

CHAPTER 4

SAMPLE PREPARATION AND ANALYSIS

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CHAPTER 4

SAMPLE PREPARATION AND ANALYSIS

**4.1 BASIS OF DETERMINATION**

The following table summarizes the basis of determination and sample portion requirements for NIRT analysis of grain constituents:

Table 1, Basis of Determination

	Basis of Determination	Size of Representative Portion	
		Models 1225, 1226, 1227, 1229	Model 1241
<b>Wheat</b> protein wet gluten	After the removal of dockage	From approximately 500g to work portion size (IRIS only)	From approximately 600g to work portion size
<b>Barley</b> protein	After the removal of dockage		
<b>Soybeans</b> protein oil	After the removal of FM	From approximately 500g to work portion size	From approximately 800g to work portion size
<b>Corn</b> protein oil starch	After the removal of BCFM		

**4.2 CLEANING SAMPLES**

a. Wheat or Barley.

Remove dockage using an approved dockage tester. The dockage tester uses aspiration (air) and a combination of riddles and sieves to remove any readily separable foreign matter. Generally, the foreign matter removed consists of all matter lighter, larger, or smaller than grain. If excessive quantities of wild buckwheat, cob joints, flaxseed, chess, and/or similar types of seeds are found additional sieving procedures are required. Refer to Book II of the Grain Inspection Handbook, Chapter 13 – Wheat, or Chapter 2 – Barley, for detailed instructions.

b. Soybeans.

Clean samples by hand sieving over an 8/64-inch round-hole sieve to remove any fine foreign material (FM). Handpick the portion remaining on top of the sieve to remove any coarse FM. Refer to NIRT Handbook, Chapter 1, Section 1.3 for the definition of coarse FM. Use the portion remaining on top of the sieve after the removal of fine and coarse FM for the analysis.

c. Corn.

Remove broken corn and foreign material (BCFM) using an approved dockage tester or by hand sieving over a 12/64-inch round-hole sieve. **Handpick any material other than corn (e.g., soybeans, pieces of corn cob) that remains in the sample.** Use the clean portion after the removal of BCFM for the analysis.

d. Mechanical/Hand Sieving Procedures.

Use the following procedures to mechanically/hand sieve foreign material (FM in soybeans, BCFM in corn).

- (1) For mechanical sieving, refer to Book II of the Grain Inspection Handbook, Chapter 1 – General Information, Section 1.13, for detailed instructions.
  - (a) Do not sieve more than 500 grams at a time.
  - (b) Set the sizer's counter to the appropriate number of strokes (20 for corn, and 5 for soybeans) and then turn it on.
- (2) For hand sieving:
  - (a) Do not sieve more than 500 grams at a time.
  - (b) Hold the sieve and bottom pan level and, using a steady motion, move the sieve from right to left approximately 10 inches. Return from left to right to complete one sieving operation. Repeat this operation 20 times for corn, and 5 times for soybeans.

### 4.3 NIRT ANALYSIS

Operators must read the user's manual and familiarize themselves with the instructions before operating the NIRT instrument.

- a. Sample Cells.
  - (1) **For Infratec Models 1225, 1226, 1227 and 1229:** Use the 30-millimeter cell for soybeans and corn determinations.
  - (2) **For Infratec Model 1229 with IRIS:** Use the 18-millimeter cell for wheat or barley determinations.
  - (3) **For Infratec Model 1241:** The Model 1241 is programmed through the calibration files to automatically adjust the sample cell to 18-millimeters for wheat and barley, or to 30-millimeters for corn and soybeans.
- b. Sample Temperature. The sample's temperature must be between 60 °F and 80 °F. If necessary, use a liquid-in-glass or digital thermometer specified to  $\pm 2$  °F ( $\pm 1$  °C) accuracy or better to measure the sample temperature. If the sample is not in the acceptable temperature range, allow it to cool or warm to within the limits before testing.
- c. Calibration. Ensure that the displayed calibration ID is a TSD approved calibration for the type of grain being tested.
- d. Standard Reference Samples. Check that the SRS for that grain type have been tested that day.
- e. Pour the entire sample into the NIRT hopper, enter the sample identification number, and press the "RUN" button.
- f. The instrument provides a display (and printout, if a printer is attached) of the percentage of the constituent being measured. For wet gluten, see below.
- g. Retain the sample for further analysis if needed.

h. Wet Gluten.

- (1) If the calibration model is installed on the official NIRT instrument, the wet gluten percentage is shown directly on the instrument display. The official wet gluten calibration is packaged with the Foss global wheat protein calibration and distributed by GIPSA, Technical Services Division (TSD), to those official testing locations which have purchased the Foss calibration diskette "Small Grain F" (Foss part number 10014260).
- (2) If the NIRT does not display wet gluten results directly, you may calculate the result manually by solving the equation using the NIRT (shown to 0.01 percent) protein result:

$$\begin{aligned} &\text{Wet gluten (14.0 percent mb)} \\ &= \text{Official protein (12.0 percent mb)} \times 3.029 - 7.83 \end{aligned}$$

For example: a sample with an NIRT wheat protein of 12.79 percent would have a wet gluten content of 30.9 percent. Official protein (12.79 percent)  $\times 3.029 - 7.83 = 30.91$ , rounded to 30.9 percent.

- (3) You may use Appendix 1, Conversion Table, at the end of this chapter.

