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United States Standards for Grades of Frozen Concentrated Blended Grapefruit Juice and Orange Juice

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This is a reprint of the United States Standards for Grades of Frozen Concentrated Blended Grapefruit Juice and Orange Juice (18 FR 7999) which have been in effect since September 21, 1968 and were updated to modify the format and to correct and align the text as originally published in the CFR.

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Specialty Crops Program,
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1400 Independence Avenue, SW, STOP 0240
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United States Standards for Grades of Frozen Concentrated Blended Grapefruit Juice and Orange Juice

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Product Description, Styles, and Grades

§52.1311 Product description.

Frozen concentrated blended grapefruit juice and orange juice is the frozen product prepared from a combination of concentrated, unfermented juices obtained from sound, mature grapefruit (*Citrus paradisi*) and from sound, mature fruit of the sweet orange group (*Citrus sinensis*) and Mandarin group (*Citrus reticulata*), except tangerines. The fruit is prepared by sorting and by washing prior to extraction of the juices to assure a clean product. The juices may be blended upon extraction of such juices or after concentration and fresh orange juice extracted from sorted and washed fruit, as aforesaid, is admixed to the concentrate. It is recommended that the frozen concentrated blended grapefruit juice and orange juice be composed of the equivalent of not less than 50 percent orange juice in the reconstituted juice; however, in oranges yielding light-colored juice it is further recommended that as much as the equivalent of 75 percent orange juice in the reconstituted juice be used. The concentrated juice is packed in accordance with good commercial practice and is frozen and maintained at temperatures necessary for the preservation of the product.

§52.1312 Styles of frozen concentrated blended grapefruit juice and orange juice.

- (a) **Style I, without sweetening ingredient added.** The Brix value of the finished concentrate shall be not less than 40 degrees nor more than 44 degrees.
- (b) **Style II, with sweetening ingredient added.** The finished concentrate, exclusive of added sweetening ingredient, has a Brix value of not less than 38 degrees; and the finished concentrate, including added sweetening ingredient, shall have a Brix value of not less than 40 degrees but not more than 48 degrees.

§52.1313 Grades of frozen concentrated blended grapefruit juice and orange juice.

- (a) **U.S. Grade A or U.S. Fancy** is the quality of frozen concentrated blended grapefruit juice and orange juice which reconstitutes properly and of which the reconstituted juice possesses the appearance of fresh juices of such a blend; possesses a very good color; is practically free from defects; possesses a very good flavor; and scores not less than 85 points when scored in accordance with the scoring system outlined in this subpart.
- (b) **U.S. Grade B or U.S. Choice** is the quality of frozen concentrated blended grapefruit juice and orange juice which reconstitutes properly and of which the reconstituted juice possesses a good color; is reasonably free from defects; possesses a good flavor; and scores not less than 70 points when scored in accordance with the scoring system outlined in this subpart.

- (c) **Substandard** is the quality of frozen concentrated blended grapefruit juice and orange juice that fails to meet the requirements of U.S. Grade B or U.S. Choice.

Fill of Container

§52.1314 Recommended fill of container.

The recommended fill of container is not incorporated in the grades of the finished product since fill of container, as such, is not a factor of quality for the purposes of these grades. It is recommended that each container be filled with frozen concentrated blended grapefruit juice and orange juice as full as practicable without impairment of quality.

Factors of Quality

§52.1315 Ascertaining the grade.

- (a) The grade of frozen concentrated blended grapefruit juice and orange juice is ascertained by considering in conjunction with the requirements of the respective grade, the respective ratings for the factors of color, absence of defects, and flavor.
- (b) The relative importance of each factor which is scored is expressed numerically on the scale of 100. The maximum number of points that may be given such factors are:

Factors	Points
Color	20
Absence of Defects	40
Flavor	40
Total Score	100

§52.1316 Ascertaining the rating for the factors which are scored.

The essential variations within each factor which is scored are so described that the value may be ascertained for each factor and expressed numerically. The numerical range within each factor which is score is inclusive (for example, **17 to 20 points** means 17, 18, 19, or 20 points).

§52.1317 Color.

