 Record count factors to the nearest whole number.

2 The entire sample of a submitted sample is considered as the lot.

3 Stones are based on sample after removal of dockage.

4 Consider feed pellets and processed grain products as foreign material, not unknown foreign substance.

5 Kernels of wheat discolored by treatment with a fungicide or similar substance (pink wheat) are considered as being discolored by an unknown foreign substance. (VRI – (W) O.F.-17.0 Unknown Foreign Substance (Pink Wheat))

6 Includes any combination of animal filth, castor beans, crotalaria seeds, glass, stones, and unknown foreign substances.

* For Distinctly Low Quality, refer to Section 13.13.

Certification. Grade wheat "U.S. Sample Grade" when one or more of the limits in Table 13.5 – U.S. Sample Grade Criteria are observed. Record the factors (count factors to the nearest whole number) on the work record and "Results" section of the certificate.

13.15 DOCKAGE

Definition. *All matter other than wheat that can be removed from the original sample by use of an approved device according to procedures prescribed in FGIS instructions. Also, underdeveloped, shriveled, and small pieces of wheat kernels removed in properly separating the material other than wheat and that cannot be recovered by properly rescreening or recleaning.*

Basis of Determination. Determine dockage (DKG) on a portion of 1,000 – 1,050 grams of the original sample.

When performing the dockage determination, check the material that passes over the riddle for threshed and sprouted kernels of wheat.

Threshed and sprouted kernels that pass over the riddle are not considered dockage. Return such kernels to the dockage-free sample. Threshed kernels of wheat are kernels with either no glumes attached or not more than one glume attached.

Consider unthreshed kernels of wheat that pass over the riddle as dockage. Unthreshed kernels are kernels with more than one glume attached. (VRI – O.F. - 30.0 Threshed and Unthreshed Kernels)

To avoid repeating operations, check the dockage for garlic bulblets, infestation, and U.S. Sample Grade factors (except stones). (Section 13.11, "Garlicky Wheat;" Section 13.12, "Infested Wheat;" and Section 13.14, "U.S. Sample Grade Criteria")

Certification. Record the word "Dockage" and the percent to the nearest tenth percent on the work record and grade line of the certificate. Also, record the percent of dockage in the factor results section of the certificate application, but do not include this result in the "Results" section of the certificate. If the dockage is less than one-tenth percent, record as "Dockage 0.0%."

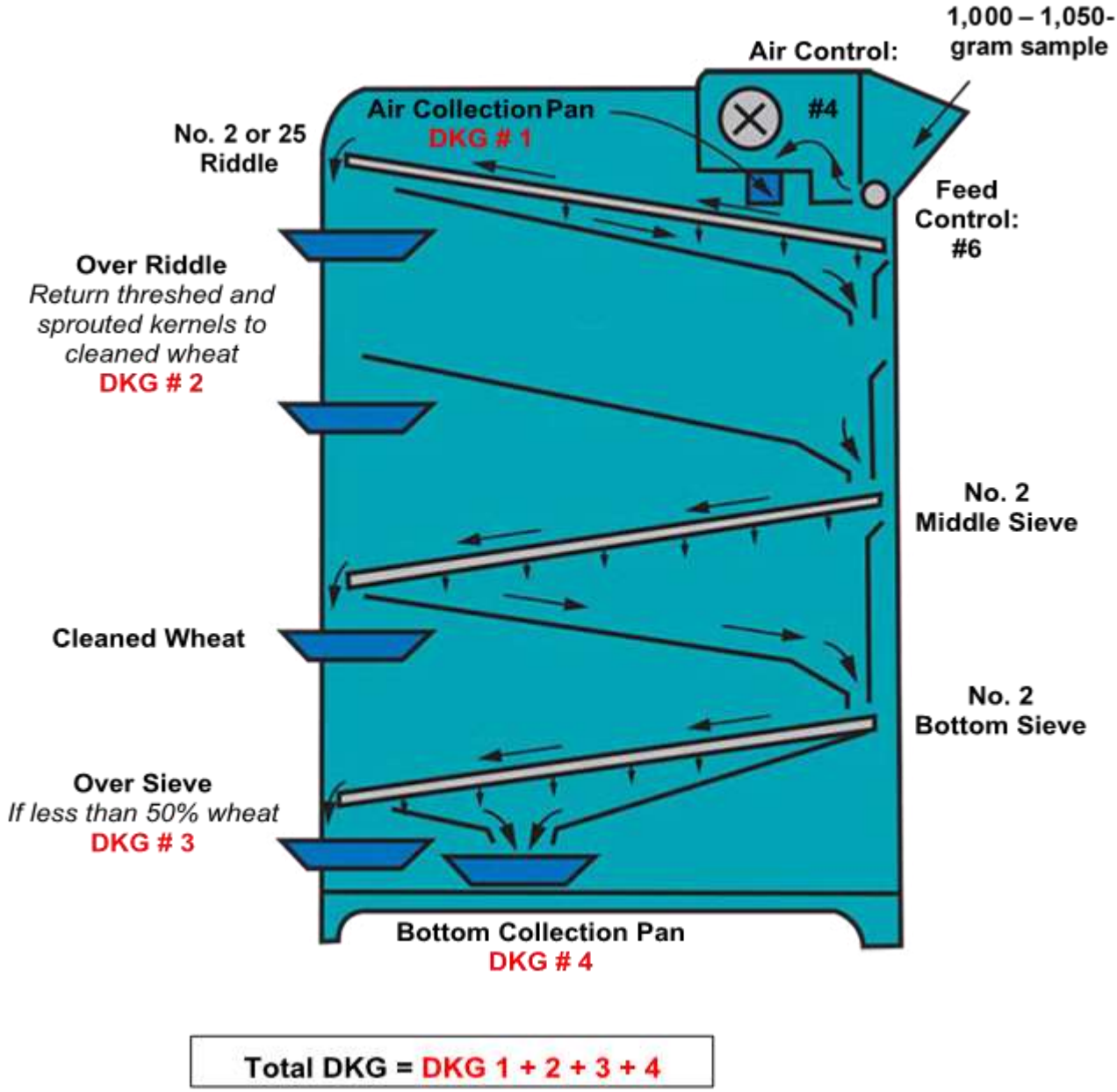

FIGURE 13.1 – PROCEDURE FOR DETERMINING DOCKAGE

Carter Dockage Tester (Mechanical Separation).

a. Set air control to 4 and the feed control to 6.

b. Insert the No. 2 riddle in the riddle carriage for HRW, HRS, SRW, HDWH, and SWH, the No. 25 riddle for DU, the No. 2 riddle for Mixed wheat unless DU is the predominant class or use the No. 2 or No. 25 riddle for Unclassed wheat according to the applicable kernel size.

c. There is no sieve in the top sieve carriage.

d. Insert a No. 2 sieve in the middle and bottom sieve carriages.

e. Start Carter Dockage Tester and pour sample into feed hopper.

f. Aspirated material in the air collection pan is dockage.

g. Material over the riddle, except for threshed and sprouted kernels, is dockage.

h. Material that passed through the bottom sieve is dockage.

i. Material passing over the bottom sieve is dockage if it contains less than 50 percent by weight of wheat. If 50 percent or more of wheat pass over the bottom sieve, return the material to the cleaned portion.

