



May 12, 1994

TO : ALL GRADERS/INSPECTORS
ALL SUPERVISORS

FROM : Suzanne L. Evans
Supervisory Egg Products Inspector

SUBJECT: Supervision of Egg Products Formulation
and Solids Verification

This memorandum supersedes Regional Memorandum No. 11,
"Supervision of Formulation/Refractometer Readings/Records,"
dated January 29, 1992.

The original purpose of this memorandum was to develop a uniform policy on how to verify product formulation, assure that egg products are produced in compliance with the egg solids requirements, provide written instructions on how to use the refractometer, and calculate product formula adjustment. Shortly after this memorandum was issued Section 7 of the Egg Products Handbook was revised.

As stated in the Egg Products Handbook, Egg Products Inspectors are responsible for observing the quality, type, and wholesomeness of raw materials and finished products, handling of ingredients, and labeling. An inspector is also required to make such observation as necessary to certify that egg products have or have not been prepared and processed in compliance with the regulations. This includes supervision of product formulation and assuring that products produced meet the egg solids requirements.

This memorandum has been revised to coincide with the instructions in Section 7. It also includes the solids requirements for formulated or standardized egg products, and further clarifies how to verify product formulations.

Refractometer and Solids Readings

The refractometer is the instrument used in the measurement of the refractive index. The refractive index is an indicator to the total solids in the product. The solids of the products must be checked to ascertain if they are in compliance with the regulations or a specification. The accuracy of all solids readings depends upon this instrument.



Care must be taken while using this instrument. (The prisms of the refract are quite soft and are easily scratched.) When operating the refractometer observe the following guidelines:

- a) The prisms must be cleaned immediately after each use. Tissue paper and water (preferable deionized or distilled) should be on hand for this purpose.
- b) The prisms should be dried after each cleaning.
- c) Always close the prisms after each use with a piece of folded tissue paper between them.

Plants producing formulated products or standardized whole eggs must have acceptable equipment for determining the egg solids content for each lot produced. Hand held refractometers may be used in conjunction with the upright refractometer model, however, they may not be used as the sole instrument for determining solids. The reason for this is that the refractometer reading varies greatly on hand held refractometers depending upon the light source and temperature of the product. Additionally, some plants are equipped with alternative methods for rapidly determining the solids content of formulated products. If you have questions about the accuracy of the equipment being used, consult your supervisor for guidance.

Analyzing Egg Products Samples

When analyzing eggs with a refractometer, it is sometimes necessary to add a salt solution (to a pre-determined amount of a sample) so that a reading of the refractive index can be obtained. After the refractive index is obtained, it must then be converted to percent solids. This is accomplished by consulting a chart listing the refractive index, temperature of the prisms, and corresponding solids content.

The temperature at which the refractive index is obtained should be constant. The temperature may vary, but regardless of the temperature chosen, proper facilities for maintaining a constant temperature should be provided. A constant temperature water bath is used to maintain the temperature of the water which is pumped through the refractometer. When conducting a refractometer reading observe the following guidelines:

1. **PRODUCTS CONTAINING NO SALT OR SUGAR:** Obtain a representative sample of the product. Measure out 10 ml in a graduated cylinder. Add .5 ml of buffer (saline solution) to the graduated cylinder and mix thoroughly. The method used may vary by plant, therefore, if you question the procedure being used at your plant, contact your supervisor.
2. **SUGAR, SALT OR WHITE PRODUCTS:** Buffer solution does not need to be added to whites or products containing sugar or salt.

3. Insure that the prisms are absolutely clean.
4. Open the top prism case and apply the sample directly to the measurement prism using a stir rod (plastic, glass, etc.). Thoroughly mix the sample to be analyzed. Insure that sufficient sample has been loaded to completely fill the space between prisms. Close the prism case.

NOTE: If bubbles form in the sample, they may sometimes be eliminated by slightly opening and closing the prism case. If this is not effective, reclean the prism surface, and repeat the procedure.

5. Turn the light arm on. Raise the arm so that it is directly opposite the closed prisms.
6. After placing the sample in the refractometer, time should be allowed for the sample to attain the temperature of the prisms. Allow approximately 15 seconds to pass before taking a reading.
7. Check the temperature of the refractometer prior to taking a refract by reading the thermometer on the side of the instrument. Remember, the temperature should remain constant. If the temperature varies from reading to reading, inform management and contact your supervisor for guidance.
8. Looking into the eye piece and using the hand wheels on the right side of the refractometer, set the borderline on the cross hair intersection. See Figure No. 1.
9. Depress the contact switch on the left side of the refractometer and read the sample value in percent total solids or refractive index. The reading will appear as shown in Figure No. 2. (The inspector would read the lower scale (percent total solids). The example in Figure No. 2 reads 68.0 percent total solids.)
10. Next, refer to the applicable solids chart to convert the refract reading to the actual percent total solids of the product being checked.
11. Clean the refractometer as previously outlined.
12. Record the adjusted total solids reading on the PY-203, "Daily Report Of Plant Operations."

The majority of refractometers are operated as outlined above. However, if the unit used at your plant operates in a different manner than described, consult your supervisor for guidance.

Frequency of Egg Solids Sampling

- 1. Refractometer readings should be taken and recorded by the applicable plant employee whenever the plant is producing egg yolks, blended products, batching salted/sugared products, or standardizing whole egg. Alternatively, a composite sample must be taken from each lot during processing and submitted to a surveillance or USDA laboratory to be analyzed for egg solids.
- 2. For routinely produced and formulated products, the inspector should take a refractometer reading a minimum of once each day.

