Methods of Analysis for Beet Sugar Factories

E. F. Ogborn.

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Supt. Great Western Sug. Co
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Gift of Mrs. E. F. Osborne

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GENERAL METHODS

BRIX DETERMINATION.

The density of all solutions up to 70° Brix is determined by a direct reading with the hydrometer, after the removal of air bubbles if present. If the determination is not made at exactly 17½° C., a correction must be applied according to Table XI on page 64.

Double Dilution Method:—In the case of material such as molasses and fillmass, where the Brix cannot be determined directly with accuracy, weigh out 300 grams, add about 200 grams of hot water, dissolve completely, cool, and make up to 600 grams with cold water. Multiply the Brix reading of this solution by 2.

POLARIZATION.

Practically all of the polariscopes in use for sugar work are graduated for the following conditions: 26.048 grams of the material weighed in air with brass weights, dissolved in water and made up to a volume of 100 Mohr cc. at 17½° C.; the solution polarized at 17½° C. in a tube 200 mm. long. A Mohr cc. is the volume occupied at 17½° C. by 1 gram of water weighed in air with brass weights.

The International Commission for Uniform Methods of Sugar Analysis has recommended the use of a normal weight of 26 grams, weighed in air with brass weights, made up at 20° C. to a volume of 100 true cc., and polarized at 20° C. With the present polariscopes the error resulting from this change is negligible, but in laboratories already equipped with apparatus graduated in Mohr cc., there is no reason for altering the old standards.

SUGAR.

In the absence of other optically active bodies the polarization represents the true percentage of sugar. In the presence of raffinose or invert sugar it is necessary to make what is known as the "Clerget Test" to determine the sugar accurately.

A. *Determination of sugar in absence of other optically active substances:*

Dissolve 26.048 grams in a small quantity of water. Rinse into a 100 cc. flask, add sufficient lead acetate solution to decolorize, avoiding any great excess, and make up to the mark with water. The contents of the flask are well shaken, filtered and polarized in a 200 mm. tube. The polariscope reading gives the percentage of sugar. In the case of molasses or dark syrups the half normal weight is to be used, in the case of thin solutions a multiple of the normal weight. Where the weight, volume or length of tube used differs from the above standards, the sugar must be calculated proportionally.

For strict accuracy the volume should be completed and the polarization made at 17½° C. It is sufficiently exact, however, for general work, if water of approximately this temperature is used for making up the solutions.

B. *Determination of sugar in presence of invert sugar—"Clerget Test":*

I. The polarization is found as above, except that the volume is completed and the reading made at 20° C. The polarization is referred to as "P" in the following formula.

II. Transfer 13.024 grams to a 100 cc. flask, using 75 cc. water. Add 5 cc. hydrochloric acid, sp. gr. 1.188, mix thoroughly and heat to 67° C. by immersion in a water bath at about 70° C. The acid solution should reach a temperature of 67° C. in from two and one-half to five minutes; use a thin flask, so that the heat may be quickly transferred to its contents. The temperature is then maintained for exactly five minutes between 67° and 70° C. From time to time shake the flask slightly, so that the temperature may be even throughout the solution. Cool quickly to 20° C., and make up to 100 cc. at 20° C.

Next add 2 to 4 grams of zinc dust, according to the amount of decolorization required, and allow to stand for half an hour, shaking at frequent intervals. To aid filtration, not over 1 gram of infusorial earth may be used; it should be added in small portions just before filtering, the flask being shaken after each addition. It is better not to use the infusorial earth if bright filtrates can be obtained without it. Polarize at 20° C. in a 200 mm. jacketed tube. The minus reading multiplied by 2 = "J."

The percentage of sugar is calculated from the following formula:

$$\% \text{ Sugar} = (P + J) \times .7537$$

C. *Determination of sugar in presence of raffinose:*

Determine "P" and "J" exactly as in "B," but substitute the following formulæ:

$$\% \text{ Sugar} = \frac{(0.5124 \times P) + J}{0.839} = Z$$

$$\% \text{ Raffinose} = \frac{P-Z}{1.852}$$

INVERT SUGAR.

Thin juices are first to be concentrated to 60°-65° Brix. Weigh out 44 grams of the fillmass, syrup, etc., dissolve in water, and rinse into a 200 cc. flask. Add lead acetate solution, fill to the mark with water, mix and filter. Measure out 100 cc. of the filtrate in a 100-110 cc. flask, add sufficient of a sodium carbonate* or a sodium sulphate† solution to precipitate all of the lead, complete the volume to 110 cc., mix and filter. 50 cc. of the filtrate, representing 10 grams of the sample, is transferred to an Erlenmeyer flask of about 250 cc. capacity containing 50 cc. of Fehling's Solution, *i. e.,* 25 cc. each of the copper sulphate and the alkali solution. The flask is then heated by a flame so regulated that the solution begins to boil in at least three and one-half to four minutes. The time at which boiling commences is to be taken as the point at which bubbles rise, not only in the middle, but at the sides of the vessel. The solution is boiled for exactly two minutes, and then cooled by adding 100 cc. of cold distilled water. It may be allowed to stand a few moments to allow the precipitate to settle, and is then filtered through an ashless filter paper. Wash the precipitate with hot water, distribute as evenly as possible over the filter with a glass rod, and ignite in a porcelain crucible. From the weight of black copper oxide obtained, the corresponding percentage of invert sugar is to be found in Table I on page 47.

* 30 parts of crystallized sodium carbonate to 100 parts water.

† 40 parts of crystallized sodium sulphate to 100 parts water.

If the amount of copper oxide obtained above is beyond the limit of the table, use 25 cc. of the second filtrate with 25 cc. water and 50 cc. Fehling's Solution, carrying out the determination as before. The percentage of invert sugar in this case, where the amount of material is 5 grams, is to be found from Table II, page 47.

Where the copper oxide weighed is in excess of 300 mg. the results cannot be relied on because of the difficulty of oxidizing all of the copper, and should not be reported. In such a case the precipitate should be collected on an asbestos filter in a glass tube, ignited in a current of hydrogen and weighed as metallic copper. Divide by 0.8 to convert Cu to Cu O.

Invert to 100 Brix:—Multiply the percentage of invert found above by 100 and divide by the Brix of the material.

ASH.

Weigh quickly, in a tared platinum dish, about 3 grams of sugar or fillmass, 2 grams of molasses, or 20 grams of thin juice of about 15° Brix. No attempt is made to take a definite weight. Thin juice must be concentrated on a water bath after weighing.

Add about ten drops of sulphuric acid, and heat the dish carefully with a flame until the sample is thoroughly carbonized. Then ignite at a dull red heat till the carbon is completely consumed. It is advantageous to cover the dish with a piece of platinum foil or place it in a muffle during this operation. The resulting ash should be grayish or nearly white.

The dish is cooled in a desiccator and weighed. Subtract one-tenth of the weight of the ash in all cases to compensate for the use of the sulphuric acid. The corrected weight of the ash multiplied by 100 and divided by the weight of the original substance taken gives the percentage of ash.

MOISTURE.

A. **Sugar:**—Weigh out 2 to 5 grams in a shallow aluminum dish and dry for three hours in an air bath at 100°-105° C. Cool in a desiccator and weigh. Repeat the drying and weighing until the loss in one hour is not over one-tenth of 1 percent. The loss in weight multiplied by 100 and divided by the amount of sugar taken gives the percentage of moisture. The percentage of moisture subtracted from 100 gives the percentage of dry substance.

B. **Fillmass, Molasses, Juices**:—Dry approximately 25 grams of prepared quartz sand (page 46) and a short glass stirring rod in an aluminum dish; cool in a desiccator and weigh. Add sufficient of the sample to approximate 1 gram of dry substance and re-weigh. No attempt should be made to take a definite weight. Mix thoroughly with the sand and dry as under "Sugar," until the loss in one hour is not over one-tenth of 1 percent.

It is well to make these determinations in duplicate.

APPARENT PURITY.

If too thick, the material must first be diluted with water to about 23° Brix. Remove any air bubbles if present and determine the Brix in the regular way, using the correction table on page 64 if the temperature is not exactly 17½°. 100 cc. is then measured out in a 100-110 cc. flask, sufficient lead acetate for clarification added, and the volume completed to 110 cc. with water. The solution is filtered, and the polariscope reading is made in a 200 mm. tube. This figure multiplied by the factor corresponding to the corrected Brix, as found in Table X, page 63, gives the apparent purity.

To simplify the above calculation, tables have been prepared covering a range of 8 to 25 Brix. The purity is found at the intersection of columns indicated by the Brix and the polariscope reading.

TRUE PURITY.

The true purity is calculated by the following formula:

Let A = True purity.
B = Moisture percent.
C = Sugar percent.

Then

$$A = \frac{C \times 100}{100 - B}$$

ALKALINITY.

The acid (page 43) used for all alkalinity determinations of juices and syrups should be of such a strength that 1 cc. = .001

gram CaO. The indicator to be used in every case is phenolphthalein solution (page 44).

Juices:—Transfer 10 cc. with a pipette to a porcelain dish, and titrate to neutrality with the acid above described. If the material is acid, add an excess of a sodium hydroxide solution, 1 cc. of which = .001 CaO (page 44), and titrate back to neutrality with the acid.

The result should be expressed as grams CaO per 100 cc. Each cc. of the acid required by 10 cc. of the material indicates 0.01 gram CaO per 100 cc. Acidity should be expressed as negative alkalinity in terms of grams CaO per 100 cc.

In the case of thick juice or any dark colored solution where it is difficult to observe the end reaction, transfer 10 cc. with a pipette to a rather wide test tube and dilute with about 50 cc. of water. Fill a second test tube in the same manner. Add phenolphthalein to one, and titrate with the standard acid until the color of the juice in both test tubes is the same.

Fillmass and Syrup:—Use 10 cc. of the portion diluted for the Brix determination, and multiply the result by 2.

The water used for diluting in any of the above cases should have neither an alkaline nor an acid reaction.

CaO BY TITRATION.

The acid to be used is nitric acid, of such a strength that 1 cc. = .05 gram CaO (page 43). The indicator to be used is phenolphthalein solution (page 44).

Dilute the weighed sample to a volume of at least 50 cc., add an excess of the standard acid, heat to boiling, and titrate back to neutrality, using a sodium hydroxide solution of which 1 cc. = .05 CaO (page 44). If carbonates are present, the solution should be boiled for not over five minutes after the addition of the acid to expel the CO_2; no loss of nitric acid need be apprehended under these conditions.

For the purpose of calculation it is convenient to take 5 grams of the sample or a multiple thereof. If 5 grams is used, the number of cc. of acid required, less the number of cc. of alkali, gives directly the percentage of CaO.

CaO BY SOAP SOLUTION.

The soap solution is to be prepared as directed on page 44. A convenient strength is such that 1 cc. = .001 CaO.

Standardization of Soap Solution:—Prepare a barium chloride solution as directed on page 45. Transfer 10-20 cc. with a pipette to a glass bottle with ground glass stopper. The bottle should be marked at the point at which it holds 50 cc. Fill to this mark with water and add the soap solution from a burette in portions of about 1 cc.; after each addition insert the stopper and shake the bottle vigorously. The end point is recognized by the formation of a fine foam 5 mm. in depth, which will last for five minutes.

Determination:— Weigh out 10 grams of the juice or material under examination, and rinse into the bottle above described, completing the volume to 50 cc. with water. Then commence the addition of the soap solution, and proceed as directed above under "Standardization." If the soap solution used is of such a strength that 1 cc. = .001 CaO, and 10 grams of material is taken, the number of cc. required must be divided by 100 to obtain the percentage of CaO.

In the case of thin juices, where a number of determinations are to be made, and the Brix does not vary essentially, it is sufficiently accurate to determine the volume corresponding to 10 grams and measure out this amount each time with a graduated pipette. If a sample is acid, it should be neutralized with ammonia before the soap solution is added.

CaO to 100 Brix, by Soap Solution:—Multiply the percentage of CaO found above by 100 and divide by the Brix of the material.

ALPHA-NAPHTHOL TEST FOR SUGAR.

This test is used for detecting small amounts of sugar, as in the condensed water from the coils, etc. To 2 or 3 cc. of the water in a test tube a few drops of alpha-naphthol solution (page 46) are added. The tube is then held in an oblique position, and concentrated sulphuric acid introduced slowly, in such a way that the acid will not mix with the water but will run to the bottom and form a separate layer. In the presence of the slightest trace of sugar there will be formed at the intersection of the two layers a lilaccolored band, which in the presence of larger amounts of sugar will assume a deep violet or almost black tinge.

If the water is hot, it should be cooled before the addition of the sulphuric acid by being held for a few moments in a stream of cold water.

REGULAR SAMPLES AND ANALYSES

GENERAL REMARKS ON SAMPLING OF JUICES AND SYRUPS.

It is advisable to use an automatic, continuous sampling device wherever possible. In the absence of this it will be necessary to depend on analyses of average samples taken in equal amounts at frequent intervals.

COSSETTES.

Determine every hour:

Sugar by hot water digestion according to Pellet.

Sampling:—A pail holding at least 2 gallons should be filled just before the sample is desired for analysis, by taking successive handfuls from the cossette conveyor. The entire sample should be ground without delay in the Enterprise Meat Chopper No. 41, fitted with plate containing ⅛ in. perforations, and running at the rate of 300 revolutions per minute. The machine should be thoroughly cleaned every time after use and should be employed only for grinding cossettes. After the sample has all been introduced into the machine, several handfuls of the ground portion should be returned to it to force through the unground material. The machine should then be stopped and opened, and all the material remaining in the interior removed and added to the bulk of the sample. The latter must then be thoroughly mixed with the hands and a small portion taken for analysis.

Analysis:—Weigh out with as little delay as possible 52.096 grams, and rinse into a flask graduated at 401.2 cc. and provided with an enlarged mouth. Add 10 to 12 cc. of lead acetate and about 300 cc. of water. Place in a water bath at 80° C. for thirty-five minutes. During the whole of the heating the body of the flask must be entirely immersed in the water and should be kept from contact with the bottom of the bath by a suitable support.

From time to time during digestion the flask should be removed and shaken with a rotary motion.

When digestion is complete add a few drops of ether and fill to a volume of 9 to 10 cc. over the mark with water of 80° C. Replace the flask in the water bath for ten minutes, then cool to approximately 17½° C., and make up to the mark with the necessary small amount of water. Shake, filter, and read in a 400 mm. tube. The reading gives directly the percentage of sugar.

Laboratories with the older equipment may use the normal weight in a 200.6 cc. flask, with 5 to 6 cc. lead acetate, heating at 80° C. for thirty minutes, etc.

PRESSED JUICE.

Determine every 2 hours:

a. Brix.
b. Purity.
c. Sugar.

Sampling:—The bulk of the sample of ground cossettes obtained above is placed in a clean, dry cloth and subjected to pressure in a suitable press. The press must be used exclusively for this purpose and be kept thoroughly clean. The resulting juice should be subjected to the action of a vacuum for the removal of air; it is then ready for analysis.

Analysis:—a and b. *Brix and Purity*:—To be determined according to the directions given in the General Methods.

c. *Sugar*:—Multiply the Brix by the purity and divide by 100.

DIFFUSION JUICE.

Determine every 2 hours:

a. Brix.
b. Purity.
c. Sugar.
d. Acidity.

Sampling:—Before passing through the reheaters the juice should be automatically sampled if possible, bichloride of mercury being used as a preservative. In the absence of a suitable device the sample should be taken just before it is desired for analysis in two portions five minutes apart.