Additional Dockage Procedures. When wheat contains wild buckwheat and similar seeds, cob joints and chaff, chess or similar seeds, canola or flaxseed, determine dockage as follows:

a. Wheat Containing Wild Buckwheat or Similar Seeds. If the sample appears to contain more than 0.5 percent of wild buckwheat, yellow or green foxtail, millet, wild mustard, or similar seeds, analyze a 50-gram portion cut from the original sample before the removal of dockage. (VRI – O.F. - 27.0 Wild Buckwheat and Similar Seeds) If the portion contains more than 0.5 percent of wild buckwheat, yellow or green foxtail, millet, wild mustard, or other similar sized seeds, proceed as follows:

(1) Set up the Carter Dockage Tester as follows:

(a) Set the air control to 4 and the feed control to 6;

(b) Use the appropriate riddle;

(c) There is no sieve in the top sieve carriage;

(d) Insert a No. 8 sieve in the middle sieve carriage;

(e) Insert a No. 2 sieve in the bottom sieve carriage.

(2) After removing the dockage, sieve approximately 50 grams of the material that *passed over* the No. 2 sieve (bottom sieve collection pan) by placing it on the upper edge of a 5/64 equilateral triangular hand sieve. Hold the sieve at a 10 to 20-degree angle and work the material down over the sieve with a gentle side-to-side motion.

(3) Repeat "Step 2" on additional 50-gram portions until all material in the bottom sieve collection pan has been sieved.

(4) If the material remaining on top of the sieve consists of 50 percent or more, by weight, of whole or broken kernels of wheat, return it to the cleaned wheat. Otherwise, add it to the dockage.

(5) Examine the material that passed through the hand sieve. If the material consists of 50 percent or more, by weight, of whole or broken kernels of wheat, repeat the sieving process on 50-gram portions of all the material that passed through the hand sieve. *Do not* perform this sieving process *more than twice*.

(6) All material that passed through the hand sieve is dockage.

(7) Dockage will then consist of the following:

(a) The material removed by the aspirator (air collection pan);

(b) The coarse material, except threshed and sprouted kernels of wheat, that passed over the riddle (riddle collection pan);

(c) The material that passed through the No. 2 sieve (bottom collection pan);

(d) The material that passed through the hand sieve;

(e) The material that remained on the hand sieve when the material consists of less than 50 percent, by weight, of wheat.

b. Wheat Containing Chess or Similar Seeds. If the sample appears to contain more than 0.5 percent of chess or similar seeds, analyze a 50-gram portion cut from the original sample before the removal of dockage. (VRI – O.F. - 4.0 Chess) If the portion contains more than 0.5 percent of chess and similar seeds, proceed as follows:

(1) Set up the Carter Dockage Tester as follows:

(a) Set the air control to 4 and the feed control to 6;

(b) Use the appropriate riddle;

(c) Insert a No. 9 combination large chess swaged-hole sieve in the top sieve carriage;

(d) There is no sieve in the middle sieve carriage; and

(e) Insert a No. 2 sieve in the bottom sieve carriage.

(2) When the wheat has cleared the No. 9 sieve, clean the sieve by sliding it in and out of the carriage several times while the machine is operating. *Do not* collect material until the sieve has been cleaned.

(3) Examine the wheat that passed over the No. 9 sieve (top collection pan). If it contains more than 0.5 percent of chess and similar seeds, repeat the operation one more time.

(4) Examine the material that passed over the No. 2 sieve (bottom sieve collection pan). This material may be reduced in size to a representative portion of not less than 8 grams for analysis. If it consists of 50 percent or more, by weight, of whole or broken kernels of wheat, recomposite the entire sample and determine dockage using the normal dockage procedures.

(5) When the material that passed over the No. 2 sieve consists of less than 50 percent of whole or broken kernels of wheat, the dockage will then consist of the following:

(a) The material removed by the aspirator (air collection pan);

(b) The coarse material, except threshed and sprouted kernels, that passed over the riddle (riddle collection pan);

(c) The material that passed through the No. 2 sieve (bottom collection pan);

(d) The material that passed over the No. 2 sieve (bottom sieve collection pan).

c. Wheat Containing Cob Joints and Chaff. If the sample appears to contain more than 0.5 percent of cob joints and chaff, analyze a 50-gram portion cut from the original sample after the removal of dockage. (VRI – O.F. - 5.0 Cob Joints) If the portion contains more than 0.5 percent of cob joints and chaff, proceed as follows:

(1) Set up the Carter Dockage Tester as follows:

(a) Set the air control to 4 and the feed control to 6;

(b) Use the appropriate riddle;

(c) Insert a No. 8 sieve in the top sieve carriage;

(d) There is no sieve in the middle sieve carriage;

(e) Insert a No. 2 sieve in the bottom sieve carriage.

(2) Run the dockage-free representative portion through the Carter dockage tester.

(3) Sieve approximately 50 grams of the material that passed over the No. 2 sieve (bottom sieve collection pan) by placing it on the upper edge of a 5/64 equilateral triangular hand sieve. Hold the sieve at a 10 to 20-degree angle and work the material down over the sieve with a gentle side-to-side motion.

(4) Repeat "Step 3" above on additional 50-gram portions until all material in the bottom sieve collection pan has been sieved.

(5) If the material remaining on top of the sieve consists of 50 percent or more, by weight, of whole or broken kernels of wheat, return it to the cleaned wheat. Otherwise, add it to the dockage.

(6) Examine the material that passed through the hand sieve. If the material consists of 50 percent or more, by weight, of whole or broken kernels of wheat, return it to the cleaned wheat. Otherwise, add it to the dockage.

(7) Dockage will then consist of:

(a) The material removed by the aspirator (air collection pan);

(b) The coarse material, except threshed and sprouted kernels of wheat, that passed over the riddle (riddle collection pan);

(c) The material that passed through the No. 2 sieve (bottom collection pan);

(d) The material that passed through the hand sieve ("Step 6" above);

(e) The material that remained on the hand sieve when the material consists of less than 50 percent, by weight, of whole or broken kernels of wheat.

d. Wheat Containing Canola, Flaxseed, or Rapeseed. If the sample appears to contain 0.3 percent or more of canola, flaxseed, or rapeseed, analyze a dockage-free portion of 50 grams. If the portion contains 0.3 percent or more of canola, flaxseed, or rapeseed, sieve the entire dockage-free sample. Use the appropriate sieve, a 5/64 triangular-hole sieve for removing canola/rapeseed, a 3/64-inch wide by 3/8-inch long or 3/64-inch wide by 11/32-inch long sieve for removing flaxseed as follows:

(1) Mechanical Sieving Method.

(a) Mount the sieve and a bottom pan on an approved mechanical sieve shaker.

(b) Set the stroke counter at 30 strokes.

(c) Place one-fourth of the dockage-free representative portion in the center of the sieve and actuate the shaker.

(d) Remove, clean the sieve, and empty the bottom pan. Return the material lodged in the perforations to the wheat on top of the sieve.

(e) Repeat this operation on the remaining portions until entire sample has been sieved.

(2) If the material which passed through the sieve consists of less than 50 percent, by weight, of whole or broken kernels of wheat, add it to the dockage. If it consists of 50 percent or more, by weight, of whole or broken kernels, recomposite it with the material remaining on top of the sieve.

(3) Dockage will then consist of:

(a) The material removed by the aspirator (air collection pan);

(b) The coarse material, except threshed and sprouted kernels, that passed over the riddle (riddle collection pan);

(c) The material that passed through the No. 2 sieve (bottom collection pan);

(d) The material which passed through the hand sieve if it consists of less than 50 percent, by weight, of whole and broken kernels of wheat.

13.16 TEST WEIGHT

Definition. *The weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine test weight (TW) on a dockage-free portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination are described in Chapter 1, General Information.