- (a) **“A” classification.** Frozen concentrated blended grapefruit juice and orange juice of which the reconstituted juice possesses a very good color may be given a score of 17 to 20 points. **Very good color** means that the color is bright, light yellow-orange, and typical of freshly extracted juices of such a blend and is free from any trace of browning indicative of scorching, oxidation, caramelization, or other causes.

- (b) **“B” classification.** If the reconstituted juice possesses a good color, a score of 14 to 16 points may be given. Frozen concentrated blended grapefruit juice and orange juice that falls into this classification shall not be graded above U.S. Grade B or U.S. Choice, regardless of the total score for the product (this is a limiting rule). **Good color** means that the color may range from light yellow to light amber, is fairly typical of freshly extracted juices of such a blend and may be slightly dull or may show traces of browning but is not off color for any reason.
- (c) **“SStd” classification.** If the reconstituted juice fails to meet the requirements of paragraph (b) of this section, a score of 0 to 13 points may be given. Frozen concentrated blended grapefruit juice and orange juice that falls into this classification shall not be graded above Substandard, regardless of the total score for the product (this is a limiting rule).

§52.1318 Absence of defects.

- (a) **General.** The factor of absence of defects refers to the degree of freedom from seeds and portions thereof, from excessive juice cells, from free and suspended pulp, from recoverable oil, and from other defects.
- (1) **Free and suspended pulp** means particles of membrane, core and peel and other similar extraneous materials in the reconstituted blended grapefruit juice and orange juice.
- (b) **“A” classification.** Frozen concentrated blended grapefruit juice and orange juice of which the reconstituted juice is practically free from defects may be given a score of 34 to 40 points. **Practically free from defects** means that there may be present:
- (1) Small seeds or portions thereof that are of such size that they could pass through round perforations not exceeding one-eighth inch in diameter, provided such seeds or portions thereof do not materially affect the appearance or drinking quality of the juice;
- (2) juice cells that do not materially affect the appearance or drinking quality of the juice;
- (3) other defects that are not more than slightly objectionable, and
- (4) not more than 12 percent free and suspended pulp. To score in this classification the frozen concentrated blended grapefruit juice and orange juice may contain not more than 0.097 ml. of recoverable oil per 100 grams of the concentrated product.

- (c) **“B” classification.** If the reconstituted juice is reasonably free from defects, a score of 28 to 33 points may be given. Frozen concentrated blended grapefruit juice and orange juice that falls into this classification shall not be graded above U.S. Grade B or U.S. Choice, regardless of the total score for the product (this is a limiting rule). **Reasonably free from defects** means that there may be present:
- (1) Small seeds or portions thereof that are of such size that they could pass through round perforations not exceeding one-eighth inch in diameter, provided such seeds or portions thereof do not seriously affect the appearance or drinking quality of the juice;
 - (2) juice cells that do not seriously affect the appearance or drinking quality of the juice;
 - (3) other defects that are not materially objectionable, and
 - (4) not more than 18 percent free and suspended pulp. To score in this classification the frozen concentrated blended grapefruit juice and orange juice may contain not more than 0.113 ml. of recoverable oil per 100 grams of the concentrated product.
- (d) **“SStd” classification.** Frozen concentrated blended grapefruit juice and orange juice that fails to meet the requirements of paragraph (c) of this section may be given a score of 0 to 27 points and shall not be graded above Substandard, regardless of the total score for the product (this is a limiting rule).

§52.1319 Flavor.

- (a) **“A” classification.** Frozen concentrated blended grapefruit juice and orange juice of which the reconstituted juice possesses a very good flavor may be given a score of 34 to 40 points. **Very good flavor** means that the flavor is fine, distinct, and substantially typical of freshly extracted juices of such a blend. To score not less than 34 points frozen concentrated blended grapefruit juice and orange juice shall meet the following requirements for the respective style:
- (1) **Style I, without sweetening ingredient added.** The ratio of Brix value to acid is not less than 10 to 1 nor more than 16 to 1 (See Table I).
 - (2) **Style II, with sweetening ingredient added.** The ratio of Brix value to acid is not less than 11 to 1 nor more than 13 to 1 (See Table II).
- (b) **“B” classification.** If the reconstituted juice possesses a good flavor, a score of 28 to 33 points may be given. Frozen concentrated blended grapefruit juice and orange juice that falls into this classification shall not be graded above U.S. Grade B or U.S. Choice, regardless of the total score for the product (this is a

limiting rule). **Good flavor** means that the flavor is fairly typical of freshly extracted juices of such a blend and is free from abnormal or off flavors of any kind. To score not less than 28 points frozen concentrated blended grapefruit juice and orange juice shall meet the following requirements for the respective style:

- (1) **Style I, without sweetening ingredient added.** The ratio of Brix value to acid is not less than 8 to 1 nor more than 18 to 1 (See Table I).
 - (2) **Style II, with sweetening ingredient added.** The ratio of Brix value to acid is not less than 9 to 1 nor more than 13 to 1 (See Table II).
- (c) **“SStd” classification.** If the frozen concentrated blended grapefruit juice and orange juice fails to meet the requirements of paragraph (b) of this section, a score of 0 to 27 points may be given. Frozen concentrated blended grapefruit juice and orange juice that falls into this classification shall not be graded above Substandard, regardless of the total score for the product (this is a limiting rule).

**Table I – Maximum and Minimum Acid for Frozen Concentrated Blended
Grapefruit Juice and Orange Juice**

Style I (Without Sweetening Ingredient Added)

Brix Value of the Concentrate in Degrees Brix	U.S. Grade A or U.S. Fancy		U.S. Grade B or U.S. Choice	
	Ratio 10:1	Ratio 16:1	Ratio 8:1	Ratio 18:1
	Acid (<i>percent by weight</i>)		Acid (<i>percent by weight</i>)	
	Maximum	Minimum	Maximum	Minimum
40.0°	4.00	2.50	5.00	2.22
40.1°	4.01	2.51	5.01	2.23
40.2°	4.02	2.51	5.03	2.23
40.3°	4.03	2.52	5.04	2.24
40.4°	4.04	2.53	5.05	2.24
40.5°	4.05	2.53	5.06	2.25
40.6°	4.06	2.54	5.08	2.26
40.7°	4.07	2.54	5.09	2.26
40.8°	4.08	2.55	5.10	2.27
40.9°	4.09	2.56	5.11	2.27
41.0°	4.10	2.56	5.13	2.28
41.1°	4.11	2.57	5.14	2.28
41.2°	4.12	2.58	5.15	2.29
41.3°	4.13	2.58	5.16	2.29
41.4°	4.14	2.59	5.18	2.30
41.5°	4.15	2.59	5.19	2.31
41.6°	4.16	2.60	5.20	2.31
41.7°	4.17	2.61	5.21	2.32
41.8°	4.18	2.61	5.23	2.32
41.9°	4.19	2.62	5.24	2.33
42.0°	4.20	2.63	5.25	2.33
42.1°	4.21	2.63	5.26	2.34
42.2°	4.22	2.64	5.28	2.34
42.3°	4.23	2.64	5.29	2.35
42.4°	4.24	2.65	5.30	2.35
42.5°	4.25	2.66	5.31	2.36
42.6°	4.26	2.66	5.33	2.37
42.7°	4.27	2.67	5.34	2.37
42.8°	4.28	2.68	5.35	2.38
42.9°	4.29	2.68	5.36	2.38
43.0°	4.30	2.69	5.38	2.39
43.1°	4.31	2.69	5.39	2.39
43.2°	4.32	2.70	5.40	2.40
43.3°	4.33	2.71	5.41	2.41
43.4°	4.34	2.71	5.43	2.41
43.5°	4.35	2.72	5.44	2.42
43.6°	4.36	2.73	5.45	2.42
43.7°	4.37	2.73	5.46	2.43
43.8°	4.38	2.74	5.48	2.43
43.9°	4.39	2.74	5.49	2.44
44.0°	4.40	2.75	5.50	2.44

**Table II – Maximum and Minimum Acid for Frozen Concentrated Blended
Grapefruit Juice and Orange Juice**

Style II (With Sweetening Ingredient Added)