#### 4.4 OUTLIER INDICATIONS

An outlier indication is a warning that the result may be in error. Outlier indications should rarely occur. If frequent outlier indications are observed, contact TSD.

- a. Types of Outliers. There are four possible outliers (A, B, C, and D). The values for each can range in degree from 0 (no outlier) to 5 (very extreme). The greater the value, the less reliable the predicted result. Review the user's manual for more information.
  - (1) "A" Outlier (Residual). The sample's scan doesn't fit the calibration.
  - (2) "B" Outlier (Leverage). The sample's scan doesn't fit the calibration and, if added, will have a strong influence.
  - (3) "C" Outlier (Standard Deviation). The standard deviation (variability) between subsamples is beyond the specified limit.
  - (4) "D" Outlier (Outside Range Limits). One or more of the subsamples have been predicted above or below the constituent value limits for the calibration.

- b. Causes of Outliers. Some conditions will cause intermittent outlier indications (not repeated on reruns) and others will cause consistent outlier indications. The most likely causes for outliers are:

For example:

- (1) Wrong calibration selected. Testing a wheat sample with the soybean calibration;
  - (2) Wrong sample cell (Infratec Models 1225, 1226 and 1227). Testing a wheat sample using the soybean/corn(30 mm) cell or vice versa;
  - (3) Extremely dirty samples;
  - (4) Poorly mixed samples;
  - (5) Sample packing or settling problems;
  - (6) Electrical interference;
  - (7) Measurement of samples not represented in the calibration set; or
  - (8) Improper instrument warm up.
- c. What to do when an outlier occurs? When any outlier indication occurs, the operator must perform the following:
- (1) Verify that the correct calibration and sample cell (Infratec Models 1225, 1226 and 1227) were used (18 mm for wheat and barley, or 30 mm for soybeans and corn).
  - (2) Make sure the sample is cleaned per official procedures.
  - (3) Make sure the room and sample temperature and the room relative humidity are within the specified ranges.
  - (4) Mix the sample thoroughly before retesting.
  - (5) Rerun the sample through the Infratec.

- (6) If the second run does not show an outlier indication, certify the results of the second run.
- (7) If the second run shows an outlier indication, certify on the basis of the average of the two runs.
- (8) Never certify a result with a level "5" outlier in the "A" or "B" positions.

**NOTE: The NIRT determines both protein and oil in soybeans, and protein, oil, and starch in corn on each run. Use the second run result for the constituent in question only. Use the first run result for the other constituent.**

#### **4.5 TESTING INDIVIDUAL AND SUBLLOT SAMPLES**

- a. Individual Sample. Official sample-lot or submitted samples of wheat, barley, corn, or soybeans are tested and certificated for protein, wet gluten, oil, or starch as applicable, in conjunction with official grade determinations or as a separate testing service.
- b. Shiplot and Lash Barges. Testing for protein in wheat is based on subplot results in accordance with the cu-sum loading plan. Testing for other constituents in wheat, barley; soybeans; and corn can be determined on an average of individual subplot results or on the basis of a composite sample representing the entire lot. Refer to the Grain Inspection Handbook, Book III, for details concerning the cu-sum loading plan.
- c. Unit Trains. Testing for protein in wheat is determined on individual or subplot basis in accordance with the cu-sum loading plan. Testing for other constituents in wheat, barley, soybeans, and corn can be determined on individual, subplot or composite sample basis. Applicants can request wheat wet gluten, corn protein, oil, and/or starch; and soybean protein and/or oil on a subplot basis while requesting inspection for grade on an individual carrier basis. When articulated railcars are used, each car is tested as a subplot.

**NOTE: The maximum size subplot for protein testing is five railcars for unit trains consisting of less than 200,000 bushels, or less than 50 railcars. For unit trains consisting of 200,000 bushels or more, or 50 railcars or more, the maximum subplot size is ten railcars.**

#### 4.6 CERTIFYING OFFICIAL RESULTS

- a. Moisture Basis. NIRT instruments are programmed to determine official criteria results (i.e., protein, wet gluten, oil, starch) on a moisture basis that is commonly used for trading purposes. The instruments will automatically report wheat protein results on a 12.0 percent moisture basis; wheat wet gluten results on a 14.0 percent moisture basis; barley protein results on a dry matter basis; soybean protein and oil results on a 13.0 percent moisture basis; and corn protein, oil, and starch results on a dry matter basis.
- b. Alternate Moisture Basis. An applicant can request an alternate moisture basis be used in lieu of the standard moisture basis for certifying a result. If an applicant requests an alternate moisture basis for a wheat protein result, show both results (12.0 percent standard basis and the alternate specified moisture basis) on the work record and certificate. Wet gluten may not be reported on an alternate moisture basis.
- c. General Procedures. All official criteria results (e.g., protein, wet gluten, oil, starch) shall be recorded on the work record and in the "Remarks" section of the official inspection certificate to the nearest tenth percent on the applicable moisture basis (wheat protein - 12.0 percent, wheat wet gluten – 14.0 percent, barley - dry matter basis, soybeans - 13.0 percent, corn - dry matter basis). Upon request, an applicant can request an alternate moisture basis be used in lieu of the standard moisture basis for certifying wheat protein, barley protein, soybean protein and oil, or corn protein, oil, and starch.

