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GRAIN INSPECTION HANDBOOK – BOOK II

Grain Grading Procedures

Program Handbook

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, as amended. In view of this fact, the Grain Inspection, Packers and Stockyards Administration, Federal Grain Inspection Service, published the Grain Inspection Handbook. The handbook includes several books each dealing with a specific function in the inspection process.

Book II, Grain Grading Procedures, illustrates the step-by-step procedures needed to effectively and efficiently inspect grain in accordance with the Official United States Standards for Grain.

Official inspection personnel and agricultural commodity graders licensed or authorized to inspect grain shall follow the procedures in this book when grading grain.

David Orr, Director
Field Management Division

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GRAIN INSPECTION HANDBOOK

BOOK II, CHAPTER 1

GENERAL INFORMATION

CHAPTER 1

GENERAL INFORMATION

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1.1 STANDARD ABBREVIATIONS

Admixture	adm
Amber Durum wheat	adu
Animal Filth	anfl
Angoumois moths	moth
Badly stained	bads
Badly weathered	badw
Barley	bly
Bird excreta	brdx
Bleached	blch
Blight	blit
Blue aleurone	blal
Blue barley	blb
Blue Malting barley	blmb
Bottom not sampled	bns
Bright	brit
Broken corn	bc
Broken corn and foreign material	bcfm
Broken glass	glas
Broken kernels	bn
Broken kernels and foreign material	bnfm
Canola	k
Castor beans	cstb
Choice	ch
Class	cl
Coarse	crse
Cockleburs	cbur
Commercially objectionable foreign odor	cofo
Contrasting classes	ccl
Conspicuous admixture	cadm
Contrasting lentils	clen
Corn	c
Crotalaria	crot
Cultivated sunflower seed	csf
Damaged kernels	dk
Damaged kernels (total)	dkt
Damaged seeds (total)	dst
Dark, Hard, and Vitreous	dhv
Dark Northern Spring wheat	dns
Defects (total)	def
Dehulled	dh
Dent	dent
Diatomaceous earth	diat
Distinctly discolored	disc
Distinctly green kernels	dgk
Distinctly low quality	dlq
Dockage	dkg
Durum wheat	du
Dyed	dyed
Ergoty	erg
Erucic acid	erc
Extra heavy	ehvy
Fine foreign material	fine
Flaxseed	flax
Flint	flin
Frost-damaged kernels	fdk
Flint and Dent	flad
Foreign material	fm
Foreign material other than rye	fmor
Foreign material other than wheat	fmow
Foreign material other than wheat or rye	fmwr
Garlic bulblets	garb
Garlicky	gar
Glucosinolates	gluc
Grain	gr
Handpicked	hp
Handpicked foreign material	hpfm
Hard Amber Durum wheat	hadu
Hard kernels	hard
Hard Red Spring wheat	hrs
Hard Red Winter wheat	hrw
Hard and Vitreous Kernels of Amber Color	hvac
Hard White wheat	hdwh
Heat-damaged kernels	ht
Heating	htg
Heavy	hvy
Inconspicuous admixture	iadm
Insect-damaged kernels	idk
Infested	inf
Injured-by-frost	ibf
Injured-by-heat	ibht
Injured-by-mold	ibm
Injured-by-sprout	ibs
Large stones, etc.	lgst
Light garlicky	lgar
Light smutty	lsm
Limed	lime
Machine separated broken kernels and foreign material	msfm
Malting barley	mb
Materially weathered	mwth
Mechanically separated dockage	mdkg
Mixed	x
Mixed corn	xc
Mixed grain	xgr
Mixed sorghum	xs
Mixed soybeans	xsb
Mixed wheat	xwht
Moisture	m

Mold-damaged kernels	mdk	Soybeans	sb
Musty	must	Soybeans of other colors	sboc
Northern Spring wheat	ns	Splits	spl
Not standardized grain	nsg	Stained	stnd
Oats	o	Stinkbug damaged	skd
Odor	odor	Stones	ston
Oil	oil	Stress cracks	sc
Other classes	ocl	Subclass	scl
Other colors	ocol	Suitable malting type	smt
Other damaged kernels	odk	Sulfured	sulf
Other grains	og	Sunflower seed	sf
Other live insects injurious to stored grain	oli	Tannin sorghum	tans
Other types	ot	Test weight	tw
Other White wheat	owh	Thin	thin
Plump	pl	Total other material	tom
Protein	prot	Treated	tret
Purple mottled or stained	pms	Triticale	trit
Red Spring wheat	rs	Two-rowed barley	trb
Rodent excreta	rodx	Two-rowed malting barley	trmb
Rye	rye	Unclassed wheat	uncl
Sample grade	sg	Unknown foreign substance	fsub
Sclerotinia	sct	Unsuitable malting type	umt
Scoured	scor	Washed	wash
Shrunken and broken kernels	shbn	Waxy	waxy
Similar seeds	ss	Weevils (live)	lw
Six-rowed barley	srb	Western White wheat	wwh
Six-rowed malting barley	srmb	Wheat	wht
Six-rowed blue malting barley	srbm	Wheat of other classes	wocl
Slightly weathered	slw	White aleurone	whal
Skinned and broken kernels	skbn	White Club wheat	whcb
Smut balls	sbal	White corn	whc
Smutty	smut	White sorghum	whs
Soft Red Winter wheat	srw	White wheat	ww
Soft White wheat	swh	Wild buckwheat	wb
Sorghum	s	Wild brome grass seed	wbg
Sound barley	sbly	Wild oats	wo
Sound oats	so	Yellow corn	yc
Sour	sour	Yellow soybeans	ysb

NOTE: Abbreviations may be expressed in upper or lower case

1.2 VISUAL GRADING AIDS

a. General. The visual grading aids system assists inspectors in making subjective grading decisions. This system consists of visual reference images (VRI) and interpretive line prints. Reference is made to visual grading aids throughout this book.

b. Visual Reference Images. 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. The system consists of a series of commodity specific VRI and descriptive text which, with regular use, controls and diminishes the impact of ordinary perceptional differences. Reference to the VRI is made throughout this handbook.

c. Interpretive Line Prints. Interpretive line prints (ILP) are used as an aid in making subjective grade determinations on general appearance. A special sample box is used to compare the grain being graded with the ILP. To compare the sample with the ILP, place the 5 x 7-inch photographic print in one side of the box and the grain in the opposite side. This allows for the comparison of the grain and the ILP under similar conditions. On the reverse side of each print is an explanation of the condition illustrated on the photograph and procedures for use of the photograph and box. ILS and ILP are available for viewing at FGIS field offices.

The Seedburo Equipment Company is responsible for the production and distribution of ILS, ILP, Slide Viewers, and Interpretive Line Slide Test Strips. Direct all correspondence and orders concerning these items to:

Seedburo Equipment Company
1022 W. Jackson Boulevard
Chicago, IL 60607
Telephone: (Business) - (312) 738-3700
(Orders) - 1-800-284-5779

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

VISUAL REFERENCE IMAGES

BARLEY

B-1.0	Blight damage
B-1.1	Mold damage
B-3.0	Injured-by-frost
B-3.1	Frost damage
B-4.0	Germ damage (discolored and/or mold)
B-5.0	Injured-by-heat
B-5.1	Heat damage
B-6.0	Weevil or insect bored
B-7.0	Injured-by-mold
B-8.0	Sprout damage
(B) OF-2.1	Skinned and broken
(B) OF-2.3	(A) Two-rowed, (B) Six-rowed
(B) OF-2.4	Injured-by-sprout

CANOLA

Canola-1.0	Distinctly green
Canola-2.0	Heat damage
Canola-3.0	Other damage (A)Rimed, (B) (Frost)
Canola-4.0	Sprout damage (A) Damage, (B) Not damage

CORN

C-1.0	Blue-eye mold
C-1.1	Purple plumule
C-2.0	Cob rot
C-3.0	Drier damage
C-4.0	Germ damage
C-4.2	Not germ damage
C-5.0	Heat damage (Drier)
C-5.1	Heat damage (White)
C-5.2	Heat damage (Yellow)
C-6.0	Insect damage
C-7.0	Mold damage
C-7.1	Not damage (Dirt)
C-7.2	Mold damage (Pink Epicoccum)
C-8.0	Silk cut
C-9.0	Sprout damage
C-10.0	Surface mold (Blight)
C-11.0	Surface mold (More than slight)
(C) OF-7.1	Mixed Corn (More than slight tinge-straw)
(C) OF-7.2	Mixed Corn (White-capped Yellow Corn)
(C) OF-7.3	Flint and Dent corn
(C) OF-7.4	Sweet corn and popcorn (BCFM)
(C) OF-7.5	Corn of other colors
(C) OF-7.7	Mixed corn (More than slight tinge-pink)
(C) OF-7.71	Mixed corn (Purple pigmented corn)
(C) OF-7.8	Slightly yellow in (White waxy) corn
(C) OF-7.9	Yellow and White corn (Waxy)
(C) OF-7.91	Yellow and White corn (Non waxy)

FLAXSEED

F-1.0	Damaged Flaxseed (Bee's wings)
F-2.0	Damaged-by-heat
F-3.0	Heat damage

OATS

O-1.0	Badly ground and/or weather damage
O-1.1	Weather damaged (Stained)
O-2.0	Germ Damage (Sick and/or mold)
O-2.1	Mold damage
O-3.0	Heat damage
O-4.0	Insect damage
O-5.0	Sprout damage

RYE

RY-1.0	Germ damage (Sick and/or mold)
RY-3.0	Sprout damage
RY-3.1	Exposed germ in sound rye (not sprout)
RY-3.2	(A) Insect chewed, (B) Sprout sockets
RY-4.0	Weevil or insect bored
RY-5.0	Other damage

SORGHUM

S-1.1	Germ Damage (Bleach method)
S-2.0	Ground and/or weather damage
S-3.0	Heat damage
S-4.0	Insect bored damage
S-5.0	Mold damage
S-5.1	Mold damage (Internal mold)
S-6.0	Sprout damage
S-7.0	Split germ (Sound kernels)
S-8.0	Purple pigment damage
S-9.0	Tannin sorghum (Bleached)
(S) OF-16.0	Non-grain sorghum
(S) OF-33.0	White sorghum

SOYBEANS

SB-1.0	Badly ground and/or weather damage
SB-1.1	Weather damage (Gray/black)
SB-2.0	Damaged by heat
SB-3.0	Green damage
SB-3.2	Frost damage (Waxy)
SB-5.0	Heat damage (Materially damaged/heating)
SB-6.0	Immature (Wafer)
SB-7.0	Insect bored kernels
SB-8.0	Mold damage
SB-8.1	Mold damage (Pink)
SB-9.0	Sprout damage
SB-10.0	Stinkbug or insect stung kernels
SB-12.0	Soybeans of other colors
SB-13.0	Shriveled and wrinkled

VISUAL REFERENCE IMAGES

SUNFLOWER SEED	
SS-1.0	Damaged-by-heat
SS-2.0	Heat damage
SS-3.0	Surface mold
WHEAT	
W-1.0	Black tip damage (Fungus)
W-2.0	Scab damage
W-3.0	Frost damage (Blistered)
W-3.1	Frost damage (Candied)
W-3.2	Frost damage (Discolored black or brown)
W-3.3	Frost damage (Flaked)
W-4.0	Germ damage
W-4.1	Mold damage
W-4.2	Germ damage (Bleach method)
W-5.0	Green damage (Immature)
W-6.0	Heat damage (Durum)
W-6.1	Heat damage (Other than durum)
W-7.0	Other damage (Mold)
W-8.0	Sprout damage
W-8.1	(A) Insect chewed, (B) Sprout sockets
W-9.0	Weevil or insect bored
W-9.1	Insect chewed wheat (Not damaged)
(W) OF-17.0	Unknown foreign substance (Pink wheat)
(W) OF-23.0	Smut in wheat (Tagged ends)
(W) OF-30.0	Threshed and unthreshed kernels

OTHER FACTORS	
OF-1.0	Animal filth
OF-2.2	Wild brome grass seeds
OF-3.0	Castor beans
OF-4.0	Chess
OF-5.0	Cob joints
OF-6.0	Cocklebur, Yellow star thistle, star/sand bur
OF-8.0	Crotalaria seeds
OF-8.1	Velvet leaf seeds
OF-9.0	Cultivated buckwheat
OF-10.0	Einkorn
OF-11.0	Emmer
OF-12.0	Ergot
OF-13.0	Green garlic bulblets (Whole)
OF-13.1	Dry garlic bulblets (⅓)
OF-14.0	Guar
OF-15.0	Hull-less barley
OF-18.0	Polish wheat
OF-19.0	Poulard wheat
OF-20.0	Rice types
OF-21.0	Safflower seed
OF-22.0	Smut balls
OF-24.0	Spelt
OF-25.0	Sunflower seed
OF-26.0	Triticale
OF-27.0	Wild buckwheat and similar seeds
OF-28.0	Wild oats
OF-31.0	Suspected fertilizer (FSUB)
OF-32.0	Sclerotia
OF-34.0	Cotton seed
OF-35.0	Malted barley

INTERPRETIVE LINE PRINTS

Soybeans	Mottled or stained by pokeberry stain
	Mottled or stained by the growth of a fungus
	Mottled or stained by dirt or dirt-like substance
Sorghum	Badly weathered (sorghum/tannin and white appearance mixed)
	Badly weathered (sorghum or tannin appearance)
	Badly weathered (white appearance)
	Distinctly discolored (sorghum/tannin and white appearance mixed)
	Distinctly discolored (sorghum or tannin appearance)
	Distinctly discolored (white appearance)
Oats	Materially weathered
	Slightly weathered
Hard White Wheat	Hard White wheat color line

1.3 WORK RECORDS

FGIS personnel shall use Forms FGIS-920, "Grain Sample Ticket," FGIS-918, "Sample Pan Ticket," FGIS-919, "Sampling Ticket," or FGIS-921, "Inspection Log," to record all sampling and inspection information.

Agency personnel shall use similar work forms to record all sampling and inspection information.

1.4 PRELIMINARY EXAMINATIONS

Inspection personnel sampling grain must: (1) observe the uniformity of the grain as to kind, quality, and condition; (2) draw an original sample; and (3) report the results to the inspector.

The inspector must consider the sampler's observations when determining the representativeness of the sample. If the inspector suspects the sample is not representative, the inspector should consult with the sampler and, if necessary, dismiss the inspection or arrange to obtain another sample.

1.5 DEFINITIONS

a. File Sample. A representative portion of an official sample (approximately 1,400 grams or more).

b. Identity (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.

c. Representative Portion. A part or limited quantity of grain separated from the original sample by means of an approved device.

d. Representative Sample. The terms "Representative Sample" and "Original Sample" are used interchangeably in the Grain Inspection Handbook and refer to a sample of approximately 2,800 grams in size drawn from a grain lot by official inspection personnel using approved procedures and sampling devices. See Book I, Sampling, for further information on sampling.

e. Work Sample. A representative portion of grain of sufficient size (approximately 1,000 - 1,050 grams) to make determinations required for a particular grain.

f. Review Inspection. A reinspection, appeal inspection, or Board appeal inspection service.

1.6 BASIS OF DETERMINATION

Each chapter in Grain Inspection Handbook, Book II, 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

According to section 800.80(a)(4) of the regulations under the United States Grain Standards Act, "A submitted sample inspection service shall 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 shall 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 shall be limited to factor(s) only inspection.

The amount of sample required to be submitted for a factor(s) only inspection depends on the factor(s) information being requested. Certain objective factors/official criteria (e.g., moisture and protein/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 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 and foreign material) or other objective factors (e.g., dockage and 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 DISCLAIMER CLAUSE

The mention of firm names or trade products does not imply that they are endorsed or recommended by the United States Department of Agriculture over other firms or similar approved products not mentioned.

1.9 BOERNER DIVIDER

The Boerner divider reduces the size of a grain sample while maintaining the representativeness of the original sample. Use the Boerner divider, or a divider that gives equivalent results, when reducing a sample to the portion size required for a specific test/analysis.

a. General Operating Procedures.

(1) Check the divider for condition and cleanliness.

(2) Close the hopper valve.

(3) Place empty collection pans under the discharge spouts.

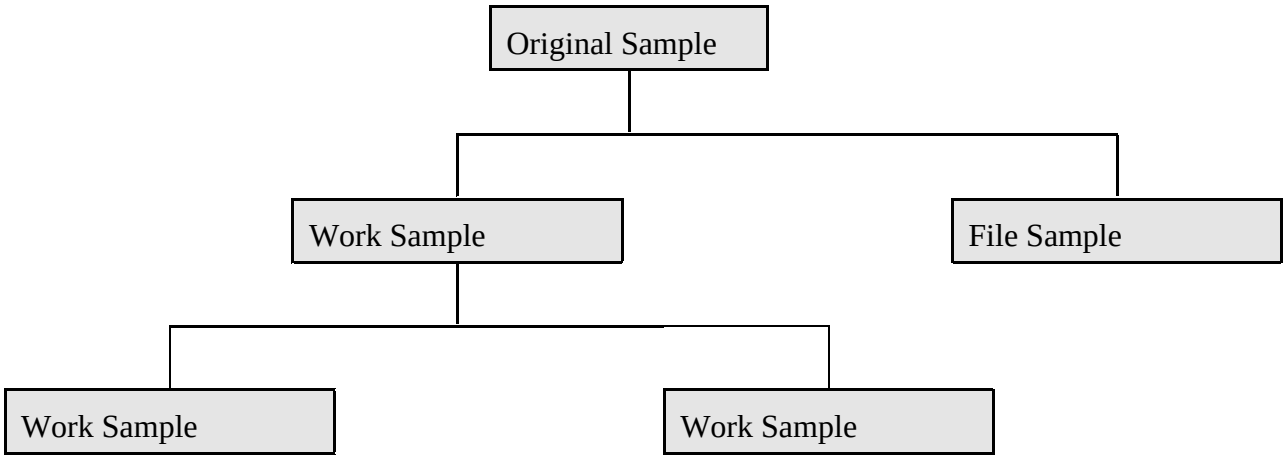
(4) Pour the sample into the hopper.

(5) 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 Boerner dividers, see chapter 7 of the Equipment Handbook.

b. Processing the Original Sample. Use the Boerner divider to subdivide the original sample into a file sample and appropriate work samples.

Chart - Processing Original Sample



c. Processing the Work Sample. Refer to the individual grain chapters for specific information on processing the work sample.

1.10 GAC 2100 MOISTURE METER

The DICKEY-john Grain Analysis Computer GAC 2100 is the designated official moisture meter for performing moisture analysis in grains.

a. Environmental Conditions. Ensure that the moisture meter is placed in a room that is within the manufacturer's basic requirements of 10-40° C (50-104° F). To minimize the effects of instrument temperature in official inspection, it is recommended that the laboratory temperature for the GAC 2100 be maintained within the range of 15-30° C (approx. 60-85° F).

b. Instrument Temperature. The built-in GAC 2100 instrument temperature range limit is 10-40° C (50-104° F). If the instrument temperature is determined to be outside the range of 10-40° C, no moisture results will be displayed.

c. Sample Temperature. The built-in GAC 2100 sample temperature range limit is 0-40° C (32-104° F). If the instrument's measured sample temperature is outside the range of 0-40° C, no moisture results will be displayed. For optimum accuracy and consistency in official inspection, it is recommended that the sample temperature be brought within the range of 10-32° C (50-90° F) before performing moisture determinations.

d. Sample-Instrument Temperature Difference. The built-in GAC 2100 sample-to-instrument temperature difference limit is 20° C (36° F). If the instrument finds the sample temperature to be different from the instrument temperature by more than 20° C, it will not display moisture results. For optimum accuracy and consistency in official inspection, it is recommended that the difference between the grain and instrument temperature not exceed 11° C (20° F).

e. Analytical Portion Size. The GAC 2100 does not require weighing a portion size. A representative portion size of approximately 225 grams is required for moisture testing purposes for oats and sunflower seed. For all other grains a portion of approximately 350 grams is required.

f. Type of Container. Keep all samples in sealed moisture-proof containers if they can not be tested within approximately 15 minutes. Do not use paper bags, fiber cartons, etc., as containers 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. **CAUTION**: Do not place paper **into** moisture samples because paper absorbs moisture and lowers the moisture of the grain.

g. Recording Results. The GAC 2100 does not require manual calculations or the reading of charts, therefore eliminating the use of a moisture log. Official personnel will maintain a work record on the pan ticket and certificate.

h. General Operating Procedures.

(1) Pour the sample through the divider at least once (to mix the sample) before filling the hopper.

(2) Select the appropriate grain from the menu.

(3) Fill the sample hopper located on top of the unit with enough grain to fill the measuring cell inside the instrument (heap grain slightly). The exact volume of grain is not important, except enough grain must be present to overfill the cell (approximately one pint). When the test begins, any excess grain spills over the cell and drops into the sample drawer. If the amount of grain is insufficient to overfill the test cell, depress UNLOAD to dump the sample and repeat the test with a sufficient sample size.

(4) Depress the LOAD key on the keyboard to start the test cycle.

(5) Wait briefly for the moisture test to finish.

(6) Observe the results of the test on the display and record the results on the work record.

(7) When finished with the measurement, depress the UNLOAD key.

NOTE: The GAC 2100 is 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 shall 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 shall be based on the average of the two determinations and rounded to the nearest 0.1 percent moisture.

(8) For additional instructions, refer to the GAC 2100 operator's manual.

1.11 TEST WEIGHT PER BUSHEL APPARATUS

Test weight per bushel is the weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device.

The determination for test weight is made on a portion of sufficient quantity to overflow the kettle. Before making a determination, refer to the chapter covering the grain being tested for the basis of determination and 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. 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.

(1) Standard Method. Carefully hang the kettle on the beam and move the weights until the beam is balanced. Read the test weight per bushel scale.

(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 (see Appendix 1), and read the corresponding test weight per bushel shown to the right of the gram weight.

(3) Alternate 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.

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 using the 1.287 conversion factor referenced above.

i. Record the test weight per bushel on the work record and certificate as prescribed for the particular grain being tested. (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 (see Appendix 2) or use the appropriate formula listed in Table No.1 below to determine kilograms per hectoliter. Record the results (to the nearest tenth kg/hl) in the "Remarks" section of the certificate.

TABLE NO. 1

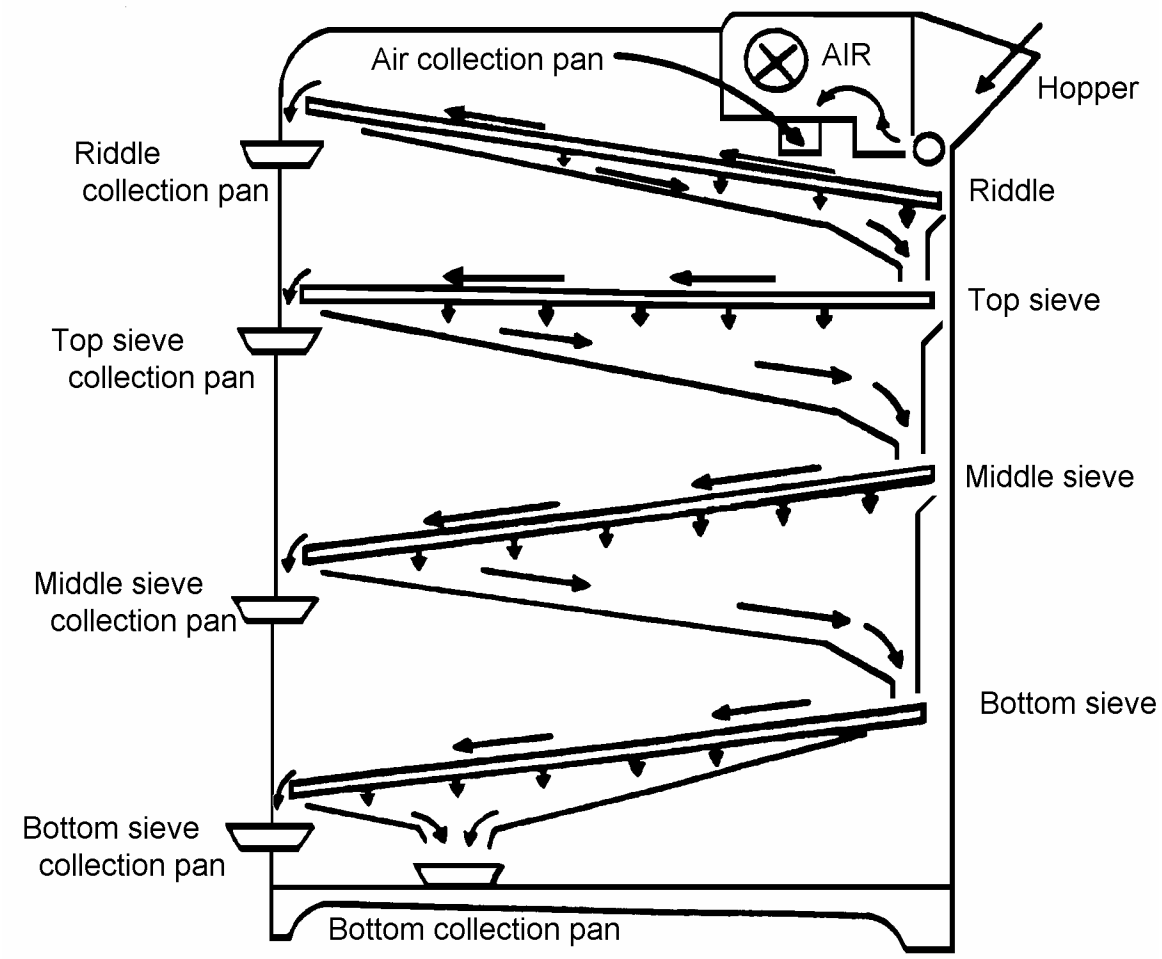
TEST WEIGHT PER BUSHEL CONVERSIONS			
From: Pounds Per Bushel (lb/bu)		To: Kilograms Per Hectoliter (kg/hl)	
Grain	Input*	Formula	Result
Durum Wheat	Pounds per bushel result	(lb/bu x 1.292) + 0.630	Kilograms per hectoliter
All other Wheat types	Pounds per bushel result	(lb/bu x 1.292) + 1.419	Kilograms 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 (e.g., 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, see chapter 5 of 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.

CARTER DOCKAGE TESTER FLOW CHART



General Operating Procedures:

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

b. Place the riddle, if applicable, and sieve(s) in the prescribed locations.

Table No. 2 lists the proper riddles, sieves, air, and feed control settings to use for each type of grain.

TABLE NO. 2

EQUIPMENT SCHEDULE & CONTROL SETTINGS						
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.						

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

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.

For more specific information on operation, maintenance, and performance testing procedures, see chapter 4 of 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 NO. 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 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 holder 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.

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.

For more specific information on the operation, maintenance, and performance testing of sieves and sieve shakers, see chapter 9 of 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 conspicuously on each machine.

General Operating Procedures:

a. Before placing the portion into the pearler:

(1) Run the pearler and open the slide to ensure that the pearling chamber is empty.

(2) Remove and empty the drawers that catch the barley hulls and pearled portion. Replace them.

(3) Securely close the slide.

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

c. Set the time for the grain being pearled.

d. 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.

e. 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, see chapter 8 of the Equipment Handbook.

1.15 LABORATORY SCALES

a. Weigh work portions and separations from work portions using an approved grain test scale with an appropriate division size as follows:

TABLE NO. 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 grams	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. See Chapter 2 of the Equipment Handbook for additional information.			

b. 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.

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

(1) 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.

(2) 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.

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

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

(5) 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 Branch.

1.16 ROUNDING

When certificating official results, use the following procedures for rounding unless otherwise specified.

A hand-held calculator or computer may be used to calculate results and to provide rounding.

a. If the calculating device is programmable, set the device to the number of decimal places or whole number needed for reporting on the work record or certificate. Test the results to ensure that the rounding procedure is identical to the FGIS rounding method described in b. below. Otherwise, set the calculating device to the floating mode and carry the results one decimal place further than the level required and round the final results as in b. below.

b. When the figure to be rounded is followed by a figure greater than or equal to 5, round to the next higher figure; for example, report 6.35 as 6.4, 0.45 as 0.5, etc. When the figure to be rounded is followed by a figure less than 5, retain the figure; for example, report 8.34 as 8.3, 1.22 as 1.2, etc.

Record all the information on the certificate as shown in Table No. 5 - Certifying Percentages and Test Weight.

TABLE NO. 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
Identity (kind of grain)	All grains	Nearest whole percent
Each kind of grain	Mixed grain	Nearest whole pecent
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, 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 shall 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 for determining germ-damaged kernels in sorghum and wheat and for the iodine test for determining 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) Hand held 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 seed coat.

(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 hygroscropic 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. It 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. <u>If dispensers are used, they must meet the following criteria</u>:

- Cylinder capacity: 50 ml

- Accuracy: ± 1.0 percent

- 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. Examples of dispensers meeting this criteria include the Brinkman dispensette and Repipet dispenser which are available through Fisher Scientific (1-800-766-7000), catalog number 13-688-70 and 13-687-57, respectively.

(b) Use major brands of bleach only (e.g., Clorox, 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.

(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.

(a) Sharp knife; or

(b) Razor blade.

(2) Spray bottle.

(a) Dark-colored, trigger-spray, polyethylene bottle; or

(b) Amber colored borosilicate glass with atomizer bulb.

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

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

(5) Iodine stock solution.

CAUTION: 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.

Follow steps (a) through (f) to prepare the iodine stock solution.

(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. Reference FGIS Program Directive 9170.13, Uniform File Sample Retention System, for detailed procedures.

b. Use of File Sample. Official personnel shall 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, odor, etc.);

(3) Review by interested persons;

(4) Reinspections, appeals, and Board appeals;

(5) Answering trade complaints; and

(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 as follows:

TABLE NO. 6

FILE SAMPLE RETENTION				
	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	-
Bins & Tanks	-	-	-	3
Submitted samples	-	-	-	3

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

d. Sample Size. File samples shall 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, sunflower seed, etc.), that require less grain to determine grade. For factor only tests or official criteria (e.g., wheat protein), 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.

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 (paragraph 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; and

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

1.19 UNOFFICIAL INSPECTION SERVICES

Occasionally, official personnel receive requests from processors, producers, seed companies, etc., 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 requests for such analysis or service, such as seed grain testing, brown test in corn, and yield in oats, may perform the service(s) on an unofficial basis.

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 NO. 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
* See Table No.1 for conversion factors.				

TABLE NO. 8

EQUIVALENTS							
				VOLUME			
Weight		Length		Dry		Liquid	
grain	= 0.06 g	1 in	= 2.54 cm = 25.4 mm	1 pt	= 0.28 L	1 pt	= 0.473 L
1 oz	= 28 g	1 ft	= .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 st	= 907 kg = 0.9t						
1 lt	= 1016.0 kg = 1.02t						
1 ppb	= 1 µg/kg						
1 ppm	= 1 mg/kg						

TABLE NO. 9

MEASURES						
Pounds Per Bushel (trade weight)		Bushels Per Ton	Short	Metric (t)	Bushels to Metric Tons	
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

TEST WEIGHT CONVERSION CHART

GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU)

275 – 295.5		296 – 316.5		317 – 337.5		338 – 358.5	
Grams	lb/bu	Grams	lb/bu	Grams	lb/bu	Grams	lb/bu
275	19.4	296	20.9	317	22.4	338	23.8
275.5	19.4	296.5	20.9	317.5	22.4	338.5	23.9
276	19.5	297	21.0	318	22.4	339	23.9
276.5	19.5	297.5	21.0	318.5	22.5	339.5	24.0
277	19.5	298	21.0	319	22.5	340	24.0
277.5	19.6	298.5	21.1	319.5	22.5	340.5	24.0
278	19.6	299	21.1	320	22.6	341	24.1
278.5	19.6	299.5	21.1	320.5	22.6	341.5	24.1
279	19.7	300	21.2	321	22.6	342	24.1
279.5	19.7	300.5	21.2	321.5	22.7	342.5	24.2
280	19.8	301	21.2	322	22.7	343	24.2
280.5	19.8	301.5	21.3	322.5	22.8	343.5	24.2
281	19.8	302	21.3	323	22.8	344	24.3
281.5	19.9	302.5	21.3	323.5	22.8	344.5	24.3
282	19.9	303	21.4	324	22.9	345	24.3
282.5	19.9	303.5	21.4	324.5	22.9	345.5	24.4
283	20.0	304	21.4	325	22.9	346	24.4
283.5	20.0	304.5	21.5	325.5	23.0	346.5	24.4
284	20.0	305	21.5	326	23.0	347	24.5
284.5	20.1	305.5	21.6	326.5	23.0	347.5	24.5
285	20.1	306	21.6	327	23.1	348	24.6
285.5	20.1	306.5	21.6	327.5	23.1	348.5	24.6
286	20.2	307	21.7	328	23.1	349	24.6
286.5	20.2	307.5	21.7	328.5	23.2	349.5	24.7
287	20.2	308	21.7	329	23.2	350	24.7
287.5	20.3	308.5	21.8	329.5	23.2	350.5	24.7
288	20.3	309	21.8	330	23.3	351	24.8
288.5	20.4	309.5	21.8	330.5	23.3	351.5	24.8
289	20.4	310	21.9	331	23.4	352	24.8
289.5	20.4	310.5	21.9	331.5	23.4	352.5	24.9
290	20.5	311	21.9	332	23.4	353	24.9
290.5	20.5	311.5	22.0	332.5	23.5	353.5	24.9
291	20.5	312	22.0	333	23.5	354	25.0
291.5	20.6	312.5	22.0	333.5	23.5	354.5	25.0
292	20.6	313	22.1	334	23.6	355	25.0
292.5	20.6	313.5	22.1	334.5	23.6	355.5	25.1
293	20.7	314	22.2	335	23.6	356	25.1
293.5	20.7	314.5	22.2	335.5	23.7	356.5	25.2
294	20.7	315	22.2	336	23.7	357	25.2
294.5	20.8	315.5	22.3	336.5	23.7	357.5	25.2
295	20.8	316	22.3	337	23.8	358	25.3
295.5	20.8	316.5	22.3	337.5	23.8	358.5	25.3

TEST WEIGHT CONVERSION CHART

GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU)

359 – 379.5		380 – 400.5		401 – 421.5		422 – 442.5	
Grams	lb/bu	Grams	lb/bu	Grams	lb/bu	Grams	lb/bu
359	25.3	380	26.8	401	28.3	422	29.8
359.5	25.4	380.5	26.8	401.5	28.3	422.5	29.8
360	25.4	381	26.9	402	28.4	423	29.8
360.5	25.4	381.5	26.9	402.5	28.4	423.5	29.9
361	25.5	382	26.9	403	28.4	424	29.9
361.5	25.5	382.5	27.0	403.5	28.5	424.5	29.9
362	25.5	383	27.0	404	28.5	425	30.0
362.5	25.6	383.5	27.1	404.5	28.5	425.5	30.0
363	25.6	384	27.1	405	28.6	426	30.1
363.5	25.6	384.5	27.1	405.5	28.6	426.5	30.1
364	25.7	385	27.2	406	28.6	427	30.1
364.5	25.7	385.5	27.2	406.5	28.7	427.8	30.2
365	25.7	386	27.2	407	28.7	428	30.2
365.5	25.8	386.5	27.3	407.5	28.7	428.5	30.2
366	25.8	387	27.3	408	28.8	429	30.3
366.5	25.9	387.5	27.3	408.5	28.8	429.5	30.3
367	25.9	388	27.4	409	28.9	430	30.3
367.5	25.9	388.5	27.4	409.5	28.9	430.5	30.4
368	26.0	389	27.4	410	28.9	431	30.4
368.5	26.0	389.5	27.5	410.5	29.0	431.5	30.4
369	26.0	390	27.5	411	29.0	432	30.5
369.5	26.1	390.5	27.5	411.5	29.0	432.5	30.5
370	26.1	391	27.6	412	29.1	433	30.5
370.5	26.1	391.5	27.6	412.5	29.1	433.5	30.6
371	26.2	392	27.7	413	29.1	434	30.6
371.5	26.2	392.5	27.7	413.5	29.2	434.5	30.7
372	26.2	393	27.7	414	29.2	435	30.7
372.5	26.3	393.5	27.8	414.5	29.2	435.5	30.7
373	26.3	394	27.8	415	29.3	436	30.8
373.5	26.3	394.5	27.8	415.5	29.3	436.5	30.8
374	26.4	395	27.9	416	29.3	437	30.8
374.5	26.4	395.5	27.9	416.5	29.4	437.5	30.9
375	26.5	396	27.9	417	29.4	438	30.9
375.5	26.5	396.5	28.0	417.5	29.5	438.5	30.9
376	26.5	397	28.0	418	29.5	439	31.0
376.5	26.6	397.5	28.0	418.5	29.5	439.5	31.0
377	26.6	398	28.1	419	29.6	440	31.0
377.5	26.6	398.5	28.1	419.5	29.6	440.5	31.1
378	26.7	399	28.1	420	29.6	441	31.1
378.5	26.7	399.5	28.2	420.5	29.7	441.5	31.1
379	26.7	400	28.2	421	29.7	442	31.2
379.5	26.8	400.5	28.3	421.5	29.7	442.5	31.2

TEST WEIGHT CONVERSION CHART

GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU)

443 – 463.5		464 – 484.5		485 – 505.5		506 – 526.5	
Grams	lb/bu	Grams	lb/bu	Grams	lb/bu	Grams	lb/bu
443	31.3	464	32.7	485	34.2	506	35.7
443.5	31.3	464.5	32.8	485.5	34.3	506.5	35.7
444	31.3	465	32.8	486	34.3	507	35.8
444.5	31.4	465.5	32.8	486.5	34.3	507.5	35.8
445	31.4	466	32.9	487	34.4	508	35.8
445.5	31.4	466.5	32.9	487.5	34.4	508.5	35.9
446	31.5	467	32.9	488	34.4	509	35.9
446.5	31.5	467.5	33.0	488.5	34.5	509.5	35.9
447	31.5	468	33.0	489	34.5	510	36.0
447.5	31.6	468.5	33.1	489.5	34.5	510.5	36.0
448	31.6	469	33.1	490	34.6	511	36.0
448.5	31.6	469.5	33.1	490.5	34.6	511.5	36.1
449	31.7	470	33.2	491	34.6	512	36.1
449.5	31.7	470.5	33.2	491.5	34.7	512.5	36.2
450	31.7	471	33.2	492	34.7	513	36.2
450.5	31.8	471.5	33.3	492.5	34.7	513.5	36.2
451	31.8	472	33.3	493	34.8	514	36.3
451.5	31.9	472.5	33.3	493.5	34.8	514.5	36.3
452	31.9	473	33.4	494	34.9	515	36.3
452.5	31.9	473.5	33.4	494.5	34.9	515.5	36.4
453	32.0	474	33.4	495	34.9	516	36.4
453.5	32.0	474.5	33.5	495.5	35.0	516.5	36.4
454	32.0	475	33.5	496	35.0	517	36.5
454.5	32.1	475.5	33.5	496.5	35.0	517.5	36.5
455	32.1	476	33.6	497	35.1	518	36.5
455.5	32.1	476.5	33.6	497.5	35.1	518.5	36.6
456	32.2	477	33.7	498	35.1	519	36.6
456.5	32.2	477.5	33.7	498.5	35.2	519.5	36.6
457	32.2	478	33.7	499	35.2	520	36.7
457.5	32.3	478.5	33.8	499.5	35.2	520.5	36.7
458	32.3	479	33.8	500	35.3	521	36.8
458.5	32.3	479.5	33.8	500.5	35.3	521.5	36.8
459	32.4	480	33.9	501	35.3	522	36.8
459.5	32.4	480.5	33.9	501.5	35.4	522.5	36.9
460	32.5	481	33.9	502	35.4	523	36.9
460.5	32.5	481.5	34.0	502.5	35.5	523.5	36.9
461	32.5	482	34.0	503	35.5	524	37.0
461.5	32.6	482.5	34.0	503.5	35.5	524.5	37.0
462	32.6	483	34.1	504	35.6	525	37.0
462.5	32.6	483.5	34.1	504.5	35.6	525.5	37.1
463	32.7	484	34.1	505	35.6	526	37.1
463.5	32.7	484.5	34.2	505.5	35.7	526.5	37.1

TEST WEIGHT CONVERSION CHART

GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU)

527 – 547.5		548 – 568.5		569 – 589.5		590 – 610.5	
Grams	lb/bu	Grams	lb/bu	Grams	lb/bu	Grams	lb/bu
527	37.2	548	38.7	569	40.1	590	41.6
527.5	37.2	548.5	38.7	569.5	40.2	590.5	41.7
528	37.2	549	38.7	570	40.2	591	41.7
528.5	37.3	549.5	38.8	570.5	40.2	591.5	41.7
529	37.3	550	38.8	571	40.3	592	41.8
529.5	37.4	550.5	38.8	571.5	40.3	592.5	41.8
530	37.4	551	38.9	572	40.4	593	41.8
530.5	37.4	551.5	38.9	572.5	40.4	593.5	41.9
531	37.5	552	38.9	573	40.4	594	41.9
531.5	37.5	552.5	39.0	573.5	40.5	594.5	41.9
532	37.5	553	39.0	574	40.5	595	42.0
532.5	37.6	553.5	39.0	574.5	40.5	595.5	42.0
533	37.6	554	39.1	575	40.6	596	42.0
533.5	37.6	554.5	39.1	575.5	40.6	596.5	42.1
534	37.7	555	39.2	576	40.6	597	42.1
534.5	37.7	555.5	39.2	576.5	40.7	597.5	42.2
535	37.7	556	39.2	577	40.7	598	42.2
535.5	37.8	556.5	39.3	577.5	40.7	598.5	42.2
536	37.8	557	39.3	578	40.8	599	42.3
536.5	37.8	557.5	39.3	578.5	40.8	599.5	42.3
537	37.9	558	39.4	579	40.8	600	42.3
537.5	37.9	558.5	39.4	579.5	40.9	600.5	42.4
538	38.0	559	39.4	580	40.9	601	42.4
538.5	38.0	559.5	39.5	580.5	41.0	601.5	42.4
539	38.0	560	39.5	581	41.0	602	42.5
539.5	38.1	560.5	39.5	581.5	41.0	602.5	42.5
540	38.1	561	39.6	582	41.1	603	42.5
540.5	38.1	561.5	39.6	582.5	41.1	603.5	42.6
541	38.2	562	39.6	583	41.1	604	42.6
541.5	38.2	562.5	39.7	583.5	41.2	604.5	42.6
542	38.2	563	39.7	584	41.2	605	42.7
542.5	38.3	563.5	39.8	584.5	41.2	605.5	42.7
543	38.3	564	39.8	585	41.3	606	42.8
543.5	38.3	564.5	39.8	585.5	41.3	606.5	42.8
544	38.4	565	39.9	586	41.3	607	42.8
544.5	38.4	565.5	39.9	586.5	41.4	607.5	42.9
545	38.4	566	39.9	587	41.4	608	42.9
545.5	38.5	566.5	40.0	587.5	41.4	608.5	42.9
546	38.5	567	40.0	588	41.5	609	43.0
546.5	38.6	567.5	40.0	588.5	41.5	609.5	43.0
547	38.6	568	40.1	589	41.6	610	43.0
547.5	38.6	568.5	40.1	589.5	41.6	610.5	43.1