For products produced less frequently, observe, at a minimum, the formulation of one batch out of every five production lots.

Record the refract reading on the PY-203, "Daily Report of Plant Operations" as "Egg Solids Correctly Determined". Use the additional spaces provided (items 42-47). In addition, the inspector should initial the company's batch record log for the same entry. Refractometer readings may be taken more often as necessary to insure that the products being produced are in compliance with the egg solids requirements.

- 3. Confirmation samples are to be submitted a minimum of twice a year (or more often as instructed by your supervisor). The USDA laboratory results will be compared to the solids results shown by the company's surveillance laboratory. The inspector is to record the following information on the attached Formulation Log Sheet.
 - a) Record the refractometer results obtained by the plant employee on the sample submitted.
 - b) Record the refractometer results obtained by the USDA inspector on the same sample.
 - c) Record the laboratory results received from the plant's surveillance laboratory.
 - d) Record the laboratory results received from the USDA laboratory.

The laboratory results obtained by the plant employee, the USDA Inspector, the surveillance lab, and the USDA lab should all be fairly consistent. When significant differences (exceeding 0.2 percent) are noted, corrections must be made in the plant's equipment and/or procedures and additional confirmation samples submitted. Notify your supervisor if laboratory results are not consistent.

Record the results received from the plant's surveillance laboratory in the results section of the Formulation Log Sheet in the column entitled, "USDA Lab Results" under "Other." Note in the remarks section what ingredient the

A quick test to see if the plant's refractometer is calibrated correctly is to take the refractive index of (water distilled/deionized). It should be zero. If it is not, the refractometer may need to be adjusted.

- 4. When submitting these samples for solids testing the inspector is to request the following analyses:
 - a) Percent Total Solids
 - b) Percent Egg Solids
 - c) Percent Salt and/or Percent Sugar (if applicable)
- 5. The above analyses may be requested when submitting split samples to the company's surveillance laboratory and the USDA laboratory.
- 6. Should any sample tested for percent solids not meet the following requirements, immediately notify your supervisor:
 - a) Salted (or sugared) whole eggs or egg yolks with "approximately 10 percent salt (or sugar) added" contain less than 9.5 percent or more than 10.5 percent of the applicable ingredient.
 - b) The egg portion of a sample of egg yolks, salted egg yolks, sugared egg yolks, or other yolk product contains less than 42.8 percent egg solids.
 - c) The egg component of a sample of whole eggs, salted whole eggs, sugared whole eggs, or other whole egg product contains less than 24.0 percent egg solids unless the whole eggs are in natural proportion. If the whole eggs are in natural proportion, contact the regional office if the results of any sample are less than 23 percent egg solids.

Sampling Frequency for Added Ingredients

Egg products are also to be analyzed for ingredients which have a maximum tolerance level. Refer to the Egg Products Handbook, Section 7 for this list of food ingredients. Remember, all ingredients used must be food grade.

Egg products containing ingredients which fall into the above category, i.e., Triethyl citrate, Sodium lauryl sulfate, Monosodium phosphate, etc. are to be submitted to the Gastonia Laboratory for analysis at least once per year. The Oregon Laboratory and the majority of the Surveillance laboratories are not set up to perform these type of analyses. Depending upon the amount of product produced using these ingredients, your supervisor may instruct you to submit samples more frequently.

Record the results received from the Gastonia Lab on the Formulation Log Sheet in the column entitled, "USDA Lab Results" under "% Other." Note in the remarks section what ingredient the

Sampling Frequency for Added Ingredients (Cont'd)

sample was analyzed for and the name of the USDA laboratory if different than the USDA lab listed at the top of the log sheet. Should the laboratory results indicate that the ingredient analyzed exceeded the maximum tolerance level, immediately notify your supervisor.

Supervising Product Formulation

As stated in the beginning of this memorandum, the supervision of product formulation is a very important part of every egg products inspector's job responsibilities. The plant must have available for review by the inspector, at the time of mixing, written batch records for any product which contains two or more egg or non-egg ingredients

Company batch records vary from plant to plant. Some companies record a great deal of information, others very little. At a minimum, the batch records should include the following:

- Production date or lot number
- Amount and type of product being produced
- Number of batches (if applicable)
- Refract reading on each batch and/or lot (the refract reading recorded should be the adjusted reading from the refract solids charts).
- Should the initial refract reading indicate that the solids need to be adjusted up or down, then the adjusted reading should also be recorded.
- Initials or signature of company employee responsible for taking refract readings.

Egg Products Inspectors are to verify product formulation by the following methods:

1. Visual Observation

When a product is being formulated verify by observing that the ingredients being used are being added in the prescribed amounts. Observe the actual weighing of salt/sugar to be added, etc. Document your observations on the PY-203 or PY-159. Inspectors are also to assure that all ingredients are food grade.

2. Verify Product Formulation On File

Verify the product formula on file against the formulation that is being used. Plants continually update and/or change

2. Verify Product Formulation On File (Cont'd)

product formulations to meet customer specifications. If the approved formulation does not match that of the product being made, immediately notify management and request a copy of the most recent approval. If the formula change has not been submitted to the National Office for updating, request that management do so.