If an applicant requests an alternate moisture basis for a wheat protein result, show both results (12.0 percent basis and the specified moisture basis) on the work record and certificate.

Show the official results on the inspection certificate using an approved statement as shown below. Upon request of the applicant for service, official criteria results may be stated on a certificate separate from the grade certificate or on letterhead stationery in lieu of an official certificate.

#### 4.7 CERTIFICATE STATEMENTS: PROTEIN, WET GLUTEN, OIL, AND STARCH

a. Wheat.

(1) General. 12.0 Percent Moisture Basis Only.

Protein results determined only on the 12.0 percent basis are certified with the following statement:

“Protein \_\_\_\_\_ % , 12.0% moisture basis.”

(2) 12.0 Percent and Specified Moisture Basis.

Protein results determined on the 12.0 percent basis and an alternate moisture basis are certified with the following statements:

“Protein content \_\_\_\_\_%, (requested) moisture basis, which converts to protein \_\_\_\_\_, 12.0% moisture basis. Protein content reported on an alternative moisture basis in addition to the U.S. standard 12.0 percent moisture basis at applicant's request.”

As an example, where a protein result is 13.5 percent (12.0 percent moisture basis) is converted to 15.3 percent (dry matter basis, 0.0% moisture basis), the following statement would be shown on the certificate:

“Protein 15.3%, dry matter basis, which converts to protein 13.5%, 12.0% moisture basis. Protein content reported on an alternative moisture basis in addition to the U.S. standard 12.0 percent moisture basis at applicant's request.”

(3) Protein/Wet Gluten Only. When certifying protein alone (without official grade and factors), protein and wet gluten alone (without official grade and factors), or wet gluten alone (without official grade and factors) cross out the words “Grade and”, and show only the class of wheat on the grade line of the certificate under “kind.”

Examples: “Hard Red Winter wheat”  
“Hard Red Spring wheat”  
“Soft Red Winter wheat”  
“Durum wheat”  
“Hard White wheat”  
“Soft White wheat”

- (4) Shiplot and Combined Lots. Upon request of the applicant for service, show the range of protein results using the following statement:

“Sublot protein results range from (lowest) % to (highest)%.”

- (5) Wet Gluten. Show the official results (to the nearest 0.1 percent) on the inspection certificate using the following statement:

“Wet gluten \_\_\_\_\_ %, 14.0% moisture basis.”

- b. Barley. Certify protein in the “Remarks” section of the official inspection certificate to the nearest tenth percent on a dry matter basis. Applicants have the option of requesting the results on a specified moisture basis or an “as is” moisture basis in addition to or instead of the dry matter basis. Upon request, official criteria results may be stated on a certificate separate from grade or on letterhead stationery in lieu of an official certificate.

Use the following statements to report results:

- (1) Individual results (protein).

“Protein \_\_\_\_\_ %, dry matter basis.”

For protein results reported on a *specified moisture basis*, substitute the specified “moisture basis” requested for the words “dry matter basis.”

For protein, oil, or starch results reported on an *as is moisture basis*, substitute “as is” moisture basis for the words “dry matter basis.”

- (2) Protein Only. When certifying protein alone (without official grade and factors) cross out the words “Grade and”, and show only the sub-class of barley on the grade line of the certificate under “kind.”

Examples: "Six-rowed barley"  
"Two-rowed barley"  
"Barley"

- c. Corn. Certify protein, starch, and oil in the "Remarks" section of the official inspection certificate to the nearest tenth percent on a dry matter basis. Applicants have the option of requesting the results on a specified moisture basis or an "as is" moisture basis in addition to or instead of the dry matter basis. Upon request, official criteria results may be stated on a certificate separate from grade or on letterhead stationery in lieu of an official certificate.

Use the following statements to report results:

- (1) Individual results (protein, oil, starch).

"Protein, oil, or starch (as applicable) \_\_\_\_\_%, dry matter basis."

- (2) A combination of results (protein, oil, starch).

"Protein \_\_\_\_\_%, Oil \_\_\_\_\_%, and starch \_\_\_\_\_%, dry matter basis."

For protein, oil, or starch results reported on a *specified moisture basis*, substitute the specified "moisture basis" requested for the words "dry matter basis."

For protein, oil, or starch results reported on an *as is moisture basis*, substitute "as is" moisture basis for the words "dry matter basis."

- (3) Protein and/or Oil and/or Starch Only. When certifying protein and/or oil and/or starch alone (without official grade and factors) cross out the words "Grade and" and show only the class of corn on the grade line of the certificate under "kind."

Examples: "Yellow Corn"  
"White Corn"  
"Mixed Corn"

- (4) Composite Samples. For results determined on the basis of a composite sample include the following statement in addition to the appropriate statement used to certify protein, oil, and starch.

"Results based on composite sample analysis."

d. Soybeans. Certify protein and oil in the “Remarks” section of the official inspection certificate to the nearest tenth percent on a 13.0% moisture basis. Applicants have the option of requesting the results on a specified moisture basis or an “as is” moisture basis in addition to or instead of the 13.0% moisture basis. Upon request, official criteria results may be stated on a certificate separate from grade or on letterhead stationery in lieu of an official certificate.

(1) Protein. Certify all official soybean protein results (domestic and export lots) using the following statement:

“Protein \_\_\_\_%, 13.0% moisture basis.”