Certification. Record test weight results on the work record and "Results" section of the certificate to the nearest tenth pound. If requested, convert the pounds per bushel (lbs./bu) result to kilograms per hectoliter (kg/hl) using the following formulas: for Durum wheat, [1.292 x lbs./bu] + 0.630 = kg/hl; for all other types of wheat, [1.292 x lbs./bu] + 1.419 = kg/hl. Grade Mixed wheat or Western White wheat based on the predominating class or predominating Soft White wheat subclass in the mixture.

13.17 PROCESSING THE WORK SAMPLE

At this point, all tests required to be performed prior to the removal of dockage have been completed. Also, the sample has been examined for certain sample grade and special grade factors. Now the work sample is ready to be divided into fractional portions for other determinations required after the removal of dockage.

Chart 13.1 – Dividing the Work Sample and Table 13.6 – Approximate Analytical Portion Sizes illustrate how the sample is divided into fractional parts using an approved divider.

CHART 13.1 – DIVIDING THE WORK SAMPLE

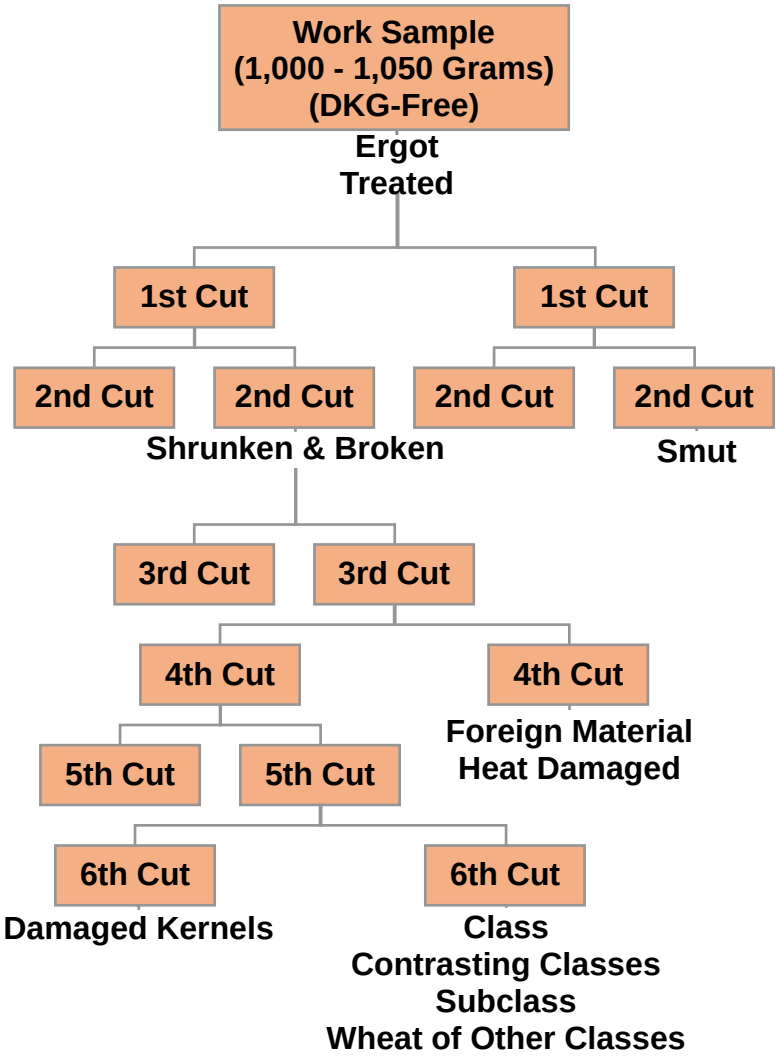

TABLE 13.6 – APPROXIMATE ANALYTICAL PORTION SIZES

Factors	Grams	Factors	Grams
Ergot	1,000	IDK Stage 1	15
Treated	1,000	IDK Stage 2	15
Smut	250	IDK Stage 3	100 – (Stage 1 + 2)
Shrunken and Broken Kernels	250	Class	15
Insect-Damaged Kernels (IDK)	100	Contrasting Classes	15
Foreign Material	50	Damaged Kernels	15
Heat-Damaged Kernels	50	Subclass	15
		Wheat of Other Classes	15

13.18 SHRUNKEN AND BROKEN KERNELS

Definition. *All matter that passes through a 0.064 x 3/8 oblong-hole sieve after sieving according to procedures prescribed in FGIS instructions.*

Basis of Determination. Determine shrunken and broken kernels (SHBN) on a dockage-free portion of 250 grams using the following method:

Mechanical Sieving Method.

a. Mount the 0.064 x 3/8 (1.626 x 9.525 mm) oblong-hole sieve and a bottom pan on the mechanical sieve shaker.

b. Set the stroke counter for 30 strokes.

c. Place the portion in the center of the sieve and actuate the shaker.

d. Remove, clean the sieve, and empty the bottom pan. Return the material lodged in the perforations to the wheat on top of the sieve.

e. All material passing through the sieve is considered shrunken and broken kernels.

Certification. Record the percent of shrunken and broken kernels on the work record and “Results” section of the certificate to the nearest tenth percent.

13.19 ERGOTY WHEAT

Definition. *Wheat that contains more than 0.05 percent of ergot.*

Basis of Determination. Determine ergoty (ERG) on a dockage-free portion of 1,000 grams.

Ergot is a hard, reddish-brown or black grain-like mass of certain parasitic fungi that replaces the kernels of wheat. Ergot applies in the determination of "Ergoty" but also functions as foreign material. (VRI – O.F. - 12.0 Ergot)

Note: All cereal grains and grasses affected by ergot function as ergot.

Dockage Weight must be subtracted from the original weight to calculate the percent of stones and/or ergot.

Original sample weight – weight of dockage
= dockage-free sample weight.
1033g – 32 (32.48 rounded) = 1001g dockage-free sample weight.

Certification. When applicable, grade the wheat "Ergoty" on the grade line of the certificate in accordance with Section 13.5, "Special Grades." Record ergot to the nearest hundredth percent on the work record and "Results" section of the certificate.

13.20 TREATED WHEAT

Definition. *Wheat that has been scoured, limed, washed, sulfured, or treated in such a manner that the true quality is not reflected by either the numerical grades or the U.S. Sample Grade designation alone.*

Basis of Determination. Determine treated (TRET) on the basis of the dockage-free work sample. If at the time of sampling, odor or other conditions indicate that the wheat has been treated, place a portion of the sample in an airtight container for examination in the laboratory.

These qualities are associated with natural, untreated wheat:

a. A natural, live, healthy feeling;

b. A bright, attractive appearance; and

c. A natural wheat odor.

Any artificial or mechanical process which tends to impair or conceal the true quality of wheat causes wheat to grade treated. Such processes include the following:

a. Scoured (SCOR) or Washed (WASH). Wheat which has been scoured or washed, in whole or in part, so that the true quality of the wheat is not reflected by either the U.S. numerical or U.S. Sample Grade designation alone, and which meets one or more of the following conditions is considered treated and graded as scoured or washed.

(1) Presents a blistered and/or abraded bran coat appearance as a result of treatment; or

(2) Has a so-called laundry odor or wet smut odor; or

(3) A dull, lifeless appearance or feeling; or

(4) Has the appearance of having been scoured for the purpose of increasing the test weight per bushel.

b. Sulfured (SULF). Wheat which, in whole or in part, has been bleached with any bleaching agent is considered treated and graded as sulfured.

c. Limed (LIME). The presence of lime in a sample of wheat (which has not been scoured) is considered as evidence that the lime was added for the purpose of covering up some defect in the wheat. Such wheat is considered treated and graded as limed.

d. Treatment for Infestation. Wheat which has been treated to exterminate live weevils or other live insects is not considered treated unless the wheat has the characteristics of treated wheat as described above.