Analysis :—a, b and c. *Brix, Purity and Sugar*:—Proceed as under "Pressed Juice."

d. *Acidity*:—Measure out 50 cc., or a convenient amount, with a pipette in a porcelain dish, add an equal volume of water and a few drops of phenolphthalein. Titrate to neutrality with a standard sodium hydroxide solution, of which 1 cc. = .001 CaO (page 44). Express the result in grams CaO per 100 cc.

PULP AND PULP WATER.

Determine the sugar every hour in a sample from each battery.

Sampling :—The workman under the battery should take from each cell a cup of the mixture of pulp and water and pour the same into a covered pail having a movable false bottom, so arranged that the water will drain into the bottom of the receptacle and not stand in contact with the pulp. The sample should be taken from the first pulp and water discharged.

The pulp is to be ground in an Enterprise Meat Chopper No. 41, as described under "Cossettes," and pressed in a clean, dry cloth in a suitable press. The grinding machine, press and cloths are to be kept clean and used only for this purpose.

Analysis :—Measure out 100 cc. of the resulting juice in a 100-110 cc. flask, and add sufficient lead acetate for clarification (ordinarily 1 or 2 cc. is sufficient). Fill to the 110 cc. mark and polarize in a 200 mm. tube. The corresponding percentage of sugar is to be found in Table III on page 48.

The pulp water is analyzed in the same way.

NOTE:—In calculating losses the pulp and pulp water are to be considered each as equal in weight to the beets from which they have been produced.

ALKALINITIES.

To be determined every hour in the following samples:

First, Second and Third Saturations :—Catch samples to be taken from the troughs of the respective filters just before they are desired for analysis.

Evaporator Thick Juice :—Catch sample to be taken from the last body of the evaporators or from the pump connected with same.

Blow-up Thick Juice :—Catch sample to be taken from the filter troughs. By blow-up thick juice is understood the thick juice after sulphuring and filtration, and in cases where other material, such as melted sugar and high wash syrup, is added in the blow-ups, it represents the mixture coming from the filters.

Analysis :—See "Alkalinity," page 11, under General Methods.

EVAPORATOR THIN JUICE.

Determine every 4 hours:

a. Brix.

b. Purity.

c. CaO to 100 Brix, by soap solution.

And when invert is found in the thick juice:

d. Invert to 100 Brix.

Sampling :—The juice should be automatically sampled, if possible, after filtration and before entering the evaporators.

Analysis :—Proceed as directed under General Methods.

EVAPORATOR THICK JUICE.

Determine every 4 hours:

a. Brix.

b. Purity.

c. CaO to 100 Brix, by soap solution.

And once a day:

d. Invert to 100 Brix.

Sampling :—To be taken with an automatic sampler, if possible, between the evaporator outlet and the blow-ups inlet.

Analysis :—Proceed as directed under General Methods.

SACCHARATE OR LIME MILK.

See also page 27—"Saccharate Milk."

Determine every hour:

a. Brix.

b. CaO in 100 cc.

Sampling :—A catch sample is to be taken hourly from the discharge line of the pump.

Analysis :—a. *Brix*:—The sample is cooled to approximately 17½° C. It is then mixed by gentle shaking, the air removed by means of a vacuum and the Brix noted as quickly as possible. In carrying out the latter operation, the spindle is inserted carefully and then tapped lightly first on one side, then on the other, until it stops sinking, when the degree Brix is read off, no correction for temperature being made. If the Brix is taken within five minutes after mixing, the result will be sufficiently accurate.

b. *CaO in 100 cc.*:—Measure out 10 cc. in a porcelain dish with a pipette, and rinse the latter into the dish with water. Proceed as directed on page 12, "CaO by Titration." To obtain the grams of CaO per 100 cc. divide the number of cc. of acid required by 2.

LIME KILN GAS.

Determine at least every 4 hours:

a. Carbon dioxide (CO_2).
b. Oxygen (O_2).
c. Carbon monoxide (CO).

Sampling :—The gas is sampled by means of a pipe leading to the laboratory from a point in the main gas line between the pump and the carbonators. The gas in the pipe should be discharged outside the building until the line is filled with fresh gas, which is then drawn into the apparatus.

Analysis :—The Orsat Apparatus is to be used for this purpose.

LIME CAKE, FIRST PRESSES.

Determine every 3 hours:

a. Free sugar.
b. Total sugar.
c. CaO.
d. Sugar to 100 CaO.

Sampling :—The lime cake is to be sampled by a messenger from the laboratory, who is to take samples from any presses which are being dumped or ready to be dumped, and the sample may be taken at any place in the press, but should be distributed equally over each frame sampled.

The sample is taken by means of a special closed can, provided with a tube which cuts a plug one inch in diameter from the cake. Several frames in a press should be sampled each time, and not less than three presses should enter into each sample used for analysis.

The samples are to be taken at irregular intervals, so that it is not known to the pressmen just when the sample is to be taken, and the lime cake constituting one sample for analysis may be taken at intervals and as often as desired.

Analysis :—The entire sample is thoroughly mixed in a large mortar.

a. *Free Sugar*:—Weigh out 50 grams, reduce to a thin cream with water, and rinse into a 200 cc. flask. Add 4 or 5 cc. of lead acetate, make up to the mark and polarize in a 200 mm. tube. The reading gives directly the percentage of free sugar.

b. *Total Sugar*:—Weigh out 50 grams as before and reduce to a cream with water. Ammonium nitrate (15 grams) may be added, if desired, to facilitate this operation. Rinse into a 200 cc. flask, add a few drops of phenolphthalein and dilute acetic acid until neutrality is reached. If acid of about 25 percent strength is added in small portions, the danger of frothing is minimized. Then add 4 or 5 cc. of lead acetate, complete the volume and polarize in a 200 mm. tube; the reading gives directly the percentage of sugar.

The total sugar minus the free sugar gives the combined sugar.

c. *CaO*.—Weigh out 5 grams and proceed as directed under "CaO by Titration," in the General Methods.

d. *Sugar to 100 CaO*:—Multiply the percentage of total sugar by 100 and divide by the percentage of CaO.

LIME CAKE, SECOND PRESSES.

Determine every 12 hours:

a. Total sugar.
b. CaO.
c. Sugar to 100 CaO.

Sampling :—This is to be sampled in the same manner as the first lime cake, but in addition a sample is to be taken by the press foreman from every press emptied.

Analysis :—Follow the same procedure as for "Lime Cake, First Presses."

LIME CAKE, FLUME WASTE.

Determine every 6 hours:

a. Total sugar.

b. CaO.

c. Sugar to 100 CaO.

Sampling:—In the absence of a satisfactory automatic sampling device, a sample should be taken from the flume every hour and preserved in a covered vessel. These hourly samples should be mixed to form a composite sample for the analysis.

Analysis:—a. *Total Sugar:*—Weigh out 52.096 grams of the well-stirred sample, and rinse into a 100 cc. flask. Add a few drops of phenolphthalein and neutralize with dilute acetic acid, as under Lime Cake. Add sufficient lead acetate for clarification, fill to the mark with water, and polarize in a 200 mm. tube. The reading divided by 2 gives the percentage of total sugar.

b. *CaO:*—Weigh out in the same manner 50 grams, or a convenient amount, of the material and titrate as directed under "CaO by Titration."

c. *Sugar to 100 CaO:*—Multiply the percentage of total sugar by 100 and divide by the percentage of CaO.

MAIN SEWER.

Determine every 24 hours the bags of sugar lost through this source.

Sampling:—In the absence of a satisfactory automatic sampling device, take a sample hourly as under "Lime Cake, Flume Waste." The whole is concentrated to a small volume. If alkaline to phenolphthalein, the thickened liquid should be neutralized with dilute acetic acid, and, if it contains suspended matter, it should then be filtered through paper.

Analysis:—Measure out 100 cc. in a 100-110 cc. flask, add sufficient lead acetate for decolorization, fill to the upper mark with water, and polarize. Obtain the sugar in 100 cc. from Table III, page 48.

The amount of sewerage per 24 hours should be measured or calculated by the best available means. From this figure, the polarization of the concentrated material, and the amount of concentration as measured by the ratio of the two volumes, calculate the loss of sugar for each 24 hours, using as a unit a bag of 100 pounds.

WHITE PAN STORAGE TANKS.

Determine:

a. Brix.
b. Alkalinity.
c. Purity.

Sampling:—Each grade of material should be automatically sampled if possible.

Analysis:—Follow the General Methods.

WHITE FILLMASS.

Determine in every strike dropped:

a. Brix.
b. Alkalinity.
c. Purity.

Sampling:—The sample is to be taken from the pan or the spout leading to the mixer before the pan is steamed out.

Analysis:—Follow the General Methods.

HIGH GREEN AND WASH SYRUP.

Determine in the green and wash syrup from every strike:
Purity.

Sampling:—The samples should be taken from the tanks which receive the syrup from the centrifugals, and not from the spouts or troughs of the machines.

Analysis:—Follow the general method for apparent purity.

NOTE:—All samples of machine syrups should be drawn by sample cocks and not dipped from the top of the tank, and when possible the syrup in the tank should previously be mixed by steam or air.

MOISTURE IN WHITE SUGAR.

Determine every 12 hours in the wet sugar, and every 24 hours in the granulated.

Sampling:—The wet sugar is sampled by taking every four hours an equal amount from either the scroll or the elevator. Several handfuls should be taken at short intervals, in order that the sample may not represent the work of only one machine. The sugar is kept in a stoppered bottle till desired for analysis. The granulated sugar is sampled by preserving in a stoppered bottle an equal portion from each lot sacked.

Analysis: —See page 10, "Moisture."

REMELT PAN STORAGE TANKS.

The samples are taken and analyzed in exactly the same way as for the white pans.

RAW FILLMASS FROM PAN.

The fillmass from each raw pan is to be sampled and analyzed as under "White Fillmass."

MOLASSES ADDED TO CRYSTALLIZER.

Whenever molasses is added to the raw fillmass in the crystallizer, the number of cubic feet and the purity of the same should be ascertained. If the molasses is added in the mixer, a note should also be made to that effect.

RAW FILLMASS FROM CRYSTALLIZER.

Each crystallizer emptied is to be sampled when about half the fillmass has run out. The analysis is to be made as under "White Fillmass."

LOW GREEN AND WASH SYRUP.

The samples should be taken and tested for purity exactly as prescribed above for "High Green and Wash Syrup."

MELTED SUGAR.

Determine every 3 hours:

a. Brix.
b. Purity.

Sampling:—The sample should be automatically taken, if possible, between the melted sugar pump and the blow-ups.

Analysis:—Follow the General Methods.

MOLASSES PRODUCED.

Determine every 12 hours:

a. Brix.
b. Sugar.
c. Purity.
d. CaO to 100 Brix, by soap solution.
e. Invert to 100 Brix.

Sampling:—No rigid directions can be given, but the best means should be adopted to obtain an everage sample of the molasses produced from the house. If an automatic sampling device is available, it can be attached to the molasses pump or the discharge line.

Analysis:—Directions for all these determinations will be found in the General Methods. In the sugar determination use the half normal weight in 100 cc.; about 10 cc. of lead acetate is usually necessary for clarification.

TESTS RELATING TO THE STEFFEN PROCESS

STEFFEN MOLASSES, MOLASSES WORKED.

Determine every 6 hours:

a. Brix.
b. Sugar.
c. Purity.

Sampling:—An average sample should be taken by the man at the molasses scale, in small portions at frequent intervals.

Analysis:—Same as under "Molasses Produced."

SOLUTION FOR COOLER.

Determine every 3 hours:

a. Brix.
b. Sugar in 100 cc.
c. Total alkalinity.
d. Soluble alkalinity.

Sampling:—A "catch" sample is to be taken from the cooler after the propeller has been started but before the addition of any lime powder, and immediately analyzed.

Analysis:—a. *Brix*:—To be taken directly.

b. *Sugar in 100 cc.*:—Transfer 50 cc. with a pipette to a 100 cc. flask. Add a few drops of phenolphthalein, and if the liquid shows an alkaline reaction neutralize with dilute acetic acid. Clarify with 3 to 6 cc. of lead acetate, fill to the mark and polarize in a 200 mm. tube. The reading is multiplied by 0.52.

c. *Total Alkalinity*:—Titrate 50 cc. with the standard nitric acid (1 cc. = .05 CaO, page 43), heating the solution, if necessary, to bring all the lime into solution.

d. *Soluble Alkalinity*:—Titrate in the cold 50 cc. of the filtered solution as in the preceding case.

SOLUTION FROM COOLER.

Determine every 3 hours:

a. Sugar in 100 cc.
b. Alkalinity (CaO in 100 cc.).
c. CaO to 100 sugar, by analysis.
d. Sugar in waste water.

Sampling:—A catch sample is to be taken from the cooler after all the lime powder has been added, just before it is desired for analysis.

Analysis:—a. *Sugar in 100 cc.*:—Measure out with a pipette 25 cc. of the well-mixed sample into a 100 cc. flask. Add phenolphthalein and neutralize with acetic acid; then clarify with about 5 cc. lead acetate, fill to the mark and polarize. Multiply the reading by 1.04.

b. *Alkalinity (CaO in 100 cc.)*:—Titrate 10 cc. with the standard nitric acid, as directed under "CaO by Titration," page 12. Divide by 2 the number of cc. of acid required.

c. *CaO to 100 Sugar, by Analysis*:—Multiply the percentage of CaO by 100 and divide by the percentage of sugar.

d. *Sugar in Waste Water*:—Filter a portion of the sample through paper, rejecting the first runnings. Determine as under "Waste Water, *c*.," below.

WASH WATER.

Determine every 4 hours:

a. Brix.

b. Alkalinity.

c. Sugar in 100 cc.

Sampling:—A catch sample is to be taken from a press just before the washing is completed, and promptly analyzed.

Analysis:—a. *Brix*:—To be determined directly.

b. *Alkalinity*:—Measure out 50 cc. with a pipette and transfer to a porcelain dish. Titrate in the cold with the standard nitric acid (1 cc. = .05 CaO), using phenolphthalein as indicator. The number of cc. of acid used divided by 10 gives the alkalinity as grams CaO per 100 cc.

c. *Sugar in 100 cc.*:—Rinse the above neutralized liquid into a 100 cc. flask, add 2 to 4 cc. of lead acetate, fill to the mark and polarize in a 200 mm. tube. Multiply the reading by 0.52.

PRESS WASTE WATER.

Determine every 2 hours:

a. Brix.

b. Alkalinity.

c. Sugar in 100 cc.

Sampling:—A catch sample should be taken from the saccharate presses just before it is desired for analysis.

Analysis:—The methods are the same as described under "Wash Water." Any precipitate present should be thoroughly mixed in by stirring before the analysis is made.

TANK WASTE WATER.

Determine every 2 hours:

a. Brix.

b. Alkalinity.

c. Sugar in 100 cc.

Sampling :—An automatic sampler should be used if possible.

Analysis :—The same methods apply as for "Wash Water" and "Press Waste Water."

SACCHARATE CAKE.

Determine every 4 hours:

a. Sugar.
b. CaO.
c. CaO to 100 sugar.
d. Purity.

Sampling :—The cake should be sampled in the same way as the lime cake (page 18).

The whole sample is mixed as thoroughly as possible. A small portion is taken for the sugar and CaO determinations; the bulk of the sample is used for the purity test, as described below.

Analysis :—a. *Sugar:*—Reduce 26.048 grams to a thin cream with water, and rinse into a 100 cc. flask. Neutralize with dilute acetic acid, adding phenolphthalein as indicator. During this operation considerable heat will be evolved, and the flask must be cooled. Add about 5 cc. of lead acetate, fill to the mark and polarize in a 200 mm. tube. The reading gives directly the percentage of sugar.

b. *CaO:*—Weigh out 5 or 10 grams, thin with water and proceed as directed in the General Methods under "CaO by Titration."

c. *CaO to 100 Sugar:*—Multiply the percentage of CaO by 100 and divide by the percentage of sugar.

d. *Purity:*—The following special apparatus will be needed: A carbonator with steam connection for heating, and an evaporator heated by steam, so constructed as to obviate any possibility of burning the juice during the evaporation.