TEST WEIGHT CONVERSION CHART

GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU)

611 – 631.5		632 – 652.5		653 – 673.5		674 – 694.5	
Grams	lb/bu	Grams	lb/bu	Grams	lb/bu	Grams	lb/bu
611	43.1	632	44.6	653	46.1	674	47.5
611.5	43.1	632.5	44.6	653.5	46.1	674.5	47.6
612	43.2	633	44.7	654	46.1	675	47.6
612.5	43.2	633.5	44.7	654.5	46.2	675.5	47.7
613	43.2	634	44.7	655	46.2	676	47.7
613.5	43.3	634.5	44.8	655.5	46.2	676.5	47.7
614	43.3	635	44.8	656	46.3	677	47.8
614.5	43.4	635.5	44.8	656.5	46.3	677.5	47.8
615	43.4	636	44.9	657	46.3	678	47.8
615.5	43.4	636.5	44.9	657.5	46.4	678.5	47.9
616	43.5	637	44.9	658	46.4	679	47.9
616.5	43.5	637.5	45.0	658.5	46.5	679.5	47.9
617	43.5	638	45.0	659	46.5	680	48.0
617.5	43.6	638.5	45.0	659.5	46.5	680.5	48.0
618	43.6	639	45.1	660	46.6	681	48.0
618.5	43.6	639.5	45.1	660.5	46.6	681.5	48.1
619	43.7	640	45.2	661	46.6	682	48.1
619.5	43.7	640.5	45.2	661.5	46.7	682.5	48.1
620	43.7	641	45.2	662	46.7	683	48.2
620.5	43.8	641.5	45.3	662.5	46.7	683.5	48.2
621	43.8	642	45.3	663	46.8	684	48.3
621.5	43.8	642.5	45.3	663.5	46.8	684.5	48.3
622	43.9	643	45.4	664	46.8	685	48.3
622.5	43.9	643.5	45.4	664.5	46.9	685.5	48.4
623	44.0	644	45.4	665	46.9	686	48.4
623.5	44.0	644.5	45.5	665.5	46.9	686.5	48.4
624	44.0	645	45.5	666	47.0	687	48.5
624.5	44.1	645.5	45.5	666.5	47.0	687.5	48.5
625	44.1	646	45.6	667	47.1	688	48.5
625.5	44.1	646.5	45.6	667.5	47.1	688.5	48.6
626	44.2	647	45.6	668	47.1	689	48.6
626.5	44.2	647.5	45.7	668.5	47.2	689.5	48.6
627	44.2	648	45.7	669	47.2	690	48.7
627.5	44.3	648.5	45.8	669.5	47.2	690.5	48.7
628	44.3	649	45.8	670	47.3	691	48.7
628.5	44.3	649.5	45.8	670.5	47.3	691.5	48.8
629	44.4	650	45.9	671	47.3	692	48.8
629.5	44.4	650.5	45.9	671.5	47.4	692.5	48.9
630	44.4	651	45.9	672	47.4	693	48.9
630.5	44.5	651.5	46.0	672.5	47.4	693.5	48.9
631	44.5	652	46.0	673	47.5	694	49.0
631.5	44.6	652.5	46.0	673.5	47.5	694.5	49.0

TEST WEIGHT CONVERSION CHART

GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU)

695 –715.5		716 – 736.5		737 – 757.5		758 – 778.5	
Grams	lb/bu	Grams	lb/bu	Grams	lb/bu	Grams	lb/bu
695	49.0	716	50.5	737	52.0	758	53.5
695.5	49.1	716.5	50.5	737.5	52.0	758.5	53.5
696	49.1	717	50.6	738	52.1	759	53.5
696.5	49.1	717.5	50.6	738.5	52.1	759.5	53.6
697	49.2	718	50.7	739	52.1	760	53.6
697.5	49.2	718.5	50.7	739.5	52.2	760.5	53.7
698	49.2	719	50.7	740	52.2	761	53.7
698.5	49.3	719.5	50.8	740.5	52.2	761.5	53.7
699	49.3	720	50.8	741	52.3	762	53.8
699.5	49.3	720.5	50.8	741.5	52.3	762.5	53.8
700	49.4	721	50.9	742	52.3	763	53.8
700.5	49.4	721.5	50.9	742.5	52.4	763.5	53.9
701	49.5	722	50.9	743	52.4	764	53.9
701.5	49.5	722.5	51.0	743.5	52.5	764.5	53.9
702	49.5	723	51.0	744	52.5	765	54.0
702.5	49.6	723.5	51.0	744.5	52.5	765.5	54.0
703	49.6	724	51.1	745	52.6	766	54.0
703.5	49.6	724.5	51.1	745.5	52.6	766.5	54.1
704	49.7	725	51.1	746	52.6	767	54.1
704.5	49.7	725.5	51.2	746.5	52.7	767.5	54.1
705	49.7	726	51.2	747	52.7	768	54.2
705.5	49.8	726.5	51.3	747.5	52.7	768.5	54.2
706	49.8	727	51.3	748	52.8	769	54.3
706.5	49.8	727.5	51.3	748.5	52.8	769.5	54.3
707	49.9	728	51.4	749	52.8	770	54.3
707.5	49.9	728.5	51.4	749.5	52.9	770.5	54.4
708	49.9	729	51.4	750	52.9	771	54.4
708.5	50.0	729.5	51.5	750.5	52.9	771.5	54.4
709	50.0	730	51.5	751	53.0	772	54.5
709.5	50.1	730.5	51.5	751.5	53.0	772.5	54.5
710	50.1	731	51.6	752	53.1	773	54.5
710.5	50.1	731.5	51.6	752.5	53.1	773.5	54.6
711	50.2	732	51.6	753	53.1	774	54.6
711.5	50.2	732.5	51.7	753.5	53.2	774.5	54.6
712	50.2	733	51.7	754	53.2	775	54.7
712.5	50.3	733.5	51.7	754.5	53.2	775.5	54.7
713	50.3	734	51.8	755	53.3	776	54.7
713.5	50.3	734.5	51.8	755.5	53.3	776.5	54.8
714	50.4	735	51.9	756	53.3	777	54.8
714.5	50.4	735.5	51.9	756.5	53.4	777.5	54.9
715	50.4	736	51.9	757	53.4	778	54.9
715.5	50.5	736.5	52.0	757.5	53.4	778.5	54.9

TEST WEIGHT CONVERSION CHART

GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU)

779 –799.5		800 – 820.5		821 – 841.5		842 – 862.5	
Grams	lb/bu	Grams	lb/bu	Grams	lb/bu	Grams	lb/bu
779	55.0	800	56.4	821	57.9	842	59.4
779.5	55.0	800.5	56.5	821.5	58.0	842.5	59.4
780	55.0	801	56.5	822	58.0	843	59.5
780.5	55.1	801.5	56.5	822.5	58.0	843.5	59.5
781	55.1	802	56.6	823	58.1	844	59.5
781.5	55.1	802.5	56.6	823.5	58.1	844.5	59.6
782	55.2	803	56.6	824	58.1	845	59.6
782.5	55.2	803.5	56.7	824.5	58.2	845.5	59.6
783	55.2	804	56.7	825	58.2	846	59.7
783.5	55.3	804.5	56.8	825.5	58.2	846.5	59.7
784	55.3	805	56.8	826	58.3	847	59.8
784.5	55.3	805.5	56.8	826.5	58.3	847.5	59.8
785	55.4	806	56.9	827	58.3	848	59.8
785.5	55.4	806.5	56.9	827.5	58.4	848.5	59.9
786	55.5	807	56.9	828	58.4	849	59.9
786.5	55.5	807.5	57.0	828.5	58.4	849.5	59.9
787	55.5	808	57.0	829	58.5	850	60.0
787.5	55.6	808.5	57.0	829.5	58.5	850.5	60.0
788	55.6	809	57.1	830	58.6	851	60.0
788.5	55.6	809.5	57.1	830.5	58.6	851.5	60.1
789	55.7	810	57.1	831	58.6	852	60.1
789.5	55.7	810.5	57.2	831.5	58.7	852.5	60.1
790	55.7	811	57.2	832	58.7	853	60.2
790.5	55.8	811.5	57.2	832.5	58.7	853.5	60.2
791	55.8	812	57.3	833	58.8	854	60.2
791.5	55.8	812.5	57.3	833.5	58.8	854.5	60.3
792	55.9	813	57.4	834	58.8	855	60.3
792.5	55.9	813.5	57.4	834.5	58.9	855.5	60.4
793	55.9	814	57.4	835	58.9	856	60.4
793.5	56.0	814.5	57.5	835.5	58.9	856.5	60.4
794	56.0	815	57.5	836	59.0	857	60.5
794.5	56.1	815.5	57.5	836.5	59.0	857.5	60.5
795	56.1	816	57.6	837	59.0	858	60.5
795.5	56.1	816.5	57.6	837.5	59.1	858.5	60.6
796	56.2	817	57.6	838	59.1	859	60.6
796.5	56.2	817.5	57.7	838.5	59.2	859.5	60.6
797	56.2	818	57.7	839	59.2	860	60.7
797.5	56.3	818.5	57.7	839.5	59.2	860.5	60.7
798	56.3	819	57.8	840	59.3	861	60.7
798.5	56.3	819.5	57.8	840.5	59.3	861.5	60.8
799	56.4	820	57.8	841	59.3	862	60.8
799.5	56.4	820.5	57.9	841.5	59.4	862.5	60.8

TEST WEIGHT CONVERSION CHART

GRAMS TO TEST WEIGHT PER BUSHEL (LB/BU)

863 – 880.5		881 - 898.5		899 – 916.5		917 – 934.5	
Grams	lb/bu	Grams	lb/bu	Grams	lb/bu	Grams	lb/bu
863	60.9	881	62.2	899	63.4	917	64.7
863.5	60.9	881.5	62.2	899.5	63.5	917.5	64.7
864	61.0	882	62.2	900	63.5	918	64.8
864.5	61.0	882.5	62.3	900.5	63.5	918.5	64.8
865	61.0	883	62.3	901	63.6	919	64.8
865.5	61.1	883.5	62.3	901.5	63.6	919.5	64.9
866	61.1	884	62.4	902	63.6	920	64.9
866.5	61.1	884.5	62.4	902.5	63.7	920.5	64.9
867	61.2	885	62.4	903	63.7	921	65.0
867.5	61.2	885.5	62.5	903.5	63.7	921.5	65.0
868	61.2	886	62.5	904	63.8	922	65.0
868.5	61.3	886.5	62.5	904.5	63.8	922.5	65.1
869	61.3	887	62.6	905	63.8	923	65.1
869.5	61.3	887.5	62.6	905.5	63.9	923.5	65.2
870	61.4	888	62.6	906	63.9	924	65.2
870.5	61.4	888.5	62.7	906.5	64.0	924.5	65.2
871	61.4	889	62.7	907	64.0	925	65.3
871.5	61.5	889.5	62.8	907.5	64.0	925.5	65.3
872	61.5	890	62.8	908	64.1	926	65.3
872.5	61.6	890.5	62.8	908.5	64.1	926.5	65.4
873	61.6	891	62.9	909	64.1	927	65.4
873.5	61.6	891.5	62.9	909.5	64.2	927.5	65.4
874	61.7	892	62.9	910	64.2	928	65.5
874.5	61.7	892.5	63.0	910.5	64.2	928.5	65.5
875	61.7	893	63.0	911	64.3	929	65.5
875.5	61.8	893.5	63.0	911.5	64.3	929.5	65.6
876	61.8	894	63.1	912	64.3	930	65.6
876.5	61.8	894.5	63.1	912.5	64.4	930.5	65.6
877	61.9	895	63.1	913	64.4	931	65.7
877.5	61.9	895.5	63.2	913.5	64.4	931.5	65.7
878	61.9	896	63.2	914	64.5	932	65.8
878.5	62.0	896.5	63.2	914.5	64.5	932.5	65.8
879	62.0	897	63.3	915	64.6	933	65.8
879.5	62.0	897.5	63.3	915.5	64.6	933.5	65.9
880	62.1	898	63.4	916	64.6	934	65.9
880.5	62.1	898.5	63.4	916.5	64.7	934.5	65.9

TEST WEIGHT/KILOGRAMS 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	27.4	35.3	31.8	40.9	36.2	46.6	40.6	52.3	45.0	57.9
23.1	29.7	27.5	35.4	31.9	41.1	36.3	46.7	40.7	52.4	45.1	58.0
23.2	29.9	27.6	35.5	32.0	41.2	36.4	46.8	40.8	52.5	45.2	58.2
23.3	30.0	27.7	35.6	32.1	41.3	36.5	47.0	40.9	52.6	45.3	58.3
23.4	30.1	27.8	35.8	32.2	41.4	36.6	47.1	41.0	52.8	45.4	58.4
23.5	30.2	27.9	35.9	32.3	41.6	36.7	47.2	41.1	52.9	45.5	58.6
23.6	30.4	28.0	36.0	32.4	41.7	36.8	47.4	41.2	53.0	45.6	58.7
23.7	30.5	28.1	36.2	32.5	41.8	36.9	47.5	41.3	53.2	45.7	58.8
23.8	30.6	28.2	36.3	32.6	42.0	37.0	47.6	41.4	53.3	45.8	58.9
23.9	30.8	28.3	36.4	32.7	42.1	37.1	47.7	41.5	53.4	45.9	59.1
24.0	30.9	28.4	36.6	32.8	42.2	37.2	47.9	41.6	53.5	46.0	59.2
24.1	31.0	28.5	36.7	32.9	42.3	37.3	48.0	41.7	53.7	46.1	59.3
24.2	31.1	28.6	36.8	33.0	42.5	37.4	48.1	41.8	53.8	46.2	59.5
24.3	31.3	28.7	36.9	33.1	42.6	37.5	48.3	41.9	53.9	46.3	59.6
24.4	31.4	28.8	37.1	33.2	42.7	37.6	48.4	42.0	54.1	46.4	59.7
24.5	31.5	28.9	37.2	33.3	42.9	37.7	48.5	42.1	54.2	46.5	59.8
24.6	31.7	29.0	37.3	33.4	43.0	37.8	48.6	42.2	54.3	46.6	60.0
24.7	31.8	29.1	37.5	33.5	43.1	37.9	48.8	42.3	54.4	46.7	60.1
24.8	31.9	29.2	37.6	33.6	43.2	38.0	48.9	42.4	54.6	46.8	60.2
24.9	32.0	29.3	37.7	33.7	43.4	38.1	49.0	42.5	54.7	46.9	60.4
25.0	32.2	29.4	37.8	33.8	43.5	38.2	49.2	42.6	54.8	47.0	60.5
25.1	32.3	29.5	38.0	33.9	43.6	38.3	49.3	42.7	55.0	47.1	60.6
25.2	32.4	29.6	38.1	34.0	43.8	38.4	49.4	42.8	55.1	47.2	60.7
25.3	32.6	29.7	38.2	34.1	43.9	38.5	49.5	42.9	55.2	47.3	60.9
25.4	32.7	29.8	38.4	34.2	44.0	38.6	49.7	43.0	55.3	47.4	61.0
25.5	32.8	29.9	38.5	34.3	44.1	38.7	49.8	43.1	55.5	47.5	61.1
25.6	32.9	30.0	38.6	34.4	44.3	38.8	49.9	43.2	55.6	47.6	61.3
25.7	33.1	30.1	38.7	34.5	44.4	38.9	50.1	43.3	55.7	47.7	61.4
25.8	33.2	30.2	38.9	34.6	44.5	39.0	50.2	43.4	55.9	47.8	61.5
25.9	33.3	30.3	39.0	34.7	44.7	39.1	50.3	43.5	56.0	47.9	61.6
26.0	33.5	30.4	39.1	34.8	44.8	39.2	50.5	43.6	56.1	48.0	61.8
26.1	33.6	30.5	39.3	34.9	44.9	39.3	50.6	43.7	56.2	48.1	61.9
26.2	33.7	30.6	39.4	35.0	45.0	39.4	50.7	43.8	56.4	48.2	62.0
26.3	33.8	30.7	39.5	35.1	45.2	39.5	50.8	43.9	56.5	48.3	62.2
26.4	34.0	30.8	39.6	35.2	45.3	39.6	51.0	44.0	56.6	48.4	62.3
26.5	34.1	30.9	39.8	35.3	45.4	39.7	51.1	44.1	56.8	48.5	62.4
26.6	34.2	31.0	39.9	35.4	45.6	39.8	51.2	44.2	56.9	48.6	62.5
26.7	34.4	31.1	40.0	35.5	45.7	39.9	51.4	44.3	57.0	48.7	62.7
26.8	34.5	31.2	40.2	35.6	45.8	40.0	51.5	44.4	57.1	48.8	62.8
26.9	34.6	31.3	40.3	35.7	45.9	40.1	51.6	44.5	57.3	48.9	62.9
27.0	34.7	31.4	40.4	35.8	46.1	40.2	51.7	44.6	57.4	49.0	63.1
27.1	34.9	31.5	40.5	35.9	46.2	40.3	51.9	44.7	57.5	49.1	63.2
27.2	35.0	31.6	40.7	36.0	46.3	40.4	52.0	44.8	57.7	49.2	63.3
27.3	35.1	31.7	40.8	36.1	46.5	40.5	52.1	44.9	57.8	49.3	63.4

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
49.4	63.6	51.2	65.9	53.0	68.2	54.8	70.5	56.6	72.8	58.4	75.2
49.5	63.7	51.3	66.0	53.1	68.3	54.9	70.7	56.7	73.0	58.5	75.3
49.6	63.8	51.4	66.2	53.2	68.5	55.0	70.8	56.8	73.1	58.6	75.4
49.7	64.0	51.5	66.3	53.3	68.6	55.1	70.9	56.9	73.2	58.7	75.5
49.8	64.1	51.6	66.4	53.4	68.7	55.2	71.0	57.0	73.4	58.8	75.7
49.9	64.2	51.7	66.5	53.5	68.9	55.3	71.2	57.1	73.5	58.9	75.8
50.0	64.4	51.8	66.7	53.6	69.0	55.4	71.3	57.2	73.6	59.0	75.9
50.1	64.5	51.9	66.8	53.7	69.1	55.5	71.4	57.3	73.7	59.1	76.1
50.2	64.6	52.0	66.9	53.8	69.2	55.6	71.6	57.4	73.9	59.2	76.2
50.3	64.7	52.1	67.1	53.9	69.4	55.7	71.7	57.5	74.0	59.3	76.3
50.4	64.9	52.2	67.2	54.0	69.5	55.8	71.8	57.6	74.1	59.4	76.4
50.5	65.0	52.3	67.3	54.1	69.6	55.9	71.9	57.7	74.3	59.5	76.6
50.6	65.1	52.4	67.4	54.2	69.8	56.0	72.1	57.8	74.4	59.6	76.7
50.7	65.3	52.5	67.6	54.3	69.9	56.1	72.2	57.9	74.5	59.7	76.8
50.8	65.4	52.6	67.7	54.4	70.0	56.2	72.3	58.0	74.6	59.8	77.0
50.9	65.5	52.7	67.8	54.5	70.1	56.3	72.5	58.1	74.8	59.9	77.1
51.0	65.6	52.8	68.0	54.6	70.3	56.4	72.6	58.2	74.9	60.0	77.2
51.1	65.8	52.9	68.1	54.7	70.4	56.5	72.7	58.3	75.0		

GRAIN INSPECTION HANDBOOK

BOOK II, CHAPTER 2

BARLEY

CHAPTER 2

BARLEY

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2.1 GENERAL INFORMATION

a. All quantities referenced in this chapter are approximate unless otherwise specified.

b. Use an approved divider to obtain subportions of a sample for analysis unless otherwise specified.

c. If an approved mechanical shaker is unavailable, inspectors may hand sieve the sample. When hand sieving, 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 30 times.

d. For specific visual reference images, see Chapter 1, section 1.2, Visual Grading Aids.

e. Official personnel shall document inspection information during sampling and grading. See book IV, chapter 2.

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 percentage by weight, a percentage for a specific type of damage, etc.).

2.2 GRADES AND GRADE REQUIREMENTS

There are two classes of barley: Malting barley and Barley. Malting barley is divided into three subclasses: Six-rowed Malting barley, Six-rowed Blue Malting barley, and Two-rowed Malting barley. Barley is divided into three subclasses: Six-rowed barley, Two-rowed barley, and Barley.

All subclasses of Malting barley are divided into four numerical grades. All subclasses of Barley are divided into five numerical grades and U.S. Sample Grade. Special grades are provided to emphasize special qualities or conditions affecting the value of barley and are added to and made a part of the grade designation. They do not affect the numerical or sample grade designation.

TABLE NO. 1 – GRADES AND GRADE REQUIREMENTS – SIX-ROWED MALTING BARLEY AND SIX-ROWED BLUE MALTING BARLEY

	Minimum Limits of -			Maximum Limits of -				
Grade	Test weight per bushel (pounds)	Suitable malting type (percent)	Sound barley 1/ (percent)	Damaged kernels 1/ (percent)	Foreign material (percent)	Other grains (percent)	Skinned and broken kernels (percent)	Thin barley * (percent)
U.S. No. 1	47.0	95.0	97.0	2.0	0.5	2.0	4.0	7.0
U.S. No. 2	45.0	95.0	94.0	3.0	1.0	3.0	6.0	10.0
U.S. No. 3	43.0	95.0	90.0	4.0	2.0	5.0	8.0	15.0
U.S. No. 4	43.0	95.0	87.0	5.0	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.

NOTES: Malting barley shall 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 and Six-rowed Blue Malting barley that does not meet the requirements for U.S. Nos. 1, 2, 3, or 4 Malting shall be graded under the Barley standards (see table 3).

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

TABLE NO. 2 - GRADES AND GRADE REQUIREMENTS - TWO-ROWED MALTING BARLEY

	Minimum Limits of -			Maximum Limits of -			
Grade	Test weight per bushel (pounds)	Suitable malting types (percent)	Sound barley 1/ (percent)	Wild Oats (percent)	Foreign material (percent)	Skinned and broken kernels (percent)	Thin barley * (percent)
U.S. No. 1	50.0	97.0	98.0	1.0	0.5	5.0	5.0
U.S. No. 2	48.0	97.0	98.0	1.0	1.0	7.0	7.0
U.S. No. 3	48.0	95.0	96.0	2.0	2.0	10.0	10.0
U.S. No. 4	48.0	95.0	93.0	3.0	3.0	10.0	10.0

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

NOTES: Malting barley shall 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 shall be graded under the Barley standards (see table 3).

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

TABLE NO. 3 - GRADES AND GRADE REQUIREMENTS - BARLEY

Grade	Minimum Limits of -			Maximum Limits of -			
	Test weight per bushel (pounds)	Sound barley (percent)	Damaged kernels 1/ (percent)	Heat damaged kernels (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:

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

(c) barley; or

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

2.3 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in tables 1, 2, or 3. 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 in alphabetical order;

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

g. Upon request, the word "Plump" with the applicable percentage range.

For the subclass Barley, applicants may request that the percentage of each barley type (i.e., six- and two-rowed) in the mixture be shown in the "Remarks" section of the inspection certificate in order of predominance.

2.4 SPECIAL GRADES

Special grades draw attention to unusual conditions in the grain and are made part of the grade designation. The 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.

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

b. Ergoty Barley. Barley that contains more than 0.10 percent ergot.

   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.

   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.

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.

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

2.5 OPTIONAL GRADE DESIGNATION

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

The optional grade designation for barley shall include the name of the applicable subclass immediately preceding the word "barley" in the grade designation. When applicable, under certain conditions, 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%

2.6 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, and 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, 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 NO. 4

BASIS OF DETERMINATION			
Lot as a Whole	Factors Determined Before the Removal of Dockage	Factors Determined on a Pearled Portion After the Removal of Dockage	Factors Determined After the Removal of Dockage
Distinctly low quality	Distinctly low quality	Blue aleurone layers	Blighted
Heating	Garlicky	Heat-damaged kernels	Broken kernels
Infested	Heating	Injured-by-heat	Class
Odor	Infested	Injured-by-sprout	Damaged kernels
	Kind of Grain	White aleurone layers	Ergot
	Moisture		Foreign material
	Odor		Frost-damaged
	U.S. Sample Grade factors		Injured-by-frost
			Injured-by-mold
			Mold-damaged
			Odor
			Other grains
			Plump barley
			Skinned and broken kernels
			Sound barley
			Smut
			Stones
			Subclass
			Test weight
			Thin barley
			Unsuitable malting type
			Wild oats

A general procedure based on the "Basis of Determination" definition is followed in the inspection and grading of barley. However, the procedure may vary according to the tests required to determine the grade. The following sections of this chapter are arranged in a logical sequence typically followed in the inspection and grading of barley.

2.7 DEFINITION OF BARLEY

Barley is defined as:

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 the United States Grain Standards Act. The term "barley" as used in these standards shall 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. Visually examine the sample 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. No further analysis is necessary on a sample designated as not standardized grain unless a specific factor test is requested.

2.8 HEATING

Barley developing a high temperature from excessive respiration is considered heating. Advanced stage of heating barley will usually have a sour or musty odor. Care should be taken not to confuse barley that is heating with barley that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

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

Certification. Grade heating barley U.S. Sample Grade and record the word "Heating" on the work record and in the "Remarks" section of the certificate.

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 NO. 5

ODOR CLASSIFICATION EXAMPLES		
Sour	Musty	Commercially Objectionable Foreign Odors
Boot	Ground	Animal hides
Fermenting	Insect	Decaying animal and vegetable matter
Insect (acrid)	Moldy	Fertilizer
Pigpen		Fumigant
		Insecticide
		Oil products
		Skunk
		Smoke
		Strong weed

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

Fumigant or insecticide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of barley contains a fumigant or insecticide 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 or insecticide odor persists based on the above criteria.

Final Determinations. The inspector(s) is responsible for making the final determination for all odors. A consensus of experienced inspectors is used, whenever possible, on samples containing marginal odors. The consensus approach is not required if no 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" in the "Remarks" section of the certificate.

2.10 MOISTURE

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 350 grams.

The procedures for performing a moisture determination using the DICKEY-john Grain Analysis Computer GAC 2100 moisture meter are described in book II, chapter 1, section 1.10.

For the class "Barley," select the predominating 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 the certificate to the nearest tenth percent.

2.11 GARLICKY BARLEY

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

Basis of Determination. Determine garlicky before the removal of dockage on a work portion of 500 grams. (Reference: Visual Reference Image Nos. OF-13.0 and OF-13.1)

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.

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

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

Three or more green garlic bulblets or an equivalent of nine dry or partly dry bulblets in a 500-gram portion apply in the determination of the special grade "Garlicky."

Garlic bulblets apply in the determination of "Garlicky" but also function as dockage or foreign material as the case may be.

Certification. When applicable, grade the barley "Garlicky" in accordance with Section 2.4, Special Grades. Upon request, provide the number of garlic bulblets in whole and thirds.

2.12 INFESTED BARLEY

Infested barley is barley that is infested with live weevils or other live insects injurious to stored grain.

The presence of any live weevil or other live insects injurious to stored grain 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.

Live weevils include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. Other live insects injurious to stored grain shall include grain beetles, grain moths, and larvae. (See Chapter 1, Section 1.2, Visual Grading Aids.)

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, see table No. 6.

TABLE NO. 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" in accordance with Section 2.4, Special Grades.

2.13 DISTINCTLY LOW QUALITY

Consider barley 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 barley is of distinctly low quality. This includes a general examination of the barley during sampling and an analysis of the obtained sample(s).

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 and too large to enter the sampling device is considered distinctly low quality.

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 distinctly low quality.

Barley suspected of containing diatomaceous earth is considered distinctly low quality unless the applicant specifically requests an examination to verify the presence of diatomaceous earth. If the laboratory examination verifies that the barley contains diatomaceous earth, the barley is not considered distinctly low quality due to diatomaceous earth. Refer to Program Directive 9180.49, Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel, for additional information regarding the testing of barley for diatomaceous earth.

Certification. Grade distinctly low quality barley as U.S. Sample Grade. Record the words "Distinctly Low Quality" and the reason(s) why in the "Remarks" section of the certificate.

2.14 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 850 - 950 grams. Determine stones on a dockage-free portion. The entire sample of a submitted sample is considered as the lot. Table No. 7 shows the criteria and corresponding visual reference images, tolerance limits, and the appropriate basis of determination. Consider feed pellets and processed grain products as foreign material not "unknown foreign substance." For Distinctly Low Quality, see section 2.13. (Reference: Visual Reference Images OF-1.0, OF-3.0, OF-6.0, OF-8.0, and OF-31.0)

TABLE NO. 7

U.S. SAMPLE GRADE CRITERIA			
	Visual Reference	Number/Weight **1**/	
Criteria	*Image*	*Sample Basis*	Lot Basis **2**/
Any numerical grading factor		Excess of limit for U.S. No. 5	N/A
Animal filth	OF-1.0	10 or more	N/A
Castor Beans	OF-3.0	2 or more	N/A
Cockleburs	OF-6.0	8 or more	N/A
Crotalaria seeds	OF-8.0	3 or more	N/A
Glass		2 or more	N/A
Odor		Presence	N/A
Stones		8 or more or any number in excess of 0.2% by weight	N/A
Unknown foreign substances **3**/	OF-31.0	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, see section 2.13

Certification. Grade barley U.S. Sample Grade when one or more of the limits in table 7 are observed. Record the reason(s) why in the "Remarks" section of the certificate. Record count factors to the nearest whole number.

2.15 DOCKAGE

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 on a portion of 850 - 950 grams.

CHART 1 - PROCEDURE FOR DETERMINING DOCKAGE

Carter Dockage Tester Setup

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

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

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

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

e. Start carter Dockage Tester and pour sample into feed hopper.

f. Aspirated material in air collection pan is dockage.

g. Material over No. 6 riddle, excluding barley, is dockage.

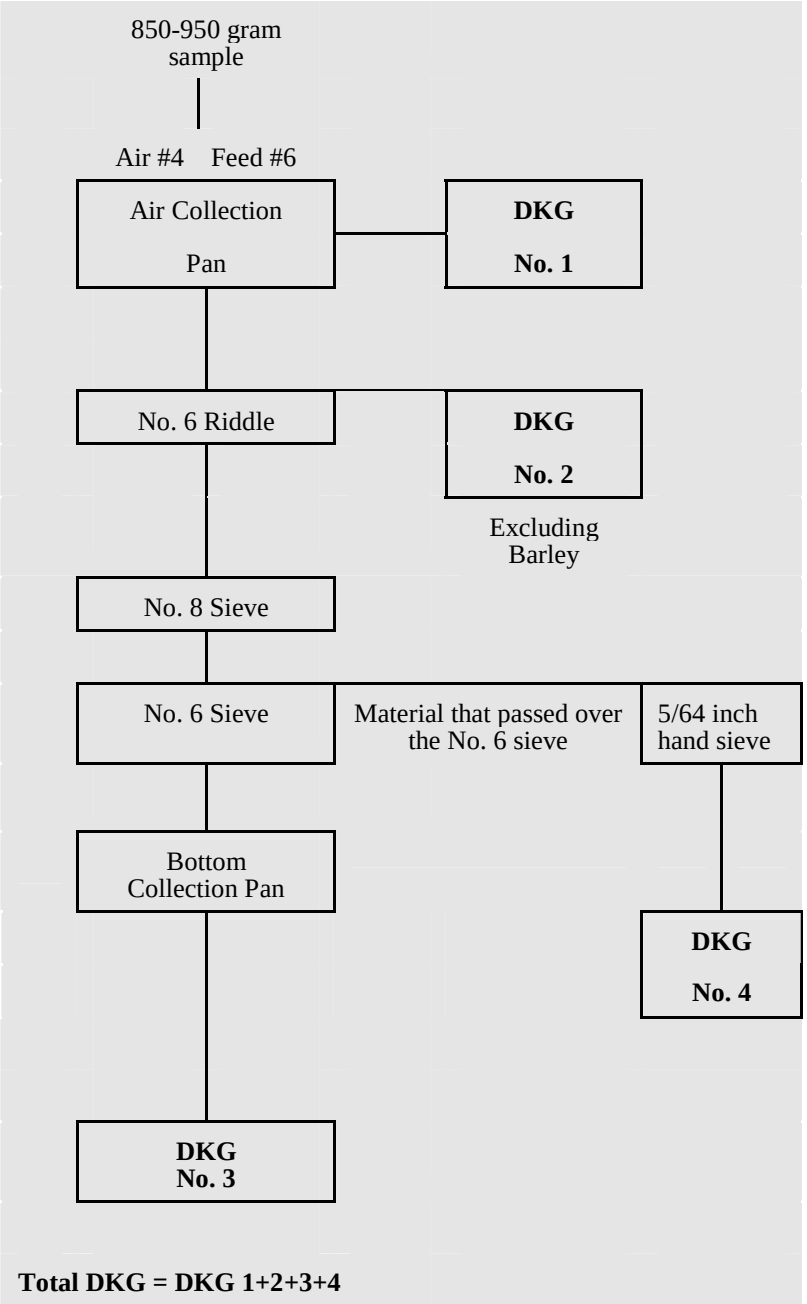
h. Material that passed through the No. 6 sieve (bottom collection pan) is dockage.

i. Examine 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 seed. If so, this material must be rescreened using a 5/64 inch equilateral triangular hole sieve.

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

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

l. 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.



Certification. Record the word "Dockage" and the percentage on the work record in hundredths and on the certificate in accordance with section 2.3, Grade Designations. When the sample contains 0.50 percent or more dockage, record the percentage of dockage on the certificate in half and whole percent with a fraction less than one-half percent disregarded. For example:

0.50 to 0.99 percent is recorded as 0.5 percent, etc.
1.00 to 1.49 percent is recorded as 1.0 percent, etc.

2.16 TEST WEIGHT

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 on a dockage-free portion of sufficient quantity to overflow the kettle.

The procedures for performing a test weight determination and available services are described in book II, chapter 1, section 1.11.

Certification. Record test weight results on the work record as displayed on the electronic scale or in whole and half pounds. Disregard fractions of a half pound. Record the test weight on 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.

2.17 PROCESSING THE WORK SAMPLE

At this point, all tests required to be performed prior to the removal of dockage have been made and the percentage of dockage has been determined. Also, the sample has been test weighed and examined for certain sample grade and special grade factors. Now divide the work sample into fractional portions for other determinations required after the removal of dockage. The following chart and table No. 8 illustrate how the sample is divided into fractional parts using the Boerner divider.

CHART 2 - DIVIDING THE WORK SAMPLE

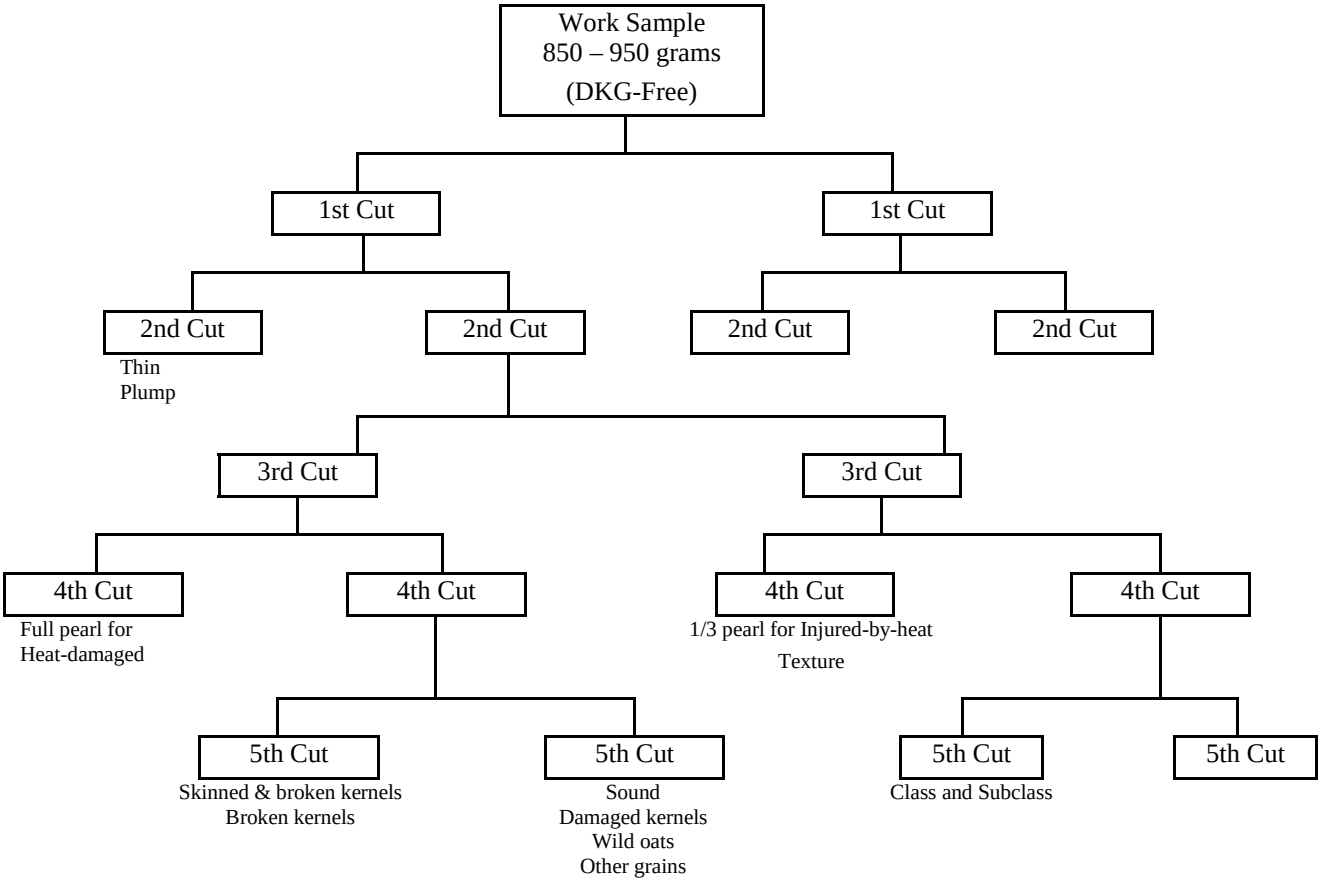


TABLE NO. 8

APPROXIMATE ANALYTICAL PORTION SIZES			
Factors	*Grams*	*Factors*	*Grams*
Blighted	25	Injured-by-mold kernels	25
Broken kernels	25	Kernel texture	50
Class and subclass	25	Kind of grain 1/	25
Damaged kernels	25	Other grains	25
Ergot	250	Plump barley	250
Foreign material	25	Skinned & broken kernels	25
Garlic bulblets 1/	500	Smutty	500
Heat-damaged kernels	50	Sound barley	25
Injured-by-frost kernels	25	Thin barley	250
Injured-by-heat kernels	50	Wild oats	25

1/ Determined before the removal of dockage.

2.18 BLIGHTED BARLEY

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. (Reference: Visual Reference Image No. B-1.0)

Certification. When applicable, record the word "Blighted" on the certificate in accordance with Section 2.4, Special Grades.

2.19 ERGOTY BARLEY

Barley that contains more than 0.10 percent ergot.

Ergot is a hard, reddish-brown or black grain-like mass of certain parasitic fungi that replaces the kernels of barley. (Reference: Visual Reference Image No. OF-12.0)

Basis of Determination. Determine ergoty on a dockage-free portion of 250 grams. Ergot also functions as foreign material.

Certification. When applicable, record the word "Ergoty" on the certificate in accordance with Section 2.4, Special Grades. Upon request, record the percentage of ergot to the nearest hundredth percent in the "Remarks" section of the certificate.

2.20 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.

Smut is a plant disease characterized by the appearance of smut balls or smut spores.

Basis of Determination. Determine the appearance of smutty barley on a dockage-free work portion. Determine the weight of smut balls on a dockage-free portion of 500 grams. Smut balls also function as foreign material.

Certification. When applicable, record the word "Smutty" on the certificate in accordance with Section 2.4, Special Grades. Upon request, record the percentage of smut balls to the nearest hundredth percent in the "Remarks" section of the certificate.

2.21 CLASS AND SUBCLASS

Barley is divided into two classes: Malting barley and Barley and each class is divided into three subclasses as follows:

a. *Malting Barley. Barley of the six-rowed or two-rowed malting type. The class Malting barley is divided into three subclasses:*

(1) *Six-rowed Malting Barley. Barley that has a minimum of 95.0 percent of a six-rowed suitable malting type that has 90.0 percent or more of kernels with white aleurone layers 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, and 0.1 percent heat-damaged kernels. Six-rowed Malting barley shall not be infested, blighted, ergoty, garlicky, or smutty as defined in § 810.107(b) and § 810.206.*

(2) *Six-rowed Blue Malting Barley. Barley that has a minimum of 95.0 percent of a six-rowed suitable malting type that has 90.0 percent or more of kernels with blue aleurone layers 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, and 0.1 percent heat-damaged kernels. Six-rowed Blue Malting barley shall not be infested, blighted, ergoty, garlicky, or smutty as defined in § 810.107(b) and § 810.206.*

(3) *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 shall not be infested, blighted, ergoty, garlicky, or smutty as defined in § 810.107(b) and § 810.206.*

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 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. (Reference: Visual Reference Image No. (B) OF-2.3)

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.

Six-rowed barley 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. (Reference: Visual Reference Image No. (B) OF-2.3)

Two-rowed and Six-rowed Malting Varieties.

In addition to the determination of Two-rowed and Six-rowed kernel characteristics, the inspector must determine if the subclasses Six-rowed Malting barley, Six-rowed Blue Malting barley, and Two-rowed Malting barley contain sufficient quantities of suitable malting varieties.

The subclasses Six-rowed Malting barley and Six-rowed Blue Malting barley may contain no more than 5.0 percent of Two-rowed Malting barley or 5.0 percent of the class Barley.

The subclass Two-rowed Malting barley may contain not more than 3.0 percent of Six-rowed Malting barley or 3.0 percent of Two- or Six-rowed barley in grades U.S. Nos. 1 and 2, and not more than 5.0 percent of Six-rowed Malting barley or 5.0 percent of Two- or Six-rowed barley in grades U.S. No. 3 and 4.

Applicants for service may request either the malting standard (table Nos. 1 and 2) or the barley standards (table No. 3) for the class Malting barley.

Suitable Malting Type. In addition to varieties recommended by the American Malting Barley Association (AMBA), a malting grade designation may be applied to other malting varieties that meet quality requirements for malting. Refer to the AMBA website at http://www.ambainc.org/ni/2004%20kymbv.pdf for a current list of suitable malting varieties.