Certification. When applicable, grade the wheat "Treated," along with the type of treatment, on the grade line of the certificate in accordance with Section 13.5, “Special Grades.”

13.21 LIGHT SMUTTY AND SMUTTY WHEAT

Light Smutty. Wheat that has an unmistakable odor of smut, or which contains, in a 250-gram portion, smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 5 smut balls, but not in excess of a quantity equal to 30 smut balls of average size.

Smutty. Wheat that contains, in a 250-gram portion, smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 30 smut balls of average size.

Basis of Determination. Determine light smutty (LSM) on the sample as a whole (odor only) or on a dockage-free portion of 250 grams. Determine smutty (SMUT) on a dockage-free portion of 250 grams.

Smut is a plant disease characterized by the appearance of smut balls or smut spores. Smut balls apply in the determination of the special grades "Light Smutty" or "Smutty" but also function as foreign material. (VRI – O.F. - 22.0 Smut Balls)

Note: Wheat containing tagged ends (i.e., wheat covered with spores of smut) equal to or worse than ILP "Tagged Ends" is regarded as exceeding 30 smut balls and considered "Smutty".

Since smut balls are recorded to the nearest whole number, add portions of smut balls that are smaller than the average size smut ball together to count them as one smut ball. When adding the portions of smut balls together, the combined size should be that of the average-sized smut ball.

Certification. When applicable, grade the wheat "Light smutty," or "Smutty" on the grade line of the certificate in accordance with Section 13.5, "Special Grades." Record the odor (in the case of Light Smutty) or the number of smut balls on the work record and "Results" section of the certificate.

13.22 FOREIGN MATERIAL

Definition. *All matter other than wheat that remains in the sample after the removal of dockage and shrunken and broken kernels.*

Basis of Determination. Determine foreign material (FM) on a dockage-free and shrunken and broken-free portion of 50 grams.

Foreign material includes other grains, oat groats, hulless oats, stones, glumes on threshed or unthreshed kernels, and all matter other than wheat. Remove the glumes from the kernels of wheat and add to the foreign material.

Certification. Record the percent of foreign material on the work record and "Results" section of the certificate to the nearest tenth percent.

13.23 HEAT-DAMAGED KERNELS

Definition. *Kernels, pieces of wheat kernels, and other grains that are materially discolored and damaged-by-heat which remain in the sample after the removal of dockage and shrunken and broken kernels.*

Basis of Determination. Determine heat-damaged kernels on a dockage-free and shrunken and broken-free portion of 50 grams. (VRI – W - 6.0 Heat Damage (Durum) and W - 6.1 Heat Damage (Other Than Durum))

Certification. Record the percent of heat-damaged kernels on the work record and "Results" section of the certificate to the nearest tenth percent.

13.24 DAMAGED KERNELS

Definition. *Kernels, pieces of wheat kernels, and other grains that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-damaged, heat-damaged, insect-bored, mold-damaged, sprout-damaged, or otherwise materially damaged.*

Special Insect Damage Analysis. To coincide with the Food and Drug Administration's defect action levels, the U.S. Standards for Wheat consider wheat containing 32 or more insect-damaged kernels per 100 grams as "U.S. Sample Grade."

Basis of Determination.

a. Damaged Kernels (DKT). Determine damaged kernels on a dockage-free and shrunken and broken-free portion of 15 grams.

b. Insect-Damaged Kernels (IDK). Determine insect-damaged kernels on a dockage-free and shrunken and broken-free portion of wheat. Insect-damaged kernels are kernels bored or tunneled by insects. (VRI – W - 9.0 Weevil or Insect-Bored) A three-stage inspection process has been developed to eliminate always examining 100 grams. This process involves examining up to a total of 100 grams and applying tolerances calculated to duplicate, as near as possible, the 32 insect-damaged kernels per 100 grams limit.

These factors apply to all wheat inspections, except for cargo shipments that use the three-stage IDK process. Wheat inspections performed in Inspection Testing and Weighing (ITW) for cargo shipments will use the three custom verbal inspector controlled factors created in the custom factor lists of the ITW application to report IDK results in stages. Table 13.9 – Stage 1 IDK Determination, Table 13.10 – Stage 2 IDK Determination, and Table 13.11 – Stage 3 IDK Determination, are used to determine whether wheat contains 32 or more insect-damaged kernels per 100 grams and how the sample is certified.

TABLE 13.7 – FACTOR NAMES AND APS ABBREVIATIONS FOR REPORTING INSECT-DAMAGED KERNELS

Factor	Abbreviation
Insect-Damaged Kernels per 15 Grams (Stage 1)	IDK1
Insect-Damaged Kernels per 15 Grams (Stage 2)	IDK2
Insect-Damaged Kernels per 100 Grams	IDK3

Note: The factor Insect-Damaged Kernels per 100 grams (IDK3) is used for all wheat IDK inspections analyzed on a 100-gram portion, except for cargo shipments inspected and results entered into Inspection, Testing, and Weighing (ITW) using the three-stage process where an occasional sublot is analyzed on a 100-gram portion.

TABLE 13.8 – INSECT-DAMAGED KERNEL ANALYSIS

Stage	Sample Size	Insect-Damaged Kernel Count		Sample Grade
		Not Sample Grade	Advance to Next Stage	
1	15 grams	1	2 – 8	9 or more
2	15 grams	1	2 – 8	9 or more
3	100 grams – Stages (1+2)	31 or less*	N/A	32 or more
* The decision rule in the third stage is based on the total insect-damaged kernels from all three stages.				

STAGE 1. Examine 15 grams (i.e., damaged kernel portion) for IDK. Apply the result and certify based on the criteria in Table 13.9 – Stage 1 IDK Determination.

TABLE 13.9 – STAGE 1 IDK DETERMINATION

Insect-Damaged Kernels	Decision
0-1	Not Sample Grade
2-8	Go to Stage 2
9 or more	Sample Grade

STAGE 2. Examine a second portion of approximately 15 grams (i.e., classing portion) for IDK. Apply the result and certify based on the criteria in Table 13.10 – Stage 2 IDK Determination

TABLE 13.10 – STAGE 2 IDK DETERMINATION

Insect-Damaged Kernels	Decision
0-1	Not Sample Grade
2-8	Go to Stage 3
9 or more	Sample Grade

STAGE 3. Examine a third portion for IDK. Determine this portion size by subtracting 100 from the combined weight of the work portions used in stages 1 and 2. Combine the number of insect-damaged kernels found in Stage 1, Stage 2, and Stage 3. Certify the results based on Table 13.11 – Stage 3 IDK Determination.

TABLE 13.11 – STAGE 3 IDK DETERMINATION

Total Insect-Damaged Kernels	Decision
31 or less	Not Sample Grade
32 or more	Sample Grade

Note: For average-grade/average-composite lot and combined-lot inspections, where the three-stage inspection process is used, do not include any results on the certificate, unless all individual samples within the lot are analyzed at Stage 3. The selection of "NONE" must be made in the "include in certificate" dropdown box for all three Stages when results for individual samples are reported at different levels (i.e., Stages 1, 2 or 3).

The following scenarios will indicate the inspection method and sample size when determining IDK in wheat:

a. The default is to pick 100 grams, using the three-stage procedure, when the following is true:

(1) There is no specific request for IDK analysis.

(2) There is no request for IDK certification.

(3) IDK analysis is requested but no limit is specified on the load order or contract.

(4) Performing single lot inspections (whether or not IDK certification is requested).