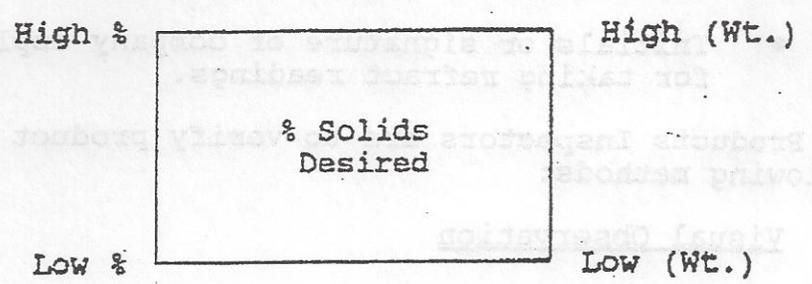
Assure that the approved label is still applicable to the changed formula. Verify that the ingredients are listed correctly (in descending order by weight). If the label is no longer correct, notify management and your supervisor. Product labeled incorrectly is to be retained until properly identified.

3. Verify Product Formulation by Calculation

As the solids content of whole egg varies from lot to lot, so does the solids content of any given batch. Inspectors must be able to verify product formulation through calculation. This can be achieved by using the Pearson Square. This calculation enables you to determine the amount of different products (by volume) that must be blended to achieve adjusted solids.

Pearson Square

To use this method, first, draw either a square or rectangle with two diagonals on a sheet of paper. The diagram will be used to indicate the various steps necessary to calculate the ratio in which high and low solids ingredients must be mixed together to obtain a desired solids content of a mixture of two ingredients.

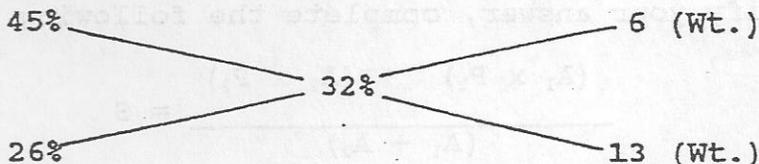


Step 1. At the upper left hand corner of the rectangle, place the % solids of the highest ingredient to be standardized. At the lower left hand corner place the % solids of the lowest ingredient to be used in standardizing. For example, if the high ingredient is 45 percent yolk, and the low ingredient is 26 % whole egg, substitute the number 45 for "High" and 26 for "Low."

Step 2. In the center of the rectangle, place the solids percent of the mixture you desire. If the percent solids desired is 32, substitute 32 in the center.

Step 3. At the right hand corners of the rectangle place the differences between the numbers at the left hand corner and the number in the center. For example $32 - 26 = 6$ and $45 - 32 = 13$. The number (6) in the upper right hand corner represents the weight or pounds of yolk of 45 percent yolk.

Step 4. The number (13) in the lower right hand corner of the rectangle represents the weight or pounds of whole eggs of 26% solids. This means that 6 parts by weight of 45 percent yolk must be mixed with 13 parts by weight of 26% whole egg to obtain 19 lbs. of 32% egg blend.



To determine the amount of product needed to adjust a given volume of product to a specific target.

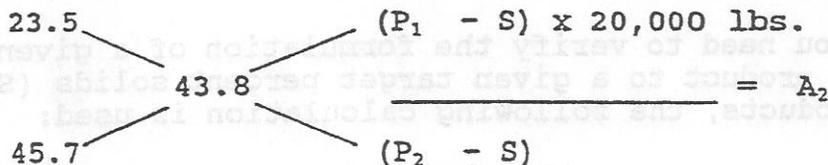
The mathematical equation would look like this:

$$\begin{matrix} P_2 & & (P_1 - S) \times A_1 \\ & \searrow & \\ & S & \\ & \swarrow & \\ P_1 & & (P_2 - S) \end{matrix} = A_2$$

To interpret this equation, the letters stand for the following:

- P_1 = Refract of product you want to adjust
- P_2 = Product used to adjust P_1
- S = Percent solids desired
- A_1 = Amount of P_1
- A_2 = Amount of P_2

Example 1: There is 20,000 lbs. of yolk in a silo with a refract of 45.7% total solids. You need to adjust it to 43.8% total solids. How much whole egg, with a refract of 23.5% total solids, will be needed?



$$\begin{array}{r}
 23.5 \quad \diagdown \\
 \quad \quad 43.8 \\
 45.7 \quad \diagup
 \end{array}
 \begin{array}{l}
 (45.7 - 43.8) \times 20,000 \\
 \hline
 (23.5 - 43.8)
 \end{array}
 = A_2$$

$$\begin{array}{r}
 23.5 \quad \diagdown \\
 \quad \quad 43.8 \\
 45.7 \quad \diagup
 \end{array}
 \begin{array}{l}
 1.9 \times 20,000 \quad 38,000 \\
 \hline
 20.3 \quad 20.3
 \end{array}
 = \frac{38,000}{20.3} = 1,872 \text{ lbs whole egg}$$

Therefore, 1,872 lbs. of whole egg needs to be added to the silo of yolk to adjust it to a refract of 43.8% total solids. To verify your answer, complete the following calculation:

$$\frac{(A_1 \times P_1) + (A_2 \times P_2)}{(A_1 + A_2)} = S$$

$$\frac{(20,000 \text{ lbs} \times 45.7\%) + (1,872 \text{ lbs} \times 23.5\%)}{(20,000 \text{ lbs} + 1,872 \text{ lbs})} = 43.8\% \text{ total solids}$$

Example 2: How much salt will be needed to adjust a 30,000 lb. silo of 10% salt yolk? The salt yolk has a refract reading of 10.02% total solids, you need 10.17% total solids?

$$\begin{array}{r}
 100\% \quad \diagdown \\
 \quad \quad 10.17\% \\
 10.02\% \quad \diagup
 \end{array}
 \begin{array}{l}
 (10.02 - 10.17) \times 30,000 \text{ lbs} \\
 \hline
 89.83 \text{ lbs}
 \end{array}
 = 50.10 \text{ lbs of salt}$$

(Since you are adjusting with a dry ingredient, P₂ = 100%.)