Certification. When barley is not of a suitable malting type (variety), record the words "Unsuitable Malting Type" on the work record and in the "Remarks" section of the certificate. When the applicant requests the application of the barley standards (table No.3) to a malting type barley, note this request on the work record but not on the certificate.

2.22 MALTING FACTORS

In addition to the grading factors listed in the grade and grade requirements tables (section 2.2), other limits have been established for malting barley. Factors, along with the grade factors listed in the tables, are determined before designating the class or subclass of barley. Upon request, malting factors may also be determined on barley that is not considered as a malting type.

TABLE NO. 9

MALTING FACTORS							
	Maximum limits of:						
Subclass	Frost Damage	Injured-by-Frost	Heat Damage	Injured-by-Heat	Mold Damage	Injured-by-Mold	Kernel Texture
Six-rowed Malting and Six-rowed Blue Malting	0.4%	1.9%	0.1%	0.2%	---	---	90%
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	50 g

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/or distinctly discolored black or brown by frost*. (Reference: Visual Reference Image No. B-3.1)

Injured-by-Frost Kernels. *Kernels and pieces of barley kernels that are distinctly indented, immature or shrunken, or discolored to a light green in color as a result of frost before maturity*. (Reference: Visual Reference Image No. B-3.0)

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

a. Frost-Damaged Kernel Limits.

(1) The class Malting barley may contain not more than 0.4 percent of frost-damaged kernels.

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

b. Injured-by-Frost Kernel Limits.

(1) The class Malting barley may contain not more than 1.9 percent of injured-by-frost kernels that may include not more than 0.4 percent of frost-damaged kernels.

(2) Malting barley exceeding the limit for injured-by-frost kernels no longer qualifies as malting barley. Injured-by-frost kernels are not considered as damaged and are not scored against sound barley.

Certification. When malting barley exceeds the limits for "malting" because of frost-damaged kernels or injured-by-frost kernels, record the reason(s) on the work record and in the "Remarks" section of the certificate.

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*. (Reference: Visual Reference Image No. B-5.1)

Injured-by-Heat Kernels. *Kernels, pieces of barley kernels, other grains, and wild oats that are slightly discolored as a result of heat*. (Reference: Visual Reference Image No. B-5.0)

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

a. Determining Injured-by-Heat Kernels.

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

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

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

(4) The class Malting barley may contain not more than 0.2 percent of injured-by-heat kernels.

b. Determining Heat-Damaged Kernels.

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

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

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

(4) The class Malting barley may contain not more than 0.1 percent of heat-damaged kernels.

Certification. When malting barley does not meet the malting requirements because it exceeds the limit for heat-damaged kernels and/or injured-by-heat kernels, record the reason(s) on the work record and in the "Remarks" section of the certificate.

See book II, chapter 1, section 1.14, for the general operating procedures of a barley pearler.

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. (Reference: Visual Reference Image No. B-1.0)

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

The quality factor injured-by-mold applies to Two-rowed Malting barley only. Injured-by-mold kernels are characterized by mold spores and have a weathered appearance. (Reference: Visual Reference Image No. B-7.0)

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

a. Mold-Damaged Kernel Limits.

(1) The subclass Two-rowed Malting barley may contain not more than 0.4 percent of mold-damaged kernels.

(2) Mold-damaged kernels in Six-rowed Malting barley and Six-rowed Blue Malting barley are scored as damaged kernels and against sound barley limits.

b. Injured-by-Mold Kernel Limits.

(1) The subclass Two-rowed Malting barley may contain not more than 1.9 percent of injured-by-mold kernels that may include not more than 0.4 percent of mold-damaged kernels.

(2) Two-rowed Malting barley exceeding the limit for injured-by-mold kernels no longer qualifies as malting barley. Injured-by-mold kernels are not considered as damaged and are not scored against sound barley.

Certification. When malting barley does not meet the requirements for malting because it exceeds the limits for malting because of mold-damaged kernels or injured-by-mold kernels, record the reason(s) why on the work record and in the "Remarks" section of the certificate.

Kernel Texture.

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

Method of Determination.

a. Pour a 50-gram portion into the pearler.

b. Set the timer for a "1/3 pearl" and turn pearler on.

c. After pearling, reweigh and then examine the kernels for texture.

Six-rowed Malting Barley.

Six-rowed Malting barley consists of 90.0 percent or more of kernels with white aleurone layers.

Six-rowed Blue Malting Barley.

Six-rowed Blue Malting barley consists of 90.0 percent or more of kernels with blue aleurone layers.

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

Certification. When barley is not considered "malting" because of white or blue aleurone layers, record the reason(s) why on the work record and in the "Remarks" section of the certificate.

2.23 PLUMP BARLEY

Plump barley is barley that remains on top of a 6/64 x 3/4 inch slotted-hole sieve after sieving according to procedures prescribed in FGIS instructions.

"Plump" is determined only upon request. Any barley may qualify for plump.

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

Methods of Determination.

a. Mechanical Sieving Method.

(1) Mount the sieve and bottom pan on the mechanical sieve shaker.

(2) Set the stroke counter for 30 strokes.

(3) Follow the procedure described in Book II, Chapter 1, Section 1.13, Mechanical Sieve Shaker.

(4) Return the material lodged in the perforations to the barley which remained on top of the sieve.

(5) All material remaining on top of the sieve is "plump" barley.

b. Hand Sieving Method.

(1) Mount the sieve on a bottom pan.

(2) Place the 250-gram portion in the center of the sieve.

(3) Hold the sieve level in both hands with elbows close to the sides and the sieve perforations parallel to the direction of movement.

(4) In a steady motion, move the sieve from left to right approximately 10 inches and then from right to left.

(5) Repeat this operation 30 times.

(6) Return the material lodged in the perforations to the barley which remained on top of the sieve.

(7) All material remaining on top of the sieve is "plump" barley.

Certification. When requested, record the actual percentage of plump barley on the work record. Show the word "Plump" and the applicable percentage range in the "Remarks" section of the certificate. Percentage ranges are recorded as: Below 50 percent, 50 to 55 percent, 56 to 60 percent, 61 to 65 percent, etc. Upon request, "Plump" barley may be certificated to the nearest whole percent in conjunction with the applicable range statement.

2.24 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 that 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 barley on a dockage-free portion of 250 grams. Use either the mechanical sieving method or the hand sieving method to determine thin. Return all material lodged in the perforations of the sieve to the barley remaining on top of the sieve. The procedures for using either of these methods are described in section 2.23.

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

2.25 SKINNED AND BROKEN KERNELS

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 on a dockage-free portion of 25 grams.

Skinned and broken kernels is a grade determining factor in the subclasses Six-rowed Malting barley, Six-rowed Blue Malting barley, and Two-rowed Malting barley. (Reference: Visual Reference Image No. (B) OF-2.1)

Certification. When malting barley does not meet the requirements for malting because it exceeds the limit for skinned and broken kernels, record the percentage of skinned and broken kernels on the work record and in the "Remarks" section of the certificate to the nearest tenth percent.

2.26 SOUND BARLEY

Kernels and pieces of barley kernels that are not damaged.

Basis of Determination. Determine sound barley 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, and

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

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

2.27 DAMAGED KERNELS

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 on a dockage-free portion of 25 grams.

The factor damaged kernels is a grade determining factor in the subclasses Six-rowed Malting barley, Six-rowed Blue Malting barley, Six-rowed barley, Two-rowed barley, and the class Barley. Damaged kernels are not considered as sound in any class or subclass of barley.

In general, kernels of barley, other grains, or wild oats are considered 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" (see section 2.18). (Reference: Visual Reference Image No. B-1.0)

Malt-Damaged Kernels. Kernels and pieces of barley kernels which have undergone the malting process and show any degree of sprout. (Reference: Visual Reference Image No.OF-35)

Frost-Damaged Kernels. Kernels and pieces of barley kernels that are badly shrunken and/or distinctly discolored black, brown, or green by frost. (Reference: Visual Reference Image No. B-3.1)

Mold-Damaged Kernels. Kernels and pieces of barley kernels 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 mold-damaged kernels as "Blighted" (see section 2.18.) (Reference: Visual Reference Image No. B-1.1)

Germ-Damaged Kernels (Sick and/or Mold). Kernels, pieces of barley kernels 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. (Reference: Visual Reference Image No. B-4.0)

Heat-Damaged Kernels. Kernels, 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. (See section 2.22) (Reference: Visual Reference Image No. B-5.1)

Weevil or Insect-Bored. Weevil or insect-bored barley is kernels and pieces of barley kernels which have been bored or tunneled by insects. (Reference: Visual Reference Image No. B-6.0)

Mold-like Substance. Mold-like substance is 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 which have sprouted or which have swelling over the germ and after examination show sprout. (Reference: Visual Reference Image No. B-8.0)

Certification. Record the percent of damaged kernels on the work record and the certificate to the nearest tenth percent.

2.28 FOREIGN MATERIAL

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 on a dockage-free portion of 25 grams.

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

2.29 WILD OATS

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

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

Wild Oats Characteristics. Wild oats are usually identified by their slender kernels and twisted awns--so called "sucker mouths"--and basal hairs or bristles on the germ end of the kernel. (Reference: Visual Reference Image No. OF-28.0)

Wild oats are a grade determining factor only in the subclass Two-rowed Malting barley. Wild oats are deducted from the percentage of sound barley in all other classes and subclasses of barley.

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

2.30 BROKEN KERNELS

Broken kernels are barley kernels with more than 1/4 of the kernel removed.

Basis of Determination. Determine broken kernels 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 the certificate to the nearest tenth percent.

2.31 OTHER GRAINS

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

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

Other grains is a grading factor in the subclasses Six-rowed Malting barley and Six-rowed Blue Malting barley. Other grains are not considered as sound in all classes and subclasses of barley.

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

2.32 OFFICIAL CRITERIA

"Injured-by-sprout" analysis is an "official criteria" factor that is determined only upon request and does not effect 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. The "injured-by-sprout" analysis shall be performed 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.

a. Determining "Injured-by-Sprout" Pearling Time.

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

For 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.

b. 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 criteria 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. (Reference: Visual Reference Image No. (B) OF-2.4)

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

Certification. Record the percentage of “injured-by-sprout” kernels on the work record and the certificate to the nearest tenth percent. Results are certified in the “Remarks” section of the certificate with the following statement:

“This barley contains _____ % of injured-by-sprout kernels.”

GRAIN INSPECTION HANDBOOK

BOOK II, CHAPTER 3

CANOLA

CHAPTER 3

CANOLA

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3.1 GENERAL INFORMATION

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.

a. All quantities referenced in this chapter are approximate unless otherwise specified.

b. Use an approved divider to obtain subportions of a sample for analysis unless otherwise specified.

c. 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 30 times.

d. For specific Visual Reference Images, see Chapter1, section 1.2, Visual Grading Aids.

e. Official inspection personnel shall document inspection information during sampling and grading. See book IV, chapter 2.

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 percentage by weight, a percentage for a specific type of damage, etc.). Furthermore, applicants may request the percentage of erucic acid, the amount of glucosinolates, and the percentage of oil.

3.2 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 of canola. Special grades do not affect the numerical or sample grade designation.

TABLE NO. 1 - GRADES AND GRADE REQUIREMENTS - 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:

U.S. Sample Grade shall be 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 or more 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.

3.3 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in table 1. 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), and

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

3.4 SPECIAL GRADES

Special grades identify unusual conditions in grain and are part of the grade designation. The canola standards include two special grades:

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

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

b. Infested Canola. Label canola "Infested" if it is infested with live weevils or other live insects injurious to stored grain.

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

3.5 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, canola may be certified 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

3.6 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, dockage, garlic, live insect infestation, large stones, moisture, temperature, and 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 NO. 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 Heating Infested Odor	Distinctly low quality Dockage Garlicky Heating Infested Kind of Grain Moisture Odor U.S. Sample Grade factors	Conspicuous Admixture Ergot Erucic acid content Glucosinolates Odor Oil Sclerotinia Stones	Damaged kernels (total) Distinctly green kernels Heat-damaged kernels Inconspicuous admixture Odor

3.7 DEFINITION OF CANOLA

Canola is defined as:

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.

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

Applicants may request that the glucosinolate content be quantitatively determined using a gas chromatography (GC) method at the FGIS Technical Services Division (TSD), Analytical, Reference, and Testing Services (ARTS). Details are provided in section 3.22. The GC analysis is independent of the grade. Final grading of the sample **should not** be delayed pending the GC result.

c. Erucic Acid. 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 ARTS' Commodity Testing Laboratory (CTL). Details are provided in section 3.22. 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. No further analysis is necessary on a sample designated as not standardized grain 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 sections 3.21 and 3.22 for those instances when an applicant requests quantitative analyses for glucosinolates and/or erucic acid.

3.8 INFESTED CANOLA

Infested canola is canola that is infested with live weevils or other live insects injurious to stored grain.

The presence of any live weevil or other live insects injurious to stored grain 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 sample is insect free.

Live weevils include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. Other live insects injurious to stored grain shall include grain beetles, grain moths, and larvae. (See Chapter 1, Section 1.2, Visual Grading Aids.)

Basis of Determination. Determine infestation on the lot as a whole and/or before the removal of dockage on 500 grams. For insect tolerances, see table No. 3.

TABLE NO. 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, record the word "Infested" on the certificate in accordance with Section 3.4, Special Grades.

3.9 HEATING

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. Care should be taken not to confuse canola that is heating with canola that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

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

Certification. Grade heating canola as U.S. Sample Grade and record the word "Heating" in the "Remarks" section of the certificate.

3.10 ODOR

Basis of Determination. Determine odor on evidence obtained at the time of sampling, on the sample either before or after the removal of dockage, or on the crushed strips (used to determine heat damage and distinctly green damage). When the crushed strips are used, determine the odor immediately after crushing.

TABLE NO. 4

ODOR CLASSIFICATION EXAMPLES		
Sour	Musty	Commercially Objectionable Foreign Odors
Boot	Ground	Animal hides
Fermenting	Insect	Decaying animal and vegetable matter
Insect (acrid)	Moldy	Fertilizer
Pigpen		Fumigant
Smoke 1/		Insecticide
		Oil products
		Skunk
		Smoke
		Strong weed

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

Fumigant or insecticide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of canola contains a fumigant or insecticide 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 or insecticide odor persists based on the above criteria.

Final Determination. The inspector(s) is responsible for making the final determination for all odors. A consensus of experienced inspectors is used, whenever possible, on samples containing marginal odors. The consensus approach is not required if no 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" in the "Remarks" section of the certificate.

3.11 ANIMAL FILTH, GLASS, AND UNKNOWN FOREIGN SUBSTANCES

Basis of Determination. Determine animal filth, glass, and unknown foreign substances before the removal of dockage on a work portion of 500 grams.

Certification. Grade canola "U.S. Sample Grade" if the level of animal filth, glass, and unknown foreign substances exceeds the limits set forth in table 1 and report the actual count.

3.12 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.

Basis of Determination. Determine garlicky before the removal of dockage on a work portion of 500 grams. (Reference: Visual Reference Image Nos. OF-13.0 and OF-13.1).

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.

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

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

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

Certification. When applicable, grade the canola "Garlicky" in accordance with Section 3.4, Special Grades. Upon request, provide the number of garlic bulblets in whole and thirds.

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. This includes a general examination of the canola during sampling and an analysis of the obtained sample(s).

a. 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 distinctly low quality.

b. 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 distinctly low quality.

Canola suspected of containing diatomaceous earth is considered distinctly low quality unless the applicant specifically requests an examination to verify the presence of diatomaceous earth. If the laboratory examination verifies that the canola contains diatomaceous earth, then the canola is not considered distinctly low quality due to diatomaceous earth. Refer to Program Directive 9180.49, Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel, for additional information regarding the testing of canola for diatomaceous earth.

Certification. Grade distinctly low quality canola as U.S. Sample Grade. Record the words "Distinctly Low Quality" and the reason(s) why in the "Remarks" section of the certificate.

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 No. 5 shows the criteria and corresponding interpretive live slides, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, bulgur, etc.), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain shall function as "unknown foreign substance."

TABLE NO. 5

U.S. SAMPLE GRADE CRITERIA			
Criteria	*Visual Reference Image*	Number/Weight **1**/	
		Sample Basis	Lot Basis **2**/
Any numerical grading factor		Excess of limit for U.S. No. 3	N/A
Animal filth	OF-1.0	4 or more	N/A
Glass		1 or more	N/A
Odor		Presence	N/A
Unknown foreign substances **3**/	OF-31.0	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, see section 3.13

Certification. Grade canola U.S. Sample Grade when one or more of the limits in table 5 are observed. Record the reason(s) why in the "Remarks" section of the certificate. Record count factors to the nearest whole number.

3.15 MOISTURE

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 350 grams.

The procedures for performing a moisture determination using the DICKEY-john Grain Analysis Computer GAC 2100 moisture meter are described in book II, chapter 1, section 1.10.

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

3.16 DOCKAGE AND CONSPICUOUS ADMIXTURE

a. Dockage. Dockage is:

(1) All material removed by aspiration;

(2) Coarse material, except threshed and sprouted kernels of canola, that passed over the riddle; and

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

b. Conspicuous Admixture. Conspicuous admixture is all matter other than canola, including but not limited to ergot, sclerotinia, and stones, which is conspicuous and readily distinguishable from canola and which remains in the sample after the removal of machine separated dockage.

The adjusted percentage of conspicuous admixture is added to the percentage of machine separated dockage in the computation of total dockage (refer to 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.

CHART 1 - PROCEDURE FOR DETERMINING DOCKAGE

STEP 1. Carter Dockage Tester

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

b. Insert No. 000 riddle in the riddle carriage and No. 4 sieve in the top sieve carriage.

c. Start carter Dockage Tester and pour 250 gram sample into feed hopper.

d. Return any kernels that may be caught in the riddle to the cleaned portion.

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

STEP 2. Reclaim Seed

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

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.

Material through the 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 the material passing through the slotted-hole sieve to the dockage.

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

c. Determine dockage/clean canola.

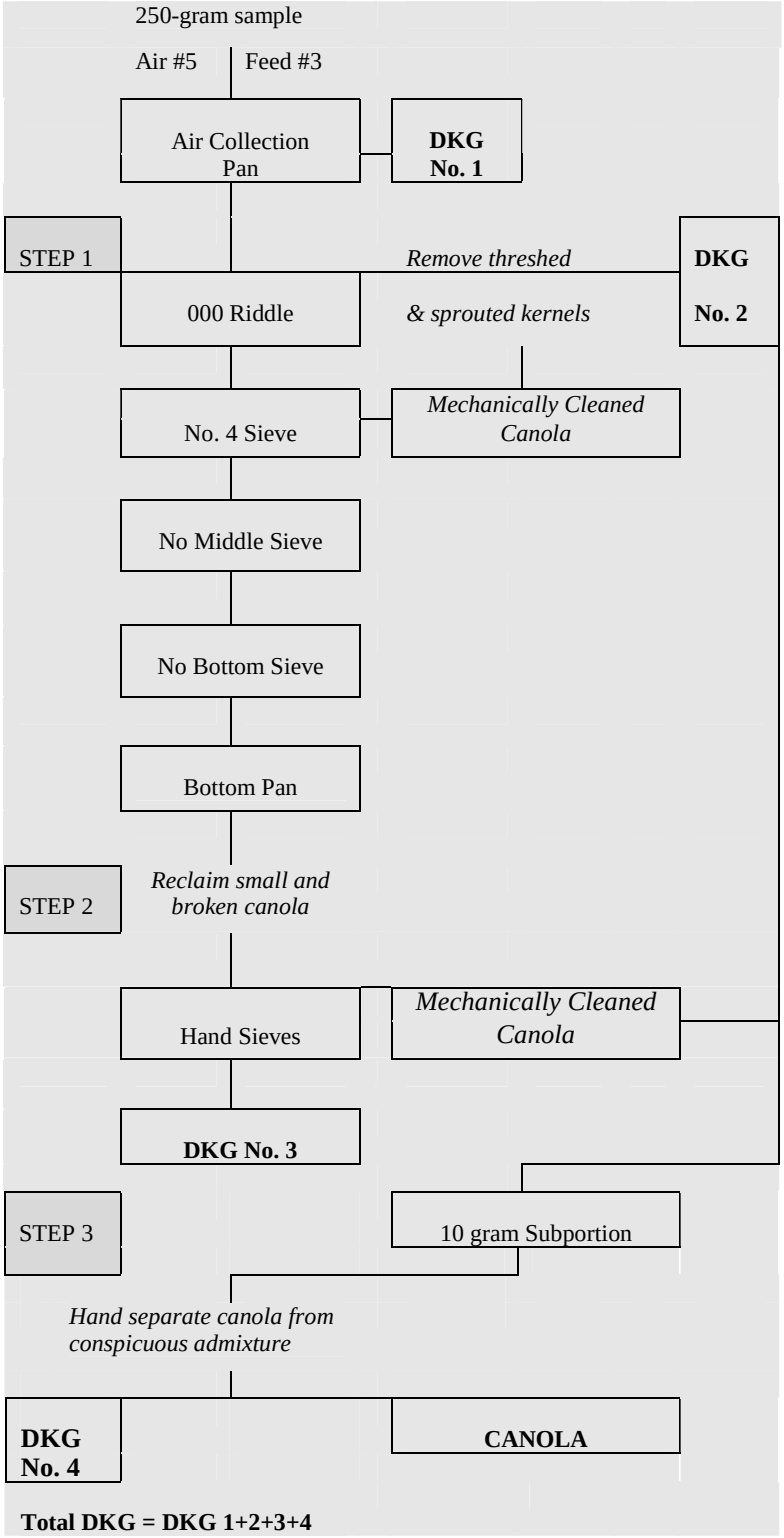
STEP 3. Handpick (Conspicuous Admixture)

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 stones, ergot, and sclerotinia (refer to section 3.16 for details).



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

Computing Total Dockage. In computing the total dockage, all mechanically separated dockage (as removed by the Carter Dockage Tester, mechanical shaker, and hand sieves) is computed on the basis of the sample as a whole. The percentage of conspicuous admixture (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 mechanically separated dockage.

Example

Original sample weight	250 grams
Weight of mechanically separated dockage	24.70 grams
Weight 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.

(24.70 g ÷ 250 g) 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 stones, ergot, sclerotinia, and any other conspicuous admixture ÷ weight of handpicked sample) x 100 = percent conspicuous admixture.

(0.20 g ÷ 10.24 g) 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) (round to 11.6%)

1/ Record the adjusted percentage of conspicuous admixture on the certificate.

Certification. Record the word "Dockage" and the percentage to the nearest tenth percent in accordance with Section 3.3, Grade Designations. Also record the adjusted percentage of conspicuous admixture to the nearest tenth percent.

3.17 STONES, ERGOT, AND SCLEROTINIA

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

Ergot. Ergot is a hard, reddish-brown or black grain-like mass of certain parasitic fungi that replaces the kernels of certain grains. (Reference: Visual Reference Image No. OF-12.0)

Sclerotinia. Sclerotinia are the dark-colored black resting bodies of the fungi Sclerotinia and Claviceps. (Reference: Visual Reference Image No. OF-32.0)

Basis of Determination. Make the determination for ergot, stones, and sclerotinia on the handpicked portion used in the determination of conspicuous admixture (refer to Section 3.16, Dockage and Conspicuous Admixture, step 3).

Computing Stones, Ergot, and Sclerotinia. To compute the percentages of stones, ergot, and sclerotinia, proceed as follows:

Example

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

a. (Weight of stones ÷ weight of handpicked sample) x 100 = percent of stones.

Percent of stones x change of base factor = adjusted percent of stones

(0.13 g ÷ 10.24 g) x 100 = 1.27% stones.

1.27 x 0.90 = 1.14% stones (adjusted)

b. (Weight of ergot ÷ weight of handpicked sample) x 100 = percent of ergot.

Percent of ergot x change of base factor = adjusted percent of ergot

(0.02 g ÷ 10.24 g) x 100 = 0.20% ergot.

0.20 x 0.90 = 0.18% ergot (adjusted)

c. (Weight of sclerotinia ÷ weight of handpicked sample) x 100 = percent of sclerotinia.

Percent of sclerotinia x change of base factor = adjusted percent of sclerotinia

(0.03 g ÷ 10.24 g) x 100 = 0.29% sclerotinia.

0.29 x 0.90 = 0.26% sclerotinia (adjusted)

Certification. Record the percentage of stones, ergot, and sclerotinia on the certificate to the nearest hundredth percent.

3.18 PROCESSING THE WORK SAMPLE

At this point, determinations have been made for kind of grain, infestation, heating, odor, garlic bulblets, sample grade criteria, moisture, dockage, conspicuous admixture, sclerotinia, stones, and ergot. Now divide the work sample into fractional portions for those determinations required after the removal of machine separated dockage and conspicuous admixture. The following chart and table No. 6 illustrate how the sample is divided into fractional parts using the Boerner divider.

CHART 2 - DIVIDING THE WORK SAMPLE

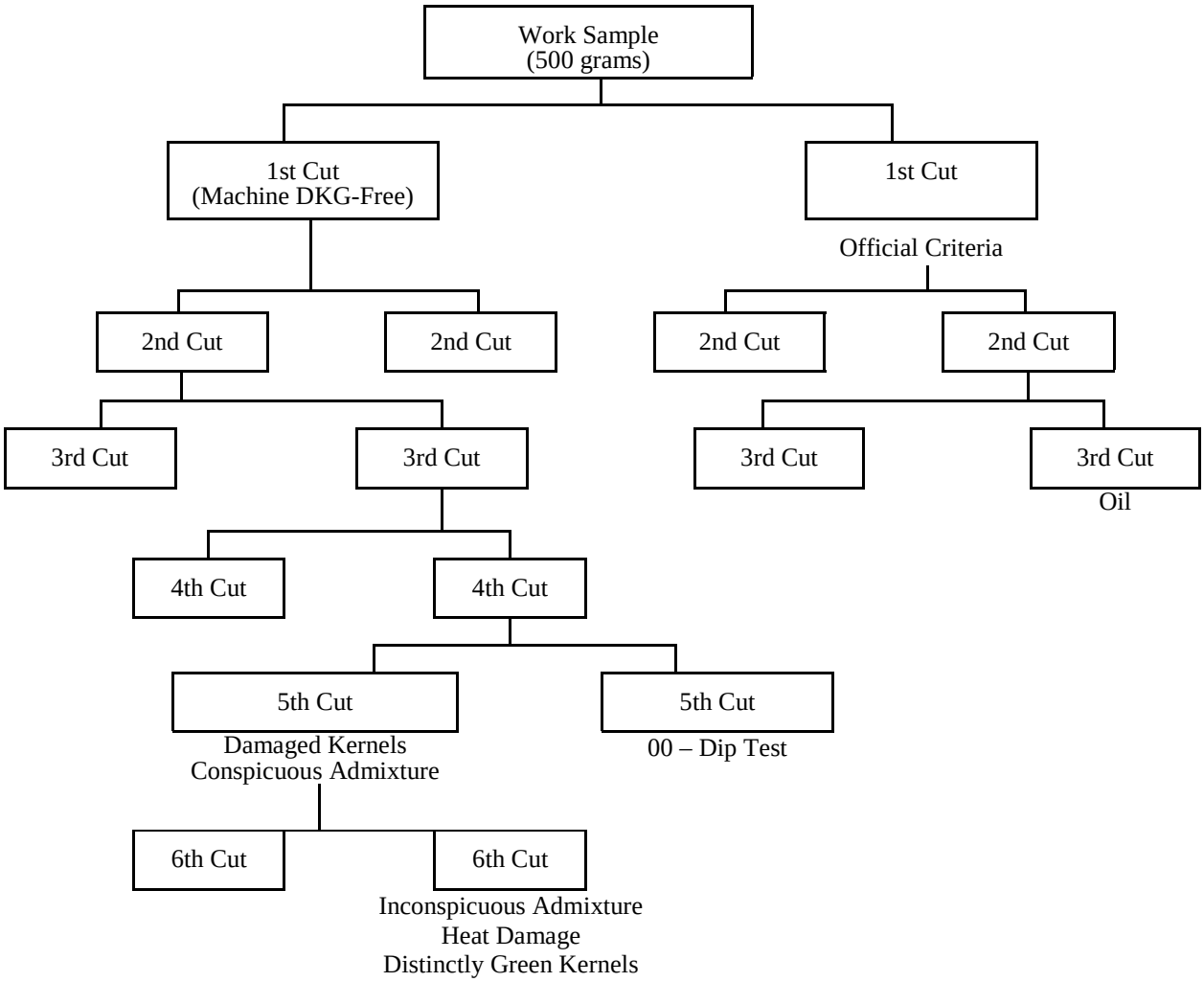


TABLE NO. 6

APPROXIMATE ANALYTICAL PORTION SIZES	
Factors	*Grams*
Damaged kernels	10
Heat-damaged kernels	5
Distinctly green kernels	5
Inconspicuous admixture	5

3.19 DAMAGED KERNELS

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 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. Note that this portion must be reweighed.

Damage must be distinct. In general, a kernel of canola is considered damaged 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.

Distinctly Green Kernels. Canola and pieces of canola which, after being crushed, exhibit a distinctly green color. (Reference: Visual Reference Image No. Canola 1.0).

Heat-Damaged Kernels. Canola and pieces of canola which, after being crushed, exhibit that they are discolored and damaged by heat. (Reference: Visual Reference Image No. Canola 2.0).

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

STEP 1 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. (Reference: Visual Reference Images Nos. Canola 3.0 and Canola 4.0).

STEP 2 Cut down the balance of the 10-gram portion to 5 grams.

STEP 3 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.

STEP 4 After each filling (total of 5 fillings when using the 100-hole board) and before crushing, tape and observe for inconspicuous admixture 1/.

STEP 5 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 1/).

STEP 6 After the strip (all 5 strips when using the 100-hole board) has been crushed and kernels counted, calculate the percentage 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 percentage of distinctly green and heat-damaged kernels on the basis of count.

Calculation. To compute damaged kernels (total), add the percentage of distinctly green, heat-damaged, and other-damaged kernels of canola.

Example

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.

0.10 g ÷ 10.04 g = 0.0099 x 100 = 0.99% other-damaged kernels.

b. 500 - number of noncanola kernels = number of canola kernels.

500 - 10 = 490 canola kernels.

1/ Refer to Section 3.20, Inconspicuous Admixture, for details.

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 percent damaged kernels (add in hundredths) (round to 8.5%)

Certification. Record the percentages of heat-damaged kernels, distinctly green kernels, and damaged kernels (total) on the certificate to the nearest tenth percent.

3.20 INCONSPICUOUS ADMIXTURE

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 on the 5-gram portion used in the determination for heat-damaged and distinctly green kernels (refer to Section 3.19, Damaged Kernels, steps 2-4).

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 inconspicuous admixture.

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.

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

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

Certification. Record the percentage of inconspicuous admixture on the certificate to the nearest tenth percent.

3.21 GLUCOSINOLATES

Testing for glucosinolates 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 glucosinalate 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 to only 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. Stop watch 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 85° F).

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 (see procedure, step b, in this section).

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. The procedures for screening canola samples for glucosinolate levels and for testing Clinistix strips for enzymatic activity are as follows:

a. <u>Procedure for Screening Canola Samples for Glucosinolate Levels</u>.

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

(2) 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.

(3) Grind the sample in two 15-second bursts. Invert and shake the grinder gently between grinding bursts.

(4) 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.

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

(6) 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.

(7) 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 (see Certification 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 (see Certification in this section).

b. Procedure for Testing Clinistix Strips for Enzymatic Activity.

(1) 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 40 ° F.

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

(3) 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.

3.22 OFFICIAL CRITERIA

a. Glucosinolate Analysis - Gas Chromatography (GC) Method. Glucosinolate analysis using the GC method is available at the FGIS Technical Center as a separate test, independent of grade. The Technical Center 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 certificated 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 shall 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 ARTS at the FGIS Technical Center can perform GC analysis. If GC analysis is requested, submit the portion to ARTS at the FGIS Technical Center in Kansas City, Missouri:

TSD, ARTS
USDA, GIPSA, FGIS Technical Center
10383 N. Ambassador Drive
Kansas City, Missouri 64153-1394
Fax: (816) 891-7314
Tel: (816) 891-0437

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

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.

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.

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 work record and in the "Remarks" section of the certificate to the nearest tenth of a micromole/gram.

Example: Gas chromatography glucosinolates 20.0 micromoles.

b. Erucic Acid. The long-chain fatty acid, erucic acid ($C_{22}H_{43}O_2$), 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 superglycerinated fully hydrogenated rapeseed oil. A low level is desired for the production of salad and vegetable oils, margarine, and shortening.

As stated in Section 3.7, Definition of Canola, an erucic acid test suitable for grading purposes does not exist. However, an analysis for erucic acid content is available at ARTS as a separate test, independent of grade. ARTS 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 erucic acid results are certificated independent of the grade certificate.

If the erucic acid 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 shall 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 erucic acid 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 CTL in Kansas City, Missouri:

USDA, GIPSA, FGIS
Technical Services Division, ARTS
Commodity Testing Laboratory
10383 North Ambassador Drive
Kansas City, Missouri 64153-1394
Fax: (816) 891-7314
Tel: (816) 891-0437

If an applicant requests both erucic acid and GC analysis for glucosinolates, submit a portion of 300 grams free of machine separated dockage to ARTS (refer to the sample preparation and mailing instructions given for glucosinolate analysis using the GC method).

Certification. Certify the erucic acid content to the nearest tenth percent. See 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 ARTS.

If an applicant requests an oil analysis and GC analysis for glucosinolates, submit a portion of 300 grams free of machine separated dockage to ARTS (refer to the sample preparation and mailing instructions given in Section 3.21, Glucosinolates).

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

Example: Oil content 38.9%.

d. Test Weight. 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 on a dockage-free portion of sufficient quantity to overflow the kettle.

Certification. Record test weight results in the "Remarks" section 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.

GRAIN INSPECTION HANDBOOK

BOOK II, CHAPTER 4

CORN

CHAPTER 4

CORN

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4.1 GENERAL INFORMATION

a. All quantities referenced in this chapter are approximate unless otherwise specified.

b. Use an approved divider to obtain subportions of a sample for analysis unless otherwise specified.

c. For specific Visual Reference Images, see Chapter 1, section 1.2, Visual Grading Aids.

d. Official inspection personnel shall document inspection information during sampling and grading. See book IV, chapter 2.

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 percentage by weight, a percentage for a specific type of damage, etc.).

4.2 GRADES AND GRADE REQUIREMENTS

Corn is divided into three classes based on color: Yellow corn, White corn, and Mixed corn. Each class is divided into five U.S. numerical grades and U.S. Sample Grade. Special grades are provided to emphasize special qualities or conditions affecting the value and are added to and made a part of the grade designation. They do not affect the numerical or sample grade designation.

TABLE NO. 1 - GRADES AND GRADE REQUIREMENTS - CORN

Grade	Minimum Limits of -	Maximum Limits of -		
	Test weight per bushel (pounds)	Heat-Damaged kernels (percent)	Damaged kernels total (percent)	Broken Corn and Foreign material (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:

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.

4.3 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in table 1. 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 and kind of grain,

e. The special grade "Flint" when applicable,

f. The special grade “Flint and Dent”, (when applicable) along with the approximate percentage of flint corn,

g. The special grade "Infested" when applicable, and

h. The special grade "Waxy" (when applicable) shall be shown last in the grade designation.

When more than one special grade applies, list them in alphabetical order.

When certificating Mixed corn, record the percent of each corn in order of predominance in the "Remarks" section to the nearest tenth percent.

Examples: U.S. No. 2 White Corn, Infested
U.S. Sample Grade Yellow Corn, Infested

4.4 SPECIAL GRADES

Special grades identify unusual conditions in grain and are part of the grade designation. The corn standards include four special grades:

a. Flint Corn. Corn that consists of 95 percent or more of flint corn.

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.

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.

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

d. Waxy Corn. Corn that consists of 95 percent or more waxy corn.

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

4.5 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, corn may be certified 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

4.6 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, and 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 NO. 2

BASIS OF DETERMINATION		
Lot as a Whole	Factors Determined Before the Removal of Broken Corn and Foreign Material	Factors Determined After the Removal of Broken Corn and Foreign Material
Distinctly low quality Heating Infested Odor	Distinctly low quality Heating Infested Kind of Grain Moisture Odor Stones Test Weight U.S. Sample Grade factors	Class Damaged kernels Flint corn Flint and dent corn Heat-damaged kernels Odor Waxy

The following sections of this chapter are arranged in a sequence typically followed in the inspection and grading of corn.

4.7 DEFINITION OF CORN

Corn is defined as:

Grain that consists of 50 percent or more of whole kernels of shelled dent corn and/or shelled flint corn (Zea mays L.) and may contain 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. No further analysis is necessary on a sample designated as not standardized grain unless a specific factor test is requested.

4.8 HEATING

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. Care should be taken not to confuse corn that is heating with corn that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

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

Certification. Grade heating corn as U.S. Sample Grade and record the word "Heating" in the "Remarks" section of the certificate.

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 NO. 3

ODOR CLASSIFICATION EXAMPLES		
Sour	Musty	Commercially Objectionable Foreign Odors
Boot	Ground	Animal hides
Fermenting	Insect	Decaying animal and vegetable matter
Insect (acrid)	Moldy	Fertilizer
Pigpen		Fumigant
		Insecticide
		Oil products
		Skunk
		Smoke
		Strong weed

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

Fumigant or insecticide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of corn contains a fumigant or insecticide 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 or insecticide odor persists based on the above criteria.

Final Determination. The inspector(s) is responsible for making the final determination for all odors. A consensus of experienced inspectors is used, whenever possible, on samples containing marginal odors. The consensus approach is not required if no 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" in the "Remarks" section of the certificate.

4.10 MOISTURE

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 350 grams.

The procedures for performing a moisture determination using the DICKEY-john Grain Analysis Computer GAC 2100 moisture meter are described in book II, chapter 1, section 1.10.

Certification. Record the percent of moisture on the certificate to the nearest tenth percent.

4.11 TEST WEIGHT

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 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 and available services are described in book II, chapter 1, section 1.11.

Certification. Record test weight results on the work record as displayed on the electronic scale or in whole and tenth pounds to the nearest tenth pound. Record the test weight on the certificate in whole and tenth pounds 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.

4.12 INFESTED CORN

Infested corn is corn that is infested with live weevils or other live insects injurious to stored grain.

The presence of any live weevil or other live insects injurious to stored grain 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.

Live weevils include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. Other live insects injurious to stored grain shall include grain beetles, grain moths, and larvae. (See Chapter 1, Section 1.2, Visual Grading Aids.)

Basis of Determination. Determine infestation on the lot as a whole or the sample as a whole. For insect tolerances, see table No. 4.

TABLE NO.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, record the word "Infested" on the certificate in accordance with Section 4.4, Special Grades.

4.13 DISTINCTLY LOW QUALITY

Consider corn 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 corn is of distinctly low quality. This includes a general examination of the corn during sampling and an analysis of the obtained sample(s).

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 are too large to enter the sampling device is considered distinctly low quality.

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 distinctly low quality.

Corn suspected of containing diatomaceous earth is considered distinctly low quality unless the applicant specifically requests an examination to verify the presence of diatomaceous earth. If the laboratory examination verifies that the corn contains diatomaceous earth, then the corn is not considered distinctly low quality due to diatomaceous earth. Refer to Program Directive 9180.49, Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel, for additional information regarding the testing of corn for diatomaceous earth.

Certification. Grade distinctly low quality corn as U.S. Sample Grade. Record the words "Distinctly Low Quality" and the reason(s) why in the "Remarks" section of the certificate.

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 based on a work portion of 1,000 to 1,050 grams. Table No. 5 shows the criteria and corresponding Visual Reference Images, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, bulgur, etc.), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain shall function as "unknown foreign substance."

TABLE NO. 5

U.S. SAMPLE GRADE CRITERIA			
Criteria	*Visual Reference Image*	Number/Weight **1**/	
		Sample Basis	Lot Basis **2**/
Any numerical grading factor		Excess of limit for U.S. No. 5	N/A
Animal filth	OF-1.0	Excess of 0.20%	N/A
Castor Beans	OF-3.0	2 or more	N/A
Cockleburs	OF-6.0	8 or more	N/A
Crotalaria seeds	OF-8.0	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**/	OF-31.0	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, see section 4.13

Certification. Grade corn U.S. Sample Grade when one or more of the limits in table 5 are exceeded. Record the reason(s) why in the "Remarks" section of the certificate. Record count factors to the nearest whole number.

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 after sieving 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 the factor broken corn and foreign material (BCFM) on a portion of 1,000 to 1,050 grams.

Procedure. The approved methods for determining the factor BCFM are the methods described in this section. Handsieving the work sample using a 12/64-inch or a 6/64-inch (4.763 millimeter round-hole sieve or a 2.381 millimeter round-hole) sieve is not recognized as an official method.

The procedure is performed in two steps: A mechanical separation of BCFM is made using a Carter Dockage Tester to remove the larger and finer particulate matter from the sample. The mechanically cleaned sample is then handpicked to remove any remaining similarly sized foreign material from the sample. To avoid repeating operations, check the material found in the BCFM sieve catch pans for live weevils and other live insects injurious to stored grain, stones, distinctly low quality, and other sample grade factors. Live weevils, other live insects injurious to stored grain, and sample grade factors are considered FM but, when present in sufficient quantities, are considered in the determination of U.S. Sample Grade and/or the special grade "Infested."

CHART 1 - PROCEDURE FOR DETERMINING BCFM

STEP 1. Carter Dockage Tester.