A suitable amount of the sample, mixed with 4 to 5 parts water to form a milk, is heated to boiling in the carbonator and treated with CO_2 till only a faint pink color is shown with phenolphthalein; the gas should not be passed to neutrality. The sample is again heated to boiling, filtered, concentrated to about 23° Brix in the special evaporator, carbonated to neutrality and again filtered.

The resulting syrup is tested for purity as described in the General Methods under "Apparent Purity," page 11.

UNWASHED SACCHARATE CAKE.

Determine every 12 hours:

Purity.

Sampling:—The sample is obtained by taking a quantity of finished cooler solution from the cooler and filtering this immediately by means of the small experimental filter press. The cake is made by starting the pump with the relief valve wide open, the latter is gradually closed until the pressure reaches 40 pounds; the press should be allowed to run at this pressure until the waste water ceases to come or comes in slow drops. A frame 2½ inches thick should be used.

Analysis:—Determine the purity as under "Saccharate Cake."

SACCHARATE MILK.

See also page 17, "Saccharate or Lime Milk."

Determine every 3 hours:

a. Brix.

b. CaO in 100 cc.

c. Purity.

d. CaO to 100 Brix, by Soap Solution.

Sampling:—The hourly samples taken for Brix and CaO determination should be saved to form a composite sample. The latter should be thoroughly mixed by stirring.

Analysis:—a and b. *Brix and CaO in 100 cc.*:—Determine as under "Saccharate or Lime Milk," page 17.

c. *Purity*:—The milk should be mixed with 3 to 4 parts of water, carbonated, filtered, evaporated, etc., exactly as described under "Saccharate Cake."

d. *CaO to 100 Brix, by Soap Solution*:—Determine in the final syrup used for the purity test, as described in the General Methods, page 13.

Determine every 6 hours:

a. Loss on ignition.

b. CaO by Titration.

c. Available CaO.

d. Percentage coarser than 200 mesh.

And once a day:

e. Make a slacking test.

Sampling:—The sample should be taken in equal portions at frequent intervals and preserved in a Mason jar or tightly stoppered bottle. Where two mills are in use the samples from each mill should be kept separate and analyzed alternately.

Analysis:—a. *Loss on Ignition:*—Weigh out 1 to 2 grams on an analytical balance in a covered platinum crucible. Ignite to constant weight at as high a temperature as possible with a blast lamp. Twenty minutes is usually sufficient.

b. *CaO by Titration:*—Weigh out 5 grams and proceed as directed in the General Methods.

c. *Available CaO:*—Rinse 5 grams into a 200 cc. flask. Add 150 cc. of a 25° Brix sugar solution, fill to the mark with water, close the flask with a stopper and shake vigorously, repeating the shaking at short intervals as the lime settles to the bottom. At the end of thirty minutes filter, and titrate 100 cc. with the standard nitric acid (1 cc. = .05 CaO), using phenolphthalein as indicator. The number of cc. of acid required multiplied by 2 gives the percentage of "Available CaO."

d. *Percentage Coarser than 200 Mesh:*—A sieve of brass wire should be used having 200 meshes to the linear inch. Transfer 20 to 50 grams of the lime powder to the sieve, and brush the material carefully with a flat camel's hair brush, until on further brushing practically no more fine powder comes through the screen. Weigh the coarse residue and figure the percentage.

e. *Slacking Test:*—Into a beaker of 250 cc. capacity measure out 100 cc. of water at exactly 20° C. Add 25 grams of the lime powder, using a thermometer as a stirring rod, and continue to stir till there is no further increase in temperature.

Record the number of degrees increase in temperature over the original 20°, and the number of minutes required to attain the maximum temperature.

SMALL COOLER TESTS.

These tests should be made from time to time to determine the efficiency of the large coolers. The directions given apply to the experimental cooler in general use. The speeds must be as follows: propeller, 200 revolutions per minute; bolter, 40; conveyor, 95; worm shaft of agitator, 1150.

The test is conducted as follows: The perfectly clean and well-drained cooler is filled with a weighed or measured amount of the dilute molasses somewhat in excess of 14 litres. The solution to be treated may be obtained from the large coolers or prepared by diluting the molasses as desired. The circulation of the cooling water is commenced immediately, but the liquid in the cooler is allowed to come to perfect rest previous to starting the propeller; this is to avoid the formation of foam.

Allow the propeller to run a few moments to insure perfect mixing, then remove sufficient of the solution to bring the volume down to 13,875 cc., keeping the propeller still in motion. In this portion determine the sugar in the usual manner.

When the solution is sufficiently cold, the calculated amount of lime is placed in the hopper and added through the bolter. The temperature of the solution should be about 4° C. at the beginning of the lime addition, and should not exceed 6° C. during the operation. It is frequently found convenient to add the lime in several portions, especially when experimenting with an unknown lime. By removing 100 cc. of the finished cooler solution after each lime addition, with the propeller running, filtering and testing for sugar in the waste water, the additional amount of lime necessary can be estimated and then added.

Record the grams of sugar in 100 cc. of the cooler solution, the same in the final waste water, the parts of lime added to 100 sugar, and the percentage of sugar precipitated. To obtain the last of the above figures, multiply by 100 the difference between the sugar in the dilute molasses and the sugar in the waste water, and divide by the sugar in the dilute molasses.

Care should be taken to wash out the cooler thoroughly after each test. It is occasionally necessary to remove the bolter and cleanse the meshes of the screen with dilute hydrochloric acid. It is then washed with hot water and dried in a hot place before being replaced.

TESTS RELATING TO THE OSMOSE PROCESS

MOLASSES TO BE OSMOSED.

Determine every 4 hours:

a. Brix.
b. Sugar.
c. Purity.

Sampling:—Preferably a continuous sample from the pipe supplying the press supply tank, or, in the absence of this, a catch sample from the tank itself.

Analysis:—Follow the General Methods.

OSMOSED MOLASSES.

Determine every 4 hours:

a. Brix.
b. Sugar.
c. Purity.

Sampling:—Preferably a continuous sample from the pipe supplying the evaporators, or, in the absence of this, a catch sample from the press receiving tank.

Analysis:—Follow the General Methods.

OSMOSE WATER.

Determine every 4 hours:

a. Brix.
b. Purity.

Sampling:—An equal volume is to be collected from each press in operation and combined to make a composite sample.

Analysis:—Follow the General Methods.

OSMOSE LOSSES.

Loss of Dry Substance:—Use the following formula:

$$X = \frac{(P2 - P1)\,100}{P2 - P3}$$

in which

X = percentage loss of dry substance.
P1 = purity of molasses to be osmosed, for example = 60.
P2 = purity of osmosed molasses, for example = 70.
P3 = purity of osmose water, for example = 40.
Then

$$X = \frac{(70-60)\ 100}{70-40} = 33\tfrac{1}{3}\,\%$$

Loss of Sugar on 100 Parts Dry Substance in the Molasses:—Multiply the percentage loss of dry substance by the purity of the osmose water and divide by 100. In the above case, for example,

$$\frac{33.3 \times 40}{100} = 13.32\%$$

Loss of Sugar on 100 Parts Sugar in the Molasses:—Multiply the percentage loss of dry substance by the purity of the osmose water and divide by the purity of the molasses to be osmosed. In the above case, for example,

$$\frac{33.3 \times 40}{60} = 22.2\%$$

MISCELLANEOUS TESTS

CONDENSED WATERS.

All main hot water collectors are to be tested for sugar every hour. The pan and evaporator condenser tailpipes should be provided with some form of continuous sampler and should be individually tested every two hours.

In each case the water should be examined with alpha-naphthol and sulphuric acid as described in the General Methods. If an apparently large amount of sugar is indicated, the water should be polarized as follows: If sufficiently clear, the water is read directly in a polarization tube, and the reading multiplied by 0.26 to convert into percentage. If the water is turbid, measure out 100 cc. in a 100-110 cc. flask, add 1 cc. of alumina cream, fill to 110 cc. with pure water and polarize. Multiply the polariscope reading in this case by 0.29.

When sugar is detected the matter should be at once traced to its source and reported to the superintendent.

BOILER WATER.

Determine every 12 hours:

Alkalinity.

Sampling:—A composite sample is to be made up by taking a small portion from each of the boilers in service.

Analysis:—Titrate with the standard acid (1 cc. = .001 CaO, page 43), using methyl orange (page 44) as indicator. Express the result as grams CaO per 100 cc.

The number of pounds of soda used for the previous 24 hours is to be entered on each daily sheet.

WEEKLY COMPOSITE SAMPLES.

A weekly analysis is to be made in the following cases:

Molasses Produced.
Saccharate Milk.
White Fillmass.
Raw Fillmass.
Evaporator Thick Juice.

Sampling:—In the case of each material an average sample for the week is to be made up by taking a small portion of each sample brought to the laboratory, and preserving in a Mason jar or stoppered bottle.

In the case of saccharate milk, the saturated and evaporated syrup from the purity test should be used, and not the original milk. Each portion should be immediately concentrated to 60°-70° Brix before it is added to the bulk of the sample.

When it is desired to remove the fillmass samples for analysis, the jar or bottle should be heated by immersion in hot water. Particular attention should be paid to mixing thoroughly the syrup and sugar crystals. In the case of raw fillmass, only the samples from the pan and not those from the crystallizer should be used.

Analysis :—Make the following determinations according to the directions in the General Methods: Brix, Moisture, Dry Substance, Apparent Purity, Sugar (by direct polarization), Sugar by Inversion, Raffinose, Invert, Ash, and CaO (by soap solution).

To obtain the percentage on dry substance in any case, having found the percentage in the syrup or juice, multiply the latter by 100 and divide by the percentage of dry substance in the syrup. To obtain the "Undetermined," subtract from 100 the sum of the percentages of Sugar by Inversion, Raffinose, Invert and Ash.

DATA AND CALCULATIONS

Juice Sheet

TONS OF BEETS SLICED.

The number of tons sliced each day is taken from the corrected reading of the automatic beet scales. The average for any period is obtained by dividing the total number of tons sliced in the period by the number of days in the period.

DRAFT OF DIFFUSION BATTERY.

Calculate for each battery every shift.

The total volume of juice drawn should be calculated from the measuring tank record. The draft is obtained by the following formula:

Let V = Total number hectolitres of juice drawn.
S = Specific gravity of same, equivalent of average Brix found by analysis.
B = Number of tons beet sliced.

$$\text{Then the draft} = \frac{11 \times S \times V}{B}$$

TEMPERATURE OF JUICE LEAVING BATTERY.

The temperature for each hour is obtained from the chart of the recording thermometer, and the average of these hourly records entered for each shift.

AVERAGE TEMPERATURE OF BATTERY SUPPLY WATER.

Enter for each shift same as preceding.

Filter Press, Etc., Sheet

SQUARE FEET EFFICIENT FILTERING SURFACE OF NEW JUTE AND DUCK CLOTH USED PER 100 TONS BEETS.

The efficient filtering surface is the area through which the juice filters. For instance, if the frames are 30 x 30 inches inside measurement, then the efficient filtering surface of one cloth is 2 x 30 x 30, or 1800 sq. in., or 12½ sq. ft.

The efficient filtering surface of a cloth as described above, multiplied by the number of new cloths used, multiplied again by 100, and divided by the number of tons of beets sliced in the same period gives the desired figure.

SQUARE FEET TOTAL FILTERING SURFACE USED PER 100 TONS BEETS.

The "total filtering surface used" of a press is the efficient filtering surface multiplied by the number of times the press is emptied. Thus to obtain this figure the number of square feet of efficient filtering surface of one press is multiplied by the number of presses emptied, in cases where all the presses are alike. If there are different sized presses, a record of the number of presses of each kind emptied must be kept.

To obtain the "Square Feet Total Filtering Surface Used per 100 Tons Beets," divide the number of square feet of total filtering surface used for the period by the number of tons of beets sliced during the period, and multiply this result by 100.

CaO INTRODUCED.

In factories having Steffen houses this should be calculated from the lime powder weighed to the crusher or coolers, and the average percentage CaO by titration. Account should also be taken of any lime used in the form of milk at the coolers or carbonation, the amount of CaO, obtained as described below, being added to the CaO introduced in the form of lime powder.

In factories not equipped with the Steffen Process, the "CaO Introduced" should be calculated from the milk of lime used.

In any case, in calculating CaO from milk of lime, the figure should be obtained, (*a*) preferably from the weight of lime introduced into the slacker and the average percentage CaO by titration; (*b*) if these figures are not at hand, from the volume of the milk of lime used and the average percentage by volume of CaO in the milk, as found by analysis; (*c*) if the percentage of CaO in the milk has not been determined, from the volume of the milk of lime used and the percentage CaO as found in Table IV, page 48, corresponding to the average Brix.

For example, if 1,500 hectolitres (150,000 litres) of milk of lime of 36° Brix were used, the analysis not being known:

$$\frac{150{,}000 \times 203}{1000} = \text{kilos CaO}$$

$$\frac{\left(\frac{150{,}000 \times 203}{1000}\right) \times 2.2}{2000} = 33\ 495 \text{ tons CaO}$$

AVERAGE WEIGHT OF LIME CAKES.

A first and a second lime cake should be weighed frequently, and the average of each obtained. This average should be readjusted, if necessary, by frequent repetition of the weighing, but in no case should a single weight be taken as the average for a day or longer period.

CUBIC FEET SEWERAGE PER 24 HOURS.

This is to be obtained by measurement or calculation, preferably the former.

MOLASSES PRODUCED.

By "molasses produced" is understood all molasses obtained from raw pan magmas and not again returned to the pans, crystallizers or mixers. In the Steffen houses the sugar in the greater part of this molasses will eventually be extracted by lime. In factories having the Steffen Process the discarded molasses should be distinguished on the sheet by an asterisk.

Pan Sheets

HEADINGS.

These are provided for the purpose of giving full information about the nature of the material used in the pans. The information on the White Pan Sheet is grouped in six double sections, and a single column marked "No of Pans Boiled from Straight Material." In the latter is to be entered, on the line opposite the material in question, the number of pans boiled from that alone, without the addition of any other liquor or syrup in or before reaching the pan. Where more than one grade of material is used in a pan, but each one introduced separately, the section farthest to the left is to be used, the number of pans being inserted in the left-hand column, and the average number of cubic feet of each material used on the proper line in the adjoining column.

The other sections provide for cases where mixtures are taken into the pan. If a mixture of thick juice and melted sugar is employed as a pan liquor, use the second section from the left, entering the number of pans in the left-hand column. In the right-hand column the first blank space, which includes two lines, is to be filled out with the average number of cubic feet of the above mixture. If high wash and high green syrup are also taken into the same pans separately, insert the proper data on the lines below.

Similarly the third section is to be used for a mixture of thick juice, melted sugar and high wash syrup, whether or not followed by high green. The sections at the right are for other possible mixtures.

The Remelt Pan Sheet is filled out in a similar manner.

Steffen Sheet No. 1

TONS OF LIME ADDED AS MILK.

From the record of the volume of milk of lime added to the coolers, the equivalent number of tons of CaO is calculated as under "CaO Introduced," page 35.

SQUARE FEET EFFICIENT FILTERING SURFACE OF NEW CLOTH USED, PER TON MOLASSES WORKED.

The efficient filtering surface of a cloth is calculated as above directed for the first and second presses; this multiplied by the number of new cloths used, and divided by the tons of molasses worked during the corresponding period, gives the desired information.