Note: The applicant has the right to forego the three-stage analysis at any time and request the analysis be based on the full 100-gram portion.

b. Analyze a full 100-gram portion (do not use the three-stage procedure) and report the number of insect-damaged kernels when the following is true:

(1) IDK certification is requested without specifying any limits.

(2) A load order or contract specifies a maximum IDK not equal to 31 (i.e., maximum 10 IDK per sublot).

(3) A load order or contract specifies an entire 100-gram portion be examined for IDK.

Note: IDK is a sample grade factor therefore not applicable for average quality.

Enter a statement in the remarks section of the work record indicating IDK based on 100 grams when applicable. Use the factor abbreviation IDK3 when reporting IDK results of an entire lot on a 100-gram portion.

Upon request, report the percent of Insect-Bored Kernels using the factor abbreviation "BORE".

Certification (IDK). When applicable, show the count of insect-damaged kernels, with corresponding stages, on the work record and "Results" section of the certificate. When the sample meets or exceed criteria in stages 1, 2, or 3, show the count of insect-damaged kernels on the work record and "Results" section of the certificate and grade the wheat "U.S. Sample Grade."

In general, consider wheat and other grains to be damaged for inspection and grading purposes only when the damage is distinctly apparent and of such character as to be recognized as damaged for commercial purposes.

TYPES OF WHEAT DAMAGE.

Black Tip Fungus. Kernels affected by black tip fungus to the extent that the fungus growth is on the germ and extends into the crease of the kernel. (VRI – W - 1.0 Black Tip Damage (Fungus))

Frost-Damaged Kernels (Blistered). Kernels with distinct frost blisters extending around the back of the kernel and into the crease. (VRI – W - 3.0 Frost Damage (Blistered))

Frost-Damaged Kernels (Candied). Kernels that have a distinctly wax-like or candied appearance. Frost-damaged (candied) kernels can be greenish, greenish yellow, brownish, or blackish in color. (VRI – W - 3.1 Frost Damage (Candied))

Frost-Damaged Kernels (Discolored Black or Brown). Kernels which are discolored black or brown and/or have a bleached or blistered appearance with dark lines showing through both sides. (VRI – W - 3.0 Frost Damage (Discolored Black or Brown))

Frost-Damaged Kernels (Flaked). Kernels that have a slightly flaked-off bran coat due to frost. Evidence of frost must be present. Do not confuse flaked-by-frost with kernels which have had the bran coat rubbed off because of handling. (VRI – W - 3.3 Frost Damage (Flaked))

Germ-Damaged Kernels (Mold). Kernels which contain mold in the germ. The bran coat covering the germ should be removed carefully; scraping the bran coat too deep could remove the mold. (VRI – W - 4.1 Mold Damage)

Green Damage (Immature). Kernels which are an intense green (immature) color and without any yellow cast showing through the green. (VRI – W - 5.0 Green Damage (Immature))

Heat-Damaged Kernels. Kernels materially discolored and damaged-by-heat. Cross section the kernels to determine the extent of damage. Heat-damaged kernels are reddish-brown, mahogany, or creamy in cross-section. (VRI – W - 6.0 Heat Damage (Durum) and W - 6.1 Heat Damage (Other Than Durum))

Insect-Bored Kernels. Kernels that have been bored or tunneled by insects. (VRI – W - 9.0 Weevil or Insect-Bored)

Kernels which have been chewed are considered sound kernels unless otherwise damaged. Do not confuse insect-chewed germs with sprout sockets. (VRI – W - 9.1 Insect Chewed Wheat (Not Damaged))

Mold-like Substance. Whole kernels of wheat which are 50 percent or more covered and pieces of kernels which are discolored and covered with a mold-like substance, which includes but not limited to gibberella.

Other Damaged Kernels. Kernels which have cracks, breaks, or "chews" which contain mold or fungus. (VRI – W - 7.0 Other Damage (Mold))

Scab Damaged Kernels. Kernels with a dull, lifeless, and chalky appearance resulting from disease. The germ and crease may also have a moldy appearance. Kernels which are not damaged enough to function as scab damage should be examined further for moldy germs and creases. (VRI – W - 2.0 Scab Damage)

Sprout-Damaged Kernels. Kernels with the germ end broken open from germination and show sprout and kernels that have sprouted but the sprouts have broken off. (VRI – W - 8.0 Sprout Damage)

Germ-Damaged Kernels (Sick). Kernels damaged as a result of heat but are not materially discolored. Sick kernels should be scraped very carefully to avoid the loss of discoloration and/or "popping" or removal of the germ. (VRI – W - 4.0 Germ Damage and W - 4.2 Germ Damage (Bleach Method))

The bleaching procedure may be used as an alternate method for determining germ-damaged wheat. For equipment and materials, refer to Chapter 1, General Information. Prior to bleaching, remove all types of damaged kernels, except germ-damaged, from the representative portion and calculate the percentage. The portion, minus the other types of damaged kernels, can now be bleached. After bleaching, reweigh the bleached portion, remove the germ-damaged kernels, and calculate the percentage.

Bleach Procedure.

a. Place 15 grams (± 1.5 grams) of wheat in the mixing jar. If the amount of "other damage" present in the original 15-gram portion reduces the weight of the sample to be bleached below 13.5 grams, an additional 15-gram portion must be analyzed for germ damage. It is not necessary to remove the other damaged kernels from the second portion before bleaching.

b. Add 15 grams of potassium hydroxide (KOH) pellets.

c. Add 20 ml of bleach.

d. Set stirring head on jar, place jar on mixer, and mix for 3 minutes.

e. Pour the wheat from the mixing jar into the tea strainer and rinse with warm tap water to remove the KOH-bleach solution. Dispose of the used KOH-bleach solution in a hazardous waste container.

f. After rising, lightly tap the tea strainer against the edge of the sink to remove the excess water. Gently press the bottom of the tea strainer on a dry paper towel to remove any additional water.

g. Place the wheat on the dryer sieve and dry for 1 – 1 ½ minutes or until the kernels are not tacky when picked up with a pair of tweezers.

h. Remove the wheat from the drying sieve and weigh. The kernels with germ damage should now be readily apparent. If not, it is permissible to carefully lift the bran coat from over the germ area to examine for damage. Obvious other damaged kernels that were missed before bleaching can be taken after bleaching, if it is evident that they were damaged.

Note: Dispose of the used hazardous chemicals in accordance with federal, state, and local laws and regulations. Consult individual site standard operating procedures for specific requirements.

i. Any deviation from the previously described procedures may result in improperly bleached wheat and could produce a hazardous condition. As such, observe the following safety procedures:

(1) Safety equipment should be worn while the bleach operation is in progress and the lab area thoroughly cleaned once bleaching is complete.

(2) Accidental spills should first be neutralized with vinegar before the liquid is wiped up.

(3) Avoid mixing the chemicals used in a test with chemical reagents or waste solutions associated with other tests.

(4) Store bleach in cool, dry place and replace any unused bleach at least every 3 months following the date of purchase.

Calculating Damaged Kernels. Calculate the percent of total damaged kernels by adding the percent of germ-damaged kernels and other damaged kernels. Add the results, as shown in the following example, in hundredths (disregard thousandths) and round the sum to the nearest tenth percent.