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

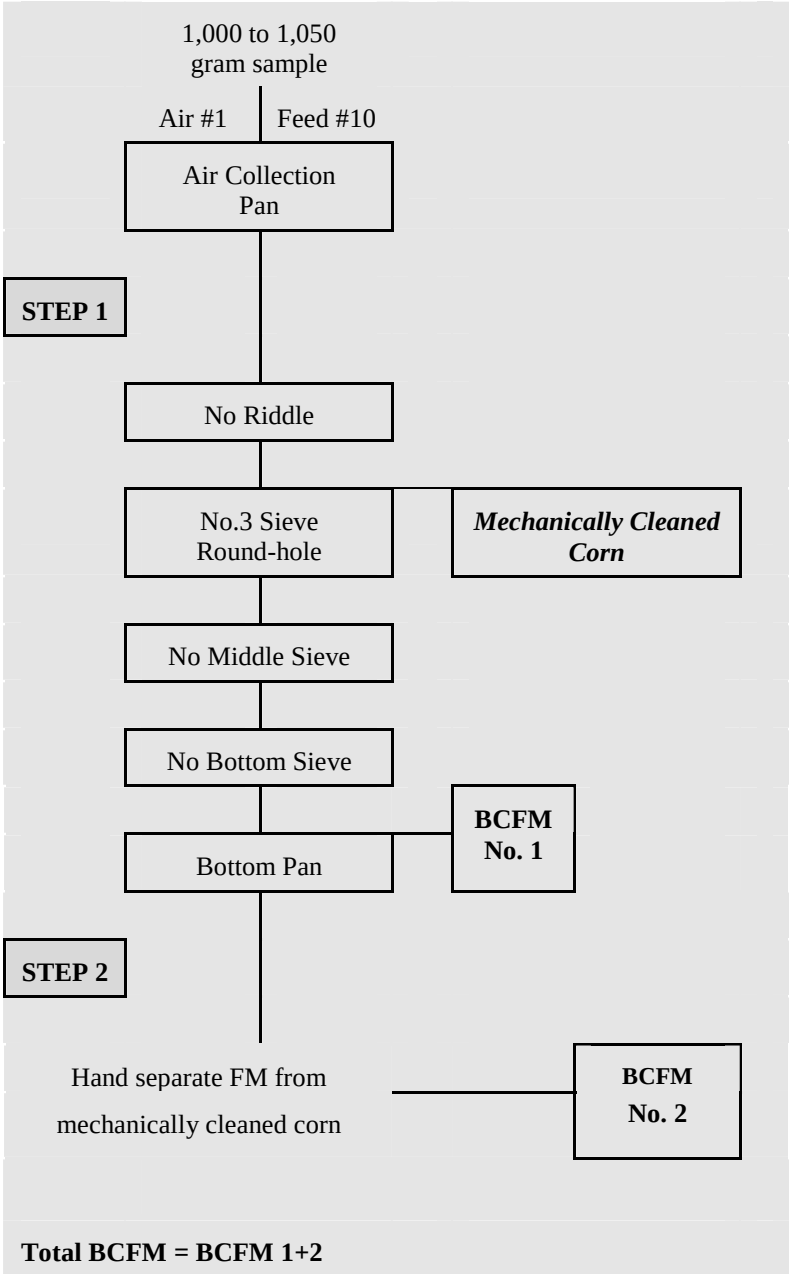
b. Insert the No. 3 sieve in the top sieve carriage

c. Run 1,000 – 1,050 grams through the dockage tester.

STEP 2. Handpick (foreign material)

a. Remove all matter other than corn, including sweet corn, blue corn, and popcorn. (Reference: Visual Reference Image No. OF–7.4), from the mechanically cleaned portion.

b. Combine the mechanically separated and handpicked BCFM.



Certification. Record the percentage of BCFM on the certificate to the nearest tenth percent. Upon request, use the following alternate procedure which allows for the separation of BC and FM.

CHART 2 – ALTERNATE PROCEDURE FOR DETERMINING BC AND FM

STEP 1. Carter Dockage Tester.

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

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

c. Run 1,000 – 1,050 grams through the dockage tester.

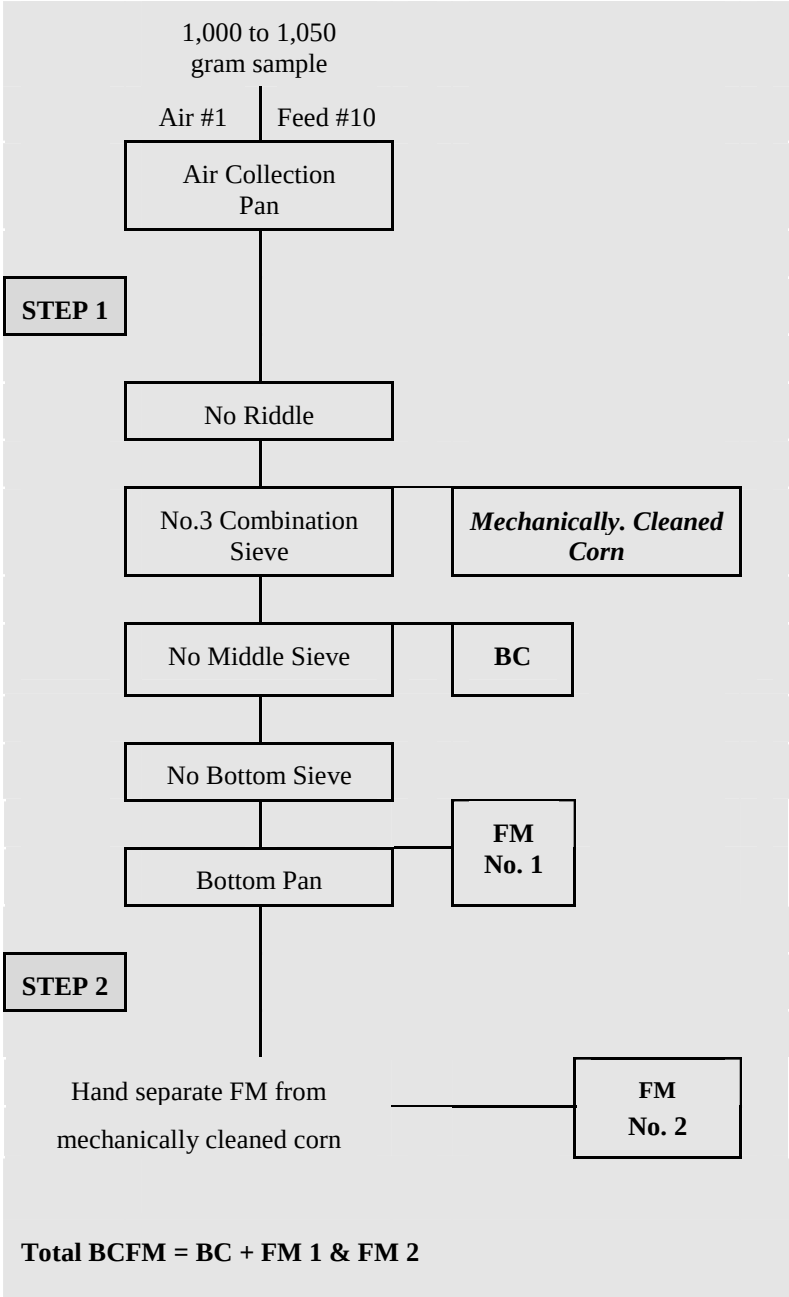
d. BC consists of all material passing through the 12/64 inch sieve and over the 6/64 inch sieve (collected in the middle sieve collection pan)

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

STEP 2. Handpick (foreign material)

a. Remove all matter other than corn, including sweet corn, blue corn, and popcorn. (Reference: Visual Reference Image No. OF–7.4), from the mechanically cleaned portion.

b. Combine the mechanically separated and handpicked FM.



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 percentage of BCFM recorded on the certificate. When this occurs, it is necessary to adjust the component nearest a midpoint (e.g.; .05, .15, .25, .35, etc.) by adding or subtracting 0.1.

Example

Original sample weight	1,012 grams
Weight of BC	38.34 grams
Weight of FM	2.64 grams
Weight of BCFM	40.98 grams

STEP 1 (38.34 ÷ 1,012) x 100 = 3.78% BC (rounded 3.8%).

STEP 2 (2.64 ÷ 1,012) x 100 = 0.26% FM (rounded 0.3%).

STEP 3 (40.98 ÷ 1,012) = 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 percentage of BC and the percentage of FM separately to the nearest tenth in the "Remarks" section of the certificate for nonexport shipments and on the loading log or similar work record for export shipments. In the "Factor" block of the certificate, record the total percentage of BCFM to the nearest tenth percent.

4.16 PROCESSING THE WORK SAMPLE

After determinations have been made for odor, test weight, moisture, BCFM, infestation, and sample grade factors, divide the work sample into portions as shown in table 6.

CHART 3 - DIVIDING THE WORK SAMPLE

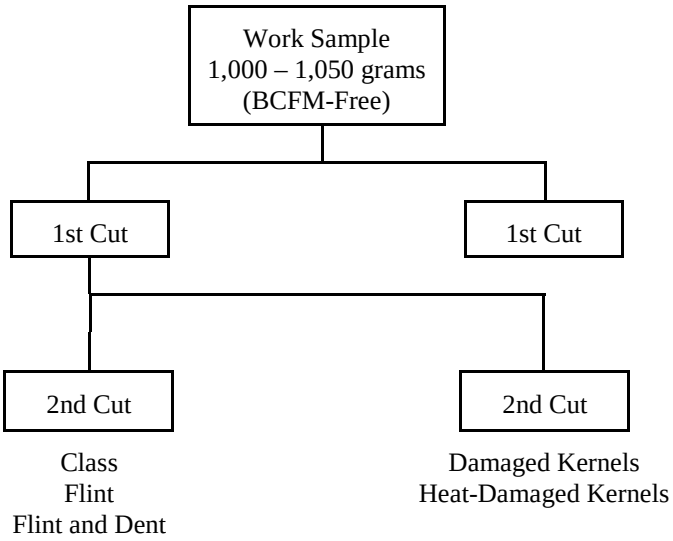


TABLE NO. 6

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 CLASS

Corn is divided into the following three 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." (Reference: Visual Reference Image No. (C) OF-7.5)

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, see section 4.21.

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." (Reference: Visual Reference Image Nos. (C) OF-7.1 and (C) OF-7.7)

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.* (Reference: Visual Reference Image No. (C) OF-7.2)

NOTE: When determining the class of corn, consider "Indian Corn" as "Corn of Other Colors."

Basis of Determination. Determine the class of corn 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 percentage of corn of other colors on the certificate to the nearest tenth percent. When certificating Mixed corn, record the percentage of the mixture, in the order of predominance, in the "Remarks" section to the nearest tenth percent.

4.18 DAMAGED KERNELS

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 the amount of damaged kernels on a 250-gram portion of BCFM-free corn.

TYPES OF CORN DAMAGE.

A kernel of corn is considered damaged for inspection and grading purposes when the damage is distinctly apparent and of such character as to be recognized as damaged for commercial purposes.

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. Otherwise, lift the germ cover carefully to avoid destroying the evidence of mold. (Reference: Visual Reference Image No. C-1.0)

Do not confuse purple plumule with blue-eye mold. Purple plumule is not damage but is a genetic or varietal characteristic. (Reference: Visual Reference Image No. C-1.1)

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. (Reference: Visual Reference Image No. C-2.0)

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 peeling off or have already peeled off; or 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). (Reference: Visual Reference Image No. C-3.0)

Germ-Damaged Kernels (slight discoloration by respiration). Kernels and pieces of kernels damaged by respiration or heat but not materially discolored. (Reference: Visual Reference Image No. C-4.0) 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.

Heat-Damaged Kernels. Kernels and pieces of kernels which are materially discolored by excessive respiration, with the dark discoloration extending out of the germ through the sides and into the back of the kernel. (Reference: Visual Reference Image No. C-5.1 for Heat-damaged White corn and No. C-5.2 for Heat-damaged Yellow corn.)

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. (Reference: Visual Reference Image No. C-5.0)

Insect-Bored Kernels. Kernels and pieces of kernels with obvious insect-bored holes or which have tunneling, insect webbing, or insect refuse. Do not consider kernels partially eaten but entirely free from refuse, webbing, insects, or other forms of damage as damaged. (Reference: Visual Reference Image No. C-6.0) Do not cut open the kernel when making this determination. If the determination for insect-bored damage cannot be made without cutting the kernel, the kernel is considered damaged.

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. (Reference: Visual Reference Image No. C-7.0) Do not confuse kernels that have dirt on them with kernels containing mold. Mold is usually blue or green in color. (Reference: Visual Reference Image No. C-7.1)

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 as being damaged. (Reference: Visual Reference Image No. C-8.0)

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. (Reference: Visual Reference Image No. C-10.0)

Surface Mold. 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 Reference Image. (Reference: Visual Reference Image No. C-11.0)

Mold (pink Epicoccum). Kernels and pieces of kernels with germs infected with mold. (Reference: Visual Reference Image No. C-7.2)

Sprout-Damaged Kernels. Sprouted kernels or those showing evidence of a sprout. (Reference: Visual Reference Image No. C-9.0)

Certification. Record the percent of damaged kernels on the certificate to the nearest tenth percent.

4.19 HEAT-DAMAGED KERNELS

Kernels and pieces of corn kernels that are materially discolored and damaged by heat.

Basis of Determination. Determine heat-damaged kernels on a portion of 250 grams of BCFM-free corn. (Reference: Visual Reference Image Nos. C-5.0, C-5.1, and C-5.2)

Certification. Record the percent of heat-damaged kernels on 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 and Flint and Dent on the characteristics of the kernels in the sample. When an analysis is necessary, use a portion of 250 grams of BCFM-free corn. (Reference: Visual Reference Image No. (C) OF-7.3)

Certification. When applicable, record the words "Flint" or "Flint and Dent" on the certificate in accordance with Section 4.4, Special Grades.

4.21 WAXY CORN

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, test the sample to determine whether the special grade Waxy applies. Use exactly 100 kernels cut out of a 35-gram portion of BCFM-free corn.

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. (Reference: Visual Reference Image No. (C) OF-7.8)

Procedure for Testing Waxy Kernels of Corn. For required materials and equipment, see chapter 1, section 1.17.

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 nonwaxy kernels will turn a blue or violet color. Consider samples with 95 kernels (95%) turning red or reddish-brown color as Waxy corn. (Reference: Visual Reference Image Nos. (C) OF-7.9 and (C) OF-7.91)

Certification. When applicable, record the word "Waxy" on the certificate in accordance with Section 4.4, Special Grades.

4.22 OFFICIAL CRITERIA

Stress Crack Analysis. Stress crack analysis is an "official criteria" determined only upon request. It does not affect the grade designation.

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.

a. For percent **total** stress crack analysis, obtain approximately 25 grams to select 50 whole kernels. Multiply the number of stressed kernels by 2 before reporting.

b. For percent **single, double, and multiple** stress crack analysis, obtain approximately 50 grams to select 100 whole kernels. Report 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.

c. 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:

(1) Place kernels on the light board with germ side down. Visually inspect each kernel for stress cracks and separate stressed kernels.

(2) Turn remaining kernels germ side up. Visually inspect each kernel for stress cracks and separate stressed kernels.

(3) Count the total number of stressed kernels.

Certification. Report the percentage of total stress cracks or the percentage of single, double, and multiple stress cracks in whole percent in the "Remarks" section of the certificate.

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. See Chapter 1, section 1.17 for Iodine test materials.

(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% 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. (Reference: Visual Reference Image Nos. (C) OF-7.9 and (C) OF-7.91)

(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. Results are certified in the "Remarks" section of the certificate with one of the following applicable statements.

"This sample contains waxy corn." or "This sample does not contain waxy corn."

GRAIN INSPECTION HANDBOOK

BOOK II, CHAPTER 5

FLAXSEED

CHAPTER 5

FLAXSEED

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5.1 GENERAL INFORMATION

a. All quantities referenced in this chapter are approximate unless otherwise specified.

b. Use an approved divider to obtain subportions of a sample for analysis unless otherwise specified.

c. 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 30 times.

d. For specific grain Visual Reference Images, see F-1.0 – F-3.0.

e. Official inspection personnel shall document inspection information during sampling and grading. See book IV, chapter 2.

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 percentage by weight, a percentage for a specific type of damage, etc.).

5.2 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 NO. 1 - GRADES AND GRADE REQUIREMENTS - 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:

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.

5.3 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in table 1. 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" shall be shown next, and

e. The word "Dockage" (when applicable) and the percentage thereof.

5.4 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, flaxseed may be certificated as U.S. No. 2 or better, U.S. Sample Grade 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 Flaxseed, Dockage 1.0%

5.5 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, and 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 NO. 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 Heating Odor	Distinctly low quality Heating Kind of Grain Moisture Odor U.S. Sample Grade factors	Damaged kernels Handpicked dockage Heat-damaged kernels Odor Stones Test weight

The following sections of this chapter are arranged in a logical sequence typically followed in the inspection and grading of flaxseed.

5.6 DEFINITION OF FLAXSEED

Flaxseed is defined as:

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 the sample 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. No further analysis is necessary on a sample designated as not standardized grain unless a specific factor test is requested.

5.7 HEATING

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

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

Certification. Grade heating flaxseed U.S. Sample Grade and record the word "Heating" in the "Remarks" section of the certificate.

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 NO. 3

ODOR CLASSIFICATION EXAMPLES		
Sour	Musty	Commercially Objectionable Foreign Odors
Boot	Ground	Animal hides
Fermenting	Insect	Decaying animal and vegetable matter
Insect (acrid)	Moldy	Fertilizer
Pigpen		Fumigant
Smoke **1**/		Insecticide
		Oil products
		Skunk
		Smoke
		Strong weed

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

Fumigant or insecticide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of flaxseed contains a fumigant or insecticide 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 or insecticide odor persists based on the above criteria.

Final Determination. The inspector(s) is responsible for making the final determination for all odors. A consensus of experienced inspectors is used, whenever possible, on samples containing marginal odors. The consensus approach is not required if no 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" in the "Remarks" section of the certificate.

5.9 DISTINCTLY LOW QUALITY

Consider flaxseed distinctly low quality when it is obviously of inferior quality and the existing grading 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. This includes a general examination of the flaxseed during sampling and an analysis of the obtained sample(s).

Large Debris. Flaxseed containing two or more stones, pieces of glass, pieces of concrete, and/or other pieces of wreckage or debris which are visible to the sampler but are too large to enter the sampling device is considered distinctly low quality.

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 distinctly low quality.

Flaxseed suspected of containing diatomaceous earth is considered distinctly low quality unless the applicant specifically requests an examination to verify the presence of diatomaceous earth. If the laboratory examination verifies that the flaxseed contains diatomaceous earth, then the flaxseed is not considered distinctly low quality due to diatomaceous earth. Refer to Program Directive 9180.49, Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel, for additional information regarding the testing of flaxseed for diatomaceous earth.

Certification. Grade distinctly low quality flaxseed as U.S. Sample Grade. Record the words "Distinctly Low Quality" and the reason(s) why in the "Remarks" section of the certificate.

5.10 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine additional 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 No. 4 shows the criteria and corresponding Visual Reference Images, 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, bulgur, etc.), or feed pellets in grain as dockage. Unidentifiable materials or material unrelated to grain shall function as "unknown foreign substance."

TABLE NO. 4

U.S. SAMPLE GRADE CRITERIA

Criteria	*Visual Reference Image*	Number/Weight **1**/	
		Sample Basis	Lot Basis **2**/
Any numerical grading factor		Excess of limit for U.S. No. 2	N/A
Animal filth	OF-1.0	10 or more	N/A
Castor Beans	OF-3.0	2 or more	N/A
Crotalaria seeds	OF-8.0	3 or more	N/A
Glass		2 or more	N/A
Odor		Presence	N/A
Stones		8 or more or any number in excess of 0.2% by weight	N/A
Unknown foreign substances **3**/	OF-31.0	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, see section 5.9

Certification. Grade flaxseed "U.S. Sample Grade" when one or more of the limits in table 4 are exceeded. Record the reason(s) why in the "Remarks" section of the certificate. Record count factors to the nearest whole number.

5.11 DOCKAGE

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 on a portion of 1,000 - 1,050 grams.

CHART 1 - PROCEDURE FOR DETERMINING DOCKAGE

STEP 1. Carter Dockage Tester.

a. Set air control on 3.5 and the feed control on 4.

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

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

d. Insert No. 2 sieve in the middle sieve carriage.

e. Insert No. 7 sieve in the bottom sieve carriage.

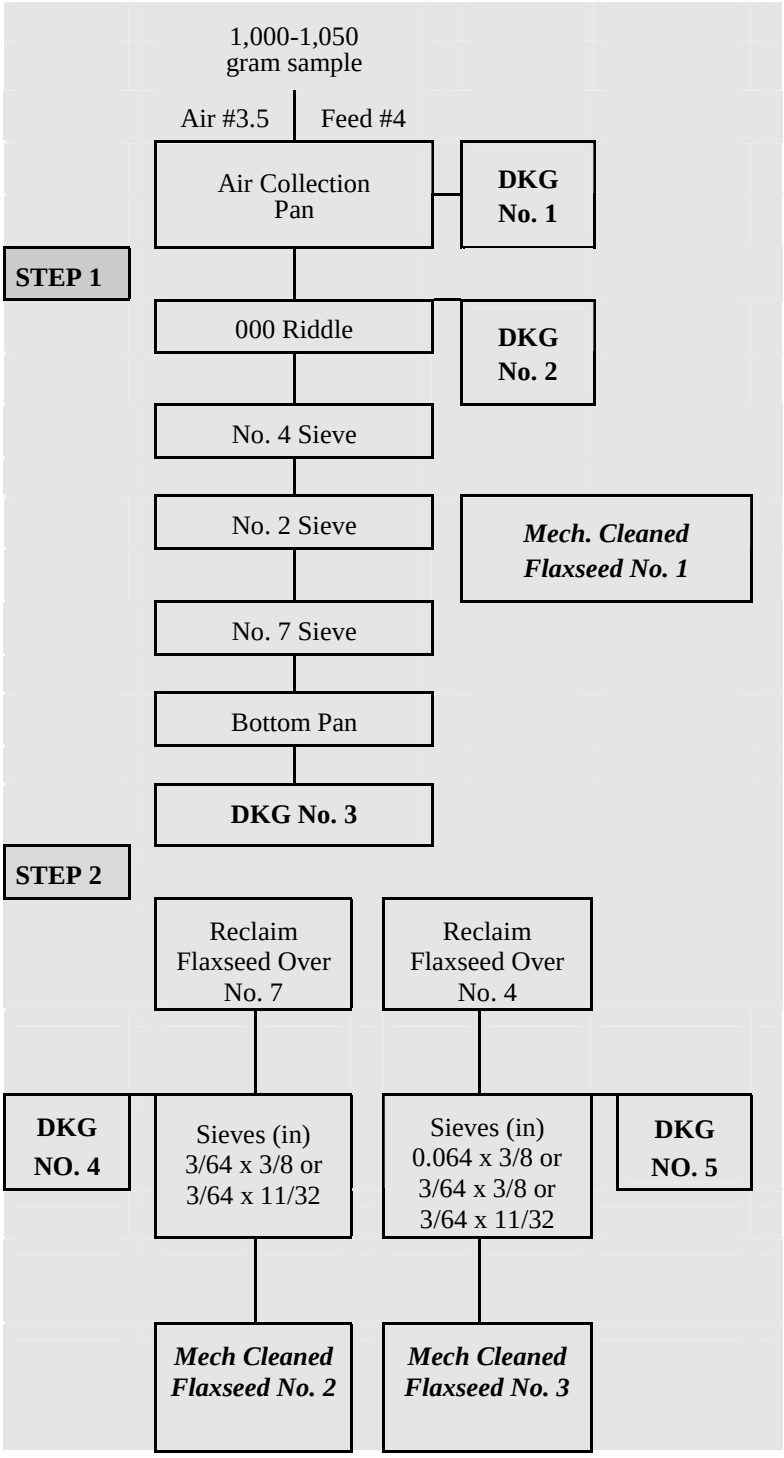
f. Start carter Dockage Tester and pour sample into feed hopper.

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.

STEP 2. Reclaim Seed

Using an approved hand sieve, reclaim the flaxseed passing over the No. 4 sieve. 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. 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. 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.



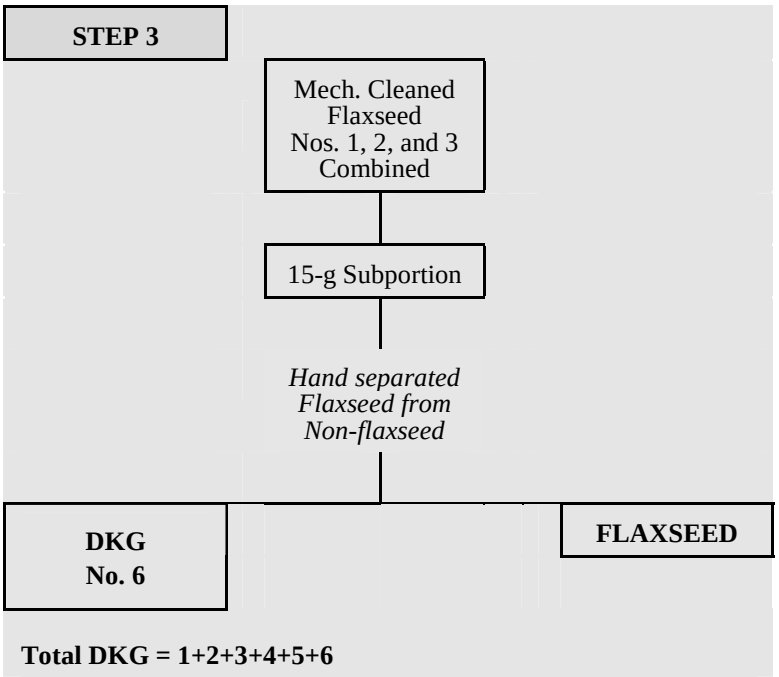
STEP 3

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 (see section 5.14) before determining handpicked dockage.



Computing Dockage. Compute the percentage of dockage by adding the percentage of mechanically separated dockage to the percentage of handpicked dockage in hundredths (disregard thousandths).

STEP 1. (weight of mechanically separated dockage ÷ original sample weight) x 100 = percent of mechanically separated dockage

STEP 2. (100 percent - percent of mechanically separated dockage) ÷ 100 = change of base factor

STEP 3. (weight of handpicked dockage ÷ weight of handpicked portion) x 100 = percent of handpicked dockage

STEP 4. Percent of handpicked dockage x change of base factor = adjusted percentage of handpicked dockage

STEP 5. Percent of mechanically separated dockage + adjusted percentage of handpicked dockage = percent of dockage

Example

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

STEP 1. (68.00 ÷ 1,000) x 100 = 6.80% mechanical dockage

STEP 2. (100% - 6.80%) ÷ 100 = 0.93 change of base factor

STEP 3. (0.55 ÷ 15.30) x 100 = 3.59% handpicked dockage

STEP 4. 3.59 x .93 = 3.33% adjusted percentage of handpicked dockage

STEP 5. 6.80% + 3.33% = 10.13% dockage

Certification. Record the word "Dockage" and the percentage on the work record in hundredths. When the sample contains 1 percent or more dockage, record the percentage of dockage on the certificate in whole percent with a fraction of a percent disregarded. For 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, etc.

5.12 MOISTURE

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 350 grams.

The procedures for performing a moisture determination using the DICKEY-john Grain Analysis Computer GAC 2100 moisture meter are described in book II, chapter 1, section 1.10.

Certification. Record the percent of moisture on the certificate to the nearest tenth percent.

5.13 TEST WEIGHT

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 on a dockage-free portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination and available services are described in book II chapter 1, section 1.11.

Certification. Record test weight results on the work record as displayed on the electronic scale or in whole and half pounds. Disregard fractions of a half pound. Record the test weight on 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.

5.14 PROCESSING THE WORK SAMPLE

At this point, all tests required to be performed prior to the removal of dockage have been made and the percentage of dockage has been determined. Also, determinations for moisture and test weight have been performed. Now the work sample is ready to be cut into fractional parts for those determinations required to be performed after the removal of dockage. The following chart and table No. 5 illustrate how the sample is divided into fractional parts using the Boerner divider.

CHART 2 - DIVIDING THE WORK SAMPLE

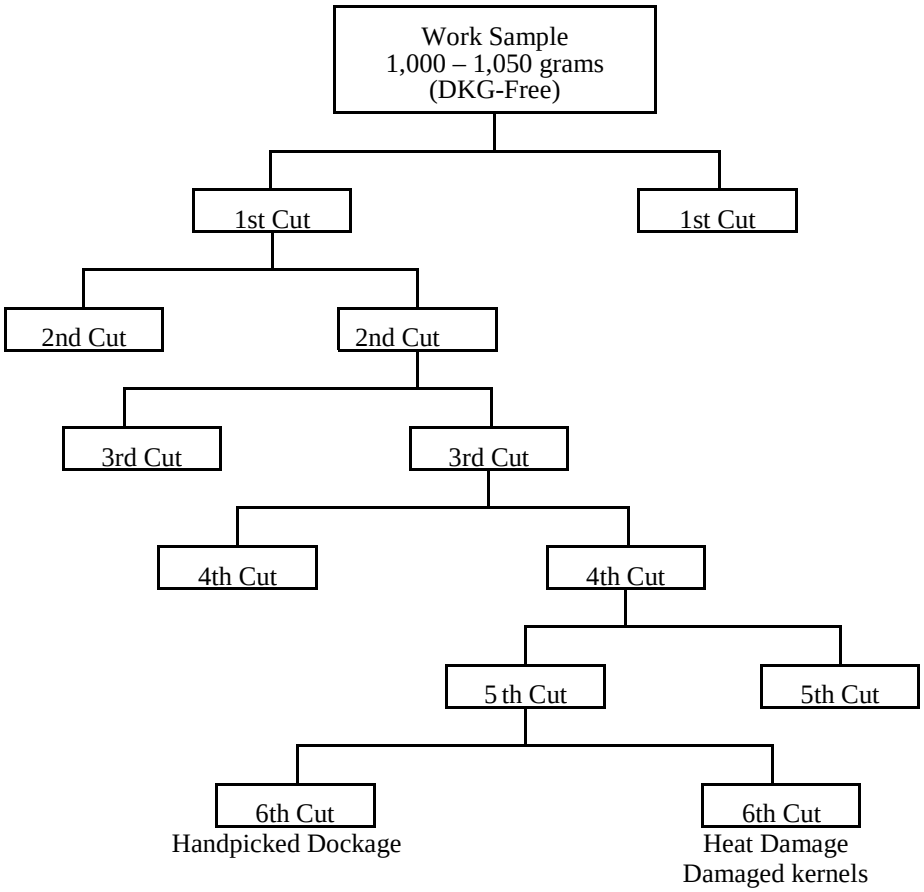


TABLE NO. 5

APPROXIMATE ANALYTICAL PORTION SIZES	
Factors	*Grams*
Damaged kernels	15
Heat-damaged kernels	15
Kind of grain	25

5.15 DAMAGED KERNELS

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 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 Flaxseed. 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" are considered as damaged. (Reference: Visual Reference Image No. F-1.0)

Damaged by Heat Flaxseed. Flaxseed and pieces of flaxseed which are damaged as a result of heat but which are not materially discolored. (Reference: Visual Reference Image No. F-2.0)

Immature Flaxseed. 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 certificate to the nearest tenth percent.

5.16 HEAT-DAMAGED KERNELS

Kernels and pieces of flaxseed kernels that are materially discolored and damaged by heat.

Basis of Determination. Determine heat-damaged kernels on mechanically cleaned portion of 15 grams. It is necessary, in most cases, to cross-section the kernels to determine if the color is a chocolate color. (Reference: Visual Reference Image No. F-3.0)

Certification. Record the percentage of heat-damaged kernels on the certificate to the nearest tenth percent.

GRAIN INSPECTION HANDBOOK

BOOK II, CHAPTER 6

MIXED GRAIN

CHAPTER 6

MIXED GRAIN

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6.1 GENERAL INFORMATION

a. All quantities referenced in this chapter are approximate unless otherwise specified.

b. Use an approved divider to obtain subportions of a sample for analysis unless otherwise specified.

c. 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 30 times.

d. Official inspection personnel shall document inspection information during sampling and grading. See book IV, chapter 2.

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 percentage by weight, a percentage for a specific type of damage, etc.).

6.2 GRADES AND GRADE REQUIREMENTS

The standards for mixed grain provide two grades for mixtures of grain. These are U.S. Mixed Grain and U.S. Sample Grade Mixed Grain. Special grades are provided to emphasize special 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 NO. 1 - GRADES AND GRADE REQUIREMENTS - MIXED GRAIN

Grade	Maximum Limits of -		
	Moisture	Damaged kernels total (percent)	Heat-Damaged kernels (percent)
U.S. Mixed Grain	16.0	15.0	3.0

U.S. Sample Grade:

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.

6.3 GRADE DESIGNATIONS

Use the following guidelines when assigning grades.

a. On the grade line.

(1) The letters "U.S.",

(2) The words "Mixed Grain" or "Sample Grade Mixed Grain", and

(3) The name of each applicable special grade in alphabetical order.

When applicable, insert the "or better" grade designation between the phrase "Sample Grade" and the phrase "Mixed Grain."

b. In the "Remarks" section.

(1) 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.

(2) When applicable, the words "Other grains" followed by the combined percentage of those kinds of grains, each of which is present in a quantity less than 10.0 percent are shown next.

(3) When applicable, the words "Foreign material and fines" together with the percentage are shown last.

6.4 SPECIAL GRADES

Special grades draw attention to unusual conditions in grain and are made part of the grade designation. The 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.

Example: U.S. Mixed Grain, Blighted
In "Remarks" 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.

Example: U.S. Mixed Grain, Ergoty
In "Remarks" 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.

Example: U.S. Mixed Grain, Garlicky
In "Remarks" 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.

Example: U.S. Mixed Grain, Infested
In "Remarks" 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.

Example: U.S. Mixed Grain, Smutty
In "Remarks" 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.

Example: U.S. Sample Grade Mixed Grain, Treated (Limed)
In "Remarks" section: Wheat 48%, Oats 42%,
Other grains 10%

6.5 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, mixed grain may be certified as U.S. Sample Grade "or better."

Example: U.S. Sample Grade or better Mixed Grain
In "Remarks" section: Corn 81%, Other grains
19%, Foreign material and fines 1%

6.6 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. 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.

6.7 DEFINITION OF MIXED GRAIN

Mixed grain is defined as:

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.

Consider grain not meeting requirements "a" or "b" not standardized grain. No further analysis is necessary on a sample designated as not standardized grain unless a specific factor test is requested.

6.8 HEATING

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. Care should be taken not to 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.

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

Certification. Grade heating mixed grain U.S. Sample Grade and record the word "Heating" in the "Remarks" section of the certificate.

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 NO. 2

ODOR CLASSIFICATION EXAMPLES		
Sour	Musty	Commercially Objectionable Foreign Odors
Boot	Ground	Animal hides
Fermenting	Insect	Decaying animal and vegetable matter
Insect (acrid)	Moldy	Fertilizer
Pigpen		Fumigant
		Insecticide
		Oil products
		Skunk
		Smoke
		Strong weed

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

Fumigant or insecticide odors are considered as commercially objectionable foreign odors if they linger and do not dissipate. When a sample of mixed grain contains a fumigant or insecticide 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 or insecticide odor persists based on the above criteria.

Final Determinations. The inspector(s) is responsible for making the final determination for all odors. A consensus of experienced inspectors is used, whenever possible, on samples containing marginal odors. The consensus approach is not required if no 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" in the "Remarks" section of the certificate.

6.10 MOISTURE

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.

The procedures for performing a moisture determination using the DICKEY-john Grain Analysis Computer GAC 2100 moisture meter are described in book II, chapter 1, section 1.10.

To determine the appropriate sample portion size and GAC 2100 instrument setting for determining moisture content, refer to the moisture testing requirements for the grain that predominates in the mixture.

Certification. Record the percent of moisture on the certificate to the nearest tenth percent. Mixed grain containing more than 16.0 percent moisture is graded U.S. Sample Grade.

6.11 TEST WEIGHT

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 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 and available services are described in book II, chapter 1, section 1.11.

Certification. Record test weight results on the work record as displayed on the electronic scale or in whole and half pounds. Disregard fractions of a half pound. Record the test weight on the certificate in whole and half pounds. If requested, convert the pounds per bushel (lbs./bu) result to kilograms per hectoliter (kg/hl). For mixtures where wheat (other than Durum) is the predominant grain, use the following formula: (lbs./bu x 1.292) + 1.419 = kg/hl. 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. 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 DISTINCTLY LOW QUALITY

Consider mixed grain distinctly low quality when it is 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 mixed grain is of distinctly low quality. This includes a general examination of the mixed grain during sampling and an analysis of the obtained sample(s).

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 but too large to enter the sampling device is considered distinctly low quality.

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 distinctly low quality.

Mixed grain suspected of containing diatomaceous earth is considered distinctly low quality unless the applicant specifically requests an examination to verify the presence of diatomaceous earth. If the laboratory examination verifies that the mixed grain contains diatomaceous earth, then the mixed grain is not considered distinctly low quality due to diatomaceous earth. Refer to Program Directive 9180.49, Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel, for additional information regarding the testing of mixed grain for diatomaceous earth.

Certification. Grade distinctly low quality mixed grain as U.S. Sample Grade. Record the words "Distinctly Low Quality" and the reason(s) why in the "Remarks" section of the certificate.

6.13 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 No. 3 shows the criteria and corresponding Visual Reference Images, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, bulgur, etc.), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain shall function as "unknown foreign substance."

TABLE NO. 3

U.S. SAMPLE GRADE CRITERIA			
Criteria	*Visual Reference Image*	Number/Weight **1**/ *Sample Basis*	Lot Basis **2**/
Any numerical grading factor		Excess of limit in Table No. 1	N/A
Animal filth	OF-1.0	10 or more	N/A
Castor Beans	OF-3.0	2 or more	N/A
Cockleburs	OF-6.0	8 or more	N/A
Crotalaria seeds	OF-8.0	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**/	OF-31.0	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, see section 6.12

Certification. Grade mixed grain U.S. Sample Grade when one or more of the limits in table 3 are observed. Record the reason(s) why in the "Remarks" section of the certificate. Record count factors to nearest whole number.

6.14 INFESTED MIXED GRAIN

Infested mixed grain is mixed grain that is infested with live weevils or other live insects injurious to stored grain.

The presence of any live weevil or other live insects injurious to stored grain 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.

Live weevils include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. Other live insects injurious to stored grain shall include grain beetles, grain moths, and larvae. (See Chapter 1, Section 1.2, Visual Grading Aids.)

Basis of Determination. Determine infestation on the lot as a whole or the sample as a whole. For insect tolerances, see table No. 4.

TABLE NO.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, record the word "Infested" on the certificate in accordance with Section 6.4, Special Grades.

6.15 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 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. (Reference: Visual Reference Image Nos. OF-13.0 and OF-13.1)

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.

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

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

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

Certification. Record the word "Garlicky" on the certificate in accordance with Section 6.4, Special Grades. Upon request, provide the number of garlic bulblets in whole and thirds.

6.16 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.

Basis of Determination. Determine treated on a portion of 1,000 - 1,050 grams.

Certification. Record the word "Treated" and the type of treatment on the certificate in accordance with Section 6.3, Grade Designations.

6.17 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 before the removal of foreign material and fines on a portion of 250 grams.

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. Smut balls apply in the determination of the special grade "Smutty" and also function as foreign material and fines.

Certification. Record the word "Smutty" on the certificate in accordance with Section 6.3, Grade Designations. Upon request, record the number or percentage of smut balls on the certificate. Record the percentage of smut balls to the nearest tenth percent and record the number of smut balls in whole numbers.

6.18 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.*

Ergot is a fungus disease that causes kernels of grain to be replaced by dark-colored growths. (Reference: Visual Reference Image No. OF-12.0)

Basis of Determination. Determine ergoty before the removal of foreign material and fines on a portion of 250 grams. Ergot applies in the determination of the special grade "Ergoty" and also functions as foreign material and fines.

Certification. Record the word "Ergoty" on the certificate in accordance with Section 6.3, Grade Designations. Upon request, record the percentage to the nearest hundredth percent on the certificate.

6.19 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.

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. Refer to book II, chapter 2, section 2.18, for the interpretation and Visual Reference Image No. B-1.0 for blighted barley.

Certification. Upon request, record the word "Blighted" and the percentage to the nearest tenth percent on the certificate in accordance with Section 6.3 Grade Designations.

6.20 PROCESSING THE WORK SAMPLE

At this point, determinations have been made for odor, test weight, moisture, sample grade factors, and the applicable special grades. Now a determination can be made for the percentage of grains in the mixture, foreign material and fines, damaged kernels, and heat-damaged kernels.

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 percentage of foreign material and fines on the basis of the sample as a whole. For mixtures where corn or soybeans predominate, determine the percentage 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 percentage 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 percentage of damaged kernels and heat-damaged kernels on the basis of the established portion size for the predominating grain (e.g., corn 250 grams, 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 section 3.21 of book II. 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 percentage 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 percentage 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 percentage of each grain comprising the mixture and the amount of damaged kernels. When computing these percentages, be sure to adjust the weight of the original portion to compensate for the removal of foreign material and fines.

Example

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
Percent of foreign material and fines (0.68 ÷ 58.00) x 100	1.17 percent
rounded to:	1.0 percent
Weight of portion used to calculate the percentage of grains and heat-damaged kernels (58.00 – 0.68, rounded to 1.0 for subtraction)	57.00 grams
Percentage of wheat (40.55 ÷ 57.00) x 100	71.14 percent
rounded to:	71.0 percent
Percentage of rye (16.77 ÷ 57.00) x 100	29.42 percent
rounded to:	29.0 percent
Percentage of heat-damaged kernels (1.40 ÷ 57.00) x 100	2.45 percent
rounded to:	2.5 percent
Weight of portion used to determine damaged kernels (wheat requires a portion of 15 grams)	16.20 grams
Percentage of damaged kernels (2.55 ÷ 16.20) x 100	15.74 percent
rounded to:	15.7 percent

Certification. Record the percentage of foreign material and fines and each kind of grain on the certificate to the nearest whole percent. Record damaged kernels and heat-damaged kernels on the certificate to the nearest tenth percent.

GRAIN INSPECTION HANDBOOK

BOOK II, CHAPTER 7

OATS

CHAPTER 7

OATS

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7.1 GENERAL INFORMATION

a. All quantities referenced in this chapter are approximate unless otherwise specified.

b. Use an approved divider to obtain subportions of a sample for analysis unless otherwise specified.

c. 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 30 times.

d. For specific Visual Reference Images, see O-1.0 – O-5.0.

e. Official inspection personnel shall document inspection information during sampling and grading. See book IV, chapter 2.

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 percentage by weight, a percentage for a specific type of damage, etc.).

7.2 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 are provided to emphasize special qualities or conditions affecting the value of the oats and are added to and made a part of the grade designation. Special grades do not affect the numerical or sample grade designation.

TABLE NO. 1 - GRADES AND GRADE REQUIREMENTS - 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:

U.S. Sample Grade are oats 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 per 1 1/8 to 1 ¼ 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.

7.3 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in table 1. 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"; and

f. The applicable special grade(s) in alphabetical order.

7.4 SPECIAL GRADES

Special grades identify unusual conditions in grain and are part of the grade designation. The oats standards include nine special grades:

a. Bleached Oats. Oats that in whole or in part, have been treated with sulfurous acid or any other bleaching agent.

Example: U.S. No. 2 Oats, Bleached

b. Bright Oats. Oats, except bleached oats, that are of good natural color.

Example: U.S. No. 1 Bright Oats

c. Ergoty Oats. Oats that contain more than 0.10 percent ergot.

Example: U.S. No. 3 Oats, Ergoty

d. Extra-Heavy Oats. Oats that have a test weight per bushel of 40 pounds or more.

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 of oats.

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.

Example: U.S. No. 2 Heavy Oats

g. Infested Oats. Oats that are infested with live weevils or other insects injurious to stored grain.

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.

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.