(2) Oil. Certify all official soybean oil results (domestic and export lots) using the following statement:

“Oil \_\_\_\_%, 13.0% moisture basis.”

(3) Protein and Oil. Certify all official soybean protein and oil results (domestic and export lots) using the following statement:

“Protein \_\_\_\_% and Oil \_\_\_\_%, 13.0% moisture basis.”

(4) Protein and/or Oil Only. When certifying protein and/or oil alone (without official grade and factors) cross out the words “Grade and” and show only the class of soybeans on the grade line of the certificate under “kind.”

Examples: “Yellow Soybeans”  
“Mixed Soybeans”

(5) Composite Samples. For results determined on the basis of a composite sample include the following statement in addition to the appropriate statement used to certify protein, and oil.

“Results based on composite sample analysis.”

## 4.8 CONVERTING RESULTS TO AN ALTERNATE MOISTURE BASIS

### a. Conversion Formulas.

Examples of alternate moisture basis specifications and formulas for correcting the NIRT results are:

- (1) Converting a wheat protein, barley protein, soybean protein/oil, or corn protein/oil/starch result from the standard moisture basis to an "as is" moisture basis.

$$A = \frac{P \times (100 - M)}{C}$$

Where A = Percent protein/oil/starch on an "as is" moisture basis.

P = NIRT protein/oil/starch result on the standard moisture basis (based on NIRT result rounded to the nearest tenth percent).

M = Official moisture result for the sample/lot (as applicable).

C = 87 for soybeans, 88 for wheat, or 100 for corn and barley.

- (2) Converting a barley protein or corn protein, oil, or starch result from the dry matter basis to another specified moisture basis.

$$A = \frac{P \times (100 - M)}{100}$$

Where A = Percent protein/oil/starch on a specified moisture basis.

P = NIRT protein/oil/starch result on a dry matter basis (based on NIRT result rounded to the nearest tenth percent).

M = Moisture basis specified by applicant.

- (3) Converting a soybean protein or oil result from the 13.0 percent moisture basis to another specified moisture basis.

$$A = \frac{P \times (100 - M)}{87}$$

Where A = Percent protein/oil on a specified moisture basis.

P = NIRT protein/oil result on the 13.0 percent moisture basis (based on NIRT result rounded to the nearest tenth percent).

M = Moisture basis specified by applicant.

- (4) Converting a soybean protein result to an oil-free and moisture-free basis.

$$B = \frac{P \times 100}{(100 - (O + 13))}$$

Where B = Percent protein on an oil-free and moisture-free basis.

P = NIRT protein result on a 13 percent moisture basis (based on NIRT result rounded to the nearest tenth percent).

O = Percent oil on a 13 percent moisture basis (based on NIRT result rounded to the nearest tenth percent).

- (5) Converting a soybean protein result to an oil-free and specified moisture basis.

$$C = \frac{P \times (100 - M)}{100 - (13 + O)}$$

Where C = Percent protein on an oil-free and specified moisture basis.

P = NIRT protein result on a 13 percent moisture basis (based on NIRT result rounded to the nearest tenth percent).

M = Moisture basis specified by the applicant.

O = NIRT oil result on 13 percent moisture basis (based on NIRT result rounded to the nearest tenth percent).

- (6) Converting a wheat protein result from the 12.0 percent moisture basis to another specified moisture basis.

$$A = \frac{P \times (100 - M)}{88}$$

Where A = Percent protein on a specified moisture basis.

P = NIRT protein result on the 12.0 percent moisture basis (based on NIRT result rounded to the nearest tenth percent).

M = Moisture basis specified by applicant.

b. Conversion Guidelines for Submitted Samples and Single Lot Inspections.

For submitted samples and single lots, use the official moisture result for the lot if the applicant requests an "as is" moisture basis.

c. Conversion Guidelines for Sublot Testing.

- (1) When sublot testing is performed on unit trains, lash barges, or ships inspected as single lots, and the applicant **does not** specify limits for protein, oil, or starch content on an alternate moisture basis, record individual sublot results and calculate CuSum values on the basis of the standard moisture basis. Upon completion of loading, convert the final average protein/oil/starch result to the specified moisture basis. For an "as is" moisture basis, use the official average moisture result in the conversion formula.
- (2) If a load order specifies limits on the protein, oil, or starch content on a specified moisture basis, convert the individual sublot protein/oil/starch results to the desired moisture basis. For an "as is" moisture basis, use the official sublot moisture result in the conversion formula.

Using two separate columns on the loading log, record the individual sublot results (from the standard moisture basis and specified moisture basis) and apply the CuSum loading plan information (e.g., breakpoints, starting values) to the specified moisture basis results column.

Upon completion of the lot, average the protein/oil/starch results in the standard moisture basis column and convert this value to the applicable protein/oil/starch value on the specified moisture basis. For an "as is" moisture basis, use the official average moisture result in the conversion formula.