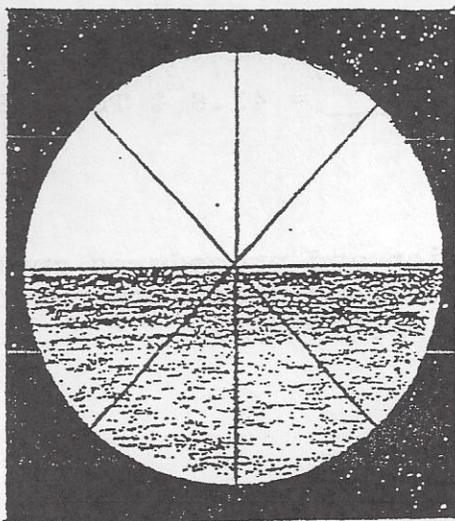
To verify:
$$\frac{(30,000 \text{ lbs} \times 10.02\%) + (50.10 \text{ lbs} \times 100\%)}{(30,000 \text{ lbs} + 50.10 \text{ lbs})} = 10.17\% \text{ total solids}$$

When you need to verify the formulation of a given total amount (T) of product to a given target percent solids (S), using two products, the following calculation is used:

$$\begin{array}{r}
 P_2 \quad \diagdown \\
 \quad \quad P_1 \\
 S \quad \quad \diagup
 \end{array}
 \begin{array}{l}
 (S - P_1) \times T \\
 \hline
 (P_2 - P_1)
 \end{array}
 = A_2$$

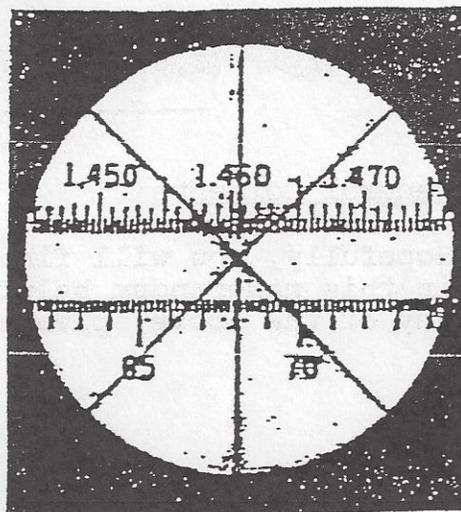
$$T - A_2 = A_1$$

FIGURE No. 1



Crosshairs as seen through
eye (sight) glass

FIGURE No. 2



Refractive Index Scale as
seen through eye (sight)
glass

FORMULA ON LOG

TS = TOTAL SOLIDS
 ES = EGG SOLIDS
 * = ADJUSTED REFRACT

NAME OF SURVEILLANCE LAB: _____

NAME OF USDA LAB : _____

DATE SAMPLED & LOT NUMBER	PRODUCT TYPE	DATE SAMPLE SENT TO LAB	COMPANY REFRACT READING *	USDA REFRACT READING *	SURVEILLANCE LAB RESULTS	USDA LAB RESULTS	REMARKS
					%TS	%TS	
					%ES	%ES	
					%SALT/ SUGAR	%SALT/ SUGAR	
					%OTHER	%OTHER	
					%TS	%TS	
					%ES	%ES	
					%SALT/ SUGAR	%SALT/ SUGAR	
					%OTHER	%OTHER	
					%TS	%TS	
					%ES	%ES	
					%SALT/ SUGAR	%SALT/ SUGAR	
					%OTHER	%OTHER	
					%TS	%TS	
					%ES	%ES	
					%SALT/ SUGAR	%SALT/ SUGAR	
					%OTHER	%OTHER	
					%TS	%TS	
					%ES	%ES	
					%SALT/ SUGAR	%SALT/ SUGAR	
					%OTHER	%OTHER	

WHOLE EGG

PERCENT SOLIDS AT INSTRUMENT TEMPATURE OF (oC)