Example: Damaged Kernel Calculation

Original weight of damage portion	16.10 grams
Weight of other type damaged kernels	2.40 grams
Sample weight before bleaching	13.70 grams
Sample weight after bleaching	11.95 grams
Weight of germ-damaged kernels	4.33 grams

a. **(Weight of other type damaged kernels ÷ weight of sample before bleaching) x 100**
= percent of other type damaged kernels.
(2.40g ÷ 16.10g) x 100 = 14.90% other type damaged kernels.

b. **(100 percent - percent of other type damaged kernels) ÷ 100**
= change of base factor.
(100% - 14.90%) ÷ 100 = 0.85 change of base factor.

c. **(Weight of germ-damaged portion ÷ weight of damaged portion after bleaching) x 100**
= percent of germ-damaged kernels.
(4.33g ÷ 11.95g) x 100 = 36.23% germ-damaged kernels.

d. **Percent of germ-damaged kernels x change of base factor**
= percent of germ-damaged kernels (adjusted).
36.23 x 0.85= 30.79% germ-damaged kernels (adjusted).

e. **Percent of other damaged kernels + percent of germ-damaged kernels (adjusted)**
= percent of damaged kernels.
14.90% + 30.79% = 45.69% damaged kernels (rounded to 45.7%).

Certification (DKT). Record the percent of damaged kernels on the work record and “Results” section of the certificate to the nearest tenth percent. If the percent damaged kernels is less than the percent heat, the percent damaged kernels must be adjusted to equal the percent heat.

13.25 DEFECTS

Definition. *Damaged kernels, foreign material, and shrunken and broken kernels. The sum of these three factors may not exceed the limit for the factor defects for each numerical grade.*

Basis of Determination. Determine defects (DEF) on the sum of damaged kernels (DKT), foreign material (FM), and shrunken and broken kernels (SHBN).

A percent for defects cannot be shown when only one or two of the factors defined as defects have been determined. However, when one or two factors are determined and their sum would change the numerical grade, or come close to changing the grade, determine the other factor and record the percent of defects.

Note: If a review inspection of a specific factor (DKT, FM, or SHBN) changes, the percent of total defects must be recalculated.

Certification. Report the percent defects on the work record and "Results" section of the certificate to the nearest tenth percent.

When the percent for DKT, SHBN, and FM are added together and the total exceeds 100 percent, adjust the percent defects by adjusting damaged kernels (total).

Due to averaging of individual factors (mathematical or weighted), the rounded averages for DKT, FM, and SHBN may not equal the rounded average of the defects. When this occurs, it is necessary to adjust the rounded average results of one of the individual factors that comprise defects. Adjustments are made by adding or subtracting one-tenth of a percent to the rounded results of the individual factor result that is nearest a midpoint (e.g., 0.05, 0.15, 0.25, or 0.35).

13.26 CLASS

There are eight classes for wheat: Durum wheat, Hard Red Spring wheat, Hard Red Winter wheat, Soft Red Winter wheat, Hard White wheat, Soft White wheat, Unclassed wheat, and Mixed wheat.

a. *Durum Wheat. All varieties of white (amber) Durum Wheat. This class is divided into the following three subclasses:*

(1) *Hard Amber Durum Wheat. Durum wheat with 75 percent or more of hard and vitreous kernels of amber color.*

(2) *Amber Durum Wheat. Durum wheat with 60 percent or more but less than 75 percent of hard and vitreous kernels of amber color.*

(3) *Durum Wheat. Durum wheat with less than 60 percent of hard and vitreous kernels of amber color.*

b. *Hard Red Spring Wheat. All varieties of Hard Red Spring wheat. This class shall be divided into the following three subclasses:*

(1) *Dark Northern Spring Wheat. Hard Red Spring wheat with 75 percent or more of dark, hard, and vitreous kernels.*

(2) *Northern Spring Wheat. Hard Red Spring wheat with 25 percent or more but less than 75 percent of dark, hard, and vitreous kernels.*

(3) *Red Spring Wheat. Hard Red Spring wheat with less than 25 percent of dark, hard, and vitreous kernels.*

c. *Hard Red Winter Wheat. All varieties of Hard Red Winter wheat. There are no subclasses in this class.*

d. *Soft Red Winter Wheat. All varieties of Soft Red Winter wheat. There are no subclasses in this class.*

e. *Hard White Wheat. All hard endosperm white wheat varieties. There are no subclasses in this class.*

f. *Soft White Wheat. All soft endosperm white wheat varieties. This class is divided into the following three subclasses:*

(1) *Soft White Wheat. Soft endosperm white wheat varieties which contain no more than 10 percent of White Club wheat.*

(2) *White Club Wheat. Soft endosperm White Club wheat varieties containing no more than 10 percent of other soft white wheats.*

(3) *Western White Wheat. Soft White wheat containing more than 10 percent of White Club wheat and more than 10 percent of other Soft White wheats.*

g. *Unclassed Wheat. Any variety of wheat that is not classifiable under other criteria provided in the wheat standards. There are no subclasses in this class. This class includes any wheat which is other than red or white in color.*

h. *Mixed Wheat. Any mixture of wheat that consists of less than 90 percent of one class and more than 10 percent of one other class, or a combination of classes that meet the definition of wheat.*

Basis of Determination. Determine class and subclass of wheat by examining kernel and varietal characteristics on a dockage-free and shrunken and broken-free portion of 15 grams.

Kernel Characteristics. Kernel characteristics include the color, shape, and length of the kernel and the shape of the germ, crease, and brush. Inspection personnel should be familiar with kernel characteristics of all classes of wheat handled in their market.

Varietal Characteristics. Some varieties possess characteristics of two or more classes. Knowledge of distinct varietal characteristics is necessary in making class determinations. Inspection personnel should be familiar with the characteristics of all varieties of wheat handled in their market.

Classification of Recognized Varieties. Hard red varieties of wheat grown during the winter season in Arizona, California, Nevada, New Mexico, and Texas and marketed in these States are classed as Hard Red Winter Wheat.

Distinguishing Between White and Red Kernels in Hard or Soft Wheat. To assist in the detection of white and red wheat kernels in samples of Hard or Soft wheat, official personnel may use the commercially available sodium-hydroxide test kit, or the potassium-hydroxide test method developed by FGIS. The tests can serve as a useful tool when samples challenge the normal visual inspection method. Due to the resulting similarity in kernel color after the process is completed and the affect these chemical processes may have on kernel morphology, it is necessary to determine whether a sample contains different classes of white or red wheat prior to performing the test.

a. Sodium-Hydroxide Test. The NaOH turns red wheat a dark red in color and turns white wheat a straw yellow in color. When using the commercially available test kit, follow the procedures as provided by the test kit manufacturer.

b. Bleach Method – Color. Follow the procedures outlined below. For equipment and materials, refer to Chapter 1, General Information.

Note: Too much KOH (step 2) or over mixing (step 4) may remove the bran in red wheat.

(1) Place approximately 15 grams of wheat in a mixing jar.

(2) Add 10 grams of KOH pellets.

(3) Add 40 ml of bleach.

(4) Set stirring head on jar, place jar on mixer, and mix for 1 to 1½ minutes.

(5) Pour the wheat from the mixing jar into a tea strainer and rinse with warm tap water to remove the KOH/bleach solution. Dispose of the used KOH-bleach solution in a hazardous waste container.

(6) After rinsing, lightly tap the tea strainer against the edge of the sink to remove the excess water. Gently press the bottom of the tea strainer on a dry paper towel to remove any additional water.

(7) Place the wheat on a dryer sieve and dry for 1 – 1 ½ minutes or until the kernels are not tacky when picked up with a pair of tweezers.

(8) Remove the wheat from the drying sieve and observe the color. White wheat turns a light straw or amber color. Red wheat turns a dark brownish/red color.

Note: Dispose of the used hazardous chemicals in accordance with federal, state, and local laws and regulations. Consult individual site standard operating procedures for specific requirements.