Enter the converted protein/oil/starch value as the final "average" under the specified moisture basis column (protein/oil/starch results) on the log. **Do not average results from the specified moisture column to obtain a "final" specified moisture basis result.**

ATTACHMENT  
NIRT HANDBOOK  
CHAPTER 4  
3-24-08

CONVERSION TABLE							
PERCENTAGE PROTEIN 12.0 % mb				TO	PERCENTAGE WET GLUTEN 14.0 % mb		
Protein	Wet Gluten	Protein	Wet Gluten	Protein	Wet Gluten	Protein	Wet Gluten
8.01	16.4	8.51	17.9	9.01	19.5	9.51	21.0
8.02	16.5	8.52	18.0	9.02	19.5	9.52	21.0
8.03	16.5	8.53	18.0	9.03	19.5	9.53	21.0
8.04	16.5	8.54	18.0	9.04	19.6	9.54	21.1
8.05	16.6	8.55	18.1	9.05	19.6	9.55	21.1
8.06	16.6	8.56	18.1	9.06	19.6	9.56	21.1
8.07	16.6	8.57	18.1	9.07	19.6	9.57	21.2
8.08	16.6	8.58	18.2	9.08	19.7	9.58	21.2
8.09	16.7	8.59	18.2	9.09	19.7	9.59	21.2
8.10	16.7	8.60	18.2	9.10	19.7	9.60	21.2
8.11	16.7	8.61	18.2	9.11	19.8	9.61	21.3
8.12	16.8	8.62	18.3	9.12	19.8	9.62	21.3
8.13	16.8	8.63	18.3	9.13	19.8	9.63	21.3
8.14	16.8	8.64	18.3	9.14	19.9	9.64	21.4
8.15	16.9	8.65	18.4	9.15	19.9	9.65	21.4
8.16	16.9	8.66	18.4	9.16	19.9	9.66	21.4
8.17	16.9	8.67	18.4	9.17	19.9	9.67	21.5
8.18	16.9	8.68	18.5	9.18	20.0	9.68	21.5
8.19	17.0	8.69	18.5	9.19	20.0	9.69	21.5
8.20	17.0	8.70	18.5	9.20	20.0	9.70	21.6
8.21	17.0	8.71	18.6	9.21	20.1	9.71	21.6
8.22	17.1	8.72	18.6	9.22	20.1	9.72	21.6
8.23	17.1	8.73	18.6	9.23	20.1	9.73	21.6
8.24	17.1	8.74	18.6	9.24	20.2	9.74	21.7
8.25	17.2	8.75	18.7	9.25	20.2	9.75	21.7
8.26	17.2	8.76	18.7	9.26	20.2	9.76	21.7
8.27	17.2	8.77	18.7	9.27	20.2	9.77	21.8
8.28	17.3	8.78	18.8	9.28	20.3	9.78	21.8
8.29	17.3	8.79	18.8	9.29	20.3	9.79	21.8
8.30	17.3	8.80	18.8	9.30	20.3	9.80	21.9
8.31	17.3	8.81	18.9	9.31	20.4	9.81	21.9
8.32	17.4	8.82	18.9	9.32	20.4	9.82	21.9
8.33	17.4	8.83	18.9	9.33	20.4	9.83	21.9
8.34	17.4	8.84	18.9	9.34	20.5	9.84	22.0
8.35	17.5	8.85	19.0	9.35	20.5	9.85	22.0
8.36	17.5	8.86	19.0	9.36	20.5	9.86	22.0
8.37	17.5	8.87	19.0	9.37	20.6	9.87	22.1
8.38	17.6	8.88	19.1	9.38	20.6	9.88	22.1
8.39	17.6	8.89	19.1	9.39	20.6	9.89	22.1
8.40	17.6	8.90	19.1	9.40	20.6	9.90	22.2
8.41	17.6	8.91	19.2	9.41	20.7	9.91	22.2
8.42	17.7	8.92	19.2	9.42	20.7	9.92	22.2
8.43	17.7	8.93	19.2	9.43	20.7	9.93	22.2
8.44	17.7	8.94	19.2	9.44	20.8	9.94	22.3
8.45	17.8	8.95	19.3	9.45	20.8	9.95	22.3
8.46	17.8	8.96	19.3	9.46	20.8	9.96	22.3
8.47	17.8	8.97	19.3	9.47	20.9	9.97	22.4
8.48	17.9	8.98	19.4	9.48	20.9	9.98	22.4
8.49	17.9	8.99	19.4	9.49	20.9	9.99	22.4
8.50	17.9	9.00	19.4	9.50	20.9	10.00	22.5