Example: U.S. No. 3 Oats, Thin

7.5 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, oats may be certificated 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

7.6 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, and 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 NO. 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 Heating Infested Odor	Bleached oats Distinctly low quality Ergot Garlicky General appearance Heating Infested Kind of Grain Moisture Odor Smut Stones Test Weight Thin oats U.S. Sample Grade factors	Heat-damaged kernels Odor Other damaged kernels Other grains Sound oats Wild oats

The following sections are arranged in a logical sequence typically followed in the inspection and grading of oats.

7.7 DEFINITION OF OATS

Oats are defined as:

Grain that consists of 50 percent or more of oats (Avena sativa L. and A. Byzantina C. Koch) and may contain, singly or in combination, not more than 25 percent of wild oats and 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, 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 the sample 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. No further analysis is necessary on a sample designated as not standardized grain unless a specific factor test is requested.

7.8 HEATING

Oats developing a high temperature from excessive respiration is considered heating. Heating oats, in its final stages, will usually have a sour or musty odor. Care should be taken not to confuse oats that are heating with oats that are warm and moist because of storage in bins, railcars, or other containers during hot weather.

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

Certification. Grade heating oats as U.S. Sample Grade and record the word "Heating" in the "Remarks" section of the certificate.

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 NO. 3

ODOR CLASSIFICATION EXAMPLES		
Sour	Musty	Commercially Objectionable Foreign Odors
Boot	Ground	Animal hides
Fermenting	Insect	Decaying animal and vegetable matter
Insect (acrid)	Moldy	Fertilizer
Pigpen		Fumigant
		Insecticide
		Oil products
		Skunk
		Smoke
		Strong weed

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

Fumigant or insecticide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of oats contains a fumigant or insecticide 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 or insecticide odor persists based on the above criteria.

Final Determinations. The inspector(s) is responsible for making the final determination for all odors. A consensus of experienced inspectors is used, whenever possible, on samples containing marginal odors. The consensus approach is not required if no 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" in the "Remarks" section of the certificate.

7.10 MOISTURE

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 225 grams.

The procedures for performing a moisture determination using the DICKEY-john Grain Analysis Computer GAC 2100 moisture meter are described in book II, chapter 1, section 1.10.

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

7.11 GENERAL APPEARANCE

General appearance factors are defined as:

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 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. 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. (Reference: Interpretive line print.)

b. Badly Stained or Materially Weathered. 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. (Reference: Interpretive line print.)

In order to assure a more uniform application of the general appearance factors in oats, it is recommended that the following procedures be followed:

a. Cut 350 grams from the original sample.

b. Place the 350-gram portion into an empty plastic box approximately the same size as the interpretive line print.

c. Compare the sample with the interpretive line print.

d. Consider the oats slightly weathered, badly stained, or materially weathered when the sample is equal to or worse than the oats in the interpretive line print.

Certification. Record the words "Slightly Weathered," "Badly Stained," or "Materially Weathered" in the "Remarks" section of the certificate.

7.12 BLEACHED OATS

Oats that in whole or in part have been treated with sulfurous acid or any other bleaching agent.

Basis of Determination. Determine bleached 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 in accordance with Section 7.4, Special Grades.

7.13 TEST WEIGHT

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 on a portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination and available services are described in book II, chapter 1, section 1.11.

There are two special grades in oats that are based on test weight. They 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. Record test weight results on the work record as displayed on the electronic scale or in whole and half pounds. Disregard fractions of a half pound. Record the test weight on 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.

When applicable, make the special grades "Extra Heavy" or "Heavy" a part of the grade designation and record on the certificate in accordance with Section 7.4, Special Grades.

7.14 INFESTED OATS

Infested oats are oats that are infested with live weevils or other live insects injurious to stored grain.

The presence of any live weevil or other live insects injurious to stored grain 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 final conclusion. Do not examine the file sample if the work portion is insect free.

Live weevils shall include rice weevils, granary weevils, cowpea weevils, maize weevils, and lesser grain borers. Other live insects injurious to stored grain shall include grain beetles, grain moths, and larvae. (See Chapter 1, Section 1.2, Visual Grading Aids.)

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, see table No. 4.

TABLE NO. 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" in accordance with Section 7.4, Special Grades.

7.15 DISTINCTLY LOW QUALITY

Consider oats distinctly low quality when they are 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 oats are of distinctly low quality. This includes a general examination of the oats during sampling and an analysis of the obtained sample(s).

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 distinctly low quality.

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 distinctly low quality.

Oats suspected of containing diatomaceous earth are considered distinctly low quality unless the applicant specifically requests an examination to verify the presence of diatomaceous earth. If the laboratory examination verifies that the oats contain diatomaceous earth, then the oats are not considered distinctly low quality due to diatomaceous earth. Refer to Program Directive 9180.49, Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel, for additional information regarding the testing of oats for diatomaceous earth.

Certification. Grade distinctly low quality oats as U.S. Sample Grade. Record the reason(s) why the oats were distinctly low quality on the certificate.

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 No. 5 shows the criteria and corresponding interpretive line slides, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, bulgur, etc.), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain shall function as "unknown foreign substance."

TABLE NO. 5

U.S. SAMPLE GRADE CRITERIA			
Criteria	*Visual Reference Image*	Number/Weight **1**/ *Sample Basis*	Lot Basis **2**/
Any numerical grading factor		Excess of limit for U.S. No. 4	N/A
Animal filth	OF-1.0	10 or more	N/A
Castor Beans	OF-3.0	2 or more	N/A
Cockleburs	OF-6.0	8 or more	N/A
Crotalaria seeds	OF-8.0	3 or more	N/A
Glass		2 or more	N/A
Odor		Presence	N/A
Stones		8 or more or any number in excess of 0.2% by weight	N/A
Unknown foreign substances **3**/	OF-31.0	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, see section 7.15

Certification. Grade oats U.S. Sample Grade when one or more of the limits in table 5 are observed. Record the reason(s) why in the "Remarks" section of the certificate. Record count factors to the nearest whole number.

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 on a portion of 250 grams of the original sample. Separate the thin oats from the sample using one of the following methods:

a. Mechanical Sieving Method:

(1) Mount a 0.064 x 3/8 inch (1.626 x 9.525 millimeters (mm)) oblong-hole sieve and a bottom pan on the mechanical sieve shaker.

(2) Set the stroke counter for 30 strokes.

(3) Follow the procedure described in Book II, Chapter 1, Section 1.13, Mechanical Sieve Shaker.

(4) Place one-third of the sample in the center of the sieve and start the machine. After the sieve shaker has stopped, remove and clean the sieve and empty the bottom pan. Return the material lodged in the perforations to the oats on top of the sieve.

(5) Repeat this operation on the remaining portions until entire sample has been sieved.

b. Hand Sieving Method:

(1) Mount a 0.064 x 3/8 inch oblong-hole sieve on a bottom pan.

(2) Place one-third of the sample in the center of the sieve.

(3) Hold the sieve level in both hands with elbows close to the sides and the sieve perforations parallel to the direction of movement.

(4) In a steady motion, move the sieve from left to right approximately 10 inches and then return from right to left.

(5) Repeat this operation 30 times.

(6) Clean the sieve and empty the bottom pan. Return the material lodged in the perforations to the oats on top of the sieve.

(7) 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" and record the percentage to the nearest tenth percent on the certificate in accordance with Section 7.4, Special Grades.

7.18 PROCESSING THE WORK SAMPLE

At this point, determinations have been made for heating, odor, moisture, general appearance, bleached, test weight, infestation, distinctly low quality, sample grade factors, and thin. Now divide the work sample into fractional portions for determining smutty, garlicky, ergoty, sound, foreign material and other grains, heat-damaged kernels, damaged, and wild oats. The following chart and table No. 6 illustrate how the sample is divided into fractional parts using the Boerner divider.

CHART 1 - DIVIDING THE WORK SAMPLE

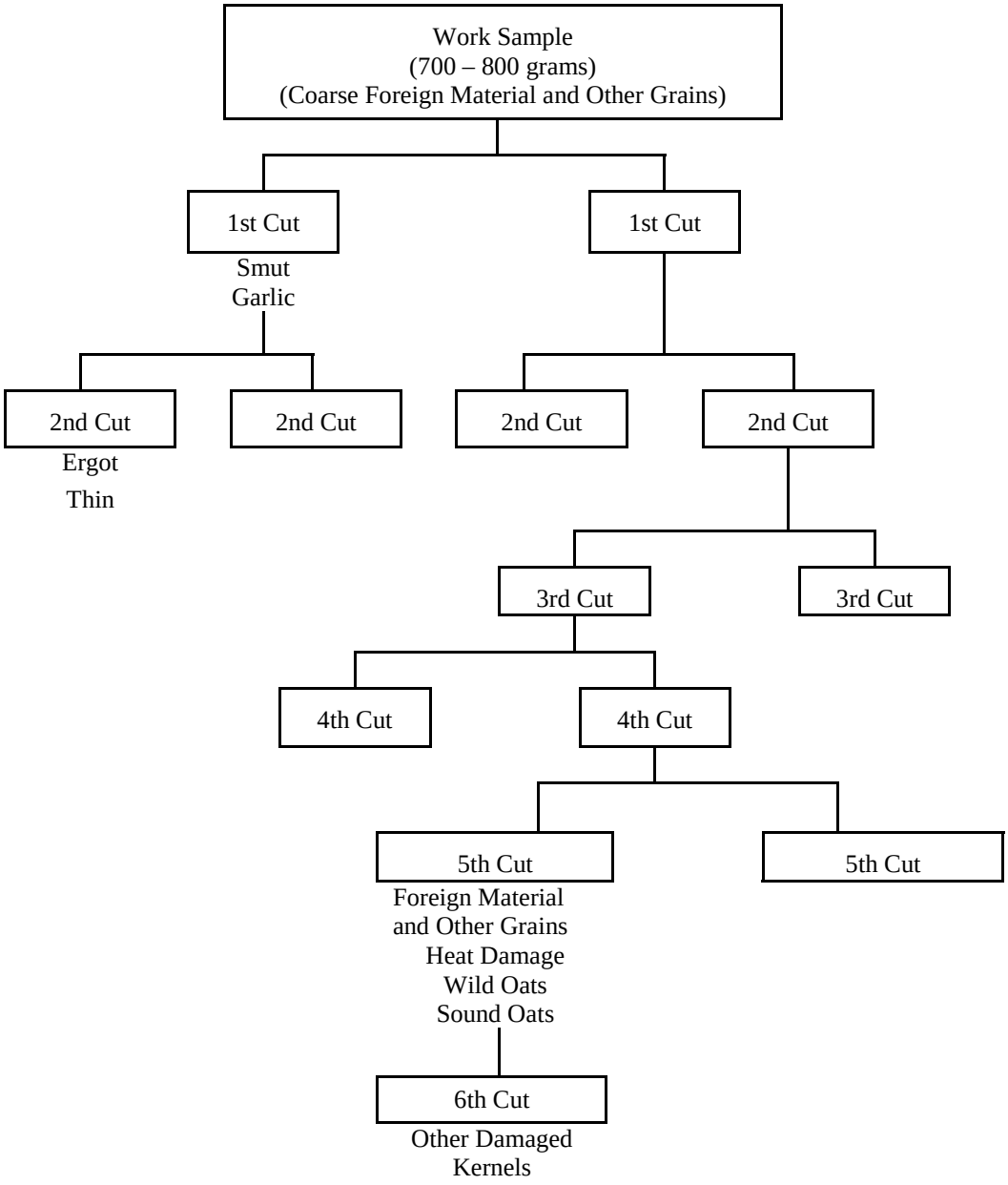


TABLE NO. 6

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 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.

Basis of Determination. Determine smutty on a portion of 500 grams of the original sample.

Smut Spores. When smut spores are in a sufficient quantity to give the entire sample a smutty appearance, grade the oats smutty. In such cases, there is often a sufficient quantity of smut balls (excess 0.2 percent) which would cause the sample to grade smutty. Smut balls apply in the determination of the special grade "Smutty" but also function as foreign material.

Certification. When applicable, grade the oats "Smutty" in accordance with Section 7.4, Special Grades.

7.20 GARLICKY OATS

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 on a portion of 500 grams of the original sample. (Reference: Visual Reference Images Nos. OF-13.0 and OF-13.1)

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.

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

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

Certification. Record the word "Garlicky" on the certificate in accordance with Section 7.4, Special Grades. Upon request, provide the number of garlic bulblets in whole and thirds.

7.21 ERGOTY OATS

Oats that contain more than 0.10 percent ergot.

Ergot is a hard, reddish-brown or black grain like mass of certain parasitic fungi that replaces oat kernels. (Reference: Visual Reference Image No. OF-12.0)

Basis of Determination. Determine ergoty on a portion of 250 grams of the original sample.

Certification. Record the word "Ergoty" on the certificate in accordance with Section 7.4, Special Grades. Upon request, record the percentage of ergot to the nearest hundredth percent.

7.22 SOUND OATS

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 percentage of sound oats, 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) (refer to section 7.23);

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 sum of the percentages of foreign material, other grains, heat-damaged kernels, other damaged kernels, and wild oats subtracted from 100 percent, equals the percentage of sound oats.

Certification. Record the percentage of sound oats on the certificate to the nearest tenth percent.

7.23 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.

Other Grains. *Barley, canola, 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.*

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 (1 inch) or more in length.

2 Approximately 1.3 cm (1/2 inch) or more with a thickness of .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. Whole kernels of corn and sweet corn are kernels with one-fourth or less of the kernel removed.

(b) Whole soybeans. Whole soybeans are soybeans with one-fourth or less of the soybean removed.

(c) Sunflower seeds. 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. Fine foreign material and fine other grains consist of the following:

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 2 - PROCEDURE FOR DETERMINING FOREIGN MATERIAL AND OTHER GRAINS

STEP 1. Coarse Foreign Material and Coarse Other Grains

a. Handpick the 700 – 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.

STEP 2. Fine Foreign Material and Fine Other Grains

a. Cut down the cleaned sample to a portion of 30 grams.

b. Either:

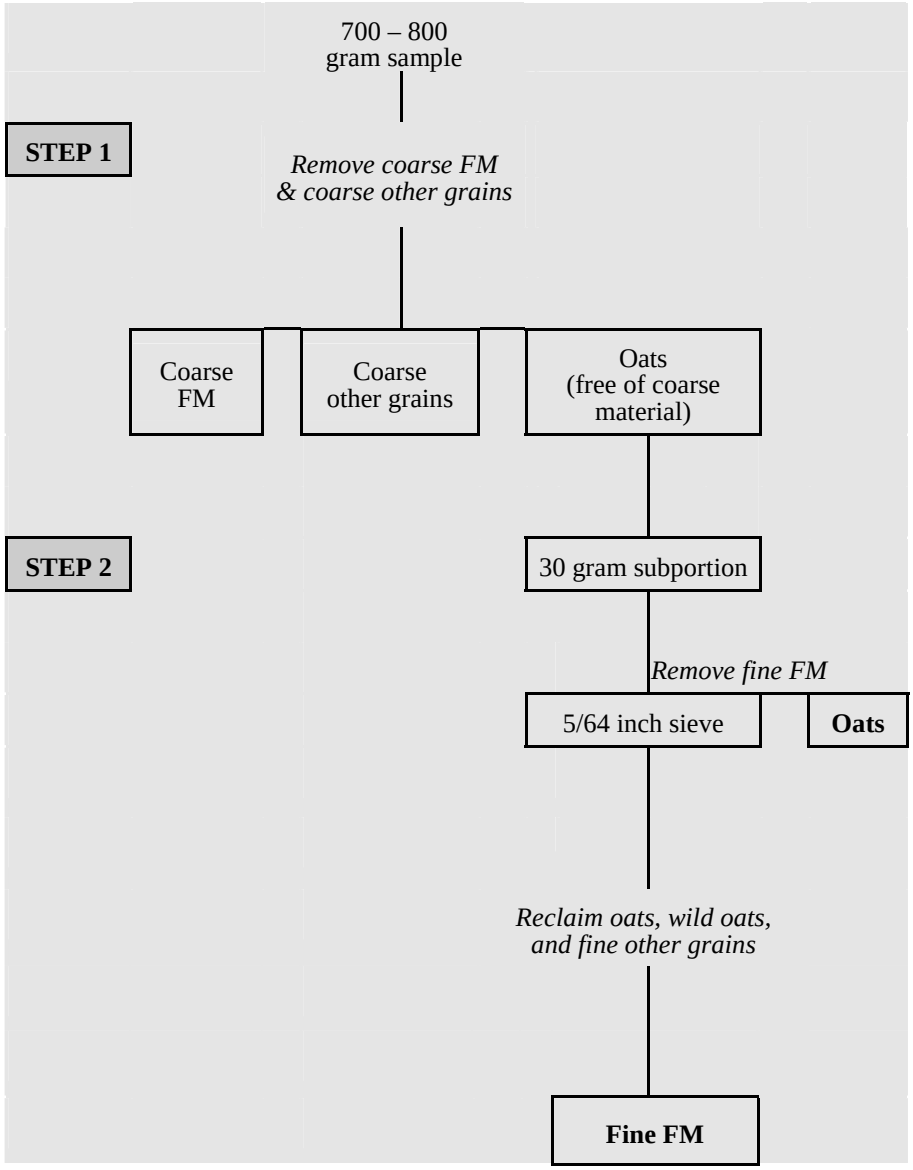
(1) handpick the 30-gram portion for fine foreign material and fine other grains; or

(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 materials which constitute fine foreign material and fine other grains.



Computing Foreign Material. Compute foreign material in oats by adding the percentage of coarse foreign material to the percentage of fine foreign material in hundredths (disregard thousandths) and round the sum to the nearest tenth percent.

Example

Weight of representative sample	700 grams
Weight of coarse foreign material	5.00 grams
Percentage of coarse foreign material (5.00 ÷ 700) x 100	0.71 percent
Weight of portion to be sieved	30.00 grams
Weight of fine foreign material	0.50 grams
Percentage of fine foreign material (0.50 ÷ 30.00) x 100	1.66 percent
Percentage of foreign material (0.71 + 1.66)	2.37 percent
rounded to:	2.4 percent

Computing Other Grains. Compute other grains in oats by adding the percentage of coarse other grains to the percentage of fine other grains (procedure similar to that given in the above example).

Certification. Record the percent of foreign material (includes coarse and fine) on the certificate to the nearest tenth percent. Record the percent of other grains (includes coarse and fine) on the work record to the nearest tenth percent.

7.24 HEAT-DAMAGED KERNELS

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. (Reference: Visual Reference Image Nos. C-5.0, C-5.1, C-5.2, SB-5.0)

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. (Reference: Visual Reference Image No. O-3.0)

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.

Computing Heat-Damaged Kernels. Compute the percentage of heat-damaged kernels by adding the percentage of heat-damaged whole corn and soybeans to the percentage of heat-damaged oats, wild oats, and other grains in hundredths (disregard thousandths) and round the sum to the nearest tenth percent.

Example

Weight of representative sample	700 grams
Weight of heat-damaged corn and soybeans	3.00 grams
Percentage of heat-damaged whole corn and soybeans (3.00 ÷ 700) x 100	0.42 percent
Weight of representative sample	30.00 grams
Weight of heat-damaged oats, wild oats, and other grains	0.30 grams
Percentage of heat-damaged oats, wild oats, and other grains (0.30 ÷ 30.00) x 100	1.00 percent
Percentage of heat-damaged kernels (0.42 + 1.00)	1.42 percent
rounded to:	1.4 percent

Certification. Record the percent of heat-damaged kernels to the nearest tenth percent on the certificate.

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 (refer to section 7.24).

Basis of Determination. Determine other damaged kernels after the removal of coarse foreign material and coarse other grains on a work portion of 15 grams.

In general, oat kernels are considered 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.

Badly-Ground and/or Weather-Damaged Kernels. Kernels which are badly discolored by ground and/or weather conditions. (Reference: Visual Reference Image No. O-1.0)

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. (Reference: Visual Reference Image No. O-2.0)

Insect-Bored Kernels. Kernels which have been bored or tunneled by insects are considered damaged and scored against sound. (Reference: Visual Reference Image No. O-4.0)

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. (Reference: Visual Reference Image No. O-5.0)

Computing Other Damaged Kernels. Compute other damaged kernels in oats as shown in the following example:

Example

Weight of representative portion	15.10 grams
Weight of other damaged kernels	0.11 grams
Percentage of other damaged kernels (0.11 ÷ 15.10) x 100	0.72 percent
rounded to:	0.7 percent

Certification. Record the percent of other damaged kernels on the work record to the nearest tenth percent.

7.26 WILD OATS

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

Basis of Determination. Determine wild oats 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 characteristic slender kernels with twisted awns (so-called "sucker mouths") and basal hairs or bristles on the germ end of the kernels. Wild oats function against sound oats. (Reference: Visual Reference Image No. OF-28.0)

Certification. Record the percent of wild oats on the certificate to the nearest tenth percent.

7.27 OFFICIAL CRITERIA

Seed sizing is considered "official criteria" and is determined only on request. It does not affect the grade designation. Use the 5/64 x 3/4 slotted-hole sieve to determine the percentage 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 one of the following methods:

a. Mechanical Sieving Method.

(1) 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.

(2) Set the stroke counter for 30 strokes.

(3) Follow the procedure described in Book II, Chapter 1, Section 1.13, Mechanical Sieve Shaker.

(4) Place the sample in the center of the sieve and start the machine. After the sieve shaker has stopped, remove and clean the sieve and empty the bottom pan. Return the material lodged in the perforations to the oats on top of the sieve.

(5) Sieve the material which passed through the 5/64 x 3/4 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 3/4 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.

b. Hand Sieving Method.

(1) Mount a 5/64 x 3/4 inch slotted-hole sieve on a bottom pan.

(2) Place the sample in the center of the sieve.

(3) Hold the sieve level in both hands with elbows close to the sides and the sieve perforations parallel to the direction of movement.

(4) In a steady motion, move the sieve from left to right approximately 10 inches and then return from right to left.

(5) Repeat this operation 30 times.

(6) Clean the sieve and empty the bottom pan. Return the material lodged in the perforations to the oats on top of the sieve.

(7) Sieve the material which passed through the 5/64 x 3/4 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 3/4 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 in the "Remarks" section of the certificate.

GRAIN INSPECTION HANDBOOK

BOOK II, CHAPTER 8

RYE

CHAPTER 8

RYE

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8.1 GENERAL INFORMATION

a. All quantities referenced in this chapter are approximate unless otherwise specified.

b. Use an approved divider to obtain subportions of a sample for analysis unless otherwise specified.

c. 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 30 times.

d. For specific Visual Reference Images, see RY-1.0 – RY-5.0.

e. Official inspection personnel shall document inspection information during sampling and grading. See Book IV, chapter 2.

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 percentage by weight, a percentage for a specific type of damage, etc.).

8.2 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 are provided to emphasize special qualities or conditions affecting the value of the rye and are added to and made a part of the grade designation. Special grades do not affect the numerical or sample grade designation.

TABLE NO. 1 - GRADES AND GRADE REQUIREMENTS - 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:

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 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.

8.3 GRADE DESIGNATIONS

Use the following guidelines when assigning grades on work records and certificates.

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 in alphabetical order, and

g. The word "Dockage" (when applicable) and the percentage thereof.

8.4 SPECIAL GRADES

Special grades draw attention to unusual conditions in grain and are made part of the grade designation. The 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.

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.

Example: U.S. No. 3 Rye, Garlicky

c. Infested Rye. Rye that is infested with live weevils or other insects injurious to stored grain.

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.

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.

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.

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.

Example: U.S. No. 2 Rye, Smutty

8.5 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, rye may be certified 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%

8.6 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 NO. 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 Heating Infested Odor	Distinctly low quality Garlicky Heating Infested Kind of Grain Moisture Odor Odor (smut) U.S. Sample Grade factors	Damaged kernels Ergot Foreign material Heat-damaged kernels Kind of grain Odor Plump Smut Stones Test weight Thin

8.7 DEFINITION OF RYE

Rye is defined as:

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 percentage of rye and other grains before the removal of dockage. Determine the percentage 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. No further analysis is necessary on a sample designated as not standardized grain unless a specific factor test is requested.

8.8 HEATING

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. Care should be taken not to confuse rye that is heating with rye that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

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

Certification. Grade heating rye as U.S. Sample Grade and record the word "Heating" in the "Remarks" section of the certificate.

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 NO. 3

ODOR CLASSIFICATION EXAMPLES		
Sour	Musty	Commercially Objectionable Foreign Odors
Boot	Ground	Animal hides
Fermenting	Insect	Decaying animal and vegetable matter
Insect (acrid)	Moldy	Fertilizer
Pigpen		Fumigant
		Insecticide
		Oil products
		Skunk
		Smoke
		Strong weed

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

Fumigant or insecticide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of rye contains a fumigant or insecticide 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 or insecticide odor persists based on the above criteria.

Final Determination. The inspector(s) is responsible for making the final determination for all odors. A consensus of experienced inspectors is used, whenever possible, on samples containing marginal odors. The consensus approach is not required if no 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" in the "Remarks" section of the certificate.

8.10 INFESTED RYE

Infested rye is rye that is infested with live weevils or other live insects injurious to stored grain.

The presence of any live weevil or other live insects injurious to stored grain 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.

Live weevils shall include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. Other live insects injurious to stored grain shall include grain beetles, grain moths, and larvae. (See Chapter 1, Section 1.2, Visual Grading Aids.)

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, see table No. 4.

TABLE NO. 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, record the word "Infested" on the certificate in accordance with Section 8.4, Special Grades.

8.11 GARLICKY AND LIGHT GARLICKY RYE

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*.

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*.

Basis of Determination. Determine garlicky and light garlicky before the removal of dockage on a portion of 1,000 grams. (Reference: Visual Reference Image Nos. OF-13.0) and OF-13.1)

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.

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

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

Garlic bulblets apply in the determination of "Garlicky" and "Light Garlicky" but also function as dockage or foreign material.

Certification. When applicable, grade the rye "Garlicky" or "Light Garlicky" in accordance with Section 8.4, Special Grades. Upon request, record the number of garlic bulblets in whole and thirds.

8.12 DISTINCTLY LOW QUALITY

Consider rye 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 distinctly low quality. This includes a general examination of the rye during sampling and an analysis of the obtained sample(s).

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 and too large to enter the sampling device is considered distinctly low quality.

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 distinctly low quality.

Rye suspected of containing diatomaceous earth is considered distinctly low quality unless the applicant specifically requests an examination to verify the presence of diatomaceous earth. If the laboratory examination verifies that the rye contains diatomaceous earth, then the rye is not considered distinctly low quality due to diatomaceous earth. Refer to Program Directive 9180.49, Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel, for additional information regarding the testing of rye for diatomaceous earth.

Certification. Grade distinctly low quality rye as U.S. Sample Grade. Record the words "Distinctly Low Quality" and the reason(s) why in the "Remarks" section of the certificate.

8.13 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 No. 5 shows the criteria and corresponding Visual Reference Images, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, bulgur, etc.), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain shall function as "unknown foreign substance."

TABLE NO. 5

U.S. SAMPLE GRADE CRITERIA

Criteria	*Visual Reference Image*	Number/Weight **1**/	
		Sample Basis	Lot Basis **2**/
Any numerical grading factor		Excess of limit for U.S. No. 4	N/A
Animal filth	OF-1.0	2 or more	N/A
Castor Beans	OF-3.0	2 or more	N/A
Crotalaria seeds	OF-8.0	3 or more	N/A
Glass		2 or more	N/A
Odor		Presence	N/A
Stones		8 or more or any number in excess of 0.2% by weight	N/A
Unknown foreign substances **3**/	OF-31.0	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, see section 8.12

Certification. Grade rye U.S. Sample Grade when one or more of the limits in table 5 are observed. Record the reason(s) why in the "Remarks" section of the certificate. Record count factors to the nearest whole number.

8.14 MOISTURE

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 350 grams.

The procedures for performing a moisture determination using the DICKEY-john Grain Analysis Computer GAC 2100 moisture meter are described in book II, chapter 1, section 1.10.

Certification. Record the percent of moisture on the certificate to the nearest tenth percent.

8.15 DOCKAGE

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 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 of rye that pass over the riddle are not considered dockage. Return them 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 glumes attached.

CHART 1 - PROCEDURE FOR DETERMINING DOCKAGE

Carter Dockage Tester Setup

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

b. Insert No. 25 plastic riddle in the riddle carriage.

c. Use no sieve in the top sieve carriage.

d. Insert a No. 2 sieve in the middle and bottom sieve carriages.

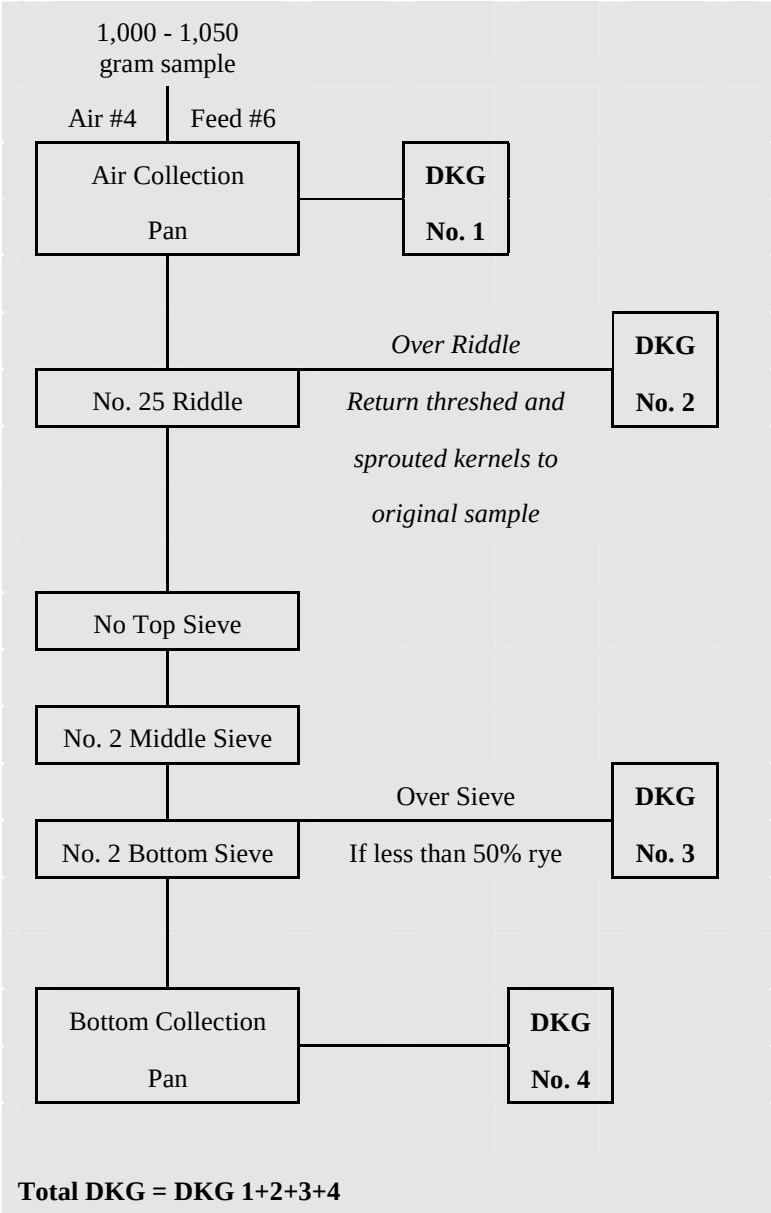
e. Start carter Dockage Tester and pour sample into feed hopper.

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. When the material consists of more than 50 percent by weight of rye, return it to the cleaned rye.



To avoid repeating operations, check the dockage for garlic bulblets, infestation, and U.S. Sample Grade factors (except stones). (See sections 8.10, 8.11, and 8.13.)

Certification. Record the word "Dockage" and the percentage to the nearest tenth percent on the work record and the certificate. If the dockage is less than one-tenth percent, report as "Dockage 0.0%."

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 it appears that the sample contains more than 0.5 percent of wild buckwheat or similar seeds, analyze a portion of approximately 50 grams of the original sample before the removal of dockage. If the portion contains more than 0.5 percent of wild buckwheat or other similar sized seeds, proceed as follows: (Reference: Visual Reference Image No. OF-27.0)

(1) Set up the Carter dockage tester as follows:

(a) Set the air control at 4;

(b) Set the feed control at 6;

(c) Insert a Number 25 riddle in the riddle carriage;

(d) Use no sieve in the top sieve carriage;

(e) Insert a Number 6 sieve in the middle sieve carriage; and

(f) Insert a Number 2 sieve in the bottom sieve carriage

(2) When the sample has been run, place approximately 50 grams of the material that passed over the Number 2 sieve (bottom collection pan) on the upper edge of a 5/64 (1.984 mm) 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 that passed over the Number 2 sieve has been sieved.

(4) If the material remaining on top of the sieve consists of 50 percent or more of whole or broken kernels of rye, return it to the sieved sample. Otherwise, add it to the dockage.

(5) Examine the material that passed through the 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 sieve. Do not perform this hand sieving process more than twice.

(6) 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 rye, that passed over the riddle (riddle collection pan);

(c) The material that passed through the Number 2 sieve (bottom collection pan);

(d) The material that passed through the hand sieve; and

(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 it appears that the sample contains 0.3 percent or more of canola, flaxseed, or rapeseed, analyze a dockage-free portion of 50 grams. If the representative portion contains 0.3 percent or more of canola, flaxseed, or rapeseed, sieve the 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) Place about one-fourth of the dockage-free representative portion on the sieve.

(c) Set the stroke counter at 30 strokes.

(d) Follow the procedures described in Book II, Chapter 1, Section 1.13, Mechanical Sieve Shaker.

(e) When the shaker has stopped, return the material lodged in the perforations to the rye remaining on top of the sieve.

(f) Clean the sieve and repeat this procedure with the three remaining similar-sized portions.

(2) Hand-Sieving Method.

(a) Mount the approved sieve on a bottom pan.

(b) Place about one-fourth of the dockage-free representative portion in the center of the sieve.

(c) Hold the sieve level in both hands with elbows close to the sides and the sieve perforations parallel to the direction of movement.

(d) In a steady motion, move the sieve from left to right approximately 10 inches and then return from right to left.

(e) Repeat this operation 30 times.

(f) Return the material lodged in the perforations to the rye remaining on top of the sieve.

(g) Clean the sieve and repeat this procedure with the three remaining similar-sized portions.

(3) 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.

(4) 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 Number 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 rye.

8.16 TEST WEIGHT

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 on a dockage-free portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination and available services are described in book II, chapter 1, section 1.11.

Certification. Record test weight results on the work record as displayed on the electronic scale or in whole and tenth pounds to the nearest tenth pound. Record the test weight on the certificate in whole and tenth pounds 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, determinations have been made for odor, test weight, moisture, dockage, infestation, and sample grade factors. Now divide the work sample into fractional portions for those determinations required after the removal of dockage. The following chart and table No. 6 illustrate how the sample is divided into fractional parts using the Boerner divider.

CHART 2 - DIVIDING THE WORK SAMPLE

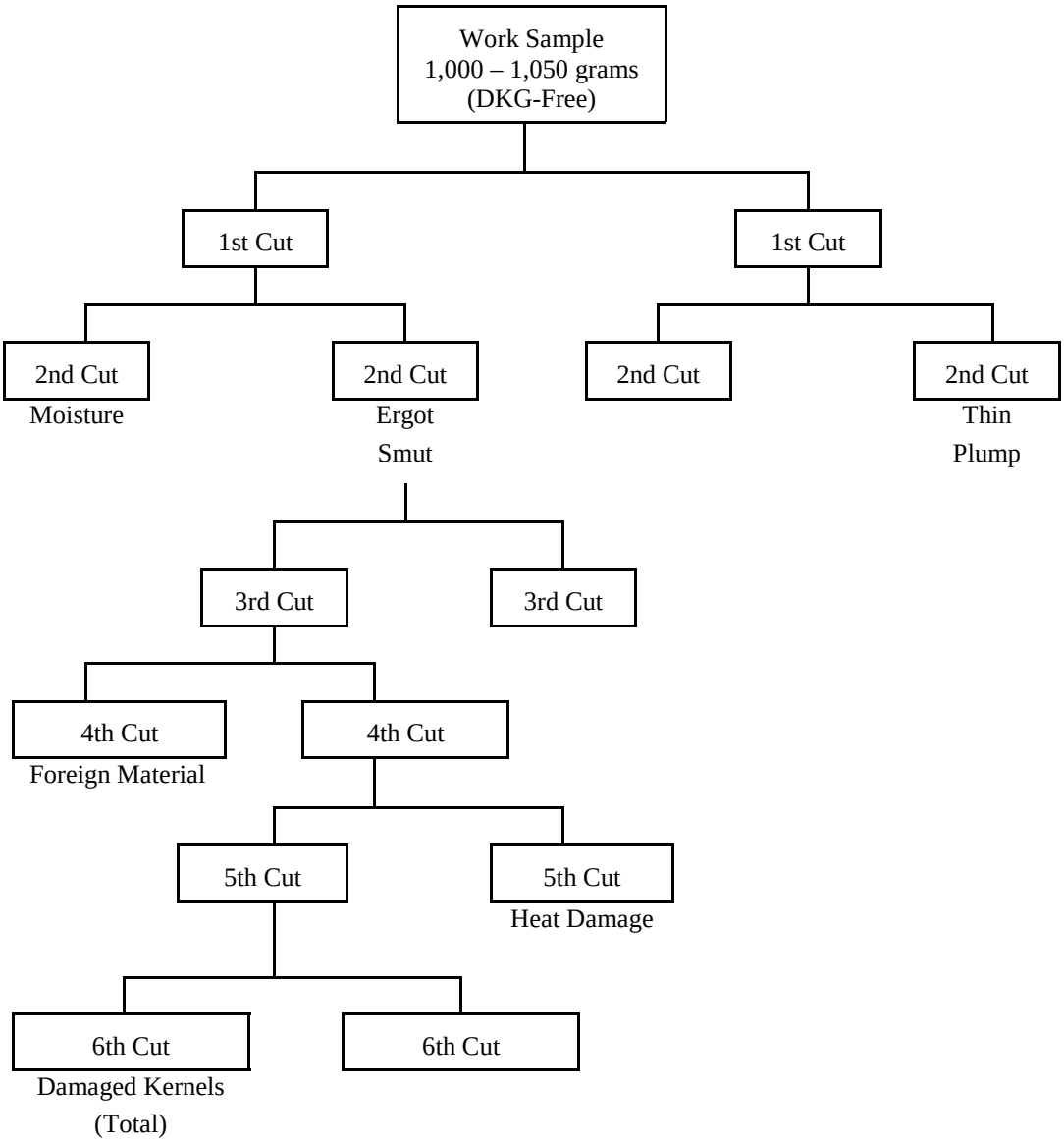


TABLE NO. 6

APPROXIMATE ANALYTICAL PORTION SIZES	
Factors	*Grams*
Damaged kernels	15
Ergot	250
Foreign material	50
Heat-damaged kernels	30
Plump	250
Smut	250
Thin	250

8.18 SMUTTY AND LIGHT SMUTTY RYE

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.*

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.*

Smut is a plant disease characterized by the appearance of smut balls or smut spores.

Basis of Determination. Determine "Smutty" on a dockage-free portion of 250 grams. Determine "Light smutty" on the sample as a whole (odor only) or on a dockage-free portion of 250 grams. Smut balls also function as foreign matter other than wheat.

Certification. Record the words "Smutty," or "Light smutty" on the certificate in accordance with Section 8.4, Special Grades. Upon request, record the odor (in the case of Light smutty) or number of smut balls on the work record and the certificate.

8.19 ERGOTY RYE

Rye that contains more than 0.30 percent of ergot.

Ergot is a hard, reddish-brown or black grain-like mass of certain parasitic fungi that replaces the kernel of rye. (Reference: Visual Reference Image No. OF-12.0)

Basis of Determination. Determine ergoty on a dockage-free portion of 250 grams. Ergot applies in the determination of ergoty but also functions as foreign matter other than wheat.

Certification. When applicable, record the word "Ergoty" on the certificate in accordance with Section 8.4, Special Grades. Upon request, record the percentage of ergot to the nearest hundredth percent in the "Remarks" section of the certificate.

8.20 THIN AND PLUMP RYE

Thin Rye. *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. *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 and plump on a dockage-free portion of 250 grams using one of the following methods:

a. Mechanical Sieving Method.

(1) 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.

(2) Set the stroke counter for 30 strokes.

(3) Follow the procedures described in Book II, Chapter 1, Section 1.13, Mechanical Sieve Shaker.

(4) Consider all material passing through the sieve as thin rye.

(5) Consider all material remaining on top of the sieve as plump rye. Return the material lodged in the perforations to the rye on top of the sieve.

b. Hand Sieving Method.

(1) Mount the 0.064 x 3/8 inch (1.626 x 9.525 mm) oblong-hole sieve on a bottom pan.

(2) Place the 250-gram portion in the center of the sieve.

(3) Hold the sieve level in both hands with elbows close to the body and the sieve perforations parallel to the direction of movement.

(4) In a steady motion, move the sieve from left to right approximately 10 inches and then return from right to left.

(5) Repeat this operation 30 times.

(6) Consider all material passing through the sieve as thin rye.

(7) Consider all material remaining on top of the sieve as plump rye. Return the material lodged in the perforations to the rye on top of the sieve.

Rye graded U.S. No. 1 may contain not more than 10.0 percent, U.S. No. 2 not more than 15.0 percent, and in U.S. No. 3 not more than 25.0 percent of thin rye.

Certification. When applicable, record the percentage of thin rye on the certificate to the nearest tenth percent.

When applicable, plump becomes a part of the grade designation and is shown on the certificate in accordance with Section 8.3, Grade Designations.

8.21 FOREIGN MATERIAL

All matter other than rye that remains in the sample after the removal of dockage.

Basis of Determination. Determine foreign material on a dockage-free portion of 50 grams.

In rye, the factor foreign material is divided into (1) foreign matter other than wheat and (2) foreign material (total).

a. Foreign Material (Total). Remove all matter other than rye from the representative portion and determine the percentage of foreign material (total).

b. Foreign Matter Other Than Wheat. Remove the wheat from the total foreign material separation. The percentage of foreign matter other than wheat is then based on the remaining foreign material after the removal of the wheat.

Certification. Record the percentages of foreign matter other than wheat and foreign material (total) on the certificate to the nearest tenth percent.

8.22 DAMAGED KERNELS

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 on a dockage-free portion of 15 grams.

In general, kernels of rye and other grains are considered 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.

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. (Reference: Visual Reference Image No. RY-1.0)

Sprout-Damaged Kernels. Kernels that have the germ end broken open from germination and show a sprout and kernels that have sprouted but which have the sprouts broken off.

Kernels from which the germs have been chewed are considered sound kernels unless otherwise damaged. Do not confuse insect-chewed germs with 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. (Reference: Visual Reference Image No. RY-3.1)

Insect-Bored Kernels. Kernels which have been bored or tunneled by insects. (Reference: Visual Reference Image No. RY-4.0)

Other Damaged Kernels. Kernels which have cracks, breaks, are chewed, contain mold or fungus, or are diseased. (Reference: Interpretive Line Slide No. RY-5.0)

Certification. Record the percent of damaged kernels to the nearest tenth percent on the certificate.