Refract. Reading	20	21	22	23	24	25	26	27	28	29	
22.0	19.3	19.4	19.5	19.5	19.6	19.7	19.7	19.8	19.9	20.0	20.0
22.1	19.4	19.5	19.6	19.6	19.7	19.8	19.9	19.9	20.0	20.1	20.1
22.2	19.5	19.6	19.7	19.8	19.8	19.9	20.0	20.0	20.1	20.2	20.2
22.3	19.6	19.8	19.8	19.9	19.9	20.0	20.1	20.1	20.2	20.3	20.4
22.4	19.8	19.8	19.9	20.0	20.0	20.1	20.2	20.3	20.3	20.4	20.5
22.5	19.9	19.9	20.0	20.1	20.2	20.2	20.3	20.4	20.4	20.5	20.6
22.6	20.0	20.1	20.1	20.2	20.3	20.3	20.4	20.5	20.5	20.6	20.7
22.7	20.1	20.2	20.2	20.3	20.4	20.4	20.5	20.6	20.7	20.7	20.8
22.8	20.2	20.3	20.3	20.4	20.5	20.6	20.6	20.7	20.8	20.8	20.9
22.9	20.3	20.4	20.5	20.5	20.6	20.7	20.7	20.8	20.9	20.9	21.0
23.0	20.4	20.5	20.6	20.6	20.7	20.8	20.8	20.9	21.0	21.1	21.1
23.1	20.5	20.6	20.7	20.7	20.8	20.9	20.9	21.0	21.1	21.2	21.2
23.2	20.6	20.7	20.8	20.8	20.9	21.0	21.1	21.1	21.2	21.3	21.3
23.3	20.7	20.8	20.9	21.0	21.0	21.1	21.2	21.2	21.3	21.4	21.4
23.4	20.9	20.9	21.0	21.1	21.1	21.2	21.2	21.3	21.4	21.5	21.6
23.5	21.0	21.0	21.1	21.2	21.2	21.3	21.4	21.5	21.5	21.6	21.7
23.6	21.1	21.1	21.2	21.3	21.3	21.4	21.5	21.6	21.6	21.7	21.8
23.7	21.2	21.3	21.3	21.4	21.5	21.5	21.6	21.7	21.7	21.8	21.9
23.8	21.3	21.4	21.4	21.5	21.6	21.6	21.7	21.8	21.9	22.0	22.0
23.9	21.4	21.5	21.5	21.6	21.7	21.7	21.8	21.9	22.0	22.0	
24.0	21.5	21.6	21.7	21.7	21.8	21.9	21.9	22.0	22.1	22.1	22.2
24.1	21.6	21.7	21.8	21.8	21.9	22.0	22.0	22.1	22.2	22.2	22.3
24.2	21.7	21.8	21.9	21.9	22.0	22.1	22.1	22.2	22.3	22.4	22.4
24.3	21.8	21.9	22.0	22.0	22.1	22.2	22.2	22.3	22.4	22.5	22.5
24.4	21.9	22.0	22.1	22.2	22.2	22.3	22.4	22.4	22.5	22.6	22.6
24.5	22.1	22.1	22.2	22.3	22.3	22.4	22.5	22.5	22.6	22.7	22.7
24.6	22.2	22.2	22.3	22.4	22.4	22.5	22.6	22.6	22.7	22.8	22.9
24.7	22.3	22.3	22.5	22.6	22.6	22.7	22.8	22.8	22.9	23.0	23.0
24.8	22.4	22.5	22.5	22.6	22.7	22.7	22.8	22.9	22.9	23.0	23.1
24.9	22.5	22.6	22.6	22.7	22.8	22.8	22.9	23.0	23.0	23.1	23.2
25.0	22.6	22.6	22.7	22.8	22.8	22.9	23.0	23.1	23.1	23.2	23.3
25.1	22.7	22.8	22.8	22.9	23.0	23.0	23.1	23.2	23.2	23.3	23.4
25.2	22.8	22.8	22.9	23.0	23.0	23.1	23.2	23.2	23.3	23.4	23.4
25.3	22.9	23.0	23.1	23.1	23.2	23.2	23.3	23.4	23.4	23.5	23.6
25.4	23.0	23.1	23.2	23.2	23.3	23.4	23.4	23.5	23.6	23.6	23.7
25.5	23.1	23.2	23.3	23.3	23.4	23.5	23.5	23.6	23.7	23.7	23.8
25.6	23.2	23.3	23.3	23.4	23.5	23.5	23.6	23.7	23.7	23.8	23.9
25.7	23.2	23.3	23.4	23.4	23.5	23.6	23.7	23.7	23.8	23.8	24.0
25.8	23.4	23.5	23.6	23.6	23.7	23.8	23.9	23.9	24.0	24.1	24.2
25.9	23.5	23.6	23.6	23.7	23.8	23.8	24.0	24.1	24.2	24.2	
26.0	23.6	23.6	23.7	23.8	23.9	24.0	24.0	24.1	24.2	24.3	
26.1	23.8	23.8	23.9	24.0	24.0	24.1	24.2	24.2	24.3	24.4	24.4
26.2	23.9	23.9	24.0	24.1	24.2	24.2	24.3	24.4	24.4	24.5	24.6
26.3	24.0	24.1	24.2	24.2	24.3	24.4	24.5	24.5	24.6	24.7	24.7
26.4	24.1	24.1	24.2	24.3	24.3	24.4	24.5	24.5	24.6	24.7	24.8

PLAIN YOLK

PERCENT SOLIDS AT INSTRUMENT TEMPERATURE OF (°C)