CaO TO 100 SUGAR ADDED AS MILK TO THE COOLERS.

This is calculated every 12 hours by multiplying by 100 the tons of lime added as milk in that period (see above) and dividing by the tons of sugar in the molasses worked during the same time.

LIME TO 100 SUGAR BY WEIGHT (SOLUTION FROM COOLER).

By this is understood only the lime added to the cooler in the form of lime powder. This is calculated daily similarly to the preceding.

Steffen Sheet No. 2

SUGAR IN TANK WASTE WATER, PERCENT BEETS.

An account is kept of the amount of tank waste water in cubic feet for each 24 hours. If the waste water is weighed instead of measured, the equivalent number of cubic feet is calculated from the average density. The percentage of sugar to be taken is the average of the sugar by analysis on the laboratory sheet for 24 hours.

The number of pounds of sugar lost is calculated by the following formula, where P = no. of lbs. of sugar lost; S = grams sugar in 100 cc., by analysis; and W = no. cu. ft. waste water:

$$P = 0.623 \times W \times S$$

Multiply P by 100 and divide by the pounds of beets sliced to obtain the percentage on beets. The percentage for a period is obtained by adding together the pounds of sugar lost each day, multiplying by 100, and dividing by the pounds of beets sliced during the period.

SUGAR IN MOLASSES WORKED, PERCENT BEETS.

To obtain this figure multiply the tons of sugar in the molasses worked by 100 and divide by the tons of beets sliced. The sugar in the molasses is calculated directly from the daily average percentage of sugar given on Steffen Sheet No. 1, by multiplying by the tons of molasses worked and dividing by 100.

SUGAR IN TANK WASTE WATER, PERCENT SUGAR IN MOLASSES.

By this is understood the percentage of the total sugar in the molasses which is lost in the waste water. Multiply by 100 the total amount of sugar in the waste water (see above) and divide by the total amount of sugar in the molasses worked (see above).

AVERAGE TEMPERATURE OF COOLING WATER.

This is obtained from the recording thermometer chart by averaging in the same way as directed under "Temperature of Juice Leaving Battery."

AVERAGE MAXIMUM TEMPERATURE OF COOLER SOLUTION IN COOLERS.

To be obtained from a recording thermometer where the latter is in use.

STOCK TAKING

As a general rule, in taking stock while the factory is running, the scale weight should be noted, and then the juice present in all tanks and apparatus measured successively without delay throughout the house. It should not be necessary to interrupt the running of the house for this purpose. Samples should be taken for analysis where the latter is not known. If it is possible to determine, by a sufficient number of observations, a figure which will represent the stock of the beet end when the factory is running normally, this may be used provided that the data previously obtained have demonstrated its accuracy. The stock in the Steffen house is to be determined by observation of the amount of saccharate on hand in the storage tanks and filter presses, and the number of coolers full. In all cases data should be at hand as to the capacity of tanks and apparatus, so that the work of calculation may be reduced to a minimum.

The percentage of available granulated in any material may be calculated from the polarization and purity with Tables V and VI, or from the Brix and purity with Tables VII and VIII. The difference between the total sugar and the available granulated, or six-tenths of the difference between the total dry substance and the available granulated, gives the sugar in the resulting molasses.

Fillmass:—All fillmass in the mixers and crystallizers is to be measured. The amount and quality of liquor and syrup in the pans at the time of taking stock is to be obtained from the sugar boiler's record.

Raw Sugar:—In taking stock of raw sugar, the pile should be evened up, and the amount estimated as closely as possible, taking the weight of a cubic foot as 55 pounds.

Molasses:—The amount of sugar should in all cases be calculated directly from the polarization. Any molasses just produced which has not been weighed at the time of taking stock is to be included in the stock as molasses in process.

Damaged Granulated and Off Sugar:—When damaged granulated from a previous campaign is re-worked, an equivalent amount must be deducted from the current year's production.

Off sugar to be remelted is to be entered on the stock invoice as sugar in process.

EXTRACTION STATEMENT

SUGAR IN COSSETTES.

The amount of sugar entering the house is to be calculated for each shift from the number of tons of beets sliced and the average sugar by digestion. The sugar for a period is the sum of the amounts found for each shift during the period.

LOSS IN PULP.

This is obtained daily from the tons of beets sliced and the average percentage of sugar in the pulp for the day. In the case of two batteries, the mean of the two averages is taken. The pulp is to be taken as equal in weight to the beets from which it has been produced.

LOSS IN PULP WATER.

This is obtained in the same way as the sugar in the pulp, using the average sugar found by analysis and considering the pulp water 100 percent on beets.

LOSS IN FILTER PRESS CAKE.

This is obtained daily from the number of presses emptied and the average weight and sugar content of the cakes. For purposes of comparison, the sugar going to waste in the lime flume should also be determined; this can be estimated by measuring the volume of the material and determining the sugar it contains, or it can be calculated from the ratio of sugar to 100 CaO and the total quantity of lime used.

LOSS IN STEFFEN WASTE WATER.

See page 37.

LOSS IN OSMOSE WASTE WATER.

See page 31.

SUGAR IN TOTAL MOLASSES PRODUCED.

The amount of molasses produced should be ascertained by actual weighing where possible. In case automatic continuous samples are taken of this molasses, the amount of sugar may be calculated from the average figure on the laboratory sheet, but where the molasses is weighed in large quantities and in irregular amounts, it is better to calculate the sugar from the weight and polarization of each lot.

EXTRACTION ON BEETS PURCHASED.

If the beets are accurately tested when received, an extraction statement should be based, at the close of the campaign, upon the weight of the beets paid for and their sugar content at the time of receipt. The average sugar content should be obtained from the individual grower's averages and the number of tons of beets furnished by each.

APPARATUS AND SUPPLIES

POLARISCOPES.

The Schmidt and Haensch half-shadow, single compensation polariscopes for 400 mm. tubes, with "Bockstativ," are recommended for ordinary work.

Metallic observation tubes are to be preferred for general use. Any found bent are not to be used in that condition.

The polariscopes are to be checked at least once a day by the chemist in charge; under no conditions should any of the assistants be allowed to change the scale.

The polariscope should be screened from strong light. For illumination a high candle power, frosted, incandescent electric light is suitable; it should be placed about six inches from the end of the instrument, and the latter protected from the heat by an appropriate screen.

HYDROMETERS.

The hydrometers for laboratory use should consist of the following sizes: 0-6, 6-12, 12-18, 18-24, 24-30, 30-36, 36-42, 42-48, 48-54, 54-60, 60-66, 66-72, graduated in one-tenths of one degree. They should be 12 inches long, with a scale covering a distance of about 4 inches on the stem.

All hydrometers for analytical work must be standardized before being used, and those which are more than one-tenth of a degree in error rejected.

FLASKS, BURETTES, PIPETTES.

Flasks, burettes, pipettes and other measuring instruments should be graduated to Mohr's cubic centimetres.

The flasks are to be of the regular "sugar" type. With the exception of those used for the inversion test and the cossette digestion, it is advisable that they should be made heavier than the ordinary standard to save breakage.

All these instruments should be standardized before use. Sugar flasks may be standardized by weighing into them distilled water at 17½° C., or by filling them from an accurate pipette. Burettes and pipettes should be tested by weighing the water discharged from them.

THERMOMETERS.

Thermometers should be compared with standard instruments. The Centigrade scale only should be employed.

For temperature corrections, in determining the Brix of solutions, the floating type, with enclosed paper scale, is recommended.

CYLINDERS (HYDROMETER JARS).

Those used with the hydrometers of the type described should be 12 inches long and 2 inches in diameter.

CHEMICALS.

All chemicals used for analytical work should be of the grade known as "C. P." unless otherwise stated.

BALANCES AND WEIGHTS.

Balances and weights should be tested from time to time. All normal and multiple normal weights, all counterweighted dishes, etc., should be checked frequently.

REAGENTS AND SOLUTIONS

STANDARD ACID SOLUTIONS.

For determining the alkalinity of juices and syrups, etc., there will be required 1-28 normal acid, of which 1 cc. = .001 CaO. This acid will be needed in large quantities and is conveniently prepared by diluting normal acid to 28 times its volume. To prepare the normal acid, take 55 grams of sulphuric acid, sp. gr. 1.84; 100 grams of hydrochloric acid, sp. gr., 1.19; or 95 grams of nitric acid, sp. gr., 1.42, and dilute to 1 litre. Titrate in the cold with a normal sodium carbonate solution,* using methyl orange as indicator, and dilute with the necessary amount of water to bring it to the required strength. For example, if 20 cc. of the acid is exactly neutralized by 22 cc. of the sodium carbonate solution, 2 cc. of water must be added to each 20 cc. of the original acid. The value of the corrected solution is confirmed by another titration.

For the titration of lime in Steffen products, etc., nitric acid is used, 1 cc. of which = .05 CaO. It is prepared similarly to the above, by diluting nitric acid, sp. gr. 1.42, in the proportion of 120 grams to 1 litre. Its strength is corrected by the normal sodium carbonate, each cc. of which should be equivalent to 0.56 cc. of the acid.

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* Prepared by dissolving in water 53 grams of freshly ignited sodium carbonate or bicarbonate of the highest purity obtainable, and diluting to one litre. The ignition should be conducted in a platinum crucible at a *dull red heat*, to constant weight; the material must not fuse.

STANDARD ALKALI SOLUTIONS.

Two caustic alkali solutions will be needed, respectively equivalent in value to the two above described acid solutions, on which they should be standardized. For the stronger solution use about 80 grams and the other 1.6 grams of sodium hydroxide per litre.

PHENOLPHTHALEIN INDICATOR.

Dissolve 2 grams of the powder in 500 cc. of neutralized denatured alcohol, and dilute to 1 litre with water.

METHYL ORANGE INDICATOR.

Dissolve one part of the salt in 1,000 parts of water.

SOAP SOLUTION.

Dissolve 20 grams of pure potassium hydroxide in 25 cc. of water and add 200 cc. of 95 percent alcohol. Add 100 cc. of best pure olive oil and heat on the water bath in a flask provided with a reflux condenser until saponification is complete, recognizable by the fact that several drops of the clear solution, when mixed with water, cause no turbidity.

Pour the solution into a vessel containing 3 litres of distilled water, mix well, and add calcium chloride solution as long as a precipitate is formed. The precipitate is then filtered off by means of a fine cloth, and pressed to remove the mother liquor as completely as possible.

Mix the above precipitate thoroughly with 40 parts of potassium carbonate in a large mortar, and extract with several portions of 95 percent alcohol, using a water bath and reflux condenser as before. The different portions are mixed, filtered and preserved in a stoppered bottle, forming a strong solution of potassium soap, which is diluted, as desired, to the required strength with 60 percent alcohol.

Directions for standardizing the soap solution are given on page 13.

BARIUM CHLORIDE SOLUTION.

To be used for standardizing soap solutions.

Dissolve 4.357 grams of the crystalline C. P. salt in water, add also 100 grams of granulated sugar and stir till solution is complete, then dilute the solution to a volume of 1 litre. 1 cc. of this solution is equivalent to .001 gram CaO.

FEHLING'S SOLUTION.

This consists of two separate solutions which are to be mixed in equal proportions immediately before use.

I. Dissolve 34.639 grams of C. P. crystallized copper sulphate in water and dilute to a volume of 500 cc.

II. Dissolve 173 grams of C. P. sodium potassium tartrate (Rochelle salt) and 50 grams sodium hydroxide in water, and dilute to a volume of 500 cc.

LEAD ACETATE.

Mix together one part of litharge, three parts of sugar of lead and ten parts of boiling water. Commercial articles of good quality may be used. Let the hot liquid stand for some time, stirring occasionally. Then allow the undissolved precipitate to settle, and decant the clear supernatant liquid.

The solution should have a density of about 55° Brix.

ALUMINA CREAM.

Add a slight excess of ammonium hydroxide to a cold saturated solution of alum, then bring to a faint acid reaction with a portion of the original alum solution retained for the purpose.

ALPHA-NAPHTHOL.

Dissolve 20 grams of alpha-naphthol in 100 cc. of 95 percent alcohol.

REAGENTS FOR ORSAT APPARATUS.

Caustic Potash Solution:—To be used for the absorption of carbon dioxide (CO_2). This solution should have a specific gravity of 1.26 to 1.28, and is prepared by dissolving 25 grams potassium hydroxide in 100 parts of water.

Pyrogallic Acid Solution:—To be used for the absorption of oxygen (O_2). 27 grams of pyrogallic acid are dissolved in 60 cc. hot water; the solution is filtered and cooled, and then mixed with 105 cc. caustic potash solution of 1.26 to 1.28 specific gravity, and immediately placed in the absorption pipette of the apparatus. Caustic potash purified with alcohol should not be used.

Cuprous Chloride Solution:—To be used for the absorption of carbon monoxide (CO). 53 grams of cupric chloride and 75 grams of copper turnings are covered with 300 cc. of concentrated hydrochloric acid and allowed to stand in a stoppered bottle for about 24 hours, with occasional shaking. The cuprous chloride solution thus produced is diluted with 150 cc. water and preserved in a tightly stoppered bottle.

QUARTZ SAND FOR MOISTURE DETERMINATIONS.

Clean quartz sand is digested with strong hydrochloric acid, washed, dried, ignited and preserved in a stoppered bottle.

TABLE I.

For obtaining the percentage of Invert Sugar in presence of Sucrose from the Copper Oxide (CuO) found (10 grams of material).

CuO mg	Invert Sugar %	CuO mg	Invert Sugar %	CuO mg	Invert Sugar %	CuO mg	Invert Sugar %
63	.05	150	.40	238	.79	319	1.16
69	.07	156	.43	244	.82	325	1.19
75	.09	163	.45	250	.85	331	1.21
81	.11	169	.48	256	.88	338	1.24
88	.14	175	.51	263	.90	344	1.27
94	.16	181	.53	269	.93	350	1.30
100	.19	188	.56	275	.96	356	1.33
106	.21	194	.59	281	.99	363	1.36
113	.24	200	.62	288	1.02	369	1.38
119	.27	206	.65	294	1.05	375	1.41
125	.30	213	.68	300	1.07	381	1.44
131	.32	219	.71	306	1.10	388	1.47
138	.35	225	.74	313	1.13	394	1.50
144	.38	231	.76				

TABLE II.

For obtaining the percentage of Invert Sugar in presence of Sucrose from the Copper Oxide (CuO) found (5 grams of material).

CuO mg	Invert Sugar %	CuO mg	Invert Sugar %	CuO mg	Invert Sugar %	CuO mg	Invert Sugar %
(44)	(.04)	138	.83	231	1.65	319	2.44
50	.09	144	.88	238	1.70	325	2.50
56	.14	150	.93	244	1.76	331	2.56
63	.19	156	.99	250	1.82	338	2 62
69	.25	163	1.04	256	1.87	344	2.68
75	.30	169	1.10	263	1.93	350	2.74
81	.35	175	1.15	269	1.98	356	2 79
88	.40	181	1.21	275	2.04	363	2.85
94	.45	188	1.26	281	2.10	369	2.91
100	.51	194	1.31	288	2.16	375	2.97
106	.56	200	1.37	294	2.21	381	3.03
113	.61	206	1.42	300	2.27	388	3.09
119	.66	213	1.48	306	2.33	394	3.15
125	.72	219	1.54	313	2.39	400	3.21
131	.77	225	1.59				

TABLE III.

Polarization of Pulp and Pulp Water.

