

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 (<i>Crotalaria</i> spp.), 2 or more castor beans (<i>Ricinus communis</i> 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, cockleburrs, 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, 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 Heating Infested Odor	Distinctly Low Quality Garlicky Heating Infested Kind of Grain Moisture Odor Odor (Smut) Sample Grade Criteria	Ergot Kind of Grain Odor Protein Shrunken and Broken Kernels Smut Stones Test Weight Treated	Class Contrasting Classes Damaged Kernels Foreign Material Heat-Damaged Kernels Subclass Wheat of Other Classes

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:

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

<i>Samples meeting or exceeding any one of these tolerances are infested: 2 LW, or 1 LW + 1 OLI, or 2 OLI</i>		
1,000-gram representative sample¹ (+ 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%.”

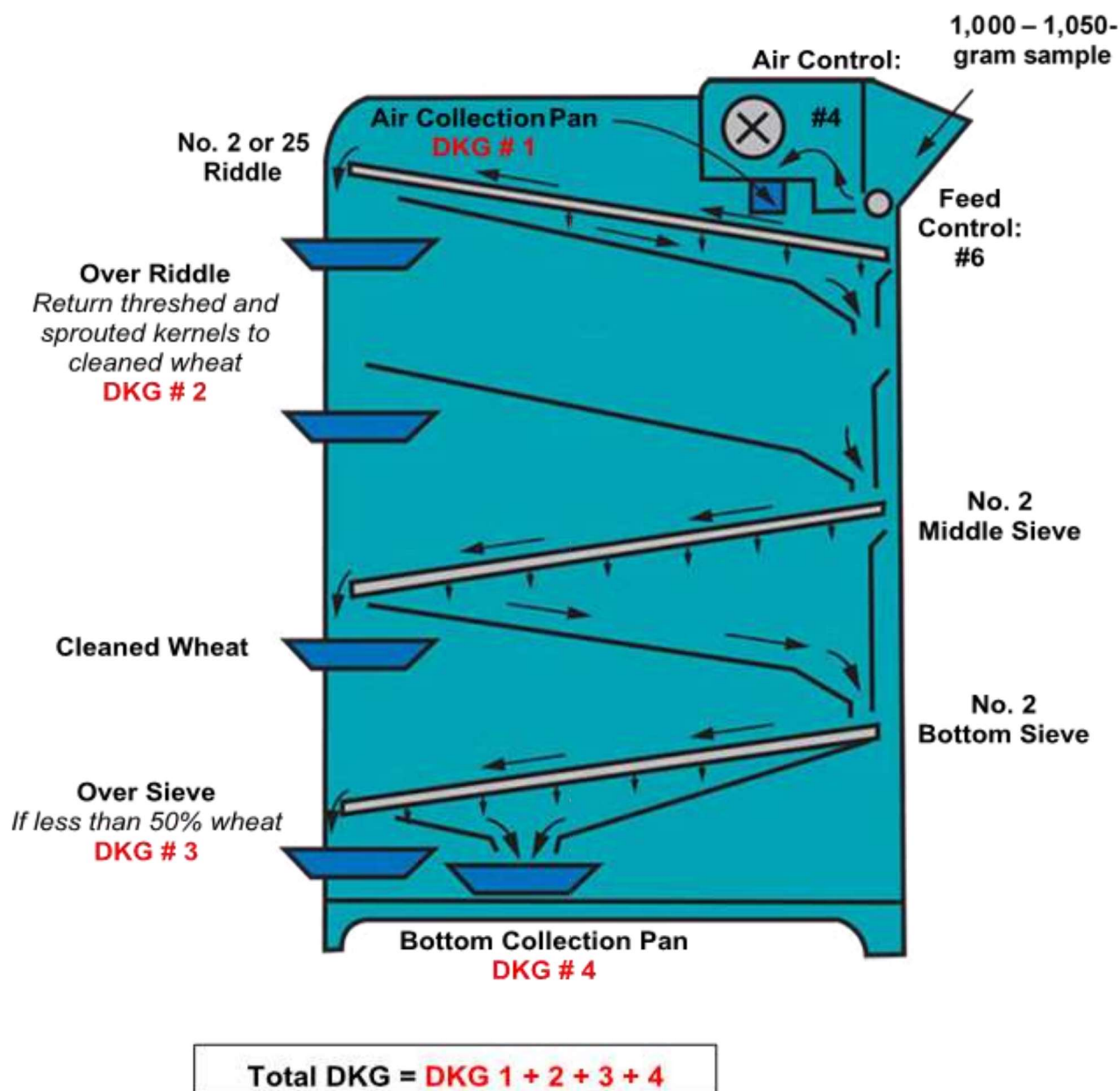


FIGURE 13.1 – PROCEDURE FOR DETERMINING DOCKAGE

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, recombine 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, $[1.292 \times \text{lbs./bu}] + 0.630 = \text{kg/hl}$; for all other types of wheat, $[1.292 \times \text{lbs./bu}] + 1.419 = \text{kg/hl}$. 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