**CONVERSION TABLE**  
**PERCENTAGE PROTEIN TO PERCENTAGE WET GLUTEN**  
**12.0 % mb 14.0 % mb**

Protein	Wet Gluten						
10.01	22.5	10.51	24.0	11.01	25.5	11.51	27.0
10.02	22.5	10.52	24.0	11.02	25.5	11.52	27.1
10.03	22.6	10.53	24.1	11.03	25.6	11.53	27.1
10.04	22.6	10.54	24.1	11.04	25.6	11.54	27.1
10.05	22.6	10.55	24.1	11.05	25.6	11.55	27.2
10.06	22.6	10.56	24.2	11.06	25.7	11.56	27.2
10.07	22.7	10.57	24.2	11.07	25.7	11.57	27.2
10.08	22.7	10.58	24.2	11.08	25.7	11.58	27.2
10.09	22.7	10.59	24.2	11.09	25.8	11.59	27.3
10.10	22.8	10.60	24.3	11.10	25.8	11.60	27.3
10.11	22.8	10.61	24.3	11.11	25.8	11.61	27.3
10.12	22.8	10.62	24.3	11.12	25.9	11.62	27.4
10.13	22.9	10.63	24.4	11.13	25.9	11.63	27.4
10.14	22.9	10.64	24.4	11.14	25.9	11.64	27.4
10.15	22.9	10.65	24.4	11.15	25.9	11.65	27.5
10.16	22.9	10.66	24.5	11.16	26.0	11.66	27.5
10.17	23.0	10.67	24.5	11.17	26.0	11.67	27.5
10.18	23.0	10.68	24.5	11.18	26.0	11.68	27.5
10.19	23.0	10.69	24.6	11.19	26.1	11.69	27.6
10.20	23.1	10.70	24.6	11.20	26.1	11.70	27.6
10.21	23.1	10.71	24.6	11.21	26.1	11.71	27.6
10.22	23.1	10.72	24.6	11.22	26.2	11.72	27.7
10.23	23.2	10.73	24.7	11.23	26.2	11.73	27.7
10.24	23.2	10.74	24.7	11.24	26.2	11.74	27.7
10.25	23.2	10.75	24.7	11.25	26.2	11.75	27.8
10.26	23.2	10.76	24.8	11.26	26.3	11.76	27.8
10.27	23.3	10.77	24.8	11.27	26.3	11.77	27.8
10.28	23.3	10.78	24.8	11.28	26.3	11.78	27.9
10.29	23.3	10.79	24.9	11.29	26.4	11.79	27.9
10.30	23.4	10.80	24.9	11.30	26.4	11.80	27.9
10.31	23.4	10.81	24.9	11.31	26.4	11.81	27.9
10.32	23.4	10.82	24.9	11.32	26.5	11.82	28.0
10.33	23.5	10.83	25.0	11.33	26.5	11.83	28.0
10.34	23.5	10.84	25.0	11.34	26.5	11.84	28.0
10.35	23.5	10.85	25.0	11.35	26.5	11.85	28.1
10.36	23.6	10.86	25.1	11.36	26.6	11.86	28.1
10.37	23.6	10.87	25.1	11.37	26.6	11.87	28.1
10.38	23.6	10.88	25.1	11.38	26.6	11.88	28.2
10.39	23.6	10.89	25.2	11.39	26.7	11.89	28.2
10.40	23.7	10.90	25.2	11.40	26.7	11.90	28.2
10.41	23.7	10.91	25.2	11.41	26.7	11.91	28.2
10.42	23.7	10.92	25.2	11.42	26.8	11.92	28.3
10.43	23.8	10.93	25.3	11.43	26.8	11.93	28.3
10.44	23.8	10.94	25.3	11.44	26.8	11.94	28.3
10.45	23.8	10.95	25.3	11.45	26.9	11.95	28.4
10.46	23.9	10.96	25.4	11.46	26.9	11.96	28.4
10.47	23.9	10.97	25.4	11.47	26.9	11.97	28.4
10.48	23.9	10.98	25.4	11.48	26.9	11.98	28.5
10.49	23.9	10.99	25.5	11.49	27.0	11.99	28.5
10.50	24.0	11.00	25.5	11.50	27.0	12.00	28.5

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CONVERSION TABLE								
PERCENTAGE PROTEIN 12.0 % mb				TO	PERCENTAGE WET GLUTEN 14.0 % mb			
Protein	Wet Gluten	Protein	Wet Gluten		Protein	Wet Gluten	Protein	Wet Gluten
12.01	28.5	12.51	30.1		13.01	31.6	13.51	33.1
12.02	28.6	12.52	30.1		13.02	31.6	13.52	33.1
12.03	28.6	12.53	30.1		13.03	31.6	13.53	33.2
12.04	28.6	12.54	30.2		13.04	31.7	13.54	33.2
12.05	28.7	12.55	30.2		13.05	31.7	13.55	33.2
12.06	28.7	12.56	30.2		13.06	31.7	13.56	33.2
12.07	28.7	12.57	30.2		13.07	31.8	13.57	33.3
12.08	28.8	12.58	30.3		13.08	31.8	13.58	33.3
12.09	28.8	12.59	30.3		13.09	31.8	13.59	33.3
12.10	28.8	12.60	30.3		13.10	31.8	13.60	33.4
12.11	28.9	12.61	30.4		13.11	31.9	13.61	33.4
12.12	28.9	12.62	30.4		13.12	31.9	13.62	33.4
12.13	28.9	12.63	30.4		13.13	31.9	13.63	33.5
12.14	28.9	12.64	30.5		13.14	32.0	13.64	33.5
12.15	29.0	12.65	30.5		13.15	32.0	13.65	33.5
12.16	29.0	12.66	30.5		13.16	32.0	13.66	33.5
12.17	29.0	12.67	30.5		13.17	32.1	13.67	33.6
12.18	29.1	12.68	30.6		13.18	32.1	13.68	33.6
12.19	29.1	12.69	30.6		13.19	32.1	13.69	33.6
12.20	29.1	12.70	30.6		13.20	32.2	13.70	33.7
12.21	29.2	12.71	30.7		13.21	32.2	13.71	33.7
12.22	29.2	12.72	30.7		13.22	32.2	13.72	33.7
12.23	29.2	12.73	30.7		13.23	32.2	13.73	33.8
12.24	29.2	12.74	30.8		13.24	32.3	13.74	33.8
12.25	29.3	12.75	30.8		13.25	32.3	13.75	33.8
12.26	29.3	12.76	30.8		13.26	32.3	13.76	33.8
12.27	29.3	12.77	30.9		13.27	32.4	13.77	33.9
12.28	29.4	12.78	30.9		13.28	32.4	13.78	33.9
12.29	29.4	12.79	30.9		13.29	32.4	13.79	33.9
12.30	29.4	12.80	30.9		13.30	32.5	13.80	34.0
12.31	29.5	12.81	31.0		13.31	32.5	13.81	34.0
12.32	29.5	12.82	31.0		13.32	32.5	13.82	34.0
12.33	29.5	12.83	31.0		13.33	32.5	13.83	34.1
12.34	29.5	12.84	31.1		13.34	32.6	13.84	34.1
12.35	29.6	12.85	31.1		13.35	32.6	13.85	34.1
12.36	29.6	12.86	31.1		13.36	32.6	13.86	34.2
12.37	29.6	12.87	31.2		13.37	32.7	13.87	34.2
12.38	29.7	12.88	31.2		13.38	32.7	13.88	34.2
12.39	29.7	12.89	31.2		13.39	32.7	13.89	34.2
12.40	29.7	12.90	31.2		13.40	32.8	13.90	34.3
12.41	29.8	12.91	31.3		13.41	32.8	13.91	34.3
12.42	29.8	12.92	31.3		13.42	32.8	13.92	34.3
12.43	29.8	12.93	31.3		13.43	32.8	13.93	34.4
12.44	29.9	12.94	31.4		13.44	32.9	13.94	34.4
12.45	29.9	12.95	31.4		13.45	32.9	13.95	34.4
12.46	29.9	12.96	31.4		13.46	32.9	13.96	34.5
12.47	29.9	12.97	31.5		13.47	33.0	13.97	34.5
12.48	30.0	12.98	31.5		13.48	33.0	13.98	34.5
12.49	30.0	12.99	31.5		13.49	33.0	13.99	34.5
12.50	30.0	13.00	31.5		13.50	33.1	14.00	34.6