Polariscope Reading	Percent Sugar	Polariscope Reading	Percent Sugar	Polariscope Reading	Percent Sugar
.1	.03	1.3	.37	2.5	.71
.2	.06	1.4	.40	2.6	.74
.3	.08	1.5	.43	2.7	.76
.4	.11	1 6	.46	2.8	.79
.5	.14	1.7	.47	2.9	.82
.6	.17	1 8	.51	3.0	.85
.7	.19	1.9	.54	3.1	.88
.8	.22	2.0	.57	3.2	.91
.9	.25	2.1	.60	3.3	.93
1.0	.29	2.2	.63	3 4	.96
1.1	.32	2.3	.65	3.5	.99
1.2	.35	2.4	.68	3.6	1.02

TABLE IV.

CaO in Milk of Lime of Various Densities (15° C).

Degrees Brix	Specific Gravity	Grams CaO per Litre	% CaO by Weight	Degrees Brix	Specific Gravity	Grams CaO per Litre	% CaO by Weight
25	1.107	135	12.2	36	1.160	203	17.5
26	1.111	141	12.6	37	1.165	209	17.9
27	1.116	147	13.2	38	1.170	215	18.4
28	1.120	153	13 7	39	1.175	221	18.8
29	1.125	159	14.1	40	1.180	228	19.3
30	1.130	165	14.6	41	1.185	235	19.8
31	1.135	171	15.1	42	1.190	242	20.3
32	1.140	177	15.5	43	1.195	248	20.8
33	1.145	183	16.0	44	1.200	255	21.3
34	1.150	189	16.4	45	1.205	262	21.7
35	1.155	195	16.9	46	1.210	269	22.2

TABLE V.

Weight Per Cubic Foot, and U. S. Gallon (231 Cubic Inches) of Sugar Solutions at 17½° C.

(Calculated from Stammer's Table of Specific Gravities.)

Degree Brix.	Degree Baumé (corrected).	Weight of 1 cubic foot.	Weight of 1 gallon (231 cubic in.).	Degree Brix.	Degree Baumé (corrected).	Weight of 1 cubic foot.	Weight of 1 gallon (231 cubic in.).	Degree Brix.	Degree Baumé (corrected).	Weight of 1 cubic foot.	Weight of 1 gallon (231 cubic in.).
		Lbs.	Lbs.			Lbs.	Lbs.			Lbs.	Lbs.
1	0.6	62.59	8.36	24	13.5	68.68	9.18	47	26.1	75.84	10.13
1.5	0.85	62.72	8.38	24.5	13.8	68.82	9.20	47.5	26.4	76.01	10.15
2	1.1	62.84	8.39	25	14.1	68.96	9.22	48	26.6	76.18	10.18
2.5	1.4	62.96	8.40	25.5	14.3	69.11	9.24	48.5	26.9	76.35	10.20
3	1.7	63.08	8.42	26	14.6	69.26	9.26	49	27.2	76.52	10.23
3.5	2.0	63.20	8.44	26.5	14.9	69.41	9.27	49.5	27.4	76.69	10.25
4	2.3	63.32	8.46	27	15.2	69.55	9.29	50	27.7	76.87	10.27
4.5	2.55	63.44	8.48	27.5	15.5	69.69	9.31	50.5	28.0	77.04	10.29
5	2.8	63.57	8.50	28	15.7	69.84	9.33	51	28.2	77.21	10.32
5.5	3.1	63.70	8.52	28.5	16.0	69.99	9.35	51.5	28.5	77.38	10.34
6	3.4	63.83	8.53	29	16.3	70.14	9.38	52	28.8	77.56	10.36
6.5	3.7	63.95	8.55	29.5	16.6	70.29	9.39	52.5	29.0	77.73	10.38
7	4.0	64.08	8.57	30	16.8	70.44	9.41	53	29.3	77.91	10.41
7.5	4.25	64.21	8.59	30.5	17.1	70.59	9.43	53.5	29.6	78.08	10.43
8	4.5	64.34	8.60	31	17.4	70.74	9.45	54	29.8	78.26	10.46
8.5	4.8	64.47	8.61	31.5	17.7	70.89	9.47	54.5	30.1	78.44	10.48
9	5.1	64.60	8.63	32	17.95	71.04	9.49	55	30.4	78.62	10.51
9.5	5.4	64.72	8.65	32.5	18.2	71.19	9.51	55.5	30.6	78.79	10.53
10	5.7	64.84	8.67	33	18.5	71.35	9.53	56	30.9	78.97	10.55
10.5	5.9	64.97	8.69	33.5	18.8	71.50	9.55	56.5	31.2	79.15	10.57
11	6.2	65.11	8.71	34	19.05	71.65	9.58	57	31.4	79.33	10.60
11.5	6.5	65.24	8.72	34.5	19.3	71.80	9.60	57.5	31.7	79.51	10.62
12	6.8	65.38	8.74	35	19.6	71.96	9.62	58	31.9	79.70	10.65
12.5	7.1	65.51	8.76	35.5	19.9	72.11	9.64	58.5	32.2	79.87	10.67
13	7.4	65.64	8.78	36	20.1	72.27	9.66	59	32.5	80.05	10.70
13.5	7.6	65.77	8.79	36.5	20.4	72.43	9.68	59.5	32.7	80.24	10.72
14	7.9	65.91	8.81	37	20.7	72.59	9.70	60	33.0	80.43	10.75
14.5	8.2	66.04	8.82	37.5	21.0	72.74	9.72	60.5	33.2	80.62	10.77
15	8.5	66.18	8.84	38	21.2	72.90	9.74	61	33.5	80.80	10.80
15.5	8.8	66.31	8.86	38.5	21.5	73.06	9.76	61.5	33.8	80.98	10.82
16	9.0	66.44	8.88	39	21.8	73.22	9.78	62	34.0	81.17	10.85
16.5	9.3	66.58	8.90	39.5	22.05	73.38	9.80	62.5	34.3	81.35	10.87
17	9.6	66.72	8.92	40	22.3	73.54	9.83	63	34.5	81.54	10.90
17.5	9.9	66.85	8.93	40.5	22.6	73.70	9.85	63.5	34.8	81.73	10.92
18	10.1	66.99	8.95	41	22.9	73.86	9.87	64	35.1	81.92	10.95
18.5	10.4	67.13	8.97	41.5	23.1	74.02	9.89	64.5	35.3	82.11	10.97
19	10.7	67.27	8.99	42	23.4	74.18	9.91	65	35.6	82.30	11.00
19.5	11.0	67.41	9.01	42.5	23.7	74.34	9.93	65.5	35.8	82.49	11.02
20	11.3	67.55	9.03	43	23.95	74.51	9.96	66	36.1	82.68	11.05
20.5	11.6	67.69	9.04	43.5	24.2	74.67	9.98	66.5	36.3	82.87	11.07
21	11.8	67.83	9.06	44	24.5	74.84	10.00	67	36.6	83.06	11.10
21.5	12.1	67.97	9.08	44.5	24.8	75.00	10.02	67.5	36.85	83.25	11.12
22	12.4	68.11	9.10	45	25.0	75.17	10.05	68	37.1	83.45	11.15
22.5	12.7	68.25	9.13	45.5	25.3	75.34	10.07	68.5	37.4	83.64	11.17
23	13.0	68.39	9.16	46	25.6	75.51	10.09	69	37.6	83.84	11.20
23.5	13.2	68.54	9.17	46.5	25.8	75.67	10.11	69.5	37.9	84.03	11.23

Weight Per Cubic Foot, and U. S. Gallon (231 Cubic Inches) of Sugar Solutions at 17½° C.—*Continued.*

Degree Brix.	Degree Baumé (corected).	Weight of 1 cubic foot.	Weight of 1 gallon (231 cubic in.).	Degree Brix.	Degree Baumé (corrected).	Weight of 1 cubic foot.	Weight of 1 gallon (231 cubic in.).	Degree Brix.	Degree Baumé (corrected).	Weight of 1 cubic foot.	Weight of 1 gallon (231 cubic in.).
		Lbs.	Lbs.			Lbs.	Lbs.			Lbs.	Lbs.
70	38.1	84.23	11.26	78.5	42.4	87.65	11.71	87	46.5	91.26	12.20
70.5	38.4	84.42	11.28	79	42.6	87.86	11.74	87.5	46.7	91.48	12.23
71	38.6	84.62	11.31	79.5	42.9	88.07	11.77	88	47.0	91.70	12.26
71.5	38.9	84.82	11.33	80	43.1	88.28	11.80	88.5	47.2	91.92	12.28
72	39.1	85.02	11.36	80.5	43.3	88.49	11.82	89	47.45	92.14	12.31
72.5	39.4	85.21	11.39	81	43.6	88.70	11.85	89.5	47.7	92.36	12.34
73	39.6	85.41	11.42	81.5	43.8	88.91	11.88	90	47.9	92.58	12.37
73.5	39.9	85.61	11.44	82	44.1	89.13	11.91	90.5	48.2	92.80	12.40
74	40.1	85.81	11.47	82.5	44.3	89.34	11.94	91	48.4	93.02	12.43
74.5	40.4	86.01	11.49	83	44.6	89.55	11.97	91.5	48.6	93.24	12.46
75	40.6	86.22	11.52	83.5	44.8	89.76	11.99	92	48.9	93.47	12.49
75.5	40.9	86.42	11.55	84	45.1	89.97	12.02	92.5	49.1	93.69	12.52
76	41.1	86.63	11.58	84.5	45.3	90.18	12.05	93	49.3	93.92	12.55
76.5	41.4	86.83	11.60	85	45.5	90.40	12.08	93.5	49.6	94.14	12.58
77	41.6	87.04	11.63	85.5	45.8	90.61	12.11	94	49.8	94.37	12.61
77.5	41.9	87.24	11.66	86	46.0	90.83	12.14	94.5	50.0	94.60	12.64
78	42.1	87.45	11.69	86.5	46.3	91.04	12.17	95	50.3	94.83	12.67

TABLE VI.

Percentage of Available Granulated on Total Sugar of Sugar Solutions, Molasses Purity of 60.0.

Purity of Juice	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
98.0										
97.0										
96.0	93.81									
95.0	92.11	92.28	92 45	92.62	92.79	92.96	93.13	93.30	93.47	93.64
94.0	90.43	90.60	90.77	90 93	91.10	91.27	91.44	91.61	91.77	91.94
93.0	88.71	88.87	89.05	89.22	89.39	89.57	89.74	89.91	90.08	90.26
92.0	86 95	87.13	87.30	87.48	87.65	87.83	88.00	88.18	88.35	88.53
91.0	85.16	85.34	85.52	85.70	85.88	86.06	86.23	86.41	86.59	86.77
90.0	83.33	83.51	83.70	83.88	84.06	84.25	84.43	84.61	84.79	84.98
89.0	81.46	81.65	81.83	82.02	82.21	82.40	82.58	82.77	82.96	83.14
88.0	79.54	79 73	79.92	80.12	80.31	80.50	80.69	80.88	81.08	81.29
87.0	77.58	77.78	77.97	78.17	78.36	78 56	78.76	78.95	79.15	79.34
86.0	75.58	75.78	75 98	76.18	76.38	76.58	76.78	76.98	77.18	77.38
85.0	73.53	73.74	73.94	74.15	74.35	74.56	74.76	74.97	75.17	75.38
84.0	71.43	71.64	71.85	72.06	72.27	72.48	72.69	72.90	73.11	73.32
83.0	69.28	69.50	69.71	69.93	70.14	70.36	70 57	70.79	71.00	71.22
82.0	67.07	67.29	67.51	67.73	67.95	68.18	68.40	68.62	68.84	69 06
81.0	64.81	65.04	65.26	65.49	65.71	65.94	66.17	66.39	66.62	66.84
80 0	62.50	62.73	62.96	63.19	63.42	63.66	63.89	64.12	64.35	64.60
79.0	60.13	60.37	60.60	60.84	61.08	61.32	61.55	61.79	62.03	62.26
78.0	57.69	57.93	58.18	58.42	58.67	58.91	59.15	59.40	59.64	59.89
77.0	55.19	55.44	55.69	55.94	56.19	56.44	56.69	56.94	57.19	57.44
76.0	52.63	52.89	53.14	53.40	53.65	53.91	54.17	54.42	54.69	54.93
75.0	50.00	50.26	50.53	50.79	51.05	51.32	51.58	51.84	52.10	52.37
74.0	47.29	47.56	47.83	48.10	48.37	48.65	48.92	49.19	49.46	49.73
73.0	44.52	44.80	45.07	45.35	45.63	45.91	46.18	46.46	46.74	47.01
72.0	41.67	41 96	42.24	42.53	42.81	43.10	43.38	43.67	43.95	44 24
71.0	38.72									
70.0	35.71									
69.0										
68.0										
67.0										
66.0										
65.0										
64.0										
63 0										
62.0										
61.0										
60.0										

Formula: $\frac{(\text{Purity}-60)\ 2.5}{\text{Purity}} = \text{factor in table}$

and (lbs. sugar in a juice) $\times \frac{\text{Factor}}{100} =$ lbs. available granulated

TABLE VII.

Pounds Total Solids Per Cubic Foot of Sugar Solutions.