8.23 HEAT-DAMAGED KERNELS

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.

In most cases, it is necessary to cross-section the kernels to determine if they are heat-damaged. Heat-damaged kernels are kernels which are reddish-brown, mahogany, or creamy in cross-section.

Certification. Record the percent of heat-damaged kernels to the nearest tenth percent on the certificate.

GRAIN INSPECTION HANDBOOK

BOOK II, CHAPTER 9

SORGHUM

CHAPTER 9

SORGHUM

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9.1 GENERAL INFORMATION

a. All quantities referenced in this chapter are approximate unless otherwise specified.

b. Use an approved divider to obtain subportions of a sample for analysis unless otherwise specified.

c. For specific Visual Reference Images, see S-1.1 - S-9.0.

d. Official inspection personnel shall document inspection information during sampling and grading. See book IV, chapter 2.

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 percentage by weight, a percentage for a specific type of damage, etc.).

9.2 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 are provided to emphasize special qualities or conditions affecting the value of sorghum.

Special grades are added to and made a part of the grade designation. They do not affect the numerical or sample grade designation.

TABLE NO. 1 - GRADES AND GRADE REQUIREMENTS - SORGHUM

Grade	Minimum Limits of -	Maximum Limits of -			
		Damaged Kernels		Broken Kernels and foreign material	
	Test weight per bushel (pounds)	Heat (percent)	Total (percent)	Foreign material (part of total) (percent)	Total (percent)
U.S. No. 1	57.0	0.2	2.0	1.5	4.0
U.S. No. 2	55.0	0.5	5.0	2.5	7.0
U.S. No. 3 **1/**	53.0	1.0	10.0	3.5	10.0
U.S. No. 4	51.0	3.0	15.0	4.5	13.0

U.S. Sample Grade:

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, 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.

9.3 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in table 1. 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 in alphabetical order, and

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

When certificating Mixed sorghum, record in the "Remarks" section of the certificate, in the order of predominance, the name and percentage of the classes in the mixture.

9.4 SPECIAL GRADES

Special grades identify unusual conditions in grain and are part of the grade designation. The sorghum standards include two special grades:

a. Infested Sorghum. Sorghum that is infested with live weevils or other live insects injurious to stored grain.

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.

Example: U.S. No. 3 Sorghum, Smutty

9.5 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, sorghum may be certified 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

9.6 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, and 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 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 NO. 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 Infested Kind of grain Moisture Odor Smut Test weight U.S. Sample Grade factors	Broken kernels and foreign material	Class Damaged kernels Heat-damaged kernels Odor Stones

The following sections of this chapter are arranged in a logical sequence typically followed in the inspection and grading of sorghum.

9.7 DEFINITION OF SORGHUM

Sorghum is defined as:

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. No further analysis is necessary on a sample designated as not standardized grain unless a specific factor test is requested.

9.8 HEATING

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. Care should be taken not to confuse sorghum that is heating with sorghum that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

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

Certification. Grade heating sorghum U.S. Sample Grade and record the word "Heating" in the "Remarks" section of the certificate.

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 NO. 3

ODOR CLASSIFICATION EXAMPLES		
Sour	Musty	Commercially Objectionable Foreign Odors
Boot	Ground	Animal hides
Fermenting	Insect	Decaying animal and vegetable matter
Insect (acrid)	Moldy	Fertilizer
Pigpen		Fumigant
		Insecticide
		Oil products
		Skunk
		Smoke
		Strong weed

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

Fumigant or insecticide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of sorghum contains a fumigant or insecticide 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 or insecticide odor persists based on the above criteria.

Final Determinations. The inspector(s) is responsible for making the final determination for all odors. A consensus of experienced inspectors is used, whenever possible, on samples containing marginal odors. The consensus approach is not required if no 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" in the "Remarks" section of the certificate.

9.10 MOISTURE

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 350 grams.

The procedures for performing a moisture determination using the DICKEY-john Grain Analysis Computer GAC 2100 moisture meter are described in book II, chapter 1, section 1.10.

Certification. Record the percent of moisture on the certificate to the nearest tenth percent.

9.11 TEST WEIGHT

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 before the removal of dockage on a portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination and available services are described in book II, chapter 1, section 1.11.

Certification. Record test weight results on the work record as displayed on the electronic scale or in whole and half pounds. Disregard fractions of a half pound. Record the test weight on 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.

9.12 INFESTED SORGHUM

Infested sorghum is sorghum that is infested with live weevils or other live insects injurious to stored grain.

The presence of any live weevil or other live insects injurious to stored grain 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.

Live weevils shall include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. Other live insects injurious to stored grain shall include grain beetles, grain moths, and larvae. (See Chapter 1, Section 1.2, Visual Grading Aids.)

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, see table No. 4.

TABLE NO. 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" in accordance with Section 9.4, Special Grades.

9.13 GENERAL APPEARANCE

Distinctly Discolored. Sorghum which is distinctly discolored shall be graded not 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 (yellow or brown appearance). 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. (Reference: Interpretive Line Print (sorghum or tannin). Interpretive Line Print (sorghum/tannin or white); Interpretive Line Print (white).)

Badly Weathered. Sorghum that has been discolored by adverse weather conditions to a point where many of the kernels are badly discolored. (Reference: Interpretive Line Print (sorghum or tannin), Interpretive Line Print (sorghum/tannin or white), Interpretive Line Print (white).)

In order to ensure a uniform application of the general appearance factors, follow the procedures outlined below:

a. Cut out 400 grams of sorghum from the original sample.

b. Pour the sorghum into an empty plastic box until the sorghum is level with the top of the box.

c. Compare the appearance of the sorghum in the box with the appearance of the sorghum in the Interpretive Line Print.

d. Sorghum is considered "Distinctly Discolored" or "Badly Weathered" when the representative portion is equal to or worse than the sorghum in the Interpretive Line Print.

Certification. Distinctly discolored sorghum is graded not higher than U.S. No. 3. Record the words "Distinctly Discolored" in the "Remarks" section of the certificate.

Badly weathered sorghum is graded U.S. Sample Grade. Record the words "Badly Weathered" in the "Remarks" section of the certificate.

9.14 SMUTTY SORGHUM

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.

Smut is a plant disease characterized by the appearance of smut balls or smut spores.

Basis of Determination.

a. Smut spores. Determine smut spores before the removal of dockage on a portion of 1,000 to 1,050 grams. Grade the sorghum smutty when smut spores are present in sufficient quantities to give the sample a smutty appearance.

b. Smut balls. Determine the number of smut balls before the removal of dockage on approximately 100 grams. Grade the sorghum smutty when 20 or more smut balls are present. Smut balls apply in the determination of smutty but also function as broken kernels, foreign material, and other grains.

Certification. When applicable, grade the sorghum "Smutty" in accordance with Section 9.4, Special Grades. Upon request, show the number of smut balls in the "Remarks" section of the certificate.

9.15 DISTINCTLY LOW QUALITY

Consider sorghum 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 sorghum is of distinctly low quality. This includes a general examination of the sorghum during sampling and an analysis of the obtained sample(s).

The following guidelines are provided to assist in determining whether to apply the distinctly low quality designations.

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 are too large to enter the sampling device is considered distinctly low quality.

Other Unusual Conditions. Sorghum that is obviously affected by other unusual conditions which adversely affect its quality but which cannot be properly graded by use of the grading factors specified or defined in the standards is considered distinctly low quality.

Sorghum suspected of containing diatomaceous earth is considered distinctly low quality unless the applicant specifically requests an examination to verify the presence of diatomaceous earth. If the laboratory examination verifies that the sorghum contains diatomaceous earth, then the sorghum is not considered distinctly low quality due to diatomaceous earth. Refer to Program Directive 9180.49, Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel, for additional information regarding the testing of sorghum for diatomaceous earth.

Certification. Grade distinctly low quality sorghum as U.S. Sample Grade. Record the reason(s) why the sorghum was distinctly low quality on the certificate.

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 to 1,050 grams. Table No. 5 shows the criteria and corresponding Visual Reference Images, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, bulgur, etc.), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain shall function as "unknown foreign substance." Determine stones on a dockage and broken kernel and foreign material-free portion.

TABLE NO. 5

U.S. SAMPLE GRADE CRITERIA			
Criteria	*Visual Reference Image*	Number/Weight **1**/ *Sample Basis*	Lot Basis **2**/
Any numerical grading factor		Excess of limit for U.S. No. 4	N/A
Animal filth	OF-1.0	10 or more	N/A
Castor Beans	OF-3.0	2 or more	N/A
Cockleburs	OF-6.0	8 or more	N/A
Crotalaria seeds	OF-8.0	3 or more	N/A
Glass		2 or more	N/A
Odor		Presence	N/A
Stones		8 or more or any number in excess of 0.2% by weight	N/A
Unknown foreign substances **3**/	OF-31.0	4 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/ Consider feed pellets and processed grain products as foreign material, not unknown foreign substance.

* For Distinctly Low Quality, see section 9.15

Certification. Grade sorghum U.S. Sample Grade when one or more of the limits in table 5 are observed. Record the reason(s) why in the "Remarks" section of the certificate. Record count factors to the nearest whole number.

9.17 DOCKAGE

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 on a portion of 1,000 to 1,050 grams of the original sample.

CHART 1 - PROCEDURE FOR DETERMINING DOCKAGE

STEP 1. Carter Dockage Tester

a. Set the air control to 1, and the feed control to 6.

b. Insert the No. 6 riddle in the riddle carriage, a No. 6 sieve in the top sieve carriage, and a No. 1 sieve in the bottom sieve carriage. No sieve required in the middle sieve carriage.

c. Run 1,000 – 1,050 grams through the dockage tester.

d. Return sorghum kernels that may caught in the riddle to the cleaned portion.

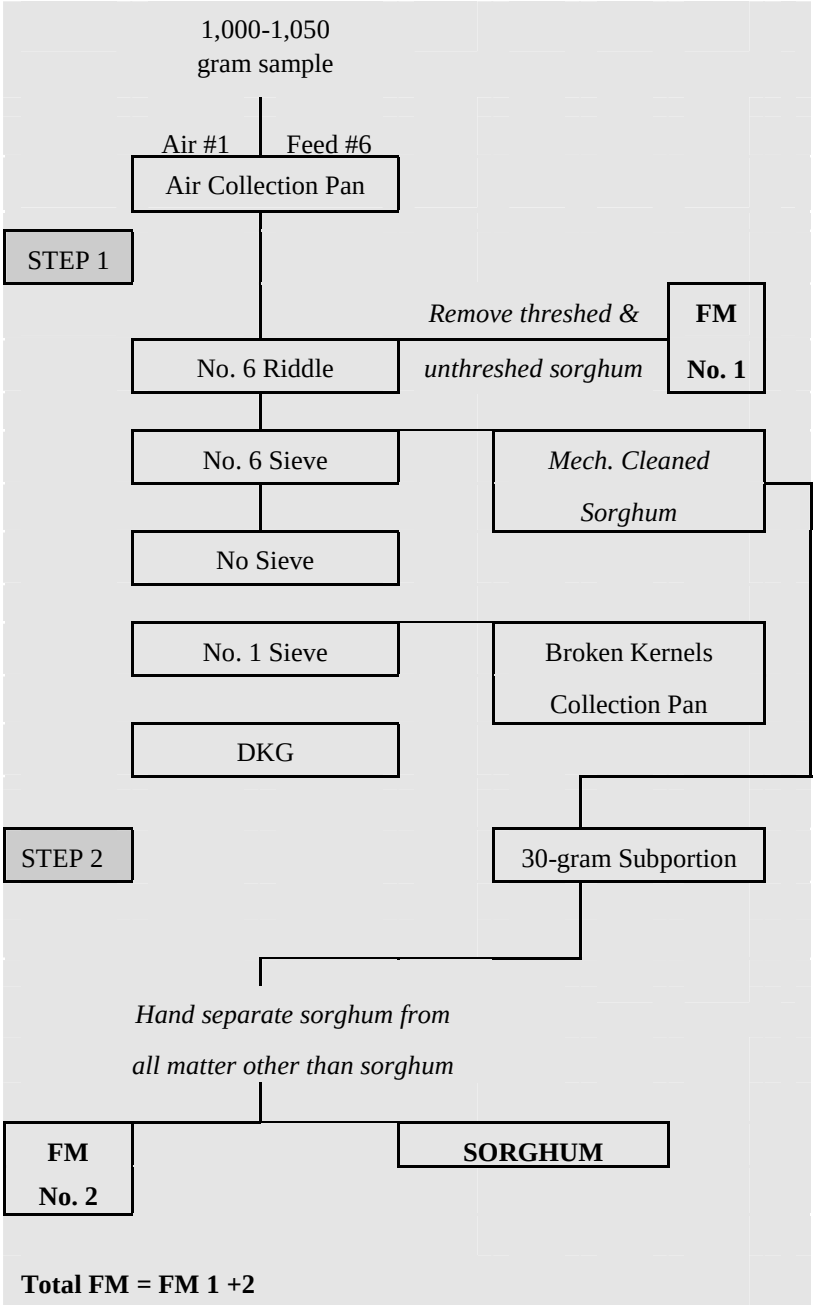
e. Remove threshed, unthreshed and clumps of sorghum from material that passed over the riddle and add it the cleaned sorghum

STEP 2. 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 number 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 word "Dockage" and the percentage on the work record in hundredths. When the sample contains 1 percent or more dockage, record the percentage of dockage on the certificate in whole percent with a fraction of a percent disregarded.

1.00 to 1.99 percent is recorded as 1.0 percent
2.00 to 2.99 percent is recorded as 2.0 percent, etc.

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, sorghum-sudangrass, and sweet sorghum (Sorgo).*

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. (Reference: Visual Reference Image No. (S) OF-16.0)

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 and foreign material are determined by:

a. Sieving 1,000 to 1,050 grams of dockage-free sorghum with a 1.98 mm (5/64) triangular-hole sieve (Number 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.

Computing Broken Kernels and Foreign Material. The mechanically separated broken kernels and foreign material used to make this calculation are in the bottom collection pan and the riddle collection pan. (See section 9.17.) Obtain the total percentage of broken kernels and foreign material by adding the percentage 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.

STEP 1. Percent of dockage = (Weight of dockage ÷ weight of original sample) x 100

STEP 2. Weight of dockage-free sample = Weight of original sample - weight of dockage

STEP 3. Percent of broken kernels (BN) = (Weight of BN ÷ weight of dockage-free sample) x 100

STEP 4. Percent of mechanically separated foreign material (FM) = (Weight of FM removed by No. 6 riddle ÷ weight of dockage-free sample) x 100

STEP 5. Percent of handpicked FM = (Weight of handpicked FM (including other grains) ÷ weight of handpicked portion) x 100

STEP 6. Total percent of FM = Percent of handpicked FM + percent of mechanically separated FM

STEP 7. Total percent of broken kernels and foreign material (BNFM) = Percent BN + total percent FM

Example

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

STEP 1. Percent dockage = 3.81 ÷ 1,007 x 100 = 0.37

STEP 2. Dockage-free sample weight = 1,007 - 4 (3.8 rounded) = 1,003

STEP 3. Percent broken kernels = 54.11 ÷ 1,003 x 100 = 5.39

STEP 4. Percent mechanically separated FM = 4.33 ÷ 1,003 x 100 = 0.43

STEP 5. Percent handpicked FM = 0.37 ÷ 29.7 x 100 = 1.24

STEP 6. Percent total FM = 1.24 + .43 = 1.67 (round to 1.7)

STEP 7. Percent total broken kernels and foreign material (BNFM) = 5.39 + 1.67 = 7.06 (rounded to 7.1)

Certification. Record the total percent of broken kernels and foreign material (step 7) and the percent of foreign material (step 6) on the certificate to the nearest tenth percent. Upon request, report the percent of broken kernels (step 3) on the certificate to the nearest tenth.

Adjustment of Factors. In certain instances, when reporting broken kernels and foreign material separately, the sum of BN and FM in sorghum, due to rounding, will not equal the percentage of BNFM recorded on the certificate. When this occurs, it is necessary to adjust the component (BN or FM) nearest a midpoint (e.g.; .05, .15, .25, .35, etc.) by adding or subtracting 0.1.

9.19 PROCESSING THE WORK SAMPLE

At this point, all other tests required to be performed prior to the removal of dockage have been made and the percentage of dockage has been determined. Now the work sample is ready to be divided into fractional portions for those determinations required after the removal of dockage, broken kernels, and foreign material. The following chart and table No. 6 illustrate how the sample is divided into fractional parts using the Boerner divider.

CHART 2 - DIVIDING THE WORK SAMPLE

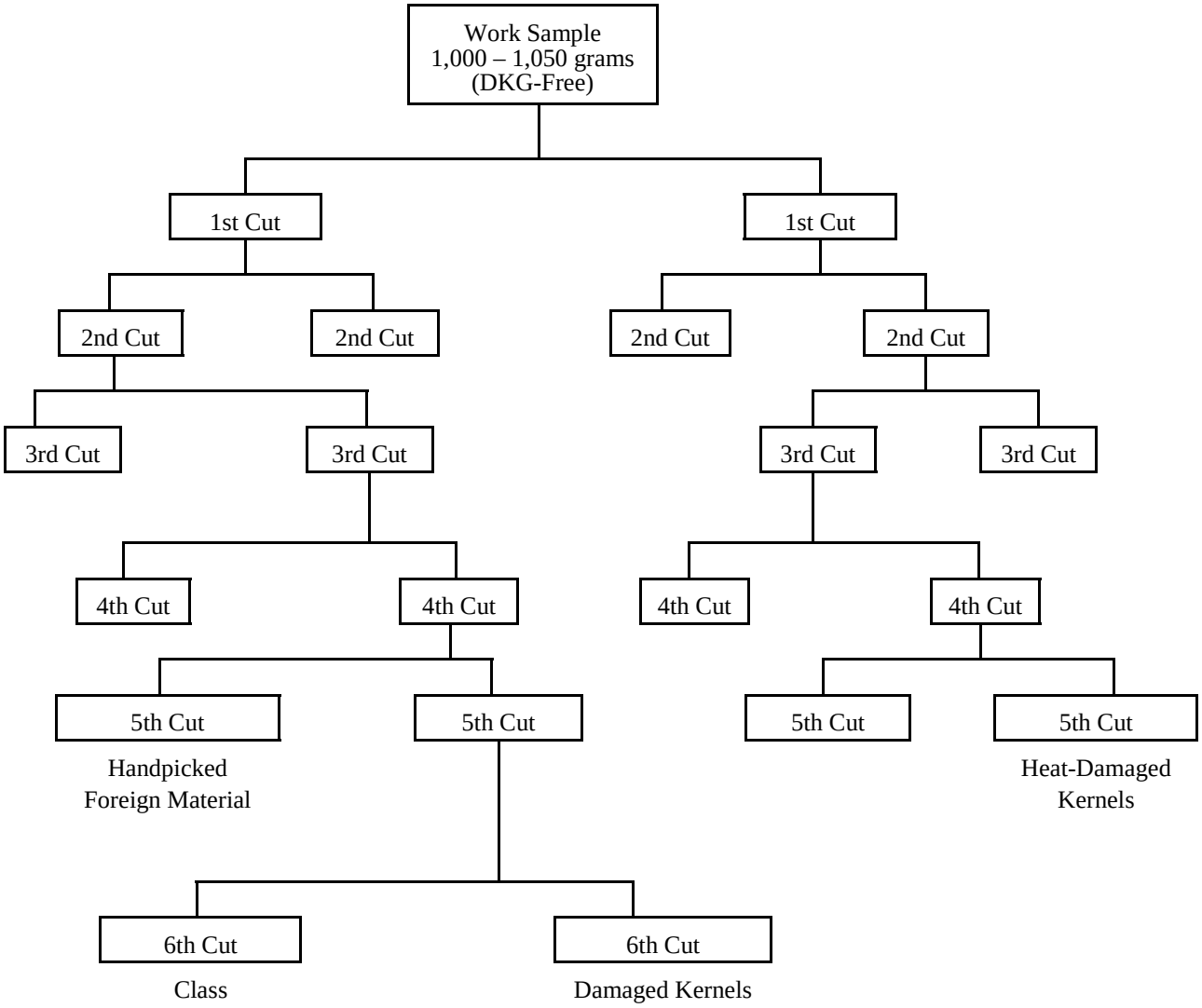


TABLE NO. 6

APPROXIMATE ANALYTICAL PORTION SIZES	
Factors	*Grams*
Damaged kernels	15
Heat-damaged kernels	30
Kind of grain	30*

* Factor determined before the removal of dockage.

9.20 CLASS

a. Sorghum. *Sorghum which is low in tannin content due to the absence of 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 is high in tannin content due to the presence of a pigmented testa (subcoat) and contains not more than 10.0 percent non-Tannin sorghum. The pericarp color of this class is usually brown but may also be white, yellow, pink, orange, red, or bronze.*

c. White Sorghum. *Sorghum which is low in tannin content due to the absence of a pigmented testa (subcoat) and contains not more than 2.0 percent sorghum of other classes. The pericarp color of this class is white or translucent and 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 1/ to bleach a portion of 15 (15 ± 1.5) grams after the removal of dockage and machine-separated broken kernels and foreign material. (Reference: Visual Reference Images Nos. (S) OF-33.0, "White sorghum," and S-9.0, "Tannin sorghum (Bleached)."

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 Visual Reference Image No. S-9.0, bleach a separate portion for classing purposes. 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 percentage of White sorghum 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 (Reference: Visual Reference Image No. OF-9.0)

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 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 percentage of each class to the nearest tenth percent in the order of predominance in the "Remarks" section of the certificate.

1/ For equipment and materials, see section 1.17.

9.21 DAMAGED KERNELS

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 is a two-step process.

a. Determine damaged kernels of other grains (e.g., corn, 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.

TYPES OF SORGHUM DAMAGE.

In general, a kernel of sorghum is considered 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.

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. (Reference: Visual Reference Image No. S-1.1)

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 caused by ground and/or weather conditions. (Reference: Visual Reference Image No. S-2.0)

Heat-Damaged Kernels. Kernels and pieces of kernels of sorghum which are materially discolored and damaged by heat. (Reference: Visual Reference Image No. S-3.0) It is necessary in most cases to cross section the kernels and make an analysis to determine if the color is creamy.

Insect-Bored Kernels. Kernels and pieces of kernels of sorghum which have been bored or tunneled by insects. (Reference: Visual Reference Image No. S-4.0)

Mold-Damaged Kernels. Kernels and pieces of kernels of sorghum containing surface mold. (Reference: Visual Reference Image No. S-5.0) Do not confuse mold with dark stains or discolorations caused by ground and/or weather conditions.

Mold-Damaged Kernels (Internal Mold). Kernels and pieces of kernels containing mold, usually in the germ area under the bran layer. The bran coat should be removed carefully because scraping too deeply could remove the damage. (Reference: Visual Reference Image No. S-5.1)

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. (Reference: Visual Reference Image No. S-8.0)

Sprout-Damaged Kernels. Kernels and pieces of kernels of sorghum in which the sprout definitely protrudes from the germ. In the application of this definition, one of the following three conditions must be met:

a. The sprout has split the germ covering and is sticking straight up, or

b. The sprout has split the germ covering and extends out of the upper portion of the germ area, or

c. The sprout has split the germ covering and extends down over the tip of the kernel. (Reference: Visual Reference Image No. S-6.0)

Kernels and pieces of kernels of sorghum which have a split over the germ area, but which have no sprout protruding, are considered sound unless otherwise damaged. (Reference: Visual Reference Image No. S-7.0)

Germ Damage Determination. Use the S/J mixer method to determine germ-damage. 1/

New crop sorghum, in most cases, will not contain germ damage and will not have to be bleached. Inspection personnel should be alert to conditions that will cause germ damage and bleach samples when necessary. In most instances, once sorghum is handled in elevators and blending occurs, it will be necessary to bleach samples to properly determine germ damage.

Prior to bleaching, remove all types of damaged kernels, except germ-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-damaged kernels, and calculate the percentage.

1/ For equipment and materials, see section 1.17.

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 KOH pellets.

c. Add 40 ml of bleach. 1/

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.

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 damage should now be readily apparent. Some kernels may have the seed coat attached to the germ area; therefore, it is permissible to carefully lift the bran coat from over the germ area to examine for damage.

Any deviation from the previously described procedures may result in improperly bleached sorghum and could produce a hazardous condition. Further,

- Safety equipment should be worn while the bleach operation is in progress and the lab area thoroughly cleaned once bleaching is complete.

- Accidental spills should first be neutralized with vinegar before the liquid is wiped up.

1/ Store bleach in cool, dry place and replace any unused bleach at least every 3 months following the date of purchase.

- Avoid mixing the potassium hydroxide (KOH)-bleach solution used in this test with chemical reagents or waste solutions associated with other tests.

- When disposing of the KOH-bleach solution, wash the solution down the sink drain with large quantities of water.

Computing Damaged Kernels

Obtain the percentage of damaged kernels by adding the percentage 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.

STEP 1. Weight of other type damaged kernels ÷ weight of sample before bleaching x 100 = percent of other type damaged kernels.

STEP 2. 100 percent - percent of other type damaged kernels ÷ 100 = change of base factor.

STEP 3. Weight of germ damaged portion ÷ weight of damaged portion after bleaching x 100 = percent of germ damaged kernels.

STEP 4. Percent of germ damaged kernels x change of base factor = adjusted percent of germ damaged kernels.

STEP 5. Weight of damaged kernels of corn/soybeans removed by No. 6 riddle ÷ weight of mechanically cleaned sample = percent of damaged corn/soybeans.

STEP 6. Percent of other damaged kernels + adjusted percent of germ damaged kernels + percent of damaged corn/soybeans = percent of damaged kernels.

Example

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 No. 6 riddle	2.50 grams

STEP 1. (2.40g ÷ 16.10g) x 100 = 14.90 percent of other type damaged kernels.

STEP 2. (100% - 14.90%) ÷ 100 = 0.85 change of base factor.

STEP 3. (4.33g ÷ 11.95g) x 100 = 36.23 percent germ damaged kernels.

STEP 4. 0.85 x 36.23 = 30.79 adjusted percent of germ damaged kernels.

STEP 5. (2.50g ÷ 949) x 100 = 0.26 percent damaged kernels of corn/soybeans

STEP 6. 14.90% + 30.79% + 0.26% = 45.95 (rounded to 46.0) percent damaged kernels.

Certification. Record the percent of damaged kernels on the certificate to the nearest tenth percent.

9.22 HEAT-DAMAGED KERNELS

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 and machine-separated broken kernels and foreign material on a portion of 30 grams. It is necessary, in most cases, to cross-section the kernels to determine if the color is creamy. (Reference: Visual Reference Image No. S-3.0)

Procedure for Determining Heat-Damaged Kernels of Grain Removed by Riddle. (See section 9.17.) The percent of heat-damaged kernels of corn and/or soybeans removed by the Number 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. Compute 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. See page 9-24, step 5, for calculations.

Certification. Record heat-damaged kernels on the certificate to the nearest tenth percent.

9.23 OFFICIAL CRITERIA

The analysis for the percentage of ergot is considered as an "official criteria" factor in sorghum. Ergot analysis is performed only upon request of the applicant for service and does not affect the grade designation.

Basis of Determination. Determine ergot before the removal of dockage on a work portion of approximately 1,000 to 1,050 grams.

Certification: Record the percentage of ergot on the work record to the nearest hundredth percent. Use one of the following statements (as requested by the applicant) to record the percentage of ergot 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."*

GRAIN INSPECTION HANDBOOK

BOOK II, CHAPTER 10

SOYBEANS

CHAPTER 10

SOYBEANS

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10.1 GENERAL INFORMATION

a. All quantities referenced in this chapter are approximate unless otherwise specified.

b. Use an approved divider to obtain subportions of a sample for analysis unless otherwise specified.

c. 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 five times.

d. For specific Visual Reference Images see SB-1.0 – SB-13.0.

e. Official inspection personnel shall document inspection information during sampling and grading. See book IV, chapter 2.

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 percentage by weight, a percentage for a specific type of damage, etc.).

10.2 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 are provided to emphasize special qualities or conditions affecting the value and are added to and made a part of the grade designation. They do not affect the numerical or sample grade designation.

TABLE NO. 1 - GRADES AND GRADE REQUIREMENTS - SOYBEANS

Grade	Minimum Limits of -	Maximum Limits of -				
		Damaged Kernels				
	Test weight per bushel (pounds)	Heat (part of total) (percent)	Total (percent)	Foreign Material (percent)	Splits (percent)	Soybeans of other colors 1/ (percent)
U.S. No. 1	56.0	0.2	2.0	1.0	10.0	1.0
U.S. No. 2	54.0	0.5	3.0	2.0	20.0	2.0
U.S. No. 3	52.0	1.0	5.0	3.0	30.0	5.0
U.S. No. 4	49.0	3.0	8.0	5.0	40.0	10.0

U.S. Sample Grade:

U.S. Sample Grade is soybeans that:

(a) Does 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

10.3 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in table 1. 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, shall be shown next;

d. The name of the class; and

e. The applicable special grades in alphabetical order.

For Mixed soybeans, record the percentage of Yellow soybeans and soybeans of other colors to the nearest tenth percent on the work record and in the "Remarks" section of the certificate.

For Mixed soybeans, record the percentage of Yellow soybeans and soybeans of other colors to the nearest tenth percent on the work record and in the "Remarks" section of the certificate.

Example: U.S. No. 2 Yellow Soybeans

U.S. No. 3 Mixed Soybeans
In "Remarks": Yellow Soybeans 75.4%
Soybeans of other colors 24.6%

U.S. No. 2 or better Yellow Soybeans

10.4 SPECIAL GRADES

Special grades identify unusual conditions in grain and are part of the grade designation. The soybean standards include three special grades:

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.

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.

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.

Example: U.S. No. 2 Yellow Soybeans, Purple Mottled or Stained.

10.5 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, soybeans may be certified 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

10.6 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, and 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 NO. 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 Heating Infested Odor	Distinctly low quality Garlicky Heating Infested Kind of Grain Moisture Odor Purple Mottled or Stained Stones Test Weight U.S. Sample Grade factors	Heat-damaged kernels Damaged kernels Odor Soybeans of other colors Splits

The following sections of this chapter are arranged in a logical sequence typically followed in the inspection and grading of soybeans.

10.7 DEFINITION OF SOYBEANS

Soybeans are defined as:

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 on a portion of 125 grams before the removal of foreign material.

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. No further analysis is necessary on a sample designated as not standardized grain unless a specific factor test is requested.

10.8 HEATING

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. Care should be taken not to confuse soybeans that are heating with soybeans that are warm and moist because of storage in bins, railcars, or other containers during hot weather.

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

Certification. Grade heating soybeans U.S. Sample Grade and record the word "Heating" in the "Remarks" section of the certificate.

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 NO. 3

ODOR CLASSIFICATION EXAMPLES		
Sour	Musty	Commercially Objectionable Foreign Odors
Boot	Ground	Animal hides
Fermenting	Insect	Decaying animal and vegetable matter
Insect (acrid)	Moldy	Fertilizer
Pigpen		Fumigant
Smoke **1**/		Insecticide
		Oil products
		Skunk
		Smoke
		Strong weed

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. Commercially objectionable foreign odors are odors, except smut and garlic odors, foreign to grain that render it unfit for normal commercial usage.

Fumigant or insecticide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of soybeans contains a fumigant or insecticide 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 or insecticide odor persists based on the above criteria.

Final Determinations. The inspector(s) is responsible for making the final determination for all odors. A consensus of experienced inspectors is used, whenever possible, on samples containing marginal odors. The consensus approach is not required if no 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" in the "Remarks" section of the certificate.

10.10 MOISTURE

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 350 grams.

The procedures for performing a moisture determination using the DICKEY-john Grain Analysis Computer GAC 2100 moisture meter are described in book II, chapter 1, section 1.10.

Certification. Record the percent of moisture on the certificate to the nearest tenth percent.

10.11 TEST WEIGHT

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 before the removal of 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 book II, chapter 1, section 1.11.

Certification. Record test weight results on the work record as displayed on the electronic scale or in whole and half pounds. Disregard fractions of a half pound. Record the test weight on 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.

10.12 INFESTED SOYBEANS

Infested soybeans are soybeans that are infested with live weevils or other live insects injurious to stored grain.

The presence of any live weevil or other live insects injurious to stored grain 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.

Live weevils include rice weevils, granary weevils, cowpea weevils, maize weevils, and lesser grain borers. Other live insects injurious to stored grain shall include grain beetles, grain moths, and larvae. (See Chapter 1, Section 1.2, Visual Grading Aids.)

Basis of Determination. Determine infestation on the lot as a whole or the sample as a whole. For insect tolerances, see table No. 4.

TABLE NO. 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

10.13 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.

Basis of Determination. Determine garlicky before the removal of foreign material on a portion of 1,000 grams. (Reference: Visual Reference Image Nos. OF-13.0 and OF-13.1)

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.

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

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

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

Certification. When applicable, grade the soybeans "Garlicky" in accordance with Section 10.4, Special Grades. Upon request, record the number of garlic bulblets in whole and thirds.

10.14 PURPLE MOTTLED OR STAINED

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 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 shall be considered purple mottled or stained. (Reference: Interpretive line print.)

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 shall be considered purple mottled or stained. (Reference: Interpretive line print.)

Soybeans Purple Mottled or Stained by Pokeberry Stain. Soybeans with seed coats discolored by pokeberry stain are considered purple mottled or stained. (Reference: Interpretive line print.)

Basis of Determination. Determine general appearance on the sample as a whole.

To assure a more uniform application of the general appearance factors in soybeans, it is recommended that the following procedures be followed:

a. Cut out 400 grams of soybeans from the original sample.

b. Pour the soybeans into an empty plastic box until the soybeans are level with the top of the box.

c. Place the interpretive line print in the lid of the box.

d. Compare the appearance of the soybeans in the plastic box with the appearance of the soybeans in the interpretive line print.

e. Consider the soybeans purple mottled or stained when the soybeans in the box are equal to or worse in appearance than the soybeans in the interpretive line print. (Reference: Interpretive line print.)

Certification. When applicable, grade the soybeans "Purple Mottled or Stained" in accordance with Section 10.4, 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. This includes a general examination of the soybeans during sampling and an analysis of the obtained sample(s).

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 distinctly low quality.

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 distinctly low quality.

Soybeans suspected of containing diatomaceous earth are considered distinctly low quality unless the applicant specifically requests an examination to verify the presence of diatomaceous earth. If the laboratory examination verifies that the soybeans contain diatomaceous earth, then the soybeans are not considered distinctly low quality due to diatomaceous earth. Refer to Program Directive 9180.49, Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel, for additional information regarding the testing of soybeans for diatomaceous earth.

Certification. Grade distinctly low quality soybeans U.S. Sample Grade. Record the words "Distinctly Low Quality" and the reason(s) why in the "Remarks" section of the certificate.

10.16 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine additional U.S. Sample Grade criteria before the removal of foreign material based on a work portion of 1,000 - 1,050 grams. Table No. 5 shows the criteria and corresponding Visual Reference Images, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, bulgur, etc.), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain shall function as "unknown foreign substance."

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 NO. 5

U.S. SAMPLE GRADE CRITERIA			
Criteria	*Visual Reference Image*	Number/Weight **1**/ *Sample Basis*	Lot Basis **2**/
Any numerical grading factor		Excess of limit for U.S. No. 4	N/A
Animal filth	OF-1.0	10 or more	N/A
Castor Beans	OF-3.0	2 or more	N/A
Crotalaria seeds	OF-8.0	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**/	OF-31.0	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, see section 10.15

Certification. Grade soybeans U.S. Sample Grade when one or more of the limits in table 5 are exceeded. Record the reason(s) why in the "Remarks" section of the certificate. Record count factors to the nearest whole number.

10.17 FOREIGN MATERIAL

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 larger than soybeans, sweet corn, 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 seed, 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 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. 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 1 - PROCEDURE FOR DETERMINING FOREIGN MATERIAL

STEP 1. Coarse Foreign Material

Handpick the 1,000 – 1,050 gram portion for coarse foreign material. (Refer to section 10.17a for the definition of coarse foreign material)

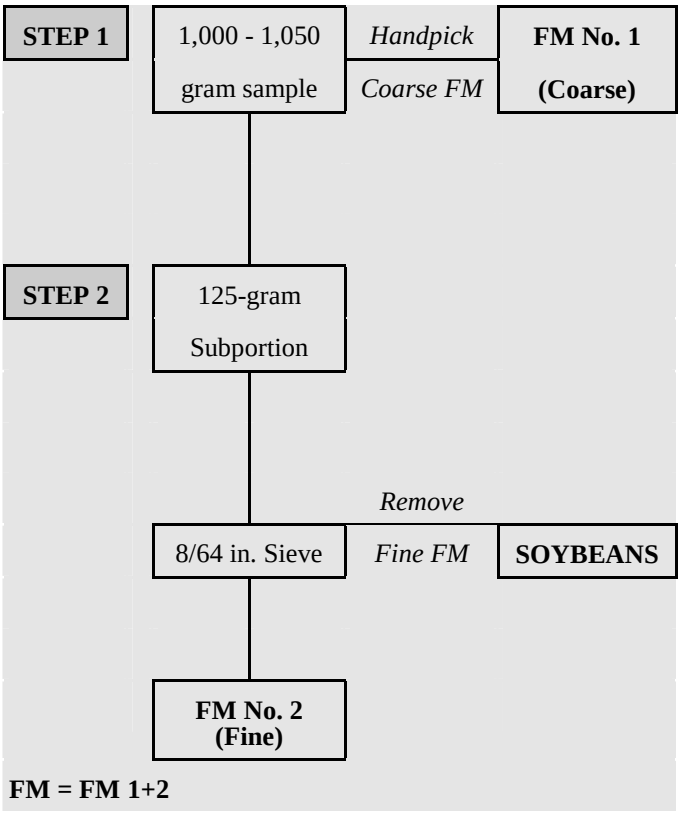
STEP 2. Fine Foreign Material

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 an 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. (See section 10.20 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.



Computing Foreign Material. Compute foreign material in soybeans by adding the percentage of coarse foreign material to the percentage of fine foreign material in hundredths (disregard thousandths) and round the sum to the nearest tenth percent.

Example

Weight of representative sample	1,025 grams
Weight of coarse foreign material	5.00 grams
Percentage of coarse foreign material (5.00 ÷ 1,025) x 100	0.48 percent
Weight of portion to be sieved	125 grams
Weight of fine foreign material	1.60 grams
Percentage of fine foreign material (1.60 ÷ 125) x 100	1.28 percent
Percentage of foreign material (0.48 + 1.28)	1.76 percent
rounded to:	1.8 percent

Certification. Record the percent of foreign material on the certificate to the nearest tenth percent.

10.18 PROCESSING THE WORK SAMPLE

At this point, determinations have been made for those tests that are performed prior to the removal of foreign material and the percentage of foreign material has been determined. Now the work sample is ready to be divided into fractional portions for those determinations required after the removal of the foreign material. The following chart and table No. 6 illustrate how the sample is divided into fractional parts using the Boerner divider.

CHART 2 - DIVIDING THE WORK SAMPLE

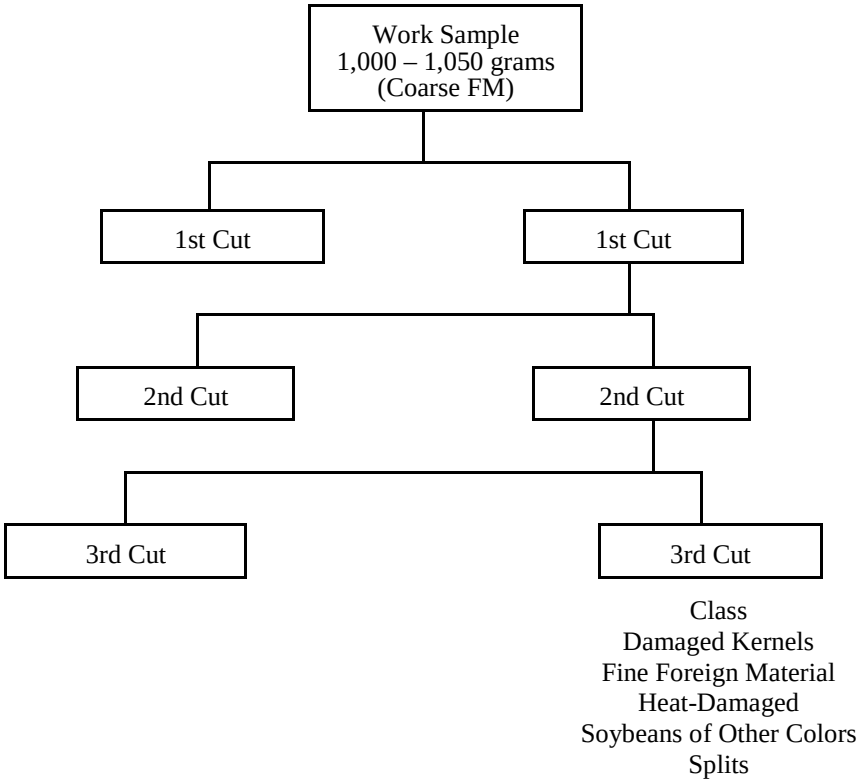


TABLE NO. 6

APPROXIMATE ANALYTICAL PORTION SIZES	
Factors	*Grams*
Damaged kernels	125
Foreign material	125
Heat-damaged kernels	125
Kind of grain **1**/	125
Soybeans of other colors	125
Splits	125

1/ Factor determined before the removal of foreign material.

10.19 CLASS

The two classes of soybeans are:

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*. (Reference: Visual Reference Image No. SB-12.0)

Soybeans of other colors 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.

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 in the "Remarks" section of the certificate to the nearest tenth percent.

When not a mixture, record the percent of "soybeans of other colors," in the appropriate factor results section of the certificate to the nearest tenth percent.

10.20 SPLITS

Soybeans with more than one-fourth of the bean removed and that are not damaged. (See Section 10.21, Damaged Kernels.)

Basis of Determination. Determine splits 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 3/4 (3.175 x 19.050 mm) or 9/64 x 3/4 (3.572 x 19.50 mm) oblong-hole or 10/64 x 3/4 (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. (See Section 10.17, 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 percentage of splits.

Example

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
Weight of portion used to calculate splits 125 – 2.40 (rounded for subtraction to 2)	123 grams
Percentage of splits (10.60 ÷ 123) x 100	8.61 percent
rounded to:	8.6 percent

Certification. Record the percent of splits on the certificate to the nearest tenth percent.

10.21 DAMAGED KERNELS

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 the amount of damaged kernels 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.

TYPES OF SOYBEAN DAMAGE.

In general, a soybean is considered 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.