Refract Reading	20	21	22	23	24	25	26	27	28	29	30
41.2	42.4	42.5	42.6	42.7	42.8	42.9	43.0	43.2	43.3	43.4	43.5
41.3	42.5	42.6	42.7	42.8	43.0	43.1	43.2	43.3	43.4	43.5	43.7
41.4	42.7	42.8	42.9	43.0	43.1	43.2	43.3	43.4	43.5	43.7	43.8
41.5	42.8	42.9	43.0	43.1	43.2	43.4	43.5	43.6	43.7	43.8	43.9
41.6	42.9	43.0	43.2	43.3	43.4	43.5	43.6	43.7	43.8	43.9	44.0
41.7	43.1	43.2	43.3	43.4	43.5	43.7	43.7	43.9	44.0	44.1	44.2
41.8	43.2	43.3	43.4	43.5	43.7	43.8	43.9	44.0	44.1	44.2	44.3
41.9	43.4	43.5	43.6	43.7	43.8	43.9	44.0	44.1	44.2	44.4	44.5
42.0	43.5	43.6	43.7	43.8	43.9	44.1	44.2	44.3	44.4	44.5	44.6
42.1	43.6	43.7	43.9	44.0	44.1	44.2	44.3	44.4	44.5	44.6	44.7
42.2	43.8	43.9	44.0	44.1	44.2	44.3	44.4	44.6	44.7	44.8	44.9
42.3	43.9	44.0	44.1	44.2	44.4	44.5	44.6	44.7	44.8	44.9	45.0
42.4	44.1	44.2	44.3	44.4	44.5	44.6	44.7	44.8	44.9	45.1	45.2
42.5	44.2	44.3	44.4	44.5	44.6	44.8	44.9	45.0	45.1	45.2	45.3
42.6	44.3	44.4	44.6	44.7	44.8	44.9	45.0	45.1	45.2	45.3	45.4
42.7	44.5	44.6	44.7	44.8	44.9	45.0	45.1	45.3	45.4	45.5	45.6
42.8	44.6	44.7	44.8	44.9	45.1	45.2	45.3	45.4	45.5	45.6	45.7
42.9	44.8	44.9	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.8	45.9
43.0	44.9	45.0	45.1	45.2	45.3	45.5	45.6	45.7	45.8	45.9	46.0
43.1	45.0	45.1	45.3	45.4	45.5	45.6	45.7	45.8	45.9	46.1	46.2
43.2	45.2	45.3	45.4	45.5	45.6	45.7	45.8	46.0	46.1	46.2	46.3
43.3	45.3	45.4	45.5	45.6	45.8	45.8	46.0	46.1	46.2	46.3	46.4
43.4	45.5	45.6	45.7	45.8	45.9	46.0	46.1	46.2	46.3	46.4	46.5
43.5	45.6	45.7	45.8	45.9	46.0	46.1	46.3	46.4	46.5	46.6	46.7
43.6	45.7	45.8	46.0	46.1	46.2	46.3	46.4	46.5	46.7	46.8	46.9
43.7	45.9	46.0	46.1	46.2	46.3	46.4	46.5	46.7	46.8	46.9	47.0
43.8	46.0	46.1	46.2	46.3	46.5	46.6	46.7	46.8	46.9	47.0	47.1
43.9	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	47.0	47.2	47.3

SUGAR YOLK

PERCENT SOLIDS AT INSTRUMENT TEMPERATURE OF (°C)

Refract. Reading	20	21	22	23	24	25	26	27	28	29	
44.2	44.3	44.5	44.6	44.7	44.9	45.0	45.1	45.3	45.4	45.5	45.7
44.3	44.5	44.6	44.8	44.9	45.0	45.2	45.3	45.4	45.6	45.7	45.8
44.4	44.7	44.8	44.9	45.1	45.2	45.3	45.5	45.6	45.7	45.9	46.0
44.5	44.8	45.0	45.1	45.2	45.4	45.5	45.6	45.8	45.9	46.0	46.2
44.6	45.0	45.1	45.3	45.4	45.5	45.7	45.8	45.9	46.1	46.2	46.3
44.7	45.2	45.3	45.4	45.6	45.7	45.8	46.0	46.1	46.2	46.4	46.5
44.8	45.3	45.5	45.6	45.7	45.9	46.0	46.1	46.3	46.4	46.5	46.7
44.9	45.5	45.6	45.8	45.9	46.0	46.2	46.3	46.4	46.6	46.7	46.8
45.0	45.7	45.8	45.9	46.1	46.2	46.3	46.5	46.8	46.7	46.9	47.0
45.1	45.8	46.0	46.1	46.2	46.4	46.5	46.6	46.8	46.9	47.0	47.2
45.2	46.0	46.1	46.3	46.4	46.5	46.7	46.8	46.9	47.1	47.2	47.3
45.3	46.2	46.3	46.4	46.6	46.7	46.8	47.0	47.1	47.2	47.3	47.5
45.4	46.3	46.4	46.6	46.7	46.9	47.0	47.1	47.2	47.4	47.5	47.6
45.5	46.6	46.7	46.8	47.0	47.1	47.2	47.4	47.5	47.6	47.8	47.9
45.6	46.8	46.9	47.0	47.1	47.3	47.4	47.5	47.7	47.8	47.9	48.1
45.7	46.9	47.0	47.2	47.3	47.4	47.6	47.7	47.8	48.0	48.1	48.2
45.8	47.1	47.2	47.3	47.5	47.6	47.7	47.9	48.0	48.1	48.3	48.4
45.9	47.2	47.4	47.5	47.6	47.8	47.9	48.0	48.2	48.3	48.4	48.6
46.0	47.4	47.5	47.7	47.8	47.9	48.1	48.2	48.3	48.5	48.6	
46.1	47.6	47.7	47.8	48.0	48.1	48.2	48.4	48.5	48.6	48.8	
46.2	47.7	47.8	48.0	48.1	48.3	48.4	48.5	48.7	48.8	48.9	49.1
46.3	47.9	48.0	48.2	48.3	48.4	48.6	48.7	48.8	49.0	49.1	49.2
46.4	48.1	48.2	48.3	48.5	48.6	48.7	48.9	49.0	49.1	49.3	49.4
46.5	48.2	48.3	48.5	48.6	48.8	48.9	49.0	49.2	49.3	49.4	49.5
46.6	48.4	48.5	48.7	48.8	48.9	49.1	49.2	49.3	49.4	49.6	49.7
46.7	48.6	48.7	48.8	49.0	49.1	49.2	49.4	49.5	49.6	49.7	49.9
46.8	48.7	48.8	49.0	49.1	49.3	49.4	49.5	49.6	49.8	49.9	50.0
46.9	48.9	49.0	49.2	49.3	49.4	49.6	49.7	49.8	49.9	50.1	50.2
47.0	49.1	49.2	49.3	49.4	49.6	49.7	49.8	50.0	50.1	50.2	50.4
47.1	49.2	49.3	49.5	49.6	49.7	49.9	50.0	50.1	50.3	50.4	50.5
47.2	49.4	49.5	49.6	49.8	49.9	50.0	50.2	50.3	50.4	50.6	50.7
47.3	49.5	49.7	49.8	49.9	50.1	50.2	50.3	50.5	50.6	50.7	50.9
47.4	49.7	49.8	50.0	50.1	50.2	50.4	50.5	50.6	50.8	50.9	51.0
47.5	49.9	50.0	50.1	50.3	50.4	50.5	50.7	50.8	50.9	51.1	51.2
47.6	50.1	50.2	50.4	50.5	50.7	50.8	50.9	51.1	51.2	51.3	51.5
47.7	50.3	50.4	50.6	50.7	50.8	51.0	51.1	51.2	51.3	51.5	51.6
47.8	50.5	50.6	50.7	50.9	51.0	51.1	51.3	51.4	51.5	51.6	51.8
47.9	50.6	50.7	50.9	51.0	51.2	51.3	51.4	51.5	51.7	51.8	51.9
48.0	50.8	50.9	51.1	51.2	51.3	51.4	51.6	51.7	51.8	52.0	