Brix	Lbs. Total Solids	Brix	Lbs. Total Solids	Brix	Lbs. Total Solids	Brix	Lbs. Total Solids	Brix	Lbs. Total Solids	Brix	Lbs. Total Solids	Brix	Lbs. Total Solids
40 0	29.47	44.0	33.00	48.0	36.65	52.0	40.43	56.0	44.31	60.0	48.37	64.0	52.56
40.1	29.56	44.1	33.09	48.1	36.74	52.1	40.51	56 1	44.42	60.1	48.47	64.1	52.66
40.2	29.65	44.2	33.18	48.2	36.83	52.2	40.60	56.2	44.53	60.2	48.57	64.2	52.76
40.3	29.75	44.3	33.26	48.3	36.93	52.3	40.70	56.3	44.63	60.3	48.67	64.3	52.86
40.4	29.84	44.4	33.35	48.4	37.03	52.4	40.81	56.4	44.73	60.4	48.77	64.4	52.97
40.5	29.93	44.5	33.44	48 5	37.12	52.5	40.90	56.5	44.83	60.5	48.87	64.5	53.07
40.6	30.02	44.6	33.53	48.6	37.21	52.6	40.99	56.6	44.93	60.6	48.97	64.6	53.17
40.7	30.10	44.7	33 62	48.7	37.30	52.7	41.08	56.7	45.02	60.7	49.07	64.7	53.29
40.8	30.19	44.8	33.71	48.8	37.40	52.8	41.18	56 8	45.12	60.8	49.17	64.8	53.42
40.9	30.27	44.9	33.81	48.9	37.49	52.9	41.27	56.9	45.22	60.9	49.29	64.9	53.52
41.0	30.36	45.0	33.92	49.0	37.58	53.0	41.37	57.0	45.32	61.0	49.41	65.0	53.62
41.1	30.45	45.1	34.00	49.1	37.67	53.1	41.48	57.1	45.41	61.1	49.51	65.1	53.73
41.2	30.54	45.2	34.09	49.2	37.77	53.2	41.59	57.2	45.51	61.2	49.61	65.2	53.83
41.3	30.62	45.3	34.18	49.3	37 87	53.3	41.67	57.3	45.62	61.3	49.71	65.3	53.93
41.4	30.71	45.4	34.28	49.4	37.96	53.4	41.76	57.4	45.74	61.4	49.81	65.4	54.03
41.5	30.79	45.5	34.36	49.5	38.05	53.5	41 86	57.5	45.83	61.5	49.90	65.5	54.13
41.6	30.88	45.6	34.45	49.6	38.15	53.6	41.97	57.6	45.93	61.6	50.00	65.6	54.24
41.7	30.97	45.7	34.54	49.7	38.24	53.7	42.06	57.7	46.03	61.7	50.10	65.7	54.36
41.8	31.06	45.8	34.63	49 8	38.35	53.8	42.16	57.8	46.13	61 8	50.21	65.8	54.49
41.9	31.15	45.9	34.72	49 9	38.44	53.9	42.25	57.9	46.24	61.9	50 33	65.9	54.59
42.0	31.24	46.0	34.81	50.0	38.53	54.0	42.35	58.0	46.35	62.0	50.45	66.0	54 70
42.1	31.32	46.1	34.90	50.1	38.62	54.1	42.45	58.1	46.43	62.1	50.55	66.1	54.80
42 2	31.41	46.2	34.99	50.2	38 72	54.2	42.55	58.2	46.52	62.2	50.65	66.2	54.90
42.3	31.50	46.3	35.08	50.3	38.81	54.3	42.66	58.3	46.61	62.3	50.75	66.3	55.00
42.4	31.59	46.4	35.17	50 4	38.90	54.4	42.74	58.4	46.70	62.4	50.85	66.4	55.11
42.5	31.67	46.5	35.26	50 5	39.00	54.5	42.83	58.5	46.82	62.5	50.95	66.5	55.23
42.6	31.76	46.6	35.35	50 6	39.09	54.6	42.93	58.6	46.95	62.6	51.06	66.6	55.36
42.7	31.85	46.7	35.44	50.7	39.18	54.7	43.04	58.7	47.05	62.7	51.16	66.7	55.46
42.8	31.93	46.8	35.54	50.8	39.27	54 8	43.15	58.8	47.15	62.8	51.26	66.8	55.57
42.9	32.02	46.9	35.63	50.9	39.36	54.9	43.25	58.9	47.25	62.9	51.38	66.9	55.67
43.0	32.11	47 0	35.72	51 0	39.46	55.0	43 35	59.0	47.35	63.0	51.49	67.0	55.78
43.1	32.20	47.1	35.81	51.1	39.55	55.1	43.44	59.1	47.44	63.1	51.60	67.1	55.88
43.2	32.29	47.2	35.90	51.2	39.65	55.2	43.54	59.2	47.54	63.2	51.70	67.2	55.98
43.3	32.38	47.3	36.00	51.3	39.74	55.3	43.63	59.3	47.64	63 3	51.81	67.3	56.09
43.4	32.47	47.4	36.11	51.4	39.83	55.4	43.73	59.4	47.74	63.4	51.91	67.4	56.19
43.5	32.55	47.5	36.20	51.5	39.94	55.5	43.82	59.5	47.84	63.5	52.01	67.5	56.31
43.6	32.64	47.6	36.29	51.6	40.05	55.6	43.92	59.6	47.94	63.6	52.11	67.6	56.44
43.7	32.74	47.7	36.38	51.7	40.14	55.7	44.02	59.7	48.06	63.7	52.23	67.7	56.54
43.8	32.83	47.8	36.47	51.8	40.24	55.8	44.12	59.8	48.18	63.8	52.34	67.8	56.65
43 9	32.91	47.9	36.56	51.9	40.33	55.9	44 21	59.9	48.27	63.9	52.45	67.9	56.76

Pounds Total Solids Per Cubic Foot of Sugar Solutions.—*Continued.*

Brix	Lbs. Total Solids	Brix	Lbs. Total Solids	Brix	Lbs. Total Solids	Brix	Lbs. Total Solids	Brix	Lbs. Total Solids	Brix	Lbs. Total Solids	Brix	Lbs. Total Solids
68.0	56.86	72.0	61.33	76.0	65.98	80.0	70.80	84.0	75.76	88.0	80.85	92.0	86.21
68.1	56.99	72.1	61.46	76.1	66.12	80.1	70.91	84.1	75.87	88.1	80.98	92.1	86.35
68.2	57.12	72.2	61.59	76.2	66.25	80.2	71.03	84.2	75.99	88.2	81.12	92.2	86.49
68.3	57.22	72.3	61.70	76.3	66.36	80.3	71.16	84.3	76.13	88.3	81.25	92.3	86.62
68.4	57.32	72.4	61.81	76.4	66.47	80.4	71.30	84.4	76.28	88.4	81.38	92.4	86.74
68.5	57.43	72.5	61.91	76.5	66.58	80.5	71.41	84.5	76.39	88.5	81.53	92.5	86.86
68.6	57.54	72.6	62.03	76.6	66.69	80.6	71.53	84.6	76.51	88.6	81.68	92.6	86.97
68.7	57.64	72.7	62.16	76.7	66.82	80.7	71.64	84.7	76.63	88.7	81.83	92.7	87.13
68.8	57.75	72.8	62.29	76.8	66.96	80.8	71.76	84.8	76 74	88.8	81.98	92.8	87.29
68.9	57.87	72.9	62.40	76.9	67.07	80.9	71.87	84.9	76.88	88.9	82.09	92.9	87.43
69.0	58.00	73.0	62.57	77.0	67.18	81.0	71.99	85.0	77.03	89.0	82.21	93.0	87.54
69.1	58.10	73.1	62.62	77.1	67.29	81.1	72.13	85.1	77.15	89.1	82.34	93.1	87.69
69.2	58.21	73.2	62.73	77.2	67.40	81.2	72.27	85.2	77.26	89.2	82.47	93.2	87.84
69.3	58.32	73.3	62.83	77.3	67.51	81 3	72.37	85.3	77.41	89.3	82.61	93.3	87.96
69.4	58.43	73.4	62.94	77.4	67.63	81.4	72.48	85 4	77.55	89.4	82.75	93.4	88.09
69.5	58.53	73.5	63.07	77.5	67.76	81.5	72.63	85.5	77.67	89.5	82.87	93.5	88.21
69.6	58.64	73.6	63.20	77.6	67.90	81.6	72.78	85.6	77.79	89.6	82.99	93.6	88.33
69.7	58.76	73.7	63.31	77.7	68.01	81.7	72.89	85.7	77.90	89.7	83.11	93.7	88.48
69.8	58 89	73.8	63.42	77.8	68.12	81.8	73.00	85.8	78.02	89.8	83.22	93.8	88.64
69.9	59.00	73.9	63.53	77.9	68.26	81.9	73.12	85.9	78.16	89.9	83.36	93.9	88.76
70.0	59.11	74.0	63.64	78.0	68.40	82.0	73.24	86.0	78.31	90.0	83.50	94.0	88.89
70.1	59.21	74.1	63.77	78.1	68.51	82.1	73.38	86.1	78.43	90.1	83.64	94.1	89.04
70.2	59.32	74.2	63.90	78.2	68.63	82.2	73.52	86.2	78.55	90.2	83.78	94.2	89.19
70.3	59.43	74.3	64.01	78.3	68.73	82.3	73.63	86.3	78.69	90.3	83.92	94.3	89.31
70.4	59.53	74.4	64.12	78.4	68.84	82.4	73.75	86 4	78.84	90.4	84.07	94.4	89.44
70.5	59.64	74.5	64.23	78.5	68.98	82.5	73.86	86.5	78.96	90.5	84.19	94.5	89.59
70.6	59.76	74.6	64.34	78 6	69.12	82.6	73 98	86 6	79.08	90.6	84.31	94.6	89.75
70.7	59.89	74.7	64.45	78.7	69.23	82.7	74.12	86.7	79.19	90.7	84.43	94.7	89.87
70.8	60.00	74 8	64 56	78.8	69.34	82.8	74.26	86 8	79.31	90.8	84.56	94.8	90.00
70.9	60.11	74.9	64 70	78.9	69.45	82.9	74.37	86.9	79.46	90.9	84.71	94.9	90.15
71.0	60.22	75.0	64.83	79.0	69.57	83.0	74.49	87.0	79.60	91.0	84.86	95.0	90.30
71.1	60.32	75.1	64.94	79.1	69.68	83.1	74.60	87.1	79.72	91.1	84.98		
71.2	60.43	75.2	65.05	79.2	69.79	83.2	74.72	87.2	79.84	91.2	85.10		
71.3	60.56	75.3	65.16	79 3	69.93	83.3	74.86	87.3	79.96	91.3	85.25		
71.4	60.69	75.4	65.27	79 4	70.07	83.4	75.01	87.4	80.07	91.4	85.40		
71.5	60.79	75.5	65.40	79.5	70.18	83.5	75.13	87.5	80.22	91.5	85.52		
71.6	60.90	75.6	65.54	79.6	70.30	83.6	75.24	87.6	80.37	91.6	85.65		
71.7	61.01	75.7	65.65	79.7	70.41	83.7	75.36	87.7	80.49	91.7	85.80		
71.8	61.12	75.8	65.76	79.8	70.52	83.8	75.52	87.8	80.61	91.8	85.95		
71.9	61.22	75.9	65.87	79.9	70.66	83.9	75.64	87.9	80.73	91.9	86.08		

TABLE VIII.

"Granulated Factors."

Percentage of Available Granulated on Total Solids of Sugar Solutions.

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	
60	.....	.25	.5	.75	1.0	1.25	1.5	1.75	2.0	2.25	60
61	2.5	2.75	3.0	3.25	3.5	3.75	4.0	4.25	4.5	4.75	61
62	5.0	5.25	5.5	5.75	6.0	6.25	6.5	6.75	7.0	7.25	62
63	7.5	7.75	8.0	8.25	8.5	8.75	9.0	9.25	9.5	9.75	63
64	10.0	10.25	10.5	10.75	11.0	11.25	11.5	11.75	12.0	12.25	64
65	12.5	12.75	13.0	13.25	13.5	13.75	14.0	14.25	14.5	14.75	65
66	15.0	15.25	15.5	15.75	16.0	16.25	16.5	16.75	17.0	17.25	66
67	17.5	17.75	18.0	18.25	18.5	18.75	19.0	19.25	19.5	19.75	67
68	20.0	20.25	20.5	20.75	21.0	21.25	21.5	21.75	22.0	22.25	68
69	22.5	22.75	23.0	23.25	23.5	23.75	24.0	24.25	24.5	24.75	69
70	25.0	25.25	25.5	25.75	26.0	26.25	26.5	26.75	27.0	27.25	70
71	27.5	27.75	28.0	28.25	28.5	28.75	29.0	29.25	29.5	29.75	71
72	30.0	30.25	30.5	30.75	31.0	31.25	31.5	31.75	32.0	32.25	72
73	32.5	32.75	33.0	33.25	33.5	33.75	34.0	34.25	34.5	34.75	73
74	35.0	35.25	35.5	35.75	36.0	36.25	36.5	36.75	37.0	37.25	74
75	37.5	37.75	38.0	38.25	38.5	38.75	39.0	39.25	39.5	39.75	75
76	40.0	40.25	40.5	40.75	41.0	41.25	41.5	41.75	42.0	42.25	76
77	42.5	42.75	43.0	43.25	43.5	43.75	44.0	44.25	44.5	44.75	77
78	45.0	45.25	45.5	45.75	46.0	46.25	46.5	46.75	47.0	47.25	78
79	47.5	47.75	48.0	48.25	48.5	48.75	49.0	49.25	49.5	49.75	79
80	50.0	50.25	50.5	50.75	51.0	51.25	51.5	51.75	52.0	52.25	80
81	52.5	52.75	53.0	53.25	53.5	53.75	54.0	54.25	54.5	54.75	81
82	55.0	55.25	55.5	55.75	56.0	56.25	56.5	56.75	57.0	57.25	82
83	57.5	57.75	58.0	58.25	58.5	58.75	59.0	59.25	59.5	59.75	83
84	60.0	60.25	60.5	60.75	61.0	61.25	61.5	61.75	62.0	62.25	84
85	62.5	62.75	63.0	63.25	63.5	63.75	64.0	64.25	64.5	64.75	85
86	65.0	65.25	65.5	65.75	66.0	66.25	66.5	66.75	67.0	67.25	86
87	67.5	67.75	68.0	68.25	68.5	68.75	69.0	69.25	69.5	69.75	87
88	70.0	70.25	70.5	70.75	71.0	71.25	71.5	71.75	72.0	72.25	88
89	72.5	72.75	73.0	73.25	73.5	73.75	74.0	74.25	74.5	74.75	89
90	75.0	75.25	75.5	75.75	76.0	76.25	76.5	76.75	77.0	77.25	90
91	77.5	77.75	78.0	78.25	78.5	78.75	79.0	79.25	79.5	79.75	91
92	80.0	80.25	80.5	80.75	81.0	81.25	81.5	81.75	82.0	82.25	92
93	82.5	82.75	83.0	83.25	83.5	83.75	84.0	84.25	84.5	84.75	93
94	85.0	85.25	85.5	85.75	86.0	86.25	86.5	86.75	87.0	87.25	94
95	87.5	87.75	88.0	88.25	88.5	88.75	89.0	89.25	89.5	89.75	95
96	90.0	90.25	90.5	90.75	91.0	91.25	91.5	91.75	92.0	92.25	96
97	92.5	92.75	93.0	93.25	93.5	93.75	94.0	94.25	94.5	94.75	97
98	95.0	95.25	95.5	95.75	96.0	96.25	96.5	96.75	97.0	97.25	98
99	97.5	97.75	98.0	98.25	98.5	98.75	99.0	99.25	99.5	99.75	99
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	

TABLE IX.

Comparison of Degrees Brix and Baumé, and of the Specific Gravity of Sugar Solutions at 17½° C.—(Stammer.)

Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.	Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.	Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.
0.0	0.0	1.00000	**3.0**	1.7	1.01173	**6.0**	3.4	1.02373
.1	0.1	1.00038	.1	1.8	1.01213	.1	3.5	1.02413
.2	0.1	1.00077	.2	1.8	1.01252	.2	3.5	1.02454
.3	0.2	1.00116	.3	1.9	1.01292	.3	3.6	1.02494
.4	0.2	1.00155	.4	1.9	1.01332	.4	3.6	1.02535
.5	0.3	1.00193	.5	2.0	1.01371	.5	3.7	1.02575
.6	0.3	1.00232	.6	2.0	1.01411	.6	3.7	1 02616
.7	0.4	1.00271	.7	2.1	1.01451	.7	3.8	1.02657
.8	0.45	1.00310	.8	2.2	1.01491	.8	3.9	1.02694
.9	0.5	1.00349	.9	2.2	1.01531	.9	3.9	1.02738
1.0	0.6	1.00388	**4.0**	2.3	1.01570	**7.0**	4.0	1.02779
.1	0.6	1.00427	.1	2.3	1.01610	.1	4.0	1.02819
.2	0.7	1.00466	.2	2.4	1.01650	.2	4.1	1.02860
.3	0.7	1.00505	.3	2.4	1.01690	.3	4.1	1.02901
.4	0.8	1.00544	.4	2.5	1 01730	.4	4.2	1.02942
.5	0.85	1.00583	.5	2.55	1.01770	.5	4.25	1.02983
.6	0.9	1.00622	.6	2.6	1.01810	.6	4.3	1.03024
.7	1.0	1.00662	.7	2.7	1.01850	.7	4.4	1.03064
.8	1.0	1.00701	.8	2.7	1.01890	.8	4.4	1.03105
.9	1.1	1.00740	.9	2.8	1.01930	.9	4.5	1.03146
2.0	1.1	1.00779	**5.0**	2.8	1.01970	**8.0**	4.5	1.03187
.1	1.2	1.00818	.1	2.9	1.02010	.1	4.6	1.03228
.2	1.2	1.00858	.2	2.95	1.02051	.2	4.6	1.03270
.3	1.3	1.00897	.3	3.0	1.02091	.3	4.7	1.03311
.4	1.4	1.00936	.4	3.1	1.02131	.4	4.8	1.03352
.5	1.4	1.00976	.5	3.1	1.02171	.5	4.8	1.03393
.6	1.5	1.01015	.6	3.2	1.02211	.6	4.9	1.03434
.7	1.5	1.01055	.7	3.2	1.02252	.7	4.9	1.03475
.8	1.6	1.01094	.8	3.3	1.02292	.8	5.0	1.03517
.9	1.6	1.01134	.9	3.35	1.02333	.9	5.0	1.03558