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. (Reference: Visual Reference Image Nos. SB-1.0 and SB-1.1)

Damaged-by-Heat Kernels. Soybeans and pieces of soybeans which have been damaged by heat but are not heat damaged. Often it is necessary to cross section the whole soybean to determine the extent of the damage. Do not cross section splits and pieces of soybeans. (Reference: Visual Reference Image No. SB-2.0)

Frost-Damaged Kernels (Green). Soybeans and pieces of soybeans which are discolored green in cross section. (Reference: Visual Reference Image No. SB-3.0)

Frost-Damaged Kernels (Waxy). Soybeans and pieces of soybeans which have a glassy or wax-like appearance. (Reference: Visual Reference Image No. SB-3.2)

Heat-Damaged Kernels. Soybeans and pieces of soybeans which are materially discolored and damaged by heat. Often kernels need to be cross sectioned to determine the extent of damage. Do not cross section splits and pieces of soybeans. (Reference: Visual Reference Image No. SB-5.0)

Immature Kernels (Wafers). 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 with no "meat" are considered damaged. (Reference: Visual Reference Image No. SB-6.0)

Mold-Damaged Kernels. Soybeans and pieces of soybeans which contain mold. (Reference: Visual Reference Image Nos. SB-8.0 and SB-8.1)

a. Invaded-by-Mold. Soybeans that are discolored; distorted; misshapen; elongated; not normal in size or shape; 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. (Reference: Visual Reference Image No. SB-8.0-A)

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 TO MEET OR EXCEED THE MINIMUM SHOWN SHALL BE CONSIDERED DAMAGE. (Reference: Visual Reference Image SB-8.0-B)

c. Mold Damage (Pink). Soybeans and pieces of soybeans with a pink discoloration caused by fungal activity. (Reference: Visual Reference Image No. SB-8.1)

Mold-Like Substance. Whole soybeans which are 50 percent or more covered and pieces of soybeans which are discolored, to any degree, and contain 50 percent or more coverage with a mold-like substance. In either instance, the mold-like substance present must be sufficiently concentrated to meet the minimum thickness or density shown on Visual Reference Image No. SB-8.0, kernel B.

Sprout-Damaged Kernels. Soybeans and pieces of soybeans which are sprouted (with the sprout protruding). (Reference: Visual Reference Image No. SB-9.0)

Insect-Bored Kernels. Soybeans and pieces of soybeans which bear evidence of boring or tunneling, indicating the presence within the kernels of insects and kernels in which noticeable weevil-bored holes have been eaten. 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. (Reference: Visual Reference Image No. SB-7.0)

Stinkbug Stung Kernels. Soybeans and pieces of soybeans which show an indentation or discoloration on the seed coat are considered as being stung by stinkbugs. It is necessary, in most cases, to cross section kernels to determine the extent of damage. Stinkbug stung kernels should not be confused with kernels that are damaged by weevils, etc. (Reference: Visual Reference Image No. SB-10.0)

Stinkbug stung kernels are considered damaged at the rate of one-fourth of the actual percentage.

Computing Damaged Kernels. Obtain the percentage of total damaged kernels by adding the percentage 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

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
Percentage of other damaged kernels: (1.60 ÷ 123) x 100	1.30 percent
Percentage of stinkbug damage: (15.00 ÷ 123) x 100 ÷ 4	3.04 percent
Damaged kernels (total) (1.30% + 3.04%)	4.34 percent
rounded to:	4.3 percent

Certification. Record the percent of damaged kernels on the certificate to the nearest tenth percent.

10.22 HEAT-DAMAGED KERNELS

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.

When determining heat-damaged kernels, refer to Section 10.21, Damaged Kernels, and Visual Reference Image No. SB-5.0.

Certification. Record the percent of heat-damaged kernels on 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 shall be performed in accordance with official procedures established by the Grain Inspection, Packers and Stockyards Administration.

Certification. Refer to the NIRT Handbook and the Grain Inspection Handbook, Book III, for certification procedures.

b. Sclerotinia Sclerotiorum. The fungus S. sclerotiorum causes a stem disease (stem rot) in soybeans which results in large black growths (sclerotia) 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 sclerotia.

Basis of Determination. Examine the work portion, 1,000 – 1,050 grams, for the presence of S. sclerotiorum.

When determining the presence of S. sclerotiorum, refer to Visual Reference Image No. OF-32.0.

Certification. Record the percentage of S. sclerotiorum to the nearest tenth in the "Remarks" section of the certificate.

c. Black Soybeans. Soybeans that have black seed coats.

Basis of Determination. Determine the percentage of black soybeans on the color characteristics of the kernels on a 125-gram portion after the removal of foreign material.

Certification. Record the percentage of black soybeans to the nearest tenth in the "Remarks" section of the certificate.

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 one of the following methods:

1. 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) Follow the procedures describe in book II, chapter I, Section 1.12, Mechanical Sieve Shaker.

   (d) All soybeans passing through or remaining on top of the sieve(s) will determine the percentage of size fractions.

2. Hand Sieving Method.

   (a) Mount the sieve on the bottom pan.

   (b) Hold the sieve level in both hands with elbow close to the body.

(c) In a steady motion, move the sieve from left to right approximately 10 inches and then return from right to left.

(d) Repeat this operation 20 times.

(e) All soybeans passing through or remaining on top of the sieve(s) will determine the percentage of the size fractions.

Example

Weight of representative portion	125 grams
Weight of foreign material	2.87 grams
Sample weight for determining seed sizing 125 grams – 3 grams (2.9 grams rounded)	122 grams
Weight of material remaining on top of sieve	50.0 grams
Weight of material passing through sieve	72.0 grams
Percent remaining on top of sieve (50 ÷ 122) x 100	40.98 percent
rounded to:	41.0 percent
Percent passing through sieve (72 ÷ 122) x 100	59.02 percent
rounded to:	59.0 percent

Certification. Record the percentage of the size fractions, as requested by the applicant, to the nearest tenth on the work record and in the "Remarks" section of the certificate using the following statement:

"_____ % passing through (a specified round-hole sieve)."

"_____ % remaining on top of (a specified sieve)."

e. Seed Count. A measurement of the number of soybeans contained in a specified weight (i.e., number of soybeans per 1,000 grams, one pound, etc.)

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

Weight of representative portion	25.00 grams
Weight of foreign material	0.87 grams
Weight of non-whole soybeans	2.93 grams
Weight of whole soybeans [25 – (0.87 + 2.93) = 25 – 4 (rounded)]	21.00 grams
Count of whole soybeans	172
Average count per gram (172 ÷ 21) (Truncated – disregard thousands)	8.19
Seed count per 1,000 grams 8.19 x 1,000	8,190

Certification. Record the seed count on the work record and in the "Remarks" section of the certificate using the following statement:

"(count) whole soybeans (per specified amount)."

f. White Hilum. A test to determine the percent of whole soybeans with clear white hilum. Upon request, tests for other hilum colors (buff, brown, etc.) can be provided.

Basis of Determination. Determine the percentage 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).

Example

Weight of representative portion	125 grams
Weight of foreign material	2.36 grams
Weight of non-whole soybeans	4.69 grams
Weight of whole soybeans [125 – (2.36 + 4.69 rounded) = 125 – 7]	118.0 grams
Weight of non-clear white hilum	1.55 grams
Weight of clear white hilum soybeans 118 – 2 (1.55 rounded)	116.0 grams
Percent of whole soybeans (118 ÷ 125) x 100	94.40 percent
Percent of clear white hilum soybeans (116 ÷ 118) x 100	98.30 percent

Certification: Record the percent of whole soybeans and the percent of clear white hilum soybeans to the nearest tenth percent in the "Remarks" section of the certificate using the following statement:

> "Sample contains 94.4% of whole soybeans of which 98.3% are clear white hilum soybeans."

g. Cracked Seedcoats. A test to determine the percent of cracked seedcoats of sound soybeans.

Basis of Determination. Determine the percentage of cracked seedcoats on a portion of 125 grams after the removal of foreign material and damaged kernels. Soybeans with cracked seedcoats shall be whole (three-fourths or more of a whole soybean) sound soybeans which have readily discernable cracked seedcoats, or have all or part of the seedcoat removed.

Example

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 [125 – (3.85 + 1.98 + 17.90) = 125 –24 (rounded)]	101.0 grams
Weight of whole soybeans with cracked seedcoats	17.50 grams
Percent of whole soybeans with cracked seedcoats (17.50 ÷ 101) x 100	17.32 percent
rounded to:	17.3 percent

Certification: Record the percentage of cracked seedcoats in the "Remarks" section of the certificate to the nearest tenth percent.

> "Contains _____% of cracked seedcoat soybeans."

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.

Basis of Determination. Determine shriveled and wrinkled soybeans after the removal of foreign material on a representative portion of 125 grams.

Example

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 soybeans that passed through a 10/64" x 3/4" oblong-hole sieve and remain on top of the 8/64" round-hole sieve. 125 – (2.57 + 1.46 + 12.90) = 125 –17 (rounded)]	108.0 grams
Weight of whole shriveled and wrinkled soybeans	24.88 grams
Percent of whole shriveled and wrinkled soybeans (24.88 ÷ 108) x 100	23.03 percent
rounded to:	23.0 percent

Certification. Record to the nearest tenth percent in the “Remarks” section of the certificate.

GRAIN INSPECTION HANDBOOK

BOOK II, CHAPTER 11

SUNFLOWER SEED

CHAPTER 11

SUNFLOWER SEED

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11.1 GENERAL INFORMATION

a. All quantities referenced in this chapter are approximate unless otherwise specified.

b. Use an approved divider to obtain subportions of a sample for analysis unless otherwise specified.

c. For specific Visual Reference Images, see Chapter 1, section 1.2, Visual Grading Aids.

d. Official inspection personnel shall document inspection information during sampling and grading. See book IV, chapter 2.

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 percentage by weight, a percentage for a specific type of damage, etc.).

11.2 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. One special grade is provided to emphasize a special condition affecting the value of sunflower seed and is added to and made a part of the grade designation. The special grade does not affect the numerical or sample grade designation.

TABLE NO. 1 - GRADES AND GRADE REQUIREMENTS - SUNFLOWER SEED

Grade	Minimum Limits of -	Maximum Limits of -		
		Damaged Kernels		
	Test weight per bushel (pounds)	Heat Damaged (percent)	Total (percent)	Dehulled Seed (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:

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 (except smut or garlic odor); or

(d) Is heating or otherwise of distinctly low quality.

11.3 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in table 1. 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", and

e. The special grade designation when applicable.

Example: U.S. Sample Grade Sunflower Seed

11.4 SPECIAL GRADE

Infested Sunflower Seed. Sunflower seed that is infested with live weevils or other insects injurious to stored grain.

Example: U.S. No. 1 Sunflower Seed, Infested

11.5 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, sunflower seed may be certified 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

11.6 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, and 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, 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 NO. 2

BASIS OF DETERMINATION		
Lot as a Whole	Factors Determined Before the Removal of Foreign Material	Factors Determined After the Removal of Foreign Material **1/**
Distinctly low quality	Admixture	Damaged kernels (total)
Heating	Distinctly low quality	Dehulled seed
Infested	Infested	Heat-damaged kernels
Odor	Kind of grain	Odor
	Moisture	Test weight
	Odor	
	U.S. Sample Grade factors	

1/ Refer to text. Some factors are determined after the removal of mechanically separated foreign material, and others are determined after the removal of all foreign material.

11.7 DEFINITION OF SUNFLOWER SEED

Sunflower seed is defined as:

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.

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 (refer to section 11.19), a hull does not constitute a sunflower seed.

According to the definition, a sunflower seed can be either the hull and kernel (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. No further analysis is necessary on a sample designated as not standardized grain unless a specific factor test is requested.

11.8 HEATING

Sunflower seed developing a high temperature from excessive respiration is considered heating. Heating sunflower seed, in its final stages, usually produces a sour or musty odor. Care should be taken not to 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.

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

Certification. Grade heating sunflower seed as U.S. Sample Grade and record the word "Heating" in the "Remarks" section of the certificate.

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 NO. 3

ODOR CLASSIFICATION EXAMPLES		
Sour	Musty	Commercially Objectionable Foreign Odors
Boot	Ground	Animal hides
Fermenting	Insect	Decaying animal and vegetable matter
Insect (acrid)	Moldy	Fertilizer
Pigpen		Fumigant
Smoke **1**/		Insecticide
		Oil products
		Skunk
		Smoke
		Strong weed

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.

Commercially Objectionable Foreign Odors. Commercially objectionable foreign odors are odors that are entirely foreign to sunflower seed that render it unfit for normal commercial usage.

Fumigant or insecticide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of sunflower seed contains a fumigant or insecticide odor which 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 or insecticide odor persists based on the above criteria.

Final Determinations. The inspector(s) is responsible for making the final determination for all odors. A consensus of experienced inspectors is used, whenever possible, on samples containing marginal odors. The consensus approach is not required if no 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" in the "Remarks" section of the certificate.

11.10 MOISTURE

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 225 grams.

The procedures for performing a moisture determination using the DICKEY-john Grain Analysis Computer GAC 2100 moisture meter are described in book II, chapter 1, section 1.10.

Certification. Record the percent of moisture on the certificate to the nearest tenth percent.

11.11 INFESTED SUNFLOWER SEED

Infested sunflower seed is sunflower seed that is infested with live weevils or other live insects injurious to stored grain.

The presence of any live weevil or other live insects injurious to stored grain 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.

Live weevils include rice weevils, granary weevils, cowpea weevils, and lesser grain borers. Other live insects injurious to stored sunflower seed and/or grain include grain beetles, sunflower moths, banded sunflower moths, Indian meal moths, grain moths, and larvae. (See Chapter 1, Section 1.2, Visual Grading Aids.)

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, see table No. 4.

TABLE NO. 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, record the word "Infested" on the certificate in accordance with Section 11.4, Special Grade.

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 distinctly low quality. This includes a general examination of the sunflower seed during sampling and an analysis of the obtained sample(s).

Large Debris. Sunflower seed containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris too large to enter the sampling device is considered distinctly low quality.

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 distinctly low quality.

Sunflower seed suspected of containing diatomaceous earth is considered distinctly low quality unless the applicant specifically requests an examination to verify the presence of diatomaceous earth. If the laboratory examination verifies that the sunflower seed contains diatomaceous earth, then the sunflower seed is not considered distinctly low quality due to diatomaceous earth. Refer to Program Directive 9180.49, Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel, for additional information regarding the testing of sunflower seed for diatomaceous earth.

Certification. Grade distinctly low quality sunflower seed as U.S. Sample Grade. Record the words "Distinctly Low Quality" and the reason(s) why in the "Remarks" section of the certificate.

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 No. 5 shows the criteria and corresponding interpretive line slides, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, bulgur, etc.), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain shall function as "unknown foreign substance."

TABLE NO. 5

U.S. SAMPLE GRADE CRITERIA			
Criteria	*Visual Reference Image*	Number/Weight **1**/	
		Sample Basis	Lot Basis **2**/
Any numerical grading factor		Excess of limit for U.S. No. 2	N/A
Animal filth	OF-1.0	10 or more	N/A
Castor Beans	OF-3.0	2 or more	N/A
Crotalaria seeds	OF-8.0	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**/	OF-31.0	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, see section 11.12

Certification. Grade sunflower seed U.S. Sample Grade when one or more of the limits in table 5 are exceeded. Record the reason(s) why in the "Remarks" section of the certificate. Record count factors to the nearest whole number.

11.14 FOREIGN MATERIAL

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 11.7.

Basis of Determination. Determine foreign material on 600 grams of the original sample. If the percentage of foreign material is requested, use the following procedures.

Chart 1 - Procedure for Determining Foreign Material

STEP 1. Carter Dockage Tester

a. Insert the Nos. 3 and 8 sieves and the oilseed riddle.

b. Set the air at the standardized setting and the feed control to 7.5

c. Run 600 grams through the dockage tester.

d. Remove sunflower seeds from the material removed by the riddle and add to the cleaned sunflower seed.

e. Aspirated material in the air collection pan is foreign material.

f. Material that passed over the riddle, except for sunflower seeds, is foreign material.

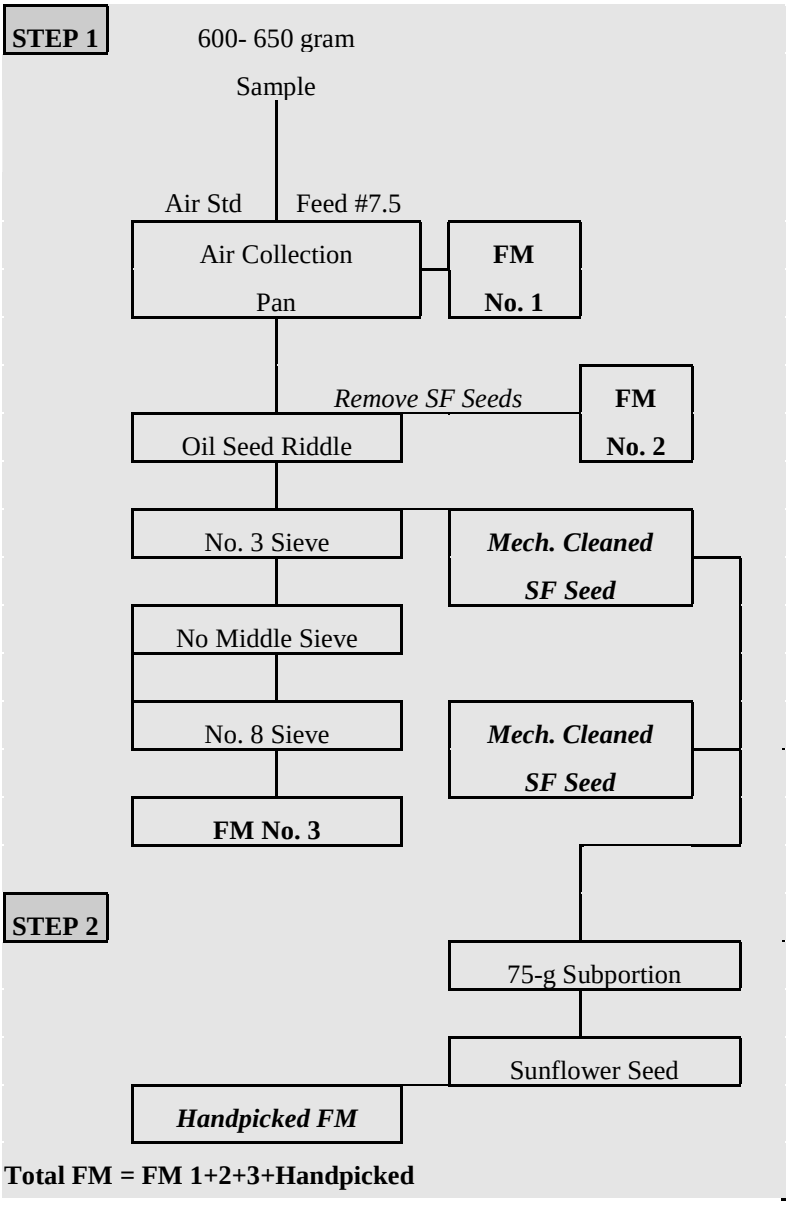
g. Material in the bottom collection pan is foreign material.

STEP 2. Handpick

a. Combine the two mechanically cleaned portions

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; refer to section 11.7 for definition.



Computing Foreign Material. To compute the percentage of foreign material, the percentage of mechanically separated foreign material is added to the percentage of handpicked foreign material using the following formula:

STEP 1. (weight of mechanically separated foreign material ÷ original sample weight) x 100 = percent of mechanically separated foreign material.

STEP 2. (100 percent - percent of mechanically separated foreign material) ÷ 100 = change of base factor.

STEP 3. (weight of handpicked foreign material ÷ weight of handpicked portion) x 100 = percent of handpicked foreign material.

STEP 4. (Percent of handpicked foreign material) x change of base factor = adjusted percentage of handpicked foreign material.

STEP 5. Percent of mechanically separated foreign material + adjusted percentage of handpicked foreign material = percent of foreign material.

Example

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

STEP 1. (50.00 ÷ 650) x 100 = 7.69% mechanically separated foreign material

STEP 2. (100% - 7.69%) ÷ 100 = .92 change of base factor

STEP 3. (0.45 ÷ 75.20) x 100 = 0.59% handpicked foreign material

STEP 4. 0.59 x .92 = 0.54%

STEP 5. 7.69% + 0.54% = 8.23% foreign material

STEP 6. Certified as 8.0% foreign material

Ranges of sunflower seed foreign material are reported 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 certificate to the nearest half percent.

11.15 TEST WEIGHT

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 per bushel 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 book II, chapter 1, section 1.11.

Certification. Record test weight results on the work record as displayed on the electronic scale or in whole and half pounds. Disregard fractions of a half pound. Record the test weight on 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.

11.16 PROCESSING THE WORK SAMPLE

At this point, determinations have been made for those factors determined before the removal of foreign material and the percentage of foreign material has been determined. Now divide the work sample into fractional portions for those determinations required after the removal of foreign material. The following chart and table No. 6 illustrate how to divide the sample into fractional parts using the Boerner divider.

CHART 2 - DIVIDING THE WORK SAMPLE

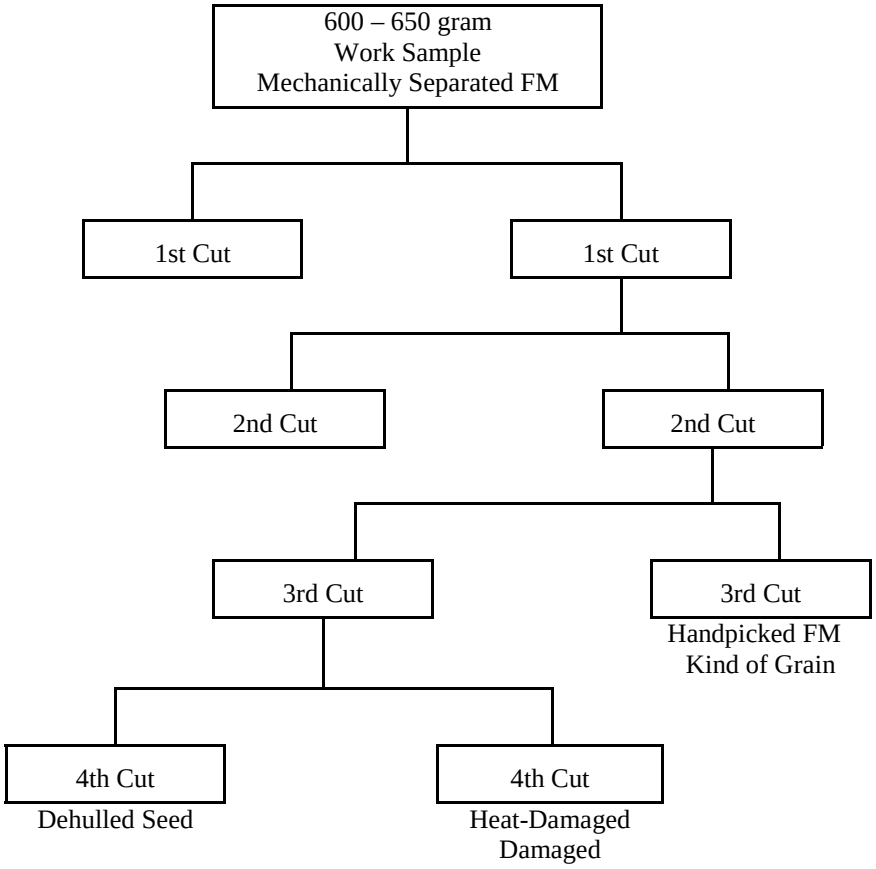


TABLE NO. 6

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

Sunflower seed that has the hull completely removed from the sunflower kernel.

Basis of Determination. Determine dehulled seed after the removal of mechanically separated foreign material on a portion of 30 grams.

Certification. Record the percent of dehulled seed on the certificate to the nearest tenth percent.

11.18 DAMAGED AND HEAT-DAMAGED SUNFLOWER SEED

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 and heat-damaged sunflower seed after the removal of mechanically separated foreign material on a portion of 30 grams (± 1.5 grams).

In general, sunflower seed is considered 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.

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 percentage 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. (Reference: Visual Reference Image No. SS-1.0)

Damaged-by-Heat. Seed and pieces of seed which are slightly discolored as a result of heating. (Reference: Visual Reference Image No. SS-2.0)

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 heat-damaged and damaged-by-heat seeds.

b. Compute the percentage for the damaged seed removed.

c. Pour the remainder of the 30-gram portion into the barley pearler. (See book II, chapter 1, section 1.14, for general operating procedures.)

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 heat-damaged kernels and damaged-by-heat kernels from the sound kernels.

Computing Total Damaged Kernels. Obtain the percentage of damaged kernels by adding the percentage of other damaged kernels, heat-damaged kernels, and damaged-by-heat kernels. Add the results, as shown in the following example, in hundredths (disregard thousandths) and round the sum to the nearest tenth percent.

STEP 1. Weight of other damaged kernels ÷ weight of representative portion after the removal of FM x 100 = percent of other damaged kernels.

STEP 2. 100 percent - percent of other damaged kernels ÷ 100 = change of base factor.

STEP 3. Weight of heat-damaged kernels ÷ weight of pearled portion x 100 = percent of heat-damaged kernels.

STEP 4. Percent of heat-damaged kernels x change of base factor = adjusted percent of heat-damaged kernels.

STEP 5. Weight of damaged-by-heat kernels ÷ weight of pearled portion x 100 = percent of damaged-by-heat kernels.

STEP 6. Percent of damaged-by-heat kernels x change of base factor = adjusted percent of damaged-by-heat kernels.

STEP 7. Percent of other damaged kernels + adjusted percent of heat-damaged kernels + adjusted percent of damaged-by-heat kernels = percent of damaged kernels

Example

Weight of representative portion after the removal of FM	30.58 grams
Weight of other damaged kernels	0.60 grams
Weight of pearled portion	15.78 grams
Weight of heat-damaged kernels	0.16 grams
Weight of damaged-by-heat kernels	1.50 grams

STEP 1. (0.60g ÷ 30.58g) x 100 = 1.96 percent of other damaged kernels.

STEP 2. (100% - 1.96%) ÷ 100 = 0.98 change of base factor.

STEP 3. (0.16g ÷ 15.78g) x 100 = 1.01 percent of heat-damaged kernels.

STEP 4. 1.01% x 0.98 = 0.98 adjusted percent of heat-damaged kernels.

STEP 5. (1.50g ÷ 15.78g) x 100 = 9.50 percent of damaged-by-heat kernels.

STEP 6. 9.50% x 0.98 = 9.31 adjusted percent of damaged-by-heat kernels.

STEP 7. 1.96% + 0.98% + 9.31% = 12.25 (round to 12.3) percent damaged kernels.

Certification. Record the percentage of damaged and heat-damaged sunflower seed on the certificate to the nearest tenth percent.

11.19 OFFICIAL CRITERIA

Admixture and oil content are "official criteria factors" and are determined only on request. They do not affect the grade designation.

Admixture. 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:

a. Place the 60-gram portion on the upper edge of a 5/64 equilateral triangular hand sieve.

b. 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.

c. 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.

d. 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 percentage of admixture on the certificate to the nearest tenth percent.

Oil Content. The procedure for determining and certifying oil content is described in the Nuclear Magnetic Resonance (NMR) Handbook.

GRAIN INSPECTION HANDBOOK

BOOK II, CHAPTER 12

TRITICALE

CHAPTER 12

TRITICALE

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12.1 GENERAL INFORMATION

a. All quantities referenced in this chapter are approximate unless otherwise specified.

b. Use an approved divider to obtain subportions of a sample for analysis unless otherwise specified.

c. 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 30 times.

d. Official inspection personnel shall document inspection information during sampling and grading. See book IV, chapter 2.

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 percentage by weight, a percentage for a specific type of damage, etc.).

12.2 GRADES AND GRADE REQUIREMENTS

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

TABLE NO. 1 - GRADES AND GRADE REQUIREMENTS - 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:

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.

12.3 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in table 1. 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 in alphabetical order; and

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

12.4 SPECIAL GRADES

Special grades draw attention to unusual conditions in grain and are made part of the grade designation. The 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.

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.

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.

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.

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.

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.

Example: U.S. No. 2 Triticale, Smutty

12.5 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, triticale may be certified 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

12.6 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, and unknown foreign substance(s), and a commonly recognized harmful or toxic substance 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 NO. 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 Garlic bulblets Infested Kind of grain Moisture Odor Odor (smut) Other unusual conditions U.S. Sample Grade factors	Ergot Kind of grain Odor Shrunken and broken kernels Smut Stones Test weight	Damaged kernels Foreign material (total) Foreign material other than wheat or rye Heat-damaged kernels

The following sections of this chapter are arranged in a logical sequence typically followed in the inspection and grading of triticale.

12.7 DEFINITION OF TRITICALE

Triticale is defined as:

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. If an analysis is necessary, make the determination on a representative portion of 50 grams. Determine the percentage of triticale and other grains before the removal of dockage. Determine the percentage 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. No further analysis is necessary on a sample designated as not standardized grain unless a specific factor test is requested.

12.8 HEATING

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. Care should be taken not to confuse triticale that is heating with triticale that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

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

Certification. Grade heating triticale as U.S. Sample Grade and record the word "Heating" in the "Remarks" section of the certificate.

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 NO. 3

ODOR CLASSIFICATION EXAMPLES		
Sour	Musty	Commercially Objectionable Foreign Odors
Boot	Ground	Animal hides
Fermenting	Insect	Decaying animal and vegetable matter
Insect (acrid)	Moldy	Fertilizer
Pigpen		Fumigant
		Insecticide
		Oil products
		Skunk
		Smoke
		Strong weed

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

Fumigant or insecticide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of triticale contains a fumigant or insecticide 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 or insecticide odor persists based on the above criteria.

Final Determination. The inspector(s) is responsible for making the final determination for all odors. A consensus of experienced inspectors is used, whenever possible, on samples containing marginal odors. The consensus approach is not required if no 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" in the "Remarks" section of the certificate.

12.10 MOISTURE

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 350 grams.

The procedures for performing a moisture determination using the DICKEY-john Grain Analysis Computer GAC 2100 moisture meter are described in book II, chapter 1, section 1.10.

Certification. Record the percent of moisture on the certificate to the nearest tenth percent.

12.11 GARLICKY AND LIGHT GARLICKY TRITICALE

a. 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.*

b. 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.*

Basis of Determination. Determine garlicky and light garlicky before the removal of dockage on a portion of 1,000 grams. (Reference: Visual Reference Image Nos. OF-13.0 and OF-13.1).

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.

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

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

Garlic bulblets apply in the determination of "Light Garlicky" and "Garlicky" but also function as dockage or foreign material, as the case may be.

Certification. When applicable, record the words "Light Garlicky" or "Garlicky" in accordance with Section 12.4, Special Grades. Upon request, record the number of garlic bulblets in whole and thirds.

12.12 INFESTED TRITICALE

Infested triticale is triticale that is infested with live weevils or other live insects injurious to stored grain.

The presence of any live weevil or other live insects injurious to stored grain 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.

Live weevils shall include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. Other live insects injurious to stored grain shall include grain beetles, grain moths, and larvae. (See Chapter 1, Section 1.2, Visual Grading Aids.)

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, see table No. 4.

TABLE NO. 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. Record the word "Infested" on the certificate in accordance with Section 12.4, Special Grades.

12.13 DISTINCTLY LOW QUALITY

Consider triticale 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 distinctly low quality. This includes a general examination of the triticale during sampling and an analysis of the obtained sample(s).

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 are too large to enter the sampling device is considered distinctly low quality.

Other Unusual Conditions. Triticale that is obviously affected by other unusual conditions which adversely affect its quality but which cannot be properly graded by use of the grading factors specified or defined in the standards is considered distinctly low quality.

Triticale suspected of containing diatomaceous earth is considered distinctly low quality unless the applicant specifically requests an examination to verify the presence of diatomaceous earth. If the laboratory examination verifies that the triticale contains diatomaceous earth, then the triticale is not considered distinctly low quality due to diatomaceous earth. Refer to Program Directive 9180.49, Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel, for additional information regarding the testing of triticale for diatomaceous earth.

Certification. Grade distinctly low quality triticale as U.S. Sample Grade. Record the words "Distinctly Low Quality" and the reason(s) why in the "Remarks" section of the certificate.

12.14 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine additional 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 No. 5 shows the criteria and corresponding Visual Reference Images, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, bulgur, etc.), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain shall function as "unknown foreign substance."

TABLE NO. 5

U.S. SAMPLE GRADE CRITERIA			
Criteria	*Visual Reference Image*	Number/Weight **1**/ *Sample Basis*	Lot Basis **2**/
Any numerical grading factor		Excess of limit for U.S. No. 4	N/A
Animal filth	OF-1.0	2 or more	N/A
Castor Beans	OF-3.0	2 or more	N/A
Crotalaria seeds	OF-8.0	3 or more	N/A
Glass		2 or more	N/A
Odor		Presence	N/A
Stones		8 or more or any number in excess of 0.2% by weight	N/A
Unknown foreign substances **3**/	OF-31.0	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, see section 12.13

Certification. Grade triticale U.S. Sample Grade when one or more of the limits in table 5 are observed. Record the reason(s) why in the "Remarks" section of the certificate. Record count factors to the nearest whole number.

12.15 DOCKAGE

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 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 or unthreshed kernels and sprouted kernels of triticale.

Threshed and sprouted kernels that pass over the riddle <u>are not</u> considered dockage. Return all 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.

Unthreshed kernels that pass over the riddle <u>are</u> considered dockage. Unthreshed kernels are kernels with more than one glume attached. (Reference: Visual Reference Image No. OF-30.0)

CHART 1 - PROCEDURE FOR DETERMINING DOCKAGE

Carter Dockage Tester Setup

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

b. Insert No. 25 plastic riddle in the riddle carriage.

c. Use no sieve in the top sieve carriage.

d. Insert a No. 2 sieve in the middle and bottom sieve carriages.

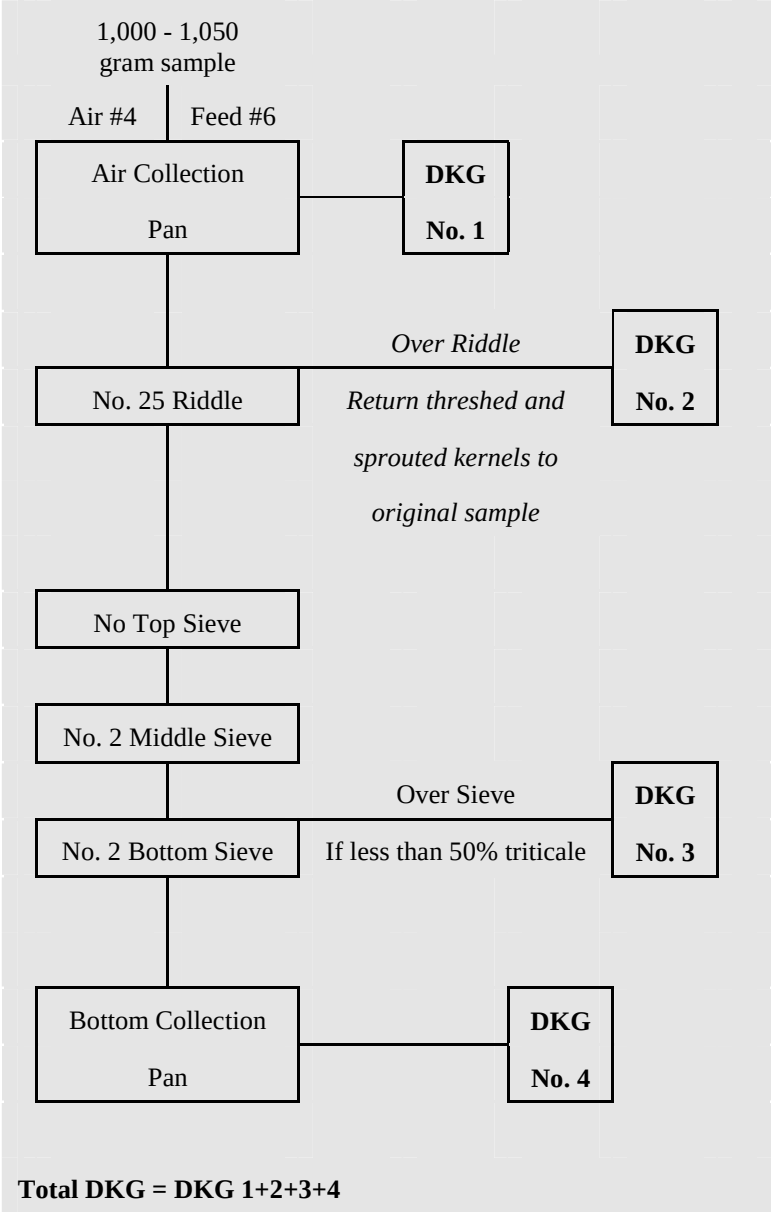
e. Start carter Dockage Tester and pour sample into feed hopper.

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 whole or broken kernels of triticale. When more than 50 percent of whole or broken kernels are found, return the material to the cleaned triticale.



To avoid repeating operations, check the dockage for garlic bulblets, infestation, and U.S. Sample Grade factors (except stones). (See sections 12.11, 12.12, and 12.14.)

Certification. Record the word "Dockage" and the percentage on the work record in hundredths and the certificate in accordance with section 12.3, Grade Designations. State the percent of dockage on 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 percent
1.00 to 1.49 percent record as 1.0 percent, etc.

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 it appears that the sample contains more than 0.5 percent of wild buckwheat or similar seeds, analyze a portion of approximately 50 grams before the removal of dockage. When the representative portion contains more than 0.5 percent of wild buckwheat or similar sized seeds, proceed as follows: (Reference: Visual Reference Image No. OF-27.0)

(1) Set up the Carter dockage tester as follows:

(a) Set the air control at 4;

(b) Set the feed control at 6;

(c) Insert a Number 25 plastic riddle in the riddle carriage;

(d) Use no sieve in the top sieve carriage;

(e) Insert a Number 8 sieve in the middle sieve carriage; and

(f) Insert a Number 2 sieve in the bottom sieve carriage.

(2) After removing the dockage, sieve approximately 50 grams of the material that passed over the Number 2 sieve (bottom 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 the material in the bottom 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 threshed and sprouted kernels of triticale, that passed over the riddle (riddle collection pan);

(c) The material that passed through the Number 2 sieve (bottom collection pan);

(d) The material that passed through the hand sieve; and

(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 it appears that the sample contains more than 0.5 percent of chess or similar seeds, analyze a portion of approximately 50 grams cut from the original sample before the removal of dockage. If the representative portion contains more than 0.5 percent of chess or similar seeds, proceed as follows: (Reference: Visual Reference Image No. OF-4.0)

(1) Set up the Carter dockage tester as follows:

(a) Set the air control at 4;

(b) Set the feed control at 6;

(c) Insert a Number 25 plastic riddle in the riddle carriage;

(d) Insert a Number 9 combination large chess swaged-hole sieve in the top sieve carriage;

(e) Use no sieve in the middle sieve carriage; and

(f) Insert a Number 2 sieve in the bottom sieve carriage.

(2) When the triticale has cleared the Number 9 sieve, clean the sieve by sliding it in and out of the carriages 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 Number 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 Number 2 sieve (bottom collection pan). 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 Number 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 Number 2 sieve (bottom collection pan); and

(d) The material that passed over the Number 2 sieve (bottom collection pan) when such material consists of less than 50 percent triticale. If the material that passed over the bottom sieve consists of 50 percent or more of whole or broken kernels of triticale, return it to the cleaned triticale.

c. Triticale Containing Canola, Flaxseed, or Rapeseed: If it appears that the sample contains 0.3 percent or more of canola, flaxseed, or rapeseed, analyze a dockage-free portion of 50 grams. If the representative 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) Place one-fourth of the dockage-free portion in the center of the sieve.

(c) Set the stroke counter at 30 strokes.

(d) Follow the procedures described in Book II, Chapter 1, Section 1.13, Mechanical Sieve Shaker.

(e) When the shaker has stopped, return the material lodged in the perforations to the triticale remaining on top of the sieve.

(f) Clean the sieve and repeat this procedure with the remaining similar-sized portions.

(2) Hand-Sieving Method:

(a) Mount the sieve on a bottom pan.

(b) Place one-fourth of the dockage-free sample in the center of the sieve.

(c) Hold the sieve level in both hands with elbows close to the sides and the sieve perforations parallel to the direction of movement.

(d) In a steady motion, move the sieve from left to right approximately 10 inches and then return from right to left.

(e) Repeat this operation 30 times.

(f) Return the material lodged in the perforations to the triticale remaining on top of the sieve.

(g) Clean the sieve and repeat this procedure with the remaining similar-sized portions.

(3) 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.

(4) 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 Number 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 triticale.

12.16 TEST WEIGHT

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 on a dockage-free portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination and available services are described in book II, chapter 1, section 1.11.

Certification. Record test weight results on the work record as displayed on the electronic scale or in whole and tenth pounds to the nearest tenth pound. Record the test weight on the certificate in whole and tenth pounds 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 made and the percentage of dockage has been determined. Also, the sample has been test weighed and 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. The following chart and table No. 6 illustrate how the sample is divided into fractional parts using the Boerner divider.