Any deviation from the previously described procedures may result in improperly bleached wheat and could produce a hazardous condition. As such, observe the following safety procedures:

(1) Safety equipment should be worn while the bleach operation is in progress and the lab area thoroughly cleaned once bleaching is complete.

(2) Accidental spills should first be neutralized with vinegar before the liquid is wiped up.

(3) Avoid mixing the chemicals used in a test with chemical reagents or waste solutions associated with other tests.

(4) Store bleach in cool, dry place and replace any unused bleach at least every 3 months following the date of purchase.

Certification. For Mixed wheat, record the percent of each class on the work record and “Results” section of the certificate to the nearest whole percent. For Unclassed wheat, record the color or other characteristics which describe the wheat, together with the percentage thereof.

13.27 SUBCLASS

Basis of Determination. When an analysis is necessary, determine subclass on a dockage-free and shrunken and broken-free portion of 15 grams.

Subclass is determined on Durum wheat, Hard Red Spring wheat, and Soft White wheat. Use the following guidelines for determining hard and vitreous kernels of amber color (HVAC) or dark, hard, and vitreous kernels (DHV). (Visual Aids: HVAC and DHV)

a. Durum Wheat (DUWH).

(1) Consider Durum kernels which are bleached but which are hard and vitreous as HVAC.

(2) Consider Durum kernels which have cracks or checks that cause a cloudy or shadowy spot on the kernel, but which are otherwise hard and vitreous as HVAC.

(3) Kernels with mottled or chalky spots, regardless of size, are not considered HVAC.

(4) Distinctly green immature kernels, kernels affected by scab, sprouted kernels, foreign material, and all other classes of wheat are not considered HVAC.

b. Hard Red Spring Wheat (HRS).

(1) Consider Hard Red Spring wheat kernels which are bleached but are hard, or hard and vitreous as DHV.

(2) Consider Hard Red Spring wheat kernels which have cracks or checks that cause a cloudy or shadowy spot on the kernel but are otherwise dark, hard, and vitreous as DHV.

(3) Consider kernels of Soft Red Winter wheat (SRW) and Hard Red Winter wheat (HRW) as DHV when they are dark, hard, and vitreous in texture.

(4) Kernels which are yellow or contain a mottled spot (regardless of size), distinctly green immature kernels, severely affected by scab, sprouted, foreign material, and kernels of Hard White wheat (HDWH), Unclassed wheat (UNCL), Soft White wheat (SWW), and Durum wheat (DUWH) are not considered DHV.

c. Soft White Wheat (SWW). The percent of White Club wheat is applicable to all subclasses of Soft White wheat.

Certification. Record the subclass on the grade line of the work record and certificate. Record the percent of DHV, HVAC, and White Club wheat kernels on the work record to the tenth percent (disregarding hundredths except when performing CuSum) but to the nearest whole percent in the "Results" section of the certificate.

Example: DHV 74.45% = 74.4% on the work record and certified as 74%.

13.28 CONTRASTING CLASSES

Contrasting classes are defined as:

a. *Durum wheat, Soft White wheat, and Unclassed wheat in the classes Hard Red Spring wheat and Hard Red Winter wheat;*

b. *Hard Red Spring wheat, Hard Red Winter wheat, Hard White wheat, Soft Red Winter wheat, Soft White wheat, and Unclassed wheat in the class Durum wheat;*

c. *Durum wheat and Unclassed wheat in the class Soft Red Winter wheat;*

d. *Durum wheat, Hard Red Spring wheat, Hard Red Winter wheat, Soft Red Winter wheat, and Unclassed wheat in the class Soft White wheat;*

e. *Durum wheat, Soft Red Winter wheat, and Unclassed wheat in the class Hard White wheat.*

Basis of Determination. Determine contrasting classes (CCL) on a dockage-free and shrunken and broken-free portion of 15 grams.

When making determinations for kernel and varietal characteristics information, refer to Section 13.26, "Class." Having an up to date wheat variety library with different classes of wheat handled within the market is helpful in learning and determining a samples' class, subclass, contrasting classes, and wheat of other classes.

TABLE 13.12 – CONTRASTING CLASSES OF WHEAT

Class	Contrasting Class
HRW and HRS wheat	DUWH, SWW, and UNCL wheat
DUWH wheat	HRS, HRW, SRW, HDWH, SWW, and UNCL wheat
SRW wheat	DUWH and UNCL wheat
SWW wheat	DUWH, HRS, HRW, SRW, and UNCL wheat
HDWH wheat	DUWH, SRW and UNCL wheat

Certification. Record the percent of contrasting classes on the work record and "Results" section of the certificate to the nearest tenth percent.

13.29 WHEAT OF OTHER CLASSES

Wheat of other classes is the total of all classes of wheat other than the predominating class and which, combined with the predominating class, meets the requirements for any one of the classes except Mixed wheat. Wheat of other classes and contrasting classes are not applicable to Mixed wheat. Wheat of other classes includes contrasting classes. Wheat of other classes is not applicable to Durum wheat.

Basis of Determination. Determine wheat of other classes (WOCL) on a dockage-free and shrunken and broken-free portion of 15 grams.

When making determinations for kernel and varietal characteristics information, refer to Section 13.26, "Class." Having an up to date wheat variety library with different classes of wheat handled within the market is helpful in learning and determining a samples' class, subclass, contrasting classes, and wheat of other classes.

Certification. Record the percent of wheat of other classes on the work record and "Results" section of the certificate to the nearest tenth percent unless that percent falls within 10.1 to 10.4 percent. When this occurs, to be consistent with the reporting requirements for Mixed wheat, certify wheat of other classes as 10.0 percent.

13.30 OFFICIAL CRITERIA

Official criteria factors, such as protein and vomitoxin, are determined only upon request and do not affect the grade designation.

Basis of Determination. All such analyses are determined in accordance with official procedures established by the Federal Grain Inspection Service.

Certification. For certification instructions, refer to the appropriate FGIS Handbooks.

CHAPTER 14:
REVISION HISTORY

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Change No. 114: **October 1, 2020**

Grain Inspection Handbook II, Grain Grading Procedures revisions incorporated policy and procedural changes and other changes including re-formatting and editorial updates. Further, each chapter was updated and re-organized to mirror the general order of operations. All graphics were updated and re-formatted for uniformity.

For all substantive revisions, updated hyperlinks were embedded within the text to link directly to both internal and external content wherever possible.

The following FGIS Directives were incorporated and/or referenced in this update:

Directive 9060.2, "Implementation of the FGIS-FDA Memorandum of Understanding."
Directive 9170.13, "Uniform File Sample Retention System."
Directive 9180.49, "Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel."
Directive 9180.61, "Official Moisture Calibrations for Unified Grain Moisture Algorithm (UGMA) Compatible Meters."
Directive 9180.75, "Testing for Presence of Waxy Corn."

The following Program Notices were incorporated and/or referenced in this update:

PN-15-02, "Visual Reference Image Interpretive Line Prints."
PN-18-08, "Changes to United States Standards for Barley Effective August 1, 2018."
PN-19-04, "Inspection of Flood Damaged Grain."

The following Policy Bulletins were incorporated and/or referenced in this update:

Policy Bulletin, Reference #177, "Dockage Machine 'On/Off' Policy."
Policy Bulletin, Reference #188, "Soybean Portion Size."
Policy Bulletin, Reference #202, "Certifying Dehulled Oats."
Policy Bulletin, Reference #217, "Reporting Sunflower Seed Foreign Material."
Policy Bulletin, Reference #239, "Determining Odor in Grain, Rice, and Similar Commodities."
Policy Bulletin, Reference #259, "Large Animal Excreta."
Policy Bulletin, Reference #260, Testing Basis for Stress Crack Analysis and Load Orders."
Policy Bulletin, Reference #269, "Fungicidal Additives Applied to Grain."