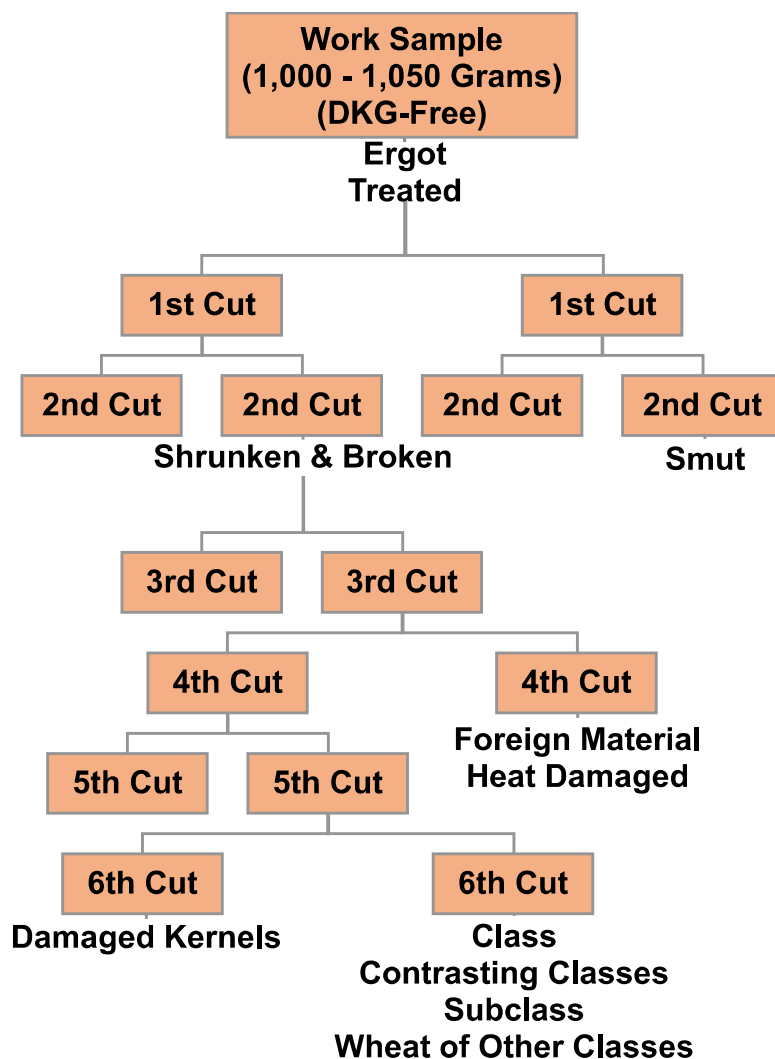


TABLE 13.6 – APPROXIMATE ANALYTICAL PORTION SIZES

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.

- 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.
- Set the stroke counter for 30 strokes.
- Place the portion in the center of the sieve and actuate the shaker.
- Remove, clean the sieve, and empty the bottom pan. Return the material lodged in the perforations to the wheat on top of the sieve.
- 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, hullless 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 subplot 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 subplot).
 - (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 exceeds 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 ($\pm$ 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.
 $(2.40g \div 16.10g) \times 100 = 14.90\%$ other type damaged kernels.
- b. **(100 percent - percent of other type damaged kernels) ÷ 100**
= change of base factor.
 $(100\% - 14.90\%) \div 100 = 0.85$ change of base factor.
- c. **(Weight of germ-damaged portion ÷ weight of damaged portion after bleaching) x 100**
= percent of germ-damaged kernels.
 $(4.33g \div 11.95g) \times 100 = 36.23\%$ germ-damaged kernels.
- d. **Percent of germ-damaged kernels x change of base factor**
= percent of germ-damaged kernels (adjusted).
 $36.23 \times 0.85 = 30.79\%$ 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](#).