Comparison of the Degrees Brix and Baumé, etc., of Sugar Solutions.—*Continued.*

Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.	Degree Brix (Per Cent Sugar.)	Degree Baumé (corrected).	Specific Gravity.	Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.
9.0	5.1	1.03599	**12.0**	6.8	1.04852	**15.0**	8.5	1.06133
.1	5.2	1.03640	.1	6.8	1.04894	.1	8.5	1 06176
.2	5.2	1.03682	.2	6.9	1 04937	.2	8.55	1.06219
.3	5.3	1.03723	.3	7.0	1.04979	.3	8.6	1.06262
.4	5.3	1.03765	.4	7.0	1 05021	.4	8.7	1 06306
.5	5.4	1 03806	.5	7.1	1.05064	.5	8.8	1.06349
.6	5.4	1.03848	.6	7.1	1.05106	.6	8.8	1.06392
.7	5.5	1.03889	.7	7.2	1 05149	.7	8.9	1.06436
.8	5.55	1.03931	.8	7.2	1.05191	.8	8.9	1.06479
.9	5.6	1.03972	.9	7.3	1.05233	.9	9.0	1.06522
10.0	5.7	1.04014	**13.0**	7.4	1.05276	**16.0**	9.0	1.06566
.1	5.7	1.04055	.1	7.4	1.05318	.1	9.1	1.06609
.2	5.8	1.04097	.2	7.5	1.05361	.2	9.2	1.06653
.3	5.8	1.04139	.3	7.5	1.05404	.3	9.2	1.06696
.4	5.9	1.04180	.4	7.6	1 05446	.4	9.3	1.06740
.5	5.9	1.04222	.5	7.7	1.05489	.5	9.3	1.06783
.6	6.0	1.04264	.6	7.7	1.05532	.6	9.4	1.06827
.7	6.1	1.04306	.7	7.75	1.05574	.7	9.4	1.06871
.8	6.1	1.04348	.8	7.8	1 05617	.8	9.5	1.06914
.9	6.2	1.04390	.9	7.9	1 05660	.9	9.5	1.06958
11.0	6.2	1.04431	**14.0**	7.9	1.05703	**17.0**	9.6	1.07002
.1	6.3	1.04473	.1	8.0	1.05746	.1	9.7	1.07046
.2	6.3	1.04515	.2	8.0	1.05789	.2	9.7	1.07090
.3	6.4	1.04557	.3	8.1	1 05831	.3	9.8	1.07133
.4	6.5	1.04599	.4	8.1	1.05874	.4	9.8	1.07177
.5	6.5	1.04641	.5	8.2	1.05917	.5	9.9	1.07221
.6	6.6	1 04683	.6	8.3	1.05960	.6	9.9	1.07265
.7	6.6	1.04726	.7	8.3	1.06003	.7	10.0	1.07309
.8	6.7	1.04768	.8	8.4	1.06047	.8	10.0	1.07353
.9	6.7	1.04810	.9	8.4	1.06090	.9	10.1	1.07397

Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.	Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.	Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.
18.0	10.1	1.07441	**23.0**	13.0	1.09686	**28.0**	15.7	1.12013
.1	10.2	1.07485	.1	13.0	1.09732	.1	15.8	1.12060
.2	10.3	1.07530	.2	13.1	1.09777	.2	15.8	1.12107
.3	10.3	1.07574	.3	13.1	1.09823	.3	15.9	1.12155
.4	10.4	1.07618	.4	13.2	1.09869	.4	16.0	1.12202
.5	10.4	1.07662	.5	13.2	1.09915	.5	16.0	1.12250
.6	10.5	1.07706	.6	13.3	1.09961	.6	16.1	1.12297
.7	10.5	1.07751	.7	13.3	1.10007	.7	16.1	1.12345
.8	10.6	1.07795	.8	13.4	1.10053	.8	16.2	1.12393
.9	10.6	1.07839	.9	13.5	1.10099	.9	16.2	1.12440
19.0	10.7	1.07884	**24.0**	13.5	1.10145	**29.0**	16.3	1.12488
.1	10.8	1.07928	.1	13.6	1.10191	.1	16.3	1.12536
.2	10.8	1.07973	.2	13.6	1.10237	.2	16.4	1.12583
.3	10.9	1.08017	.3	13.7	1.10283	.3	16.5	1.12631
.4	10.9	1.08062	.4	13.7	1.10329	.4	16.5	1.12679
.5	11.0	1.08106	.5	13.8	1.10375	.5	16.6	1.12727
.6	11.1	1.08151	.6	13.8	1.10421	.6	16.6	1.12775
.7	11.1	1.08196	.7	13.9	1.10468	.7	16.7	1.12823
.8	11.2	1.08240	.8	14.0	1.10514	.8	16.7	1.12871
.9	11.2	1.08285	.9	14.0	1.10560	.9	16.8	1.12919
20.0	11.3	1.08329	**25 0**	14.1	1.10607	**30.0**	16.8	1.12967
.1	11.3	1.08374	.1	14.1	1.10653	.1	16.9	1.13015
.2	11.4	1.08419	.2	14.2	1.10700	.2	16.95	1.13063
.3	11.5	1.08464	.3	14.2	1.10746	.3	17.0	1.13111
.4	11.5	1.08509	.4	14.3	1.10793	.4	17.1	1.13159
.5	11.6	1.08553	.5	14.3	1.10839	.5	17.1	1.13207
.6	11.6	1.08599	.6	14.4	1.10886	.6	17.2	1.13255
.7	11.7	1.08643	.7	14.5	1.10932	.7	17.2	1.13304
.8	11.7	1.08688	.8	14.5	1.10979	.8	17.3	1.13352
.9	11.8	1.08733	.9	14.6	1.11026	.9	17.3	1.13400
21.0	11.8	1.08778	**26.0**	14.6	1.11072	**31.0**	17.4	1.13449
.1	11.9	1.08824	.1	14.7	1.11119	.1	17.4	1.13497
.2	11.95	1.08869	.2	14.7	1.11166	.2	17.5	1.13545
.3	12.0	1.08914	.3	14.8	1.11213	.3	17.6	1.13594
.4	12.0	1.08959	.4	14.85	1.11259	.4	17.6	1.13642
.5	12.1	1.09004	.5	14.9	1.11306	.5	17.7	1.13691
.6	12.1	1.09049	.6	15.0	1.11353	.6	17.7	1.13740
.7	12.2	1.09095	.7	15.0	1.11400	.7	17.8	1.13788
.8	12.3	1.09140	.8	15.1	1.11447	.8	17.8	1.13837
.9	12.3	1.09185	.9	15.1	1.11494	.9	17.9	1.13885
22.0	12.4	1.09231	**27.0**	15.2	1.11541	**32.0**	17.95	1.13934
.1	12.5	1.09276	.1	15.2	1.11588	.1	18.0	1.13983
.2	12.5	1.09321	.2	15.3	1.11635	.2	18.0	1.14032
.3	12.6	1.09367	.3	15.3	1.11682	.3	18.1	1.14081
.4	12.6	1.09412	.4	15.4	1.11729	.4	18.2	1.14129
.5	12.7	1.09458	.5	15.5	1.11776	.5	18.2	1.14178
.6	12.7	1.09503	.6	15.5	1.11824	.6	18.3	1.14227
.7	12.8	1.09549	.7	15.6	1.11871	.7	18.3	1.14276
.8	12.85	1.09595	.8	15.6	1.11918	.8	18.4	1.14325
.9	12.9	1.09640	.9	15.7	1.11965	.9	18.4	1.14374

Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.	Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.	Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.
33.0	18.5	1.14423	**38.0**	21.2	1.16920	**43.0**	23.95	1.19505
.1	18.55	1.14472	.1	21.3	1.16971	.1	24.0	1.19558
.2	18.6	1.14521	.2	21.35	1.17022	.2	24.1	1.19611
.3	18.7	1.14570	.3	21.4	1.17072	.3	24.1	1.19653
.4	18.7	1.14620	.4	21.5	1.17123	.4	24.2	1.19716
.5	18.8	1.14669	.5	21.5	1.17174	.5	24.2	1.19769
.6	18.8	1.14718	.6	21.6	1.17225	.6	24.3	1.19822
.7	18.9	1.14767	.7	21.6	1.17276	.7	24.3	1.19875
.8	18.9	1.14817	.8	21.7	1.17327	.8	24.4	1.19927
.9	19.0	1.14866	.9	21.7	1.17379	.9	24.4	1.19980
34.0	19.05	1.14915	**39.0**	21.8	1.17430	**44.0**	24.5	1.20033
.1	19.1	1.14965	.1	21.8	1.17481	.1	24.55	1.20086
.2	19.2	1.15014	.2	21.9	1.17532	.2	24.6	1.20139
.3	19.2	1.15064	.3	21.9	1.17583	.3	24.65	1.20192
.4	19.3	1.15113	.4	22.0	1.17635	.4	24.7	1.20245
.5	19.3	1.15163	.5	22.05	1.17686	.5	24.8	1.20299
.6	19.4	1.15213	.6	22.1	1.17737	.6	24.8	1.20352
.7	19.4	1.15262	.7	22.2	1.17789	.7	24.9	1.20405
.8	19.5	1.15312	.8	22.2	1.17840	.8	24.9	1.20458
.9	19.5	1.15362	.9	22.3	1.17892	.9	25.0	1.20512
35.0	19.6	1.15411	**40.0**	22.3	1.17943	**45.0**	25.0	1.20565
.1	19.65	1.15461	.1	22.4	1.17995	.1	25.1	1.20618
.2	19.7	1.15511	.2	22.4	1.18046	.2	25.1	1.20672
.3	19.8	1.15561	.3	22.5	1.18098	.3	25.2	1.20725
.4	19.8	1.15611	.4	22.5	1.18150	.4	25.2	1.20779
.5	19.9	1.15661	.5	22.6	1.18201	.5	25.3	1.20832
.6	19.9	1.15710	.6	22.6	1.18253	.6	25.4	1.20886
.7	20.0	1.15760	.7	22.7	1.18305	.7	25.4	1.20939
.8	20.0	1.15810	.8	22.8	1.18357	.8	25.5	1.20993
.9	20.1	1.15861	.9	22.8	1.18408	.9	25.5	1.21046
36.0	20.1	1.15911	**41.0**	22.9	1.18460	**46.0**	25.6	1.21100
.1	20.2	1.15961	.1	22.9	1.18512	.1	25.6	1.21154
.2	20.25	1.16011	.2	23.0	1.18564	.2	25.7	1.21208
.3	20.3	1.16061	.3	23.0	1.18616	.3	25.7	1.21261
.4	20.4	1.16111	.4	23.1	1.18668	.4	25.8	1.21315
.5	20.4	1.16162	.5	23.1	1.18720	.5	25.8	1.21369
.6	20.5	1.16212	.6	23.2	1.18772	.6	25.9	1.21423
.7	20.5	1.16262	.7	23.25	1.18824	.7	25.95	1.21477
.8	20.6	1.16313	.8	23.3	1.18877	.8	26.0	1.21531
.9	20.6	1.16363	.9	23.4	1.18929	.9	26.1	1.21585
37.0	20.7	1.16413	**42.0**	23.4	1.18981	**47.0**	26.1	1.21639
.1	20.7	1.16464	.1	23.5	1.19033	.1	26.2	1.21693
.2	20.8	1.16514	.2	23.5	1.19086	.2	26.2	1.21747
.3	20.9	1.16565	.3	23.6	1.19138	.3	26.3	1.21802
.4	20.9	1.16616	.4	23.6	1.19190	.4	26.3	1.21856
.5	21.0	1.16666	.5	23.7	1.19243	.5	26.4	1.21910
.6	21.0	1.16717	.6	23.7	1.19295	.6	26.4	1.21964
.7	21.1	1.16768	.7	23.8	1.19348	.7	26.5	1.22019
.8	21.1	1.16818	.8	23.8	1.19400	.8	26.5	1.22073
.9	21.2	1.16869	.9	23.9	1.19453	.9	26.6	1.22127

Comparison of the Degrees Brix and Baumé, etc.—*Continued.*

Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.	Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.	Degree Brix (Per Cent Sugar).	Degree Baumé (corrected.)	Specific Gravity.
48.0	26.6	1.22182	**53.0**	29.3	1.24951	**58.0**	31.9	1.27816
.1	26.7	1.22236	.1	29.4	1.25008	.1	32.0	1.27874
.2	26.75	1.22291	.2	29.4	1.25064	.2	32.0	1.27932
.3	26.8	1.22345	.3	29.5	1.25120	.3	32.1	1.27991
.4	26.9	1.22400	.4	29.5	1.25177	.4	32.15	1.28049
.5	26.9	1.22455	.5	29.6	1.25233	.5	32.2	1.28107
.6	27.0	1.22509	.6	29.6	1.25290	.6	32.3	1.28166
.7	27.0	1.22564	.7	29.7	1.25347	.7	32.3	1.28224
.8	27.1	1.22619	.8	29.7	1.25403	.8	32.4	1.28283
.9	27.1	1.22673	.9	29.8	1.25460	.9	32.4	1.28342
49.0	27.2	1.22728	**54.0**	29.8	1.25517	**59.0**	32.5	1.28400
.1	27.2	1.22783	.1	29.9	1.25573	.1	32.5	1.28459
.2	27.3	1.22838	.2	29.9	1.25630	.2	32.6	1.28518
.3	27.3	1.22893	.3	30.0	1.25687	.3	32.6	1.28576
.4	27.4	1.22948	.4	30.05	1.25747	.4	32.7	1.28635
.5	27.4	1.23003	.5	30.1	1.25801	.5	32.7	1.28694
.6	27.5	1.23058	.6	30.2	1.25857	.6	32.8	1.28753
.7	27.6	1.23113	.7	30.2	1.25914	.7	32.8	1.28812
.8	27.6	1.23168	.8	30.3	1.25971	.8	32.9	1.28871
.9	27.7	1.23223	.9	30.3	1.26028	.9	32.9	1.28930
50.0	27.7	1.23278	**55.0**	30.4	1.26086	**60.0**	33.0	1.28989
.1	27.8	1.23334	.1	30.4	1.26143	.1	33.0	1.29048
.2	27.8	1.23389	.2	30.5	1.26200	.2	33.1	1.29107
.3	27.9	1.23444	.3	30.5	1.26257	.3	33.1	1.29166
.4	27.9	1.23499	.4	30.6	1.26314	.4	33.2	1.29225
.5	28.0	1.23555	.5	30.6	1.26372	.5	33.2	1.29284
.6	28.0	1.23610	.6	30.7	1.26429	.6	33.3	1.29343
.7	28.1	1.23666	.7	30.7	1.26486	.7	33.35	1.29403
.8	28.1	1.23721	.8	30.8	1.26544	.8	33.4	1.29462
.9	28.2	1.23777	.9	30.8	1.26601	.9	33.45	1.29521
51.0	28.2	1.23832	**56.0**	30.9	1.26658	**61.0**	33.5	1.29581
.1	28.3	1.23888	.1	30.9	1.26716	.1	33.6	1.29640
.2	28.35	1.23943	.2	31.0	1.26773	.2	33.6	1.29700
.3	28.4	1.23999	.3	31.05	1.26831	.3	33.7	1.29759
.4	28.5	1.24055	.4	31.1	1.26889	.4	33.7	1.29819
.5	28.5	1.24111	.5	31.2	1.26946	.5	33.8	1.29878
.6	28.6	1.24166	.6	31.2	1.27004	.6	33.8	1.29938
.7	28.6	1.24222	.7	31.3	1.27062	.7	33.9	1.29998
.8	28.7	1.24278	.8	31.3	1.27120	.8	33.9	1.30057
.9	28.7	1.24334	.9	31.4	1.27177	.9	34.0	1.30117
52.0	28.8	1.24390	**57.0**	31.4	1.27235	**62.0**	34.0	1.30177
.1	28.8	1.24446	.1	31.5	1.27293	.1	34.1	1.30237
.2	28.9	1.24502	.2	31.5	1.27351	.2	34.1	1.30297
.3	28.9	1.24558	.3	31.6	1.27409	.3	34.2	1.30356
.4	29.0	1.24614	.4	31.6	1.27464	.4	34.2	1.30416
.5	29.0	1.24670	.5	31.7	1.27525	.5	34.3	1.30476
.6	29.1	1.24726	.6	31.7	1.27583	.6	34.3	1.30536
.7	29.15	1.24782	.7	31.8	1.27641	.7	34.4	1.30596
.8	29.2	1.24839	.8	31.8	1.27699	.8	34.4	1.30657
.9	29.2	1.24895	.9	31.9	1.27758	.9	34.5	1.30717