CHART 2 - DIVIDING THE WORK SAMPLE

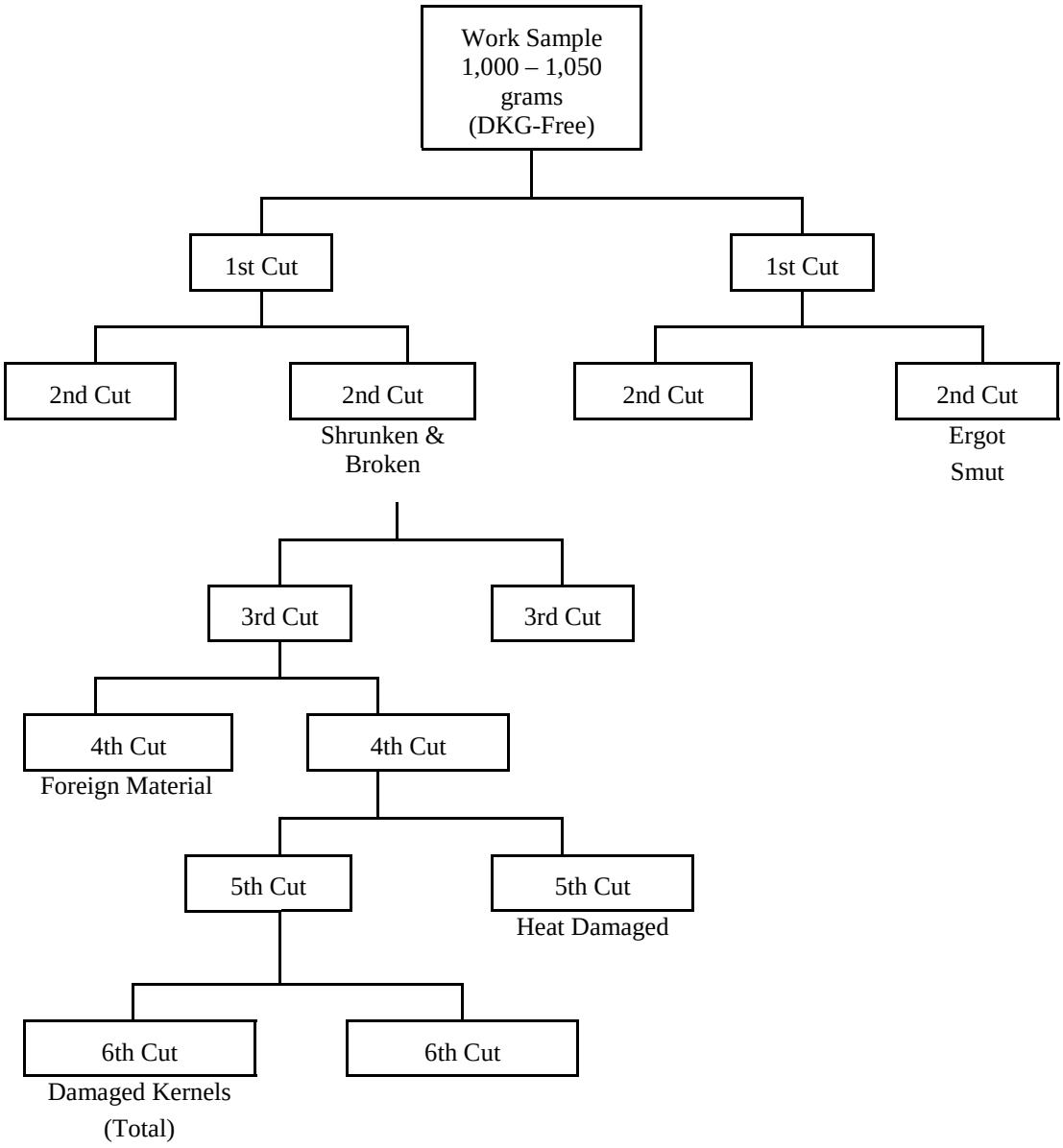


TABLE NO. 6

APPROXIMATE ANALYTICAL PORTION SIZES	
Factors	*Grams*
Ergot	250
Smut	250
Shrunken and broken kernels	250
Foreign material	50 1/
Damaged kernels (total)	15 1/
Heat-damaged kernels	30 1/

1/ Factors determined after the removal of dockage and shrunken and broken kernels.

12.18 ERGOTY TRITICALE

Triticale that contains more than 0.10 percent of ergot.

Ergot is a hard, reddish-brown or black grain-like mass of certain parasitic fungi that replaces kernels of triticale. (Reference: Visual Reference Image No. OF-12.0)

Basis of Determination. Determine ergoty on a dockage-free portion of 250 grams except when the percentage of ergot has been requested to be shown on the certificate. When the percentage is to be shown on the certificate, make the determination on a dockage-free portion of approximately 1,000 grams. Ergot applies in the determination of ergoty but also functions as foreign material.

Certification. Record the word "Ergoty" on the certificate in accordance with Section 12.4, Special Grades. Upon request, record the percentage of ergot on the certificate to the nearest hundredth percent.

12.19 SMUTTY AND LIGHT SMUTTY TRITICALE

Smutty. *Triticale that contains in a 250-gram portion smutty and smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 30 smut balls of average size.*

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.*

Basis of Determination. Determine "Smutty" on 250 grams of dockage-free triticale. Determine "Light smutty" on the sample as a whole (odor only) or on 250 grams of dockage-free triticale.

Certification. Record the words "Smutty" or "Light Smutty" on the certificate in accordance with Section 12.4, Special Grades. Upon request, show the odor (in the case of Light smutty) or the number of smut balls on the certificate.

12.20 SHRUNKEN AND BROKEN KERNELS

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 on a dockage-free portion of 250 grams using one of the following methods:

a. Mechanical Sieving Method.

(1) Mount a 0.064 x 3/8 oblong-hole (1.626 x 9.525 mm) sieve and a bottom pan on the mechanical sieve shaker.

(2) Set the stroke counter for 30 strokes.

(3) Follow the procedure described in Book II, Chapter 1, Section 1.13, Mechanical Sieve Shaker.

(4) All material passing through the sieve is considered shrunken and broken kernels. Return the material lodged in the perforations to the triticale which remained on top of the sieve.

b. Hand Sieving Method.

(1) Mount the approved sieve on a bottom pan.

(2) Place the 250-gram portion in the center of the sieve.

(3) Hold the sieve level in both hands with elbows close to the body and the sieve perforations parallel to the direction of movement.

(4) In a steady motion, move the sieve from left to right approximately 10 inches and then return from right to left.

(5) Repeat this operation 30 times.

(6) All material passing through the sieve is considered shrunken and broken kernels. Return the material lodged in the perforations to the triticale which remained on top of the sieve.

Determine shrunken and broken kernels prior to analyzing the sample for heat-damaged kernels, damaged kernels, and foreign material.

Certification. Record the percent of shrunken and broken kernels on the certificate to the nearest tenth percent.

12.21 FOREIGN MATERIAL

All matter other than triticale.

Basis of Determination. Determine foreign material on a dockage-free and shrunken and broken-free portion of 50 grams.

In triticale, foreign material is subdivided into (1) foreign material other than wheat or rye and (2) foreign material (total).

a. Foreign Material (Total). Remove all matter other than triticale from the representative portion and determine the percentage of foreign material (total).

b. Foreign Material Other Than Wheat or Rye. Remove the wheat and rye from the total foreign material separation. The percentage of foreign material other than wheat or rye is then based on the remaining foreign material after the removal of wheat and rye.

Glumes are considered foreign material 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 certificate to the nearest tenth percent.

12.22 DAMAGED KERNELS

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 on a dockage-free and shrunken and broken-free portion of 15 grams.

In general, a kernel of triticale and/or kernels of other grains are considered 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.

Germ-Damaged Kernels (Mold). Kernels and pieces of kernels of triticale which have mold in the germ. The bran coat covering the germ should be removed carefully; scraping the bran coat too deep could remove the mold. (Reference: Visual Reference Image No. W-4.1)

Green Damage (Immature). Kernels and pieces of kernels of triticale which are intense green (immature) and without any yellow appearance. (Reference: Visual Reference Image No. W-5.0)

Germ-Damaged Kernels (Sick). Kernels and pieces of kernels of triticale damaged as a result of heat but which are not materially discolored. Sick kernels should be scraped very carefully to avoid the loss of discoloration or "popping" or removal of the germ. (Reference: Visual Reference Image No. W-4.0)

Heat-Damaged Kernels. Kernels and pieces of kernels of triticale materially discolored and damaged by heat. It is necessary, in most cases, to cut the kernels and make a cross-section analysis to determine if the color is reddish-brown, mahogany, or creamy.

Other Damage. Kernels and pieces of kernels of triticale with cracks, breaks, or chews and which contain mold or fungus. (Reference: Visual Reference Image No. W-7.0)

Mold-like Substances. 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.

Sprout-Damaged Kernels. Kernels with the germ end broken open from germination and show sprout or from which the sprouts have been broken off. (Reference: Visual Reference Image Nos. W-8.0 and W-8.1)

Insect-Bored Kernels. Kernels and pieces of kernels of triticale that have been bored or tunneled by insects. (Reference: Visual Reference Image No. W-9.0)

Certification. Record the percent of damaged kernels on the certificate to the nearest tenth percent.

12.23 HEAT-DAMAGED KERNELS

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. (Reference: Visual Reference Image No. W-6.1)

Certification. Record the percent of heat-damaged kernels on the certificate to the nearest tenth percent.

12.24 DEFECTS

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 on the sum of damaged kernels, foreign material, and shrunken and broken kernels.

A percentage 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 percentage of defects.

Certification. Record the percent of defects on the certificate to the nearest tenth percent.

GRAIN INSPECTION HANDBOOK

BOOK II, CHAPTER 13

WHEAT

CHAPTER 13

WHEAT

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13.1 GENERAL INFORMATION

a. All quantities referenced in this chapter are approximate unless otherwise specified.

b. Use an approved divider to obtain subportions of a sample for analysis unless otherwise specified.

c. 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 30 times.

d. For specific Visual Reference Images, see W-1.0 – W-9.1.

e. Official inspection personnel shall document inspection information during sampling and grading. See book IV, chapter 2.

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 percentage by weight, a percentage for a specific type of damage, etc.).

13.2 GRADES AND GRADE REQUIREMENTS

Wheat is divided into eight classes based on color and kernel and varietal characteristics. The eight classes are: Hard Red Spring wheat, Hard Red Winter wheat, Soft Red Winter wheat, Durum wheat, Hard White wheat, Soft White wheat, Unclassed wheat, and Mixed wheat. The classes Hard Red Spring wheat, Durum wheat, and Soft White wheat are further divided into subclasses. Each class and subclass is divided into five U.S. numerical grades and U.S. Sample Grade. Special grades are provided to emphasize special qualities or conditions affecting the value of wheat and are added to and made a part of the grade designation. Special grades do not affect the numerical or sample grade designation.

TABLE NO. 1 – GRADES AND GRADE REQUIREMENTS – WHEAT

Grade	Minimum Limits of -		Maximum Limits of -						
	Test Weight per bushel		Damaged Kernels					Wheat of other classes 2/	
	Hard Red Spring Wheat or White Club Wheat (pounds)	All other classes and subclasses (pounds)	Heat damage (part of total) (percent)	Total (percent)	Foreign material (percent)	Shrunken and broken kernels (percent)	Defects 1/ (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:

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.
(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 not more than 10.0 percent of wheat of other classes.
3/ Includes contrasting classes.

Grades and Grade Requirements for Mixed Wheat. Grade Mixed wheat according to the U.S. numerical and U.S. Sample Grade requirements of the predominating class in the mixture. Disregard wheat of other classes.

13.3 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in table 1. 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 subclass or, in the case of Hard Red Winter wheat, Hard White wheat, Mixed wheat, Soft Red Winter wheat, and Unclassed wheat, the class;

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, etc.); and

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

In addition, include the following in the "Remarks" section of the certificate:

a. For Western White wheat, the name and percentage of White Club wheat.

b. For Unclassed wheat, the color or other characteristics which describe the wheat, together with the percentage thereof.

c. For Mixed wheat, the name and percentage of the classes that comprise the mixture in the order of predominance.

d. When applicable, the percentage of protein.

13.4 SPECIAL GRADES

Special grades draw attention to unusual conditions in grain and are made part of the grade designation. 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.

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.

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.

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.

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.

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.

Example: U.S. No. 1 Amber Durum Wheat, Treated (limed), Dockage 0.2%

13.5 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, wheat may be certified 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

13.6 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.

<u>Certain Quality Determinations</u>. 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, and 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 NO. 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 (total)
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	
	Other unusual conditions	Treated	
	U.S. Sample Grade factors		

The following sections of this chapter are arranged in a sequence typically followed in the inspection and grading of wheat.

13.7 DEFINITION OF WHEAT

Wheat is defined as:

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. If an analysis is necessary, make the determination on a representative portion of 50 grams. Determine the percentage of wheat and other grains before the removal of dockage. Determine the percentage 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. No further analysis is necessary on a sample designated as not standardized grain unless a specific factor test is requested.

13.8 HEATING

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. Care should be taken not to confuse wheat that is heating with wheat that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

Basis of Determination. Determine heating on evidence obtained at the time of sampling.

Certification. Grade heating wheat as U.S. Sample Grade and record the word "Heating" in the "Remarks" section of the certificate.

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 NO. 3

ODOR CLASSIFICATION EXAMPLES		
Sour	Musty	Commercially Objectionable Foreign Odors
Boot	Ground	Animal hides
Fermenting	Insect	Decaying animal and vegetable matter
Insect (acrid)	Moldy	Fertilizer
Pigpen		Fumigant
		Insecticide
		Oil products
		Skunk
		Smoke
		Strong weed

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

Fumigant or insecticide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of wheat contains a fumigant or insecticide 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 or insecticide odor persists based on the above criteria.

Final Determination. The inspector(s) is responsible for making the final determination for all odors. A consensus of experienced inspectors is used, whenever possible, on samples containing marginal odors. The consensus approach is not required if no 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" in the "Remarks" section of the certificate.

13.10 MOISTURE

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 350 grams.

The procedures for performing a moisture determination using the DICKEY-john Grain Analysis Computer GAC 2100 moisture meter are described in book II, chapter 1, section 1.10.

Certification. Record the percent of moisture on the certificate to the nearest tenth percent.

13.11 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.

Basis of Determination. Determine garlicky 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. (Reference: Visual Reference Image Nos. OF-13.0 and OF-13.1)

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.

NOTE: Wild onion, sometimes referred to as “crow garlic”, is considered as garlic.

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

Garlic bulblets apply in the determination of the special grade "Garlicky" and also function as dockage or foreign material.

Certification. When applicable, grade the wheat "Garlicky" in accordance with Section 13.4, Special Grades. Upon request, record the number of garlic bulblets in whole and thirds.

13.12 INFESTED WHEAT

Infested wheat is wheat that is infested with live weevils or other live insects injurious to stored grain.

The presence of any live weevil or other live insect injurious to stored grain 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.

Live weevils shall include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. Other live insects injurious to stored grain shall include grain beetles, grain moths, and larvae. (See chapter 1, Section 1.2, Visual Grading Aids.)

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, see table No. 4.

TABLE NO. 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" in accordance with Section 13.4, Special Grades.

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. This includes a general examination of the wheat during sampling and an analysis of the obtained sample(s).

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 are too large to enter the sampling device is considered distinctly low quality.

Other Unusual Conditions. Wheat that is obviously affected by other unusual conditions which adversely affect its quality but which cannot be properly graded by use of the grading factors specified or defined in the standards is considered distinctly low quality.

Wheat suspected of containing diatomaceous earth is considered distinctly low quality unless the applicant specifically requests an examination to verify the presence of diatomaceous earth. If the laboratory examination verifies that the wheat contains diatomaceous earth, then the wheat is not considered distinctly low quality due to diatomaceous earth. Refer to Program Directive 9180.49, Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel, for additional information regarding the testing of wheat for diatomaceous earth.

Certification. Grade distinctly low quality wheat as U.S. Sample Grade. Record the reason(s) why on the certificate.

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. Table No. 5 shows the criteria and corresponding Visual Reference Images, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, bulgur, etc.), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain shall function as "unknown foreign substance." Kernels of wheat discolored by treatment with a fungicide or similar substance (pink wheat) are considered as being discolored by an unknown foreign substance.

TABLE NO. 5

U.S. SAMPLE GRADE CRITERIA			
Criteria	*Visual Reference Image*	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	OF-1.0	2 or more	N/A
Castor beans	OF-3.0	2 or more	N/A
Crotalaria seeds	OF-8.0	3 or more	N/A
Glass		1 or more	N/A
Insect-damaged kernels		32 or more	
Odor		Presence	N/A
Stones		4 or more or any number in excess of 0.1% by weight	N/A
Unknown foreign substances **3**/ **4**/	OF-31.0	4 or more	N/A
Heating		Presence	Presence
Total other material **5**/		5 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/ Kernels of wheat discolored by treatment with a fungicide or similar substance (pink wheat) are considered as being discolored by an unknown foreign substance (Visual reference Image No. (W) OF-17.0)

5/ Includes any combination of animal filth, castor beans, crotalaria seeds, glass, stones, and unknown foreign substances.

* For Distinctly Low Quality, see section 13.13

Certification. Grade wheat U.S. Sample Grade when one or more of the limits in table 5 are observed. Record the reason(s) why in the "Remarks" section of the certificate. Record count factors to the nearest whole number.

13.15 DOCKAGE

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 on a portion of 1,000 to 1,050 grams of the original sample.

When performing the dockage determination, check the material that passes over the riddle for threshed or unthreshed kernels and sprouted kernels of wheat.

Threshed and sprouted kernels that pass over the riddle <u>are not</u> considered dockage. Return all 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.

Unthreshed kernels that pass over the riddle <u>are</u> considered dockage. Unthreshed kernels are kernels with more than one glume attached. (Reference: Visual Reference Image No. (W) OF-30.0)

CHART 1 - PROCEDURE FOR DETERMINING DOCKAGE

Carter Dockage Tester Setup

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

b. In the riddle carriage, use the No. 2 plastic riddle for HRW, HRS, SRW, HDWH, and SWH. Use the No. 25 plastic riddle for DU. For Mixed wheat, use the No. 2 riddle unless DU is the predominant class. If Durum wheat is predominant, use the No. 25 riddle. For Unclassed wheat, use the riddle size applicable for the kernel size. If kernels are approximately the size of Durum wheat kernels, use the No. 25 riddle; otherwise use the No. 2 riddle.

c. Use no sieve in the top sieve carriage.

d. Insert a No. 2 sieve in the middle and bottom sieve carriages.

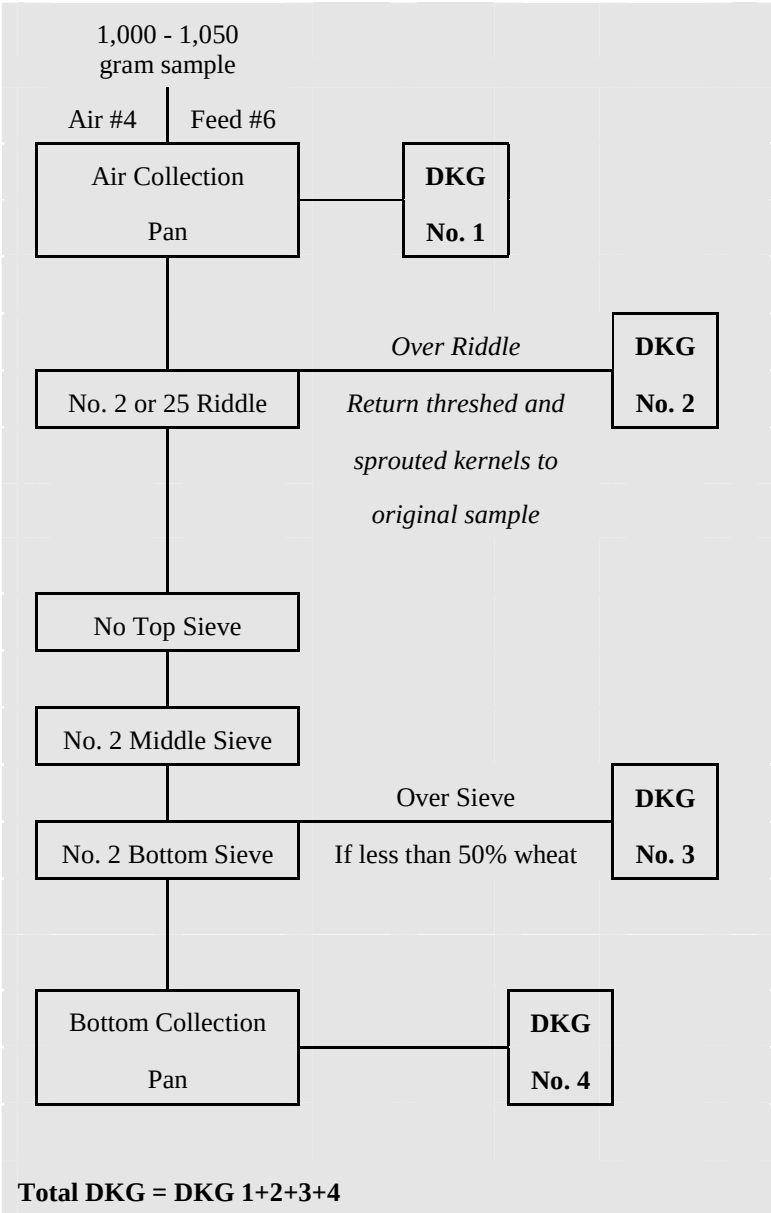
e. Start Carter Dockage Tester and pour sample into feed hopper.

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

g. Material over the riddle, except for threshed and sprouted kernels, is dockage. Threshed kernels do not have more than one glume attached (Visual Reference Image No. (W) OF-30.0). Place threshed and sprouted kernels in the cleaned wheat (over middle sieve).

h. Material passing over the bottom sieve is dockage if it contains less than 50 percent (by weight) of wheat kernels. If 50 percent or more of wheat kernels pass over the bottom sieve, return the material to the cleaned wheat.

i. Material in the bottom collection pan is dockage.



To avoid repeating operations, check the dockage for garlic bulblets, infestation, and U.S. Sample Grade factors (except stones). (See sections 13.11, 13.12, and 13.14.)

Certification. Record the word "Dockage" and the percentage to the nearest tenth percent on the work record and the certificate. If the dockage is less than one-tenth percent, report as “Dockage 0.0%.”

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 it appears that the sample contains 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. If the representative 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: (Reference: Visual Reference Image No. OF-27.0)

(1) Set up the Carter Dockage Tester as follows:

(a) Use the appropriate riddle (see page 13-15);

(b) Use no sieve in the top sieve carriage;

(c) Insert a No. 8 sieve in the middle sieve carriage; and

(d) Insert a No. 2 sieve in the bottom sieve carriage.

(2) After removing the dockage, sieve 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 the material in the bottom 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 wheat kernels, 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 wheat kernels, 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 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 it appears that the sample contains 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. If the representative portion contains more than 0.5 percent of chess and similar seeds, proceed as follows: (Reference Visual Reference Image No. OF-4.0)

(1) Set up the Carter Dockage Tester as follows:

(a) Use the appropriate riddle (see page 13-15);

(b) Insert a No. 9 combination large chess swaged-hole sieve in the top sieve carriage;

(c) Use no sieve in the middle sieve carriage; and

(d) 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 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); and

(d) The material that passed over the No. 2 sieve (bottom sieve collection pan).

c. Wheat Containing Cob Joints and Chaff. If it appears that the sample contains 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. If the dockage-free representative portion contains more than 0.5 percent of cob joints and chaff, proceed as follows: (Reference: Visual Reference Image No. OF-5.0)

(1) Set up the Carter Dockage Tester as follows:

(a) Use the appropriate riddle (see page 13-15);

(b) Insert a No. 8 sieve in the top sieve carriage;

(c) Use no sieve in the middle sieve carriage; and

(d) Insert a No. 2 sieve in the bottom sieve carriage.

(2) Run the dockage-free representative portion through the Carter dockage tester.

(3) Place 50 grams of the material that passed over the No. 2 sieve (bottom sieve collection pan) 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" on additional 50-gram portions until all the material has been sieved.

(5) If the material remaining on top of the hand sieve consists of 50 percent or more, by weight, of whole or broken kernels, 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 (see "Step 6" above); and

(e) 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 it appears that the sample contains 0.3 percent or more of canola, flaxseed, or rapeseed, analyze a dockage-free portion of 50 grams. If the representative 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) Place one-fourth of the dockage-free portion in the center of the sieve.

(c) Set the stroke counter at 30 strokes.

(d) Follow the procedures described in Book II, Chapter 1, Section 1.13, Mechanical Sieve Shaker.

(e) When the shaker has stopped, return the material lodged in the perforations to the wheat remaining on top of the sieve.

(f) Clean the sieve and repeat this procedure with the remaining similar-sized portions.

(2) Hand-Sieving Method.

(a) Mount the sieve on a bottom pan.

(b) Place one-fourth of the dockage-free sample in the center of the sieve.

(c) Hold the sieve level in both hands with elbows close to the sides and the sieve perforations parallel to the direction of movement.

(d) In a steady motion, move the sieve from left to right approximately 10 inches and then return from right to left.

(e) Repeat this operation 30 times.

(f) Return the material lodged in the perforations to the wheat remaining on top of the sieve.

(g) Clean the sieve and repeat this procedure with the remaining similar-sized portions.

(3) 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.

4) 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 Number 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 wheat.

13.16 TEST WEIGHT

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 on a dockage-free portion of sufficient quantity to overflow the kettle.

The procedures for performing the test weight determination and available services are described in book II, chapter 1, section 1.11.

Certification. Record test weight results on the work record as displayed on the electronic scale or in whole and tenth pounds to the nearest tenth pound. Record the test weight on the certificate in whole and tenth pounds 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 made and the percentage of dockage has been determined. Also, the sample has been test weighed and 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. The following chart and table No.6 illustrate how the sample is divided into fractional parts using the Boerner divider.

CHART 2 - DIVIDING THE WORK SAMPLE

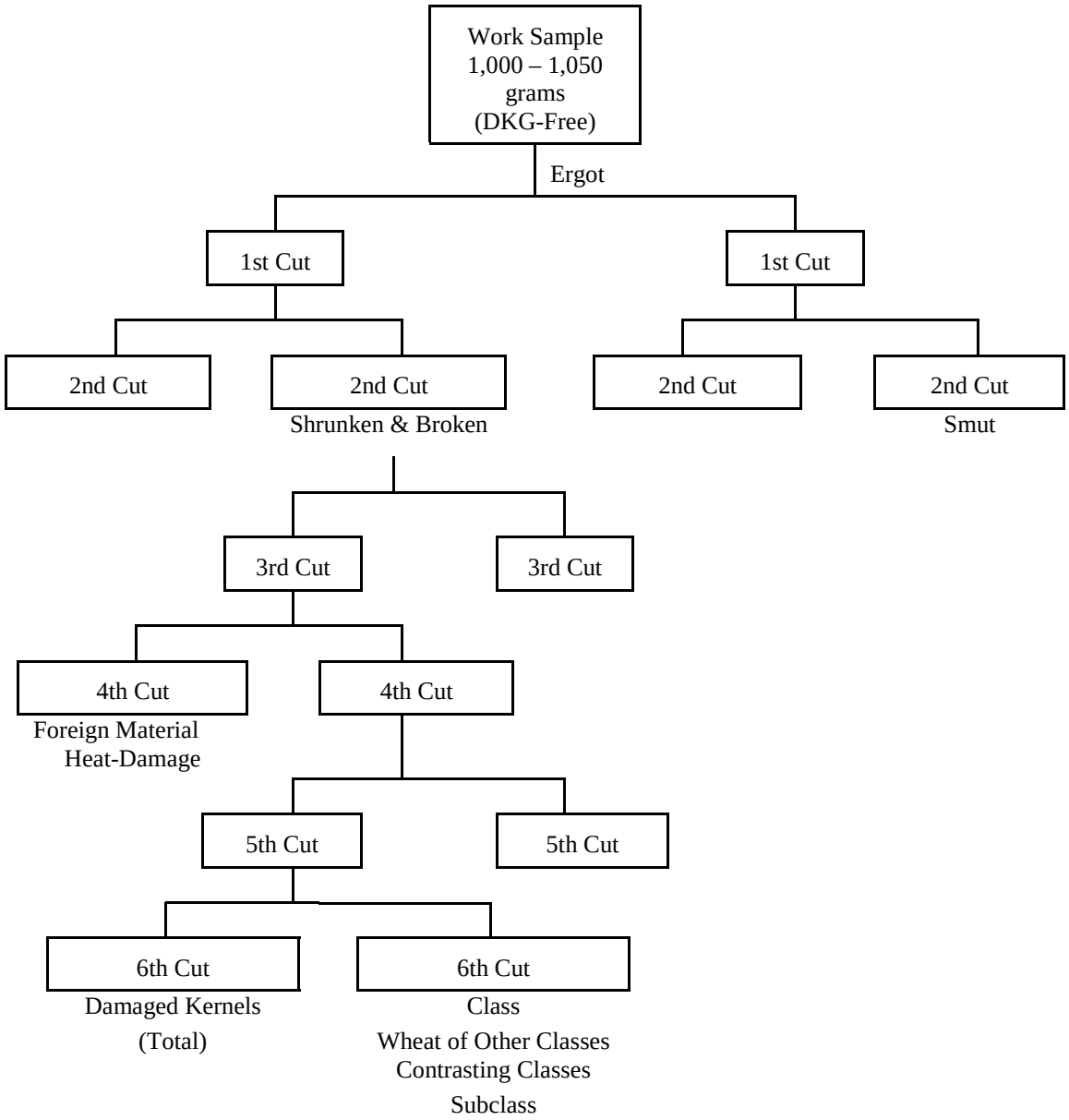


TABLE NO. 6

APPROXIMATE ANALYTICAL PORTION SIZES	
Factors	*Grams*
Ergot	1,000
Shrunken and broken kernels	250
Smut	250
Class	15
Contrasting classes	15
Damaged kernels (total)	15
Foreign material	50
Heat-damaged kernels	50
Insect-damaged kernels	100
Insect-damaged kernels Stage 1	15
Insect-damaged kernels Stage 2	15
Insect-damaged kernels Stage 3	100 – (Stage 1 + Stage 2)
Subclass	15
Wheat of other classes	15

13.18 ERGOTY WHEAT

Wheat that contains more than 0.05 percent of ergot

Ergot is a hard, reddish-brown or black grain-like mass of certain parasitic fungi that replaces the kernels of wheat. (Reference: Visual Reference Image No. OF-12.0)

Basis of Determination. Determine ergoty on a dockage-free portion of 1,000 grams. Ergot applies in the determination of ergoty and also functions as foreign material.

Certification. When applicable, grade the wheat "Ergoty" in accordance with Section 13.4, Special Grades. Upon request, show the percentage of ergot to the nearest hundredth percent on the work record and the certificate.

13.19 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" on the sample as a whole (odor only) or on a dockage-free portion of 250 grams. Determine "Smutty" on a dockage-free portion of 250 grams. Smut balls apply in the determination of the special grades "Light smutty" or "Smutty" but also function as foreign material.

Certification. When applicable, grade the wheat "Light smutty," or "Smutty" in accordance with Section 13.4, Special Grades. Upon request, show the odor (in the case of light smutty) or the number of smut balls.

13.20 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.

Basis of Determination. Determine treated 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.

Three 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:

Scoured or Washed. 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.

a. Presents a blistered and/or abraded bran coat appearance as a result of treatment; or

b. Has a so-called laundry odor or wet smut odor; or

c. A dull, lifeless appearance or feeling; or

d. Has the appearance of having been scoured for the purpose of increasing the test weight per bushel.

Sulfured Wheat. Wheat which, in whole or in part, has been bleached with any bleaching agent is considered treated and graded as sulfured.

Limed Wheat. 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.

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, in accordance with Section 13.3, Grade Designations.

13.21 SHRUNKEN AND BROKEN KERNELS

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 on a dockage-free portion of 250 grams using one of the following methods:

a. Mechanical Sieving Method.

(1) Mount the sieve and the bottom pan on the mechanical sieve shaker.

(2) Set the stroke counter for 30 strokes.

(3) Follow the procedure described in Book II, Chapter 1, Section 1.13, Mechanical Sieve Shaker.

(4) All material passing through the sieve is considered shrunken and broken kernels. Return the material lodged in the perforations to the wheat which remained on top of the sieve.

b. Hand Sieving Method.

(1) Mount the sieve on a bottom pan.

(2) Place the 250-gram portion in the center of the sieve.

(3) Hold the sieve level in both hands with elbows close to the body and the sieve perforations parallel to the direction of movement.

(4) In a steady motion, move the sieve from left to right approximately 10 inches and then return from right to left.

(5) Repeat this operation 30 times.

(6) All material passing through the sieve is considered shrunken and broken kernels. Return the material lodged in the perforations to the wheat which remained on top of the sieve.

Determine shrunken and broken kernels prior to analyzing the sample for heat-damaged kernels, damaged kernels, foreign material, subclass, wheat of other classes, and contrasting classes.

Certification. Record the percentage of shrunken and broken kernels on the certificate to the nearest tenth percent.

13.22 DAMAGED KERNELS

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. Determine damaged kernels on a dockage-free and shrunken and broken-free portion of 15 grams.

b. Insect-Damaged Kernels. Determine insect-damaged kernels on a representative portion of dockage-free and shrunken and broken-free wheat. Insect-damaged kernels are kernels bored or tunneled by insects. (Reference: Visual Reference Image No. W-9.0) A three-stage inspection process has been developed to eliminate the need to always examine 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. Use the following guidelines and table No. 7 for determining whether wheat contains 32 or more insect-damaged kernels per 100 grams.

STAGE 1 Examine 15 grams (i.e., damaged kernel portion) for insect-damaged kernels and apply the result to the following guidelines:

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 (e.g., classing portion) for insect-damaged kernels and apply the result to the following guidelines:

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 insect-damaged kernels. Determine this portion size by subtracting from 100 grams the combined weight of the work portions used in Stage 1 and Stage 2. Add together the total number of insect-damaged kernels found in all three stages and apply the total to the following guidelines:

Total Insect-Damaged Kernels	Decision
31 or less	not sample grade
32 or more	sample grade

The following table summarizes the three-stage process for easy reference.

TABLE NO. 7

INSECT-DAMAGED KERNEL ANALYSIS				
		Damaged Kernel Count		
Stage	Sample Size	Not Sample Grade	Advance to Next Stage	Sample Grade
1	15 g	1	2 – 8	9 or more
2	15 g	1	2 – 8	9 or more
3	100 g – 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.

If an applicant requests that an entire 100 grams be examined and the actual number of insect-damaged kernels reported, inspectors may provide such service.

In general, a kernel of wheat and/or kernels of other grains are considered 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. The general types of damage found in wheat are listed below.

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. (Reference: Visual Reference Image No. W-1.0)

Heat-Damaged Kernels. Kernels materially discolored and damaged by heat. It is necessary, in most cases, to cut the kernels and make a cross-section analysis to determine if the color is reddish-brown, mahogany, or creamy. (Reference: Visual Reference Image Nos. W-6.0 for heat-damaged (Durum) and W-6.1 for heat-damaged (other than Durum))

Blight or Scab. 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. (Reference: Visual Reference Image No. W-2.0)

Frost-Damaged Kernels (Blistered). Kernels with distinct frost blisters extending around the back of the kernel and into the crease. (Reference: Visual Reference Image No. W-3.0)

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. They frequently have dark stripes showing through the sides of the kernels. (Reference: Visual Reference Image No. W-3.1)

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. (Reference: Visual Reference Image No. W-3.3)

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. (Reference: Visual Reference Image No. W-3.2)

Germ-Damaged Kernels (Mold). Kernels which have mold in the germ. The bran coat covering the germ should be removed carefully as scraping the bran coat too deep could remove the mold. (Reference: Visual Reference Image No. W-4.1)

Green Damage (Immature). Kernels which are intense green (immature) and without any yellow appearance. (Reference: Visual Reference Image No. W-5.0)

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.

Other Damage. Kernels with cracks, breaks, or chews and which contain mold or fungus. (Reference: Visual Reference Image No. W-7.0)

Sprout-Damaged Kernels. Kernels with the germ end broken open from germination exhibiting sprout or from which the sprouts have been broken off. (Reference: Visual Reference Image Nos. W-8.0 and W-8.1)

Insect-Bored Kernels. Kernels that have been bored or tunneled by insects. (Reference: Visual Reference Image No. W-9.0)

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. (Reference: Visual Reference Image Nos. W-4.0 and W-4.2)

Bleach Method. The bleaching procedure that uses the S/J mixer may be used as an alternate method for determining germ-damaged wheat. 1/ 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 (13.5 to 16.5) 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.

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 1/2 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.

1/ For equipment and materials, see section 1.17.

Any deviation from the previously described procedures may result in improperly bleached wheat and could produce a hazardous condition. Further,

- Safety equipment should be worn while the bleach operation is in progress and the lab area thoroughly cleaned once bleaching is complete.

- Accidental spills should first be neutralized with vinegar before the liquid is wiped up.

- Avoid mixing the KOH-bleach solution used in this test with chemical reagents or waste solutions associated with other tests.

- When disposing of the KOH-bleach solution, wash the solution down the sink drain with large quantities of water.

Computing Damaged Kernels. Obtain the percentage of total damaged kernels by adding the percentage 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.

STEP 1. Weight of other type damaged kernels ÷ weight of sample before bleaching x 100 = percent of other type damaged kernels.

STEP 2. 100 percent - percentage of other type damaged kernels ÷ 100 = change of base factor.

STEP 3. Weight of germ-damaged portion ÷ weight of damaged portion after bleaching x 100 = percent of germ-damaged kernels.

STEP 4. Percentage of germ-damaged kernels x change of base factor = adjusted percent of germ-damaged kernels.

STEP 5. Percent of other damaged kernels + adjusted percent of germ-damaged kernels = percent of damaged kernels.

Example

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

STEP 1. (2.40 ÷ 16.10) x 100 = 14.90 percent of other type damaged kernels.

STEP 2. (100 percent - 14.90 percent) ÷ 100 percent = 0.85 change of base factor.

STEP 3. (4.33 ÷ 11.95) x 100 = 36.23 percent of germ-damaged kernels.

STEP 4. 0.85 x 36.23 = 30.79 adjusted percent of germ-damaged kernels.

STEP 5. 14.90 + 30.79 = 45.69 (rounded to 45.7) percent damaged kernels.

Certification.

a. Damaged Kernels. Record the percent of damaged kernels on the certificate to the nearest tenth percent.

b. Insect-Damaged Kernels. When the wheat contains 32 or more insect-damaged kernels per 100 gram tolerance (basis three-stage decision table), grade the wheat as U.S. Sample Grade and record the portion size and the number of insect-damaged kernels found in each stage, as applicable, on the work records. Include in the "Remarks" section of the certificate the statement "Sample Grade due to insect-damaged kernels." If an applicant requests that the number of insect-damaged kernels be reported on the certificate, use the approved statements in book IV, chapter 3, section 3.5.

13.23 HEAT-DAMAGED KERNELS

Kernels, pieces of wheat kernels, and other grains that are materially discolored and damaged by heat that 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. (Reference: Visual Reference Image Nos. W-6.0 and W-6.1)

Certification. Record the percent of heat-damaged kernels on the certificate to the nearest tenth percent.

13.24 FOREIGN MATERIAL

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 on a dockage-free and shrunken and broken-free portion of 50 grams.

Other grains including oat groats, hulless oats, glumes on threshed or unthreshed kernels, and all matter other than wheat are considered foreign material and removed from the portion. Remove the glumes from the kernels of wheat and add to the foreign material.

Certification. Record the percent of foreign material on the certificate to the nearest tenth percent.

13.25 DEFECTS

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 on the sum of damaged kernels, foreign material, and shrunken and broken kernels.

A percentage 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 percentage of defects.

Certification. Record the percent of defects on the certificate to the nearest tenth percent.

When the percentages for damaged kernels, shrunken and broken kernels, and foreign material are added together and the total exceeds 100 percent, adjust the percentage of defects by adjusting damaged kernels (total).

13.26 CONTRASTING CLASSES

Contrasting classes are defined as:

(1) Durum wheat, Soft White wheat, and Unclassed wheat in the classes Hard Red Spring wheat and Hard Red Winter wheat; (2) 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; (3) Durum wheat and unclassed wheat in the class Soft Red Winter wheat; and (4) Durum wheat, Hard Red Spring wheat, Hard Red Winter wheat, Soft Red Winter wheat, and Unclassed wheat in the classes Hard White wheat and Soft White wheat.

Basis of Determination. Determine contrasting classes on a dockage-free and shrunken and broken-free portion of 15 grams. Use kernel and varietal characteristics when making this determination. (Refer to wheat variety library, section 13.28, and table 8.)

TABLE NO. 8

CONTRASTING CLASSES OF WHEAT	
Class	*Contrasting Class*
Hard Red Winter and Hard Red Spring wheat	Durum, Soft White, and Unclassed wheat
Durum wheat	Hard Red Spring, Hard Red Winter, Soft Red Winter, Hard White, Soft White, and Unclassed wheat
Soft Red Winter wheat	Durum and Unclassed wheat
Hard White and Soft White wheat	Durum, Hard Red Winter, Hard Red Spring, Soft Red Winter, and Unclassed wheat

Certification. Record the percent of contrasting classes on the certificate to the nearest tenth percent.

13.27 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 includes contrasting classes. Wheat of other classes is not applicable to Durum wheat.

Basis of Determination. Determine wheat of other classes on a dockage-free and shrunken and broken-free portion of 15 grams. Use kernel and varietal characteristics when making this determination. (Refer to wheat variety library and section 13.28.)

Certification. Record the percent of wheat of other classes on the certificate to the nearest tenth percent unless that percentage 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.

13.28 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 is 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 not more than 10 percent of White Club wheat.*

(2) *White Club Wheat. Soft endosperm White Club wheat containing not 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 which 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 which consists of less than 90 percent of one class and more than 10 percent of one other class, or a combination of classes which meet the definition of wheat.*

Basis of Determination. Determine class on a dockage-free and shrunken and broken-free portion of 15 grams. Use kernel and varietal characteristics when making this determination.

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.

Certification. For Mixed wheat, record the percentages of each class to the nearest whole percent on the certificate in accordance with section 13.3, Grade Designations.

Distinguishing Between White and Red Kernels in Hard Wheat. To assist in the detection of white and red wheat kernels in samples of Hard 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.

a. Sodium-Hydroxide Test. The sodium-hydroxide 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. Potassium-Hydroxide Test. Follow the procedures outlined below. 1/

(1) Place approximately 15 grams of wheat in a mixing jar.

(2) Add 10 grams of potassium-hydroxide (KOH) pellets.

(3) Add 40 ml of bleach.

(4) Set stirring head on jar, place jar on mixer, and mix for 1½ to 2 minutes.

(5) Pour the wheat from the mixing jar into a tea strainer and rinse with warm tap water to remove the sodium-hydroxide/bleach solution.

(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 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.

Caution: Too much potassium-hydroxide (step 2) or over mixing (step 4) may remove the bran in red wheat.

1/ For equipment and materials, see section 1.17.

13.29 SUBCLASS

Subclass is determined on Hard Red Spring wheat, Durum wheat, and Soft White wheat.

Basis of Determination. When an analysis is necessary, determine subclass on a dockage-free and shrunken and broken-free portion of 15 grams.

Observe the following guidelines when determining dark, hard, and vitreous kernels (DHV); hard and vitreous kernels of amber color (HVAC); and White Club Wheat.

a. Hard Red Spring Wheat.

(1) Consider hard red spring kernels which are bleached but are hard, or hard and vitreous as DHV.

(2) Consider hard red spring 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 and Hard Red Winter wheat 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, Unclassed wheat, Soft White wheat, and Durum wheat are not considered DHV.

b. Durum Wheat.

(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.

c. Soft White Wheat. The percentage of White Club wheat is applicable to all subclasses of Soft White wheat.

Certification. Record the subclass and percentage of DHV; HVAC; and White Club wheat kernels on the work record to the nearest tenth percent and on the certificate to nearest whole percent in accordance with Section 13.3, Grade Designations.

13.30 OFFICIAL CRITERIA

Factors, such as protein, and single kernel hardness, are considered as "official criteria factors" that are determined upon request and do not affect the grade.

Basis of Determination. All such analyses shall be determined in accordance with official procedures established by the Grain Inspection, Packers and Stockyards Administration.

Certification. Refer to the appropriate instructions.

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