WHITES

PERCENT SOLIDS AT INSTRUMENT TEMPERATURE OF (°C)

Refract Reading	20	21	22	23	24	25	26	27	28	29	30
13.0	10.7	10.8	10.8	10.9	10.9	11.0	11.1	11.1	11.2	11.2	11.3
14.0	10.8	10.9	10.9	11.0	11.0	11.1	11.1	11.2	11.2	11.3	11.4
14.1	10.9	10.9	11.0	11.1	11.1	11.2	11.2	11.2	11.3	11.4	11.5
14.2	10.9	11.0	11.0	11.1	11.2	11.2	11.3	11.3	11.4	11.5	11.5
14.3	11.0	11.1	11.1	11.2	11.3	11.3	11.4	11.4	11.5	11.5	11.6
14.4	11.1	11.1	11.2	11.2	11.3	11.4	11.4	11.5	11.5	11.6	11.6
14.5	11.2	11.2	11.3	11.3	11.4	11.4	11.5	11.6	11.6	11.7	11.7
14.6	11.2	11.3	11.4	11.4	11.5	11.5	11.6	11.6	11.7	11.8	11.8
14.7	11.3	11.3	11.4	11.5	11.5	11.6	11.6	11.7	11.7	11.8	11.9
14.8	11.4	11.4	11.5	11.5	11.6	11.7	11.7	11.8	11.8	11.9	12.0
14.9	11.4	11.5	11.5	11.6	11.6	11.7	11.8	11.8	11.9	11.9	12.0
15.0	11.5	11.6	11.6	11.7	11.7	11.8	11.9	11.9	12.0	12.0	12.1
15.1	11.6	11.7	11.7	11.8	11.8	11.9	11.9	12.0	12.1	12.1	12.2
15.2	11.6	11.7	11.8	11.8	11.9	11.9	12.0	12.0	12.1	12.2	12.2
15.3	11.7	11.8	11.8	11.9	12.0	12.0	12.1	12.1	12.2	12.2	12.3
15.4	11.8	11.8	11.9	11.9	12.0	12.1	12.1	12.1	12.2	12.3	12.3
15.5	11.9	11.9	12.0	12.0	12.1	12.1	12.2	12.3	12.3	12.4	12.4
15.6	12.0	12.0	12.1	12.1	12.2	12.2	12.3	12.4	12.4	12.5	12.5
15.7	12.0	12.1	12.1	12.2	12.2	12.3	12.3	12.4	12.5	12.5	12.6
15.8	12.1	12.1	12.2	12.3	12.3	12.4	12.4	12.5	12.5	12.6	12.7
15.9	12.1	12.2	12.2	12.3	12.4	12.4	12.5	12.5	12.6	12.6	12.7
16.0	12.2	12.3	12.3	12.4	12.4	12.5	12.6	12.6	12.7	12.7	12.8
16.1	12.3	12.4	12.4	12.5	12.5	12.6	12.6	12.7	12.8	12.8	12.9
16.2	12.3	12.4	12.5	12.5	12.6	12.6	12.7	12.8	12.8	12.9	12.9
16.3	12.4	12.5	12.6	12.6	12.7	12.7	12.8	12.8	12.9	13.0	13.0
16.4	12.5	12.6	12.6	12.7	12.8	12.8	12.9	12.9	13.0	13.0	13.1
16.5	12.6	12.7	12.7	12.8	12.8	12.9	13.0	13.0	13.1	13.1	13.2
16.6	12.7	12.7	12.8	12.8	12.9	12.9	13.0	13.0	13.1	13.2	13.2
16.7	12.7	12.8	12.9	12.9	13.0	13.0	13.1	13.1	13.2	13.3	13.3
16.8	12.8	12.9	12.9	13.0	13.1	13.1	13.2	13.2	13.3	13.4	13.4
16.9	12.9	12.9	13.0	13.1	13.1	13.1	13.2	13.3	13.3	13.4	13.5
17.0	13.0	13.0	13.1	13.1	13.2	13.3	13.3	13.4	13.4	13.5	13.5
17.1	13.1	13.2	13.2	13.3	13.3	13.4	13.4	13.5	13.5	13.6	13.6
17.2	13.1	13.2	13.2	13.3	13.3	13.4	13.4	13.5	13.6	13.6	13.7
17.3	13.2	13.2	13.3	13.4	13.4	13.5	13.5	13.6	13.6	13.7	13.7
17.4	13.2	13.3	13.3	13.4	13.5	13.5	13.6	13.6	13.7	13.7	13.8
17.5	13.3	13.4	13.4	13.5	13.6	13.6	13.7	13.7	13.8	13.8	13.9
17.6	13.4	13.5	13.5	13.6	13.6	13.7	13.8	13.8	13.9	13.9	14.0
17.7	13.5	13.5	13.6	13.6	13.7	13.7	13.8	13.9	13.9	14.0	14.0
17.8	13.5	13.6	13.7	13.7	13.8	13.8	13.9	13.9	14.0	14.1	14.1
17.9	13.6	13.6	13.7	13.8	13.8	13.9	13.9	14.0	14.0	14.1	14.2
18.0	13.7	13.7	13.8	13.9	14.0	14.0	14.1	14.1	14.1	14.2	14.2