Comparison of the Degrees Brix and Baumé, etc.—*Continued.*

Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.	Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.	Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.
63.0	34.5	1.30777	**68.0**	37.1	1.33836	**73.0**	39.6	1.36995
.1	34.6	1.30837	.1	37.1	1.33899	.1	39.7	1.37059
.2	34.6	1.30897	.2	37.2	1.33961	.2	39.7	1.37124
.3	34.7	1.30958	.3	37.3	1.34023	.3	39.8	1.37188
.4	34.7	1.31018	.4	37.3	1.34085	.4	39.8	1.37252
.5	34.8	1.31078	.5	37.4	1.34148	.5	39.9	1.37317
.6	34.85	1.31139	.6	37.4	1.34210	.6	39.9	1.37381
.7	34.9	1.31199	.7	37.5	1.34273	.7	40.0	1.37446
.8	34.95	1.31260	.8	37.5	1.34335	.8	40.0	1.37510
.9	35.0	1.31320	.9	37.6	1.34398	.9	40.1	1.37575
64.0	35.1	1.31381	**69.0**	37.6	1.34460	**74.0**	40.1	1.37639
.1	35.1	1.31442	.1	37.7	1.34523	.1	40.2	1.37704
.2	35.2	1.31502	.2	37.7	1.34585	.2	40.2	1.37768
.3	35.2	1.31563	.3	37.8	1.34648	.3	40.3	1.37833
.4	35.3	1.31624	.4	37.8	1.34711	.4	40.3	1.37898
.5	35.3	1.31684	.5	37.9	1.34774	.5	40.4	1.37962
.6	35.4	1.31745	.6	37.9	1.34836	.6	40.4	1.38027
.7	35.4	1.31806	.7	38.0	1.34899	.7	40.5	1.38092
.8	35.5	1.31867	.8	38.0	1.34962	.8	40.5	1.38157
.9	35.5	1.31928	.9	38.1	1.35025	.9	40.6	1.38222
65.0	35.6	1.31989	**70.0**	38.1	1.35088	**75.0**	40.6	1.38287
.1	35.6	1 32050	.1	38.2	1.35151	.1	40.7	1.38352
.2	35.7	1.32111	.2	38.2	1.35214	.2	40.7	1.38417
.3	35.7	1.32172	.3	38.3	1.35277	.3	40.8	1.38482
.4	35.8	1.32233	.4	38.3	1.35340	.4	40.8	1.38547
.5	35.8	1.32294	.5	38.4	1.35403	.5	40.9	1.38612
.6	35.9	1.32355	.6	38.4	1.35466	.6	40.9	1.38677
.7	35.9	1.32417	.7	38.5	1.35530	.7	41.0	1.38743
.8	36.0	1.32478	.8	38.5	1.35593	.8	41.0	1.38808
.9	36.0	1.32539	.9	38.6	1.35656	.9	41.1	1.38873
66.0	36.1	1.32601	**71.0**	38.6	1.35720	**76.0**	41.1	1.38939
.1	36.1	1.32662	.1	38.7	1.35783	.1	41.2	1.39004
.2	36.2	1.32724	.2	38.7	1.35847	.2	41.2	1.39070
.3	36.2	1.32785	.3	38.8	1.35910	.3	41.3	1.39135
.4	36.3	1.32847	.4	38.8	1.35974	.4	41.3	1.39201
.5	36.3	1.32908	.5	38.9	1.36037	.5	41.4	1.39266
.6	36.4	1.32970	.6	38.9	1.36101	.6	41.4	1.39332
.7	36.4	1.33031	.7	39.0	1.36164	.7	41.5	1.39397
.8	36.5	1.33093	.8	39.0	1.36228	.8	41.5	1.39468
.9	36.5	1.33155	.9	39.1	1.36292	.9	41.6	1.39529
67.0	36.6	1.33217	**72.0**	39.1	1.36355	**77.0**	41.6	1.39595
.1	36.6	1.33278	.1	39.2	1.36419	.1	41.7	1.39660
.2	36.7	1.33340	.2	39.2	1.36483	.2	41.7	1.39726
.3	36.75	1.33402	.3	39.3	1.36547	.3	41.8	1.39792
.4	36.8	1.33464	.4	39.3	1.36611	.4	41.8	1.39858
.5	36.85	1.33526	.5	39.4	1.36675	.5	41.9	1.39924
.6	36.9	1.33588	.6	39.4	1.36739	.6	41.9	1.39990
.7	36.95	1.33650	.7	39.5	1.36803	.7	42.0	1.40056
.8	37.0	1.33712	.8	39.5	1.36867	.8	42.c	1.40122
.9	37.0	1.33774	.9	39.6	1.36931	.9	42.1	1.40188

Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.	Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.	Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.
78.0	42.1	1.40254	**83.0**	44.6	1.43614	**88.0**	47.0	1.47074
.1	42.2	1.40321	.1	44.6	1.43682	.1	47.0	1.47145
.2	42.2	1.40387	.2	44.7	1.43750	.2	47.1	1.47215
.3	42.3	1.40453	.3	44.7	1.43819	.3	47.1	1.47285
.4	42.3	1.40520	.4	44.8	1.43887	.4	47.2	1.47356
.5	42.4	1.40586	.5	44.8	1.43955	.5	47.2	1.47426
.6	42.4	1.40652	.6	44.9	1.44024	.6	47.3	1.47496
.7	42.5	1.40719	.7	44.9	1.44092	.7	47.3	1.47567
.8	42.5	1.40785	.8	45.0	1.44161	.8	47.4	1.47637
.9	42.6	1.40852	.9	45.0	1.44229	.9	47.4	1.47708
79.0	42.6	1.40918	**84.0**	45.1	1.44298	**89.0**	47.45	1.47778
.1	42.7	1.40985	.1	45.1	1.44367	.1	47.5	1.47849
.2	42.7	1.41052	.2	45.15	1.44435	.2	47.55	1.47920
.3	42.8	1.41118	.3	45.2	1.44504	.3	47.6	1.47991
.4	42.8	1.41185	.4	45.25	1.44573	.4	47.6	1.48061
.5	42.9	1.41252	.5	45.3	1.44641	.5	47.7	1.48132
.6	42.9	1.41318	.6	45.35	1.44710	.6	47.7	1.48203
.7	43.0	1.41385	.7	45.4	1.44779	.7	47.8	1.48274
.8	43.0	1.41452	.8	45.4	1.44848	.8	47.8	1.48345
.9	43.1	1.41519	.9	45.5	1.44917	.9	47.9	1.48416
80.0	43.1	1.41586	**85.0**	45.5	1.44986	**90.0**	47.9	1.48486
.1	43.2	1.41653	.1	45.6	1.45055	.1	48.0	1.48558
.2	43.2	1.41720	.2	45.6	1.45124	.2	48.0	1.48629
.3	43.2	1.41787	.3	45.7	1.45193	.3	48.1	1.48700
.4	43.3	1.41854	.4	45.7	1.45262	.4	48.1	1.48771
.5	43.3	1.41921	.5	45.8	1.45331	.5	48.2	1.48842
.6	43.4	1.41989	.6	45.8	1.45401	.6	48.2	1.48913
.7	43.45	1.42056	.7	45.9	1.45470	.7	48.3	1.48985
.8	43.5	1.42123	.8	45.9	1.45539	.8	48.3	1.49056
.9	43.55	1.42190	.9	46.0	1.45609	.9	48.35	1.49127
81.0	43.6	1.42258	**86.0**	46.0	1.45678	**91.0**	48.4	1.49199
.1	43.65	1.42325	.1	46.1	1.45748	.1	48.45	1.49270
.2	43.7	1.42393	.2	46.1	1.45817	.2	48.5	1.49342
.3	43.7	1.42460	.3	46.2	1.45887	.3	48.5	1.49413
.4	43.8	1.42528	.4	46.2	1.45956	.4	48.6	1.49485
.5	43.8	1.42595	.5	46.3	1.46026	.5	48.6	1.49556
.6	43.9	1.42663	.6	46.3	1.46095	.6	48.7	1.49628
.7	43.9	1.42731	.7	46.35	1.46165	.7	48.7	1.49700
.8	44.0	1.42798	.8	46.4	1.46235	.8	48.8	1.49771
.9	44.0	1.42866	.9	46.45	1.46304	.9	48.8	1.49843
82.0	44.1	1.42934	**87.0**	46.5	1.46374	**92.0**	48.9	1.49915
.1	44.1	1.43002	.1	46.55	1.46444	.1	48.9	1.49987
.2	44.2	1.43070	.2	46.6	1.46514	.2	49.0	1.50058
.3	44.2	1.43137	.3	46.65	1.46584	.3	49.0	1.50130
.4	44.3	1.43205	.4	46.7	1.46654	.4	49.05	1.50202
.5	44.3	1.43273	.5	46.7	1.46724	.5	49.1	1.50274
.6	44.4	1.43341	.6	46.8	1.46794	.6	49.15	1.50346
.7	44.4	1.43409	.7	46.8	1.46864	.7	49.2	1.50419
.8	44.5	1.43478	.8	46.9	1.46934	.8	49.2	1.50491
.9	44.5	1.43546	.9	46.9	1.47004	.9	49.3	1.50563

Comparison of the Degrees Brix and Baumé, etc.—*Continued.*

Degree Brix (Per Cent Sugar).	Degree Baumé (corrected).	Specific Gravity.	Degree Brix (Per Cent Sugar.)	Degree Baumé (corrected).	Specific Gravity.
93.0	49.3	1.50635	**94.0**	49.8	1.51359
.1	49.4	1.50707	.1	49.85	1.51431
.2	49.4	1.50779	.2	49.9	1.51504
.3	49.5	1.50852	.3	49.9	1.51577
.4	49.5	1.50924	.4	50.0	1.51649
.5	49.6	1.50996	.5	50.0	1.51722
.6	49.6	1.51069	.6	50.1	1.51795
.7	49.7	1.51141	.7	50.1	1.51868
.8	49.7	1.51214	.8	50.2	1.51941
.9	49.8	1.51286	.9	50.2	1.52014
			95.0	50.3	1.52087

TABLE X.

Table of Factors for Purity Calculations.

Deg. Brix	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	
0	...	286.4	143.1	95.40	71.52	57.20	47.64	40.82	35.71	31.72	0
1	28.54	25.94	23.77	21.93	20.36	18.99	17.80	16.74	15.81	14.97	1
2	14.22	13.53	12.91	12.34	11.83	11.35	10.91	10.50	10.12	9.769	2
3	9.440	9.132	8.843	8.572	8.316	8.076	7.848	7.633	7.429	7.236	3
4	7.052	6.878	6.711	6.553	6.401	6.257	6.118	5.985	5.859	5.737	4
5	5.620	5.508	5.400	5.295	5.195	5.099	5.006	4.916	4.829	4.745	5
6	4.665	4.587	4.511	4.437	4.366	4.298	4.231	4.166	4.103	4.041	6
7	3.983	3.925	3.869	3.815	3.761	3.710	3.659	3.610	3.563	3.517	7
8	3.471	3.427	3.384	3.342	3.300	3.260	3.221	3.182	3.145	3.109	8
9	3.073	3.038	3.004	2.970	2.938	2.906	2.874	2.843	2.813	2.784	9
10	2.755	2.726	2.698	2.671	2.644	2.618	2.592	2.567	2.542	2.518	10
11	2.494	2.471	2.448	2.425	2.403	2.381	2.360	2.339	2.318	2.297	11
12	2.277	2.257	2.238	2.219	2.200	2.182	2.164	2.146	2.128	2.111	12
13	2.094	2.077	2.060	2.044	2.028	2.012	1.996	1.981	1.966	1.951	13
14	1.936	1.922	1.907	1.893	1.879	1.866	1.852	1.839	1.826	1.813	14
15	1.800	1.787	1.774	1.762	1.750	1.738	1.726	1.715	1.703	1.692	15
16	1.681	1.670	1.659	1.648	1.637	1.626	1.616	1.605	1.595	1.585	16
17	1.575	1.565	1.555	1.546	1.537	1.527	1.518	1.508	1.499	1.490	17
18	1.482	1.473	1.464	1.455	1.447	1.439	1.430	1.422	1.414	1.406	18
19	1.398	1.390	1.382	1.374	1.367	1.360	1.352	1.344	1.337	1.330	19
20	1.322	1.315	1.308	1.301	1.295	1.288	1.281	1.274	1.267	1.261	20
21	1.254	1.248	1.242	1.235	1.229	1.222	1.216	1.210	1.204	1.198	21
22	1.192	1.186	1.180	1.175	1.169	1.164	1.158	1.152	1.146	1.141	22
23	1.136	1.131	1.125	1.120	1.114	1.109	1.104	1.099	1.094	1.089	23
24	1.084	1.079	1.074	1.069	1.064	1.059	1.055	1.050	1.045	1.041	24
25	1.036	1.032	1.027	1.023	1.019	1.014	1.010	1.005	1.001	.997	25
26	.992	.988	.984	.980	.976	.971	.967	.963	.959	.955	26
27	.951	.947	.944	.940	.936	.932	.928	.925	.921	.917	27
28	.914	.910	.906	.903	.899	.895	.892	.889	.885	.882	28
29	.878	.875	.871	.868	.865	.861	.858	.855	.852	.849	29
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	

TABLE XI.

Temperature Corrections for Brix Hydrometer (17½° C. normal temperature).

Degrees Centigrade	Degrees Brix.												
	0	5	10	15	20	25	30	35	40	50	60	70	75
	The degree read to be decreased by												
14	.1	.15	.15	.15	.2	.2	.2	.2	.2	.25	.25	.3	.3
15	.1	.1	.1	.15	.15	.15	.15	.15	.15	.15	.2	.2	.25
16	.05	.05	.1	.1	.1	.1	.1	.1	.1	.1	.15	.15	.2
17	.0	.0	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05
	The degree read to be increased by												
18	.0	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.0
19	.05	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.05
20	.1	.15	.15	.15	.15	.2	.2	.2	.2	.2	.2	.15	.1
21	.15	.2	.2	.25	.25	.25	.25	.25	.25	.25	.25	.2	.2
22	.2	.25	.3	.3	.3	.3	.3	.3	.35	.35	.3	.3	.25
23	.25	.3	.35	.35	.4	.4	.4	.4	.4	.4	.4	.35	.35
24	.3	.4	.4	.45	.45	.45	.45	.45	.45	.5	.45	.45	.4
25	.35	.45	.45	.5	.5	.55	.55	.55	.55	.6	.55	.5	.5