CONVERSION TABLE							
PERCENTAGE PROTEIN		TO		PERCENTAGE WET GLUTEN			
12.0 % mb				14.0 % mb			
Protein	Wet Gluten	Protein	Wet Gluten	Protein	Wet Gluten	Protein	Wet Gluten
14.01	34.6	14.51	36.1	15.01	37.6	15.51	39.1
14.02	34.6	14.52	36.2	15.02	37.7	15.52	39.2
14.03	34.7	14.53	36.2	15.03	37.7	15.53	39.2
14.04	34.7	14.54	36.2	15.04	37.7	15.54	39.2
14.05	34.7	14.55	36.2	15.05	37.8	15.55	39.3
14.06	34.8	14.56	36.3	15.06	37.8	15.56	39.3
14.07	34.8	14.57	36.3	15.07	37.8	15.57	39.3
14.08	34.8	14.58	36.3	15.08	37.8	15.58	39.4
14.09	34.8	14.59	36.4	15.09	37.9	15.59	39.4
14.10	34.9	14.60	36.4	15.10	37.9	15.60	39.4
14.11	34.9	14.61	36.4	15.11	37.9	15.61	39.5
14.12	34.9	14.62	36.5	15.12	38.0	15.62	39.5
14.13	35.0	14.63	36.5	15.13	38.0	15.63	39.5
14.14	35.0	14.64	36.5	15.14	38.0	15.64	39.5
14.15	35.0	14.65	36.5	15.15	38.1	15.65	39.6
14.16	35.1	14.66	36.6	15.16	38.1	15.66	39.6
14.17	35.1	14.67	36.6	15.17	38.1	15.67	39.6
14.18	35.1	14.68	36.6	15.18	38.2	15.68	39.7
14.19	35.2	14.69	36.7	15.19	38.2	15.69	39.7
14.20	35.2	14.70	36.7	15.20	38.2	15.70	39.7
14.21	35.2	14.71	36.7	15.21	38.2	15.71	39.8
14.22	35.2	14.72	36.8	15.22	38.3	15.72	39.8
14.23	35.3	14.73	36.8	15.23	38.3	15.73	39.8
14.24	35.3	14.74	36.8	15.24	38.3	15.74	39.8
14.25	35.3	14.75	36.8	15.25	38.4	15.75	39.9
14.26	35.4	14.76	36.9	15.26	38.4	15.76	39.9
14.27	35.4	14.77	36.9	15.27	38.4	15.77	39.9
14.28	35.4	14.78	36.9	15.28	38.5	15.78	40.0
14.29	35.5	14.79	37.0	15.29	38.5	15.79	40.0
14.30	35.5	14.80	37.0	15.30	38.5	15.80	40.0
14.31	35.5	14.81	37.0	15.31	38.5	15.81	40.1
14.32	35.5	14.82	37.1	15.32	38.6	15.82	40.1
14.33	35.6	14.83	37.1	15.33	38.6	15.83	40.1
14.34	35.6	14.84	37.1	15.34	38.6	15.84	40.1
14.35	35.6	14.85	37.2	15.35	38.7	15.85	40.2
14.36	35.7	14.86	37.2	15.36	38.7	15.86	40.2
14.37	35.7	14.87	37.2	15.37	38.7	15.87	40.2
14.38	35.7	14.88	37.2	15.38	38.8	15.88	40.3
14.39	35.8	14.89	37.3	15.39	38.8	15.89	40.3
14.40	35.8	14.90	37.3	15.40	38.8	15.90	40.3
14.41	35.8	14.91	37.3	15.41	38.8	15.91	40.4
14.42	35.8	14.92	37.4	15.42	38.9	15.92	40.4
14.43	35.9	14.93	37.4	15.43	38.9	15.93	40.4
14.44	35.9	14.94	37.4	15.44	38.9	15.94	40.5
14.45	35.9	14.95	37.5	15.45	39.0	15.95	40.5
14.46	36.0	14.96	37.5	15.46	39.0	15.96	40.5
14.47	36.0	14.97	37.5	15.47	39.0	15.97	40.5
14.48	36.0	14.98	37.5	15.48	39.1	15.98	40.6
14.49	36.1	14.99	37.6	15.49	39.1	15.99	40.6
14.50	36.1	15.00	37.6	15.50	39.1	16.00	40.6