SALT YOLK

Percent Solids at Instrument Temperature of (°C)

Refract. Reading	20	21	22	23	24	25	26	27	28	29	
45.5	44.7	44.8	44.9	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7
45.6	44.8	44.9	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8
45.7	44.9	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9
45.8	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9	46.0
45.9	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9	46.0	46.1
46.0	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9	46.0	46.1	46.2
46.1	45.3	45.4	45.5	45.6	45.7	45.8	45.9	46.0	46.1	46.2	46.3
46.2	45.4	45.5	45.6	45.7	45.8	45.9	46.0	46.1	46.2	46.3	46.4
46.3	45.5	45.6	45.7	45.8	45.9	46.0	46.1	46.2	46.3	46.4	46.5
46.4	45.6	45.7	45.8	45.9	46.0	46.1	46.2	46.3	46.4	46.5	46.6
46.5	45.7	45.8	45.9	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7
46.6	45.8	45.9	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8
46.7	45.9	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9
46.8	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	47.0
46.9	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	47.0	47.1
47.0	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	47.0	47.1	47.2
47.1	46.3	46.4	46.5	46.6	46.7	46.8	46.9	47.0	47.1	47.2	47.3
47.2	46.4	46.5	46.6	46.7	46.8	46.9	47.0	47.1	47.2	47.3	47.4
47.3	46.5	46.6	46.7	46.8	46.9	47.0	47.1	47.2	47.3	47.4	47.5
47.4	46.6	46.7	46.8	46.9	47.0	47.1	47.2	47.3	47.4	47.5	
47.5	46.7	46.8	46.9	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.7
47.6	46.8	46.9	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.8	47.9
47.7	46.9	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9
47.8	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9	48.0
47.9	47.1	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9	48.0	48.1
48.0	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9	48.0	48.1	48.2
48.1	47.3	47.4	47.5	47.6	47.7	47.8	47.9	48.0	48.1	48.2	48.3
48.2	47.4	47.5	47.6	47.7	47.8	47.9	48.0	48.1	48.2	48.3	48.4
48.3	47.5	47.6	47.7	47.8	47.9	48.0	48.1	48.2	48.3	48.4	48.5
48.4	47.6	47.7	47.8	47.9	48.0	48.1	48.2	48.3	48.4	48.5	48.6
48.5	47.7	47.8	47.9	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7
48.6	47.8	47.9	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8
48.7	47.9	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9
48.8	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9	49.0
48.9	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9	49.0	49.1
49.0	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9	49.0	49.1	49.2
49.1	48.3	48.4	48.5	48.6	48.7	48.8	48.9	49.0	49.1	49.2	49.3
49.2	48.4	48.5	48.6	48.7	48.8	48.9	49.0	49.1	49.2	49.3	49.4
49.3	48.5	48.6	48.7	48.8	48.9	49.0	49.1	49.2	49.3	49.4	49.5
49.4	48.6	48.7	48.8	48.9	49.0	49.1	49.2	49.3	49.4	49.5	4
49.5	48.7	48.8	48.9	49.0	49.1	49.2	49.3	49.4	49.5	49.6	4
49.6	48.8	48.9	49.0	49.1	49.2	49.3	49.4	49.5	49.6	49.7	49.8
49.7	48.9	49.0	49.1	49.2	49.3	49.4	49.5	49.6	49.7	49.8	49.9