Additionally, acronyms and organizational details were updated to reflect accurate administrative structure and associated program information (i.e., references to the Grain Inspection Packers and Stockyards Administration (GIPSA) were replaced by FGIS).

Change No. 113 **November 30, 2018**

Chapter 4, Corn:

4.22 Official Criteria - Changed Yes to Positive and changed no to Negative

Change No. 112: **September 1, 2018**

Chapter 1, General Information:

1.2 Visual Grading Aids - All information regarding Interpretive Line Slides (ILS) was changed to Interpretive Line Prints (ILP); Added contact information for the TSD digital media group.

1.4 Preliminary Examinations - Changed language in paragraph from “inspector should ask” to “inspector will ask.”

Boerner Dividers - Added statement “FGIS Approved” Boerner dividers; Added statement sub section (a.) “FGIS Approved” Boerner dividers; Added statement, sub section (b.) “FGIS Approved” Boerner dividers; Added word, sub section (b.) “Portion” to “work portion samples”

Odor - Sub section (a.) #5, added statement “when a proper number of inspectors are available.”

1.12 Test Weight Per Bushel Apparatus - General Operating Procedures (H.) No. (1&3), have traded places

Change No. 111: **April 11, 2017**

This Handbook revision includes changes to the following chapters: Chapter 4, Corn and Chapter 13, Wheat.

This Handbook revision includes all the following changes to the entire document: Edited to reflect all guidelines stated in the Signature Process Improvement Directive Style Sheet. Edited for syntax and format. All hyperlinks to referenced documents and visual reference images were updated.

All of the applicable sections were updated with certification language to align with current certification procedures

Change No. 110: **May 1, 2014**

Chapter 13 - Replaced definition of Contrasting Classes for Hard White wheat and established new standalone definition of Contrasting Classes for Soft White wheat. Table 8 is updated to reflect the changes to Contrasting Classes definitions.

Change No. 109: **July 30, 2013**

Chapter 1 - Replaced GAC 2100 instructions with GAC2500-UGMA and Perten AM 5200-A instructions and incorporated Policy Bulletin Board #239, 'Determining Odor Grain, Rice, and Similar Commodities.

Chapters 2 - 8 - Replaced GAC 2100 instructions with GAC2500-UGMA and Perten AM 5200-A Instructions.

Chapter 9 - Replaced GAC 2100 instructions with GAC2500-UGMA and Perten AM 5200-A instructions and updated hyperlinks.

Chapter 10 - Replaced GAC 2100 instructions with GAC2500-UGMA and Perten AM 5200-A Instructions.

Chapter 11 - Replaced GAC 2100 instructions with GAC2500-UGMA and Perten AM 5200-A Instructions and incorporated Policy Bulletin Board #217 'Reporting Sunflower Seed Foreign Material'.

Chapter 12 - Replaced GAC 2100 instructions with GAC2500-UGMA and Perten AM 5200-A Instructions.

Chapter 13 – Replaced GAC 2100 instructions with GAC2500-UGMA and Perten AM 5200-A instructions and incorporated Policy Bulletin Board #248 'Inspection of Insect Damage Kernels in Wheat'.

Change No. 108: **June 31, 2008**

Grain Inspection Handbook Book II, Chapter 9, Sorghum, is revised to incorporate changes made to the United States Standards for Sorghum that are effective 6-1-08. Also, revised was Grain Inspection Handbook III, Chapter 1, Table 15 to reflect new grade limits and breakpoints for Sorghum.

Change No. 106: **June 16, 2008**

Sections of Book II have been revised to show changes made to the reporting requirements for Garlic. These changes were made to conform with and be compatible for the linear data transfer to the new Inspection Data Warehouse.

Change No. 105: **September 1, 2007**

The Grain Inspection Handbook, Book II, Grain Grading Procedures, Chapter 10, Soybeans, and the Grain Inspection Handbook, Book III, Grain Inspection Procedures, Chapter 1, Inspection of Shiplots, Unit Trains, and Lash Barges, have been revised to reflect changes to the U.S. Standards for soybeans. On September 1, 2007, test weight per bushel in soybeans will be removed as a grading factor from the U.S. Standards for soybeans.

Additionally, soybean test weight per bushel, when determined by official analysis, will be reported and certified to the nearest tenth of a pound.

These changes also impact the application of the CuSum loading plan. Therefore, Book III is revised to reflect changes associated with the tables listing the applicable grade limits and breakpoints for soybeans. Minor editorial changes were made to other pages (listed below) of Chapter 1.

Change No. 104: **August 9, 2007**

U.S. Sample Grade criteria for Stones in Flaxseed, Oats, and Rye, editorial change to Barley chapter Table 3, along with establishing file sample retention requirements for containers.

Change No. 103: **June 18, 2007**

Chapter 4, Corn, is revised to incorporate Program Notice 05-01, dated 11-15-04, which detailed the alternate method (hand sieving) for determining broken corn and foreign material and to revise the table of contents.

Change No. 102: **June 1, 2007**

Chapter 9, Sorghum, is revised to show the test procedures for the alternate method for determining internal mold and a new definition for Mold Damaged Kernels (Internal Mold) and the elimination of the “or any number for stones in Table 5.

Change No. 101: **April 2, 2007**

Chapter 13, Wheat, is revised to show the expansion of the optional alkali test methods (sodium hydroxide or potassium hydroxide) to assist in the determination of mixtures of soft red and soft white. Additionally, the mixing time requirement for the Potassium- Hydroxide test has been revised to specify a mixing duration of 1 to 1 ½ minutes.

Change No. 99: **May 1, 2006**

The Grain Inspection Handbook, Book II, Chapter 13, Wheat, is revised to make minor editorial changed, to incorporate the new wheat standards changes effective May 1, 2006, and to address the agency’s policy for the classification of

Hard White wheat kernels when found in samples of Hard red Winter wheat and Hard Red Spring wheat.

Specifically, effective May 1, 2006, GIPSA will implements the following policy for the classification of Hard White wheat. 1) all Hard White wheat varieties are considered Hard White wheat regardless of color and regardless of whether they are in a predominantly Hard White wheat sample or a predominantly Hard Red wheat sample; 2) all Hard White wheat kernels will be counted as wheat of other classed in Hard Red Winter wheat and Hard Red Spring wheat, and 3) Hard White wheat kernels are not contrasting classes in Hard Ren Winter wheat and Hard Red Spring wheat. This policy change was announced in Program Notice 05-04, dated 4-11-05.

Change No. 97: **August 9, 2004**

Book II is revised to incorporate 1997 through 2004 policy and procedural changes, reformat the complete handbook, and make minor editorial changes. Additionally, hyperlinks have been created throughout the handbook to link the Visual Reference Images (VRI) to pertinent grain grading factors. The hyperlinks are active when the handbook is viewed from the GIPSA website.

Some of the changes to the handbook include:

- Redefining the file sample size from 1300 grams to 1400 grams.
- Replacing Motomco Moisture Meter Instruction with GAC 2100 instructions.
- Inclusion of a table for test weight/kilograms per hectoliter conversions.
- Revised Dockage determination chart for Canola.
- Inclusion of Presence of Waxy Kernels as an Official Criteria Factor in Corn.
- Clarification of material considered as coarse/fine foreign material and other grains in Oats.
- Changing the other damage kernels portions size in Oats from 30 grams to 15 grams.
- Changing the sieve size for special dockage procedures for wheat containing canola/rapeseed.
- Inclusion of instructions for performing alkali test to detect Hard White/Red wheat kernels.