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CONVERSION TABLE								
PERCENTAGE PROTEIN 12.0 % mb				TO	PERCENTAGE WET GLUTEN 14.0 % mb			
Protein	Wet Gluten	Protein	Wet Gluten	Protein	Wet Gluten	Protein	Wet Gluten	
16.01	40.7	16.51	42.2	17.01	43.7	17.51	45.2	
16.02	40.7	16.52	42.2	17.02	43.7	17.52	45.2	
16.03	40.7	16.53	42.2	17.03	43.8	17.53	45.3	
16.04	40.8	16.54	42.3	17.04	43.8	17.54	45.3	
16.05	40.8	16.55	42.3	17.05	43.8	17.55	45.3	
16.06	40.8	16.56	42.3	17.06	43.8	17.56	45.4	
16.07	40.8	16.57	42.4	17.07	43.9	17.57	45.4	
16.08	40.9	16.58	42.4	17.08	43.9	17.58	45.4	
16.09	40.9	16.59	42.4	17.09	43.9	17.59	45.5	
16.10	40.9	16.60	42.5	17.10	44.0	17.60	45.5	
16.11	41.0	16.61	42.5	17.11	44.0	17.61	45.5	
16.12	41.0	16.62	42.5	17.12	44.0	17.62	45.5	
16.13	41.0	16.63	42.5	17.13	44.1	17.63	45.6	
16.14	41.1	16.64	42.6	17.14	44.1	17.64	45.6	
16.15	41.1	16.65	42.6	17.15	44.1	17.65	45.6	
16.16	41.1	16.66	42.6	17.16	44.1	17.66	45.7	
16.17	41.1	16.67	42.7	17.17	44.2	17.67	45.7	
16.18	41.2	16.68	42.7	17.18	44.2	17.68	45.7	
16.19	41.2	16.69	42.7	17.19	44.2	17.69	45.8	
16.20	41.2	16.70	42.8	17.20	44.3	17.70	45.8	
16.21	41.3	16.71	42.8	17.21	44.3	17.71	45.8	
16.22	41.3	16.72	42.8	17.22	44.3	17.72	45.8	
16.23	41.3	16.73	42.8	17.23	44.4	17.73	45.9	
16.24	41.4	16.74	42.9	17.24	44.4	17.74	45.9	
16.25	41.4	16.75	42.9	17.25	44.4	17.75	45.9	
16.26	41.4	16.76	42.9	17.26	44.5	17.76	46.0	
16.27	41.5	16.77	43.0	17.27	44.5	17.77	46.0	
16.28	41.5	16.78	43.0	17.28	44.5	17.78	46.0	
16.29	41.5	16.79	43.0	17.29	44.5	17.79	46.1	
16.30	41.5	16.80	43.1	17.30	44.6	17.80	46.1	
16.31	41.6	16.81	43.1	17.31	44.6	17.81	46.1	
16.32	41.6	16.82	43.1	17.32	44.6	17.82	46.1	
16.33	41.6	16.83	43.1	17.33	44.7	17.83	46.2	
16.34	41.7	16.84	43.2	17.34	44.7	17.84	46.2	
16.35	41.7	16.85	43.2	17.35	44.7	17.85	46.2	
16.36	41.7	16.86	43.2	17.36	44.8	17.86	46.3	
16.37	41.8	16.87	43.3	17.37	44.8	17.87	46.3	
16.38	41.8	16.88	43.3	17.38	44.8	17.88	46.3	
16.39	41.8	16.89	43.3	17.39	44.8	17.89	46.4	
16.40	41.8	16.90	43.4	17.40	44.9	17.90	46.4	
16.41	41.9	16.91	43.4	17.41	44.9	17.91	46.4	
16.42	41.9	16.92	43.4	17.42	44.9	17.92	46.4	
16.43	41.9	16.93	43.5	17.43	45.0	17.93	46.5	
16.44	42.0	16.94	43.5	17.44	45.0	17.94	46.5	
16.45	42.0	16.95	43.5	17.45	45.0	17.95	46.5	
16.46	42.0	16.96	43.5	17.46	45.1	17.96	46.6	
16.47	42.1	16.97	43.6	17.47	45.1	17.97	46.6	
16.48	42.1	16.98	43.6	17.48	45.1	17.98	46.6	
16.49	42.1	16.99	43.6	17.49	45.1	17.99	46.7	
16.50	42.1	17.00	43.7	17.50	45.2	18.00	46.7	