Brix Value of the Concentrate in Degrees Brix	U.S. Grade A or U.S. Fancy		U.S. Grade B or U.S. Choice	
	Ratio 11:1	Ratio 13:1	Ratio 9:1	Ratio 13:1
	Acid (<i>percent by weight</i>)		Acid (<i>percent by weight</i>)	
	Maximum	Minimum	Maximum	Minimum
40.0°	3.64	3.08	4.44	3.08
40.1°	3.65	3.08	4.46	3.08
40.2°	3.65	3.09	4.47	3.09
40.3°	3.66	3.10	4.48	3.10
40.4°	3.67	3.11	4.49	3.11
40.5°	3.68	3.12	4.50	3.12
40.6°	3.69	3.12	4.51	3.12
40.7°	3.70	3.13	4.52	3.13
40.8°	3.71	3.14	4.53	3.14
40.9°	3.72	3.15	4.54	3.15
41.0°	3.73	3.15	4.56	3.15
41.1°	3.74	3.16	4.57	3.16
41.2°	3.75	3.17	4.58	3.17
41.3°	3.75	3.18	4.59	3.18
41.4°	3.76	3.18	4.60	3.18
41.5°	3.77	3.19	4.61	3.19
41.6°	3.78	3.20	4.62	3.20
41.7°	3.79	3.21	4.63	3.21
41.8°	3.80	3.22	4.64	3.22
41.9°	3.81	3.22	4.66	3.22
42.0°	3.82	3.23	4.67	3.23
42.1°	3.83	3.24	4.68	3.24
42.2°	3.84	3.25	4.69	3.25
42.3°	3.85	3.25	4.70	3.25
42.4°	3.85	3.26	4.71	3.26
42.5°	3.86	3.27	4.72	3.27
42.6°	3.87	3.28	4.73	3.28
42.7°	3.88	3.28	4.74	3.28
42.8°	3.89	3.29	4.76	3.29
42.9°	3.90	3.30	4.77	3.30
43.0°	3.91	3.31	4.78	3.31
43.1°	3.92	3.32	4.79	3.32
43.2°	3.93	3.32	4.80	3.32
43.3°	3.94	3.33	4.81	3.33
43.4°	3.95	3.34	4.82	3.34
43.5°	3.95	3.35	4.83	3.35
43.6°	3.96	3.35	4.84	3.35
43.7°	3.97	3.36	4.86	3.36
43.8°	3.98	3.37	4.87	3.37
43.9°	3.99	3.38	4.88	3.38
44.0°	4.00	3.38	4.89	3.38

**Table II – Maximum and Minimum Acid for Frozen Concentrated Blended
Grapefruit Juice and Orange Juice**

Style II (With Sweetening Ingredient Added) – *Continued*

Brix Value of the Concentrate in Degrees Brix	U.S. Grade A or U.S. Fancy		U.S. Grade B or U.S. Choice	
	Ratio 11:1	Ratio 13:1	Ratio 9:1	Ratio 13:1
	Acid (<i>percent by weight</i>)		Acid (<i>percent by weight</i>)	
	Maximum	Minimum	Maximum	Minimum
44.1°	4.01	3.39	4.90	3.39
44.2°	4.02	3.40	4.91	3.40
44.3°	4.03	3.41	4.92	3.41
44.4°	4.04	3.42	4.93	3.42
44.5°	4.05	3.42	4.94	3.42
44.6°	4.05	3.43	4.96	3.43
44.7°	4.06	3.44	4.97	3.44
44.8°	4.07	3.45	4.98	3.45
44.9°	4.08	3.45	4.99	3.45
45.0°	4.09	3.46	5.00	3.46
45.1°	4.10	3.47	5.01	3.47
45.2°	4.11	3.48	5.02	3.48
45.3°	4.12	3.48	5.03	3.48
45.4°	4.13	3.49	5.04	3.49
45.5°	4.14	3.50	5.06	3.50
45.6°	4.15	3.51	5.07	3.51
45.7°	4.15	3.52	5.08	3.52
45.8°	4.16	3.52	5.09	3.52
45.9°	4.17	3.53	5.10	3.53
46.0°	4.18	3.54	5.11	3.54
46.1°	4.19	3.55	5.12	3.55
46.2°	4.20	3.55	5.13	3.55
46.3°	4.21	3.56	5.14	3.56
46.4°	4.22	3.57	5.16	3.57
46.5°	4.23	3.58	5.17	3.58
46.6°	4.24	3.58	5.18	3.58
46.7°	4.25	3.59	5.19	3.59
46.8°	4.25	3.60	5.20	3.60
46.9°	4.26	3.61	5.21	3.61
47.0°	4.27	3.62	5.22	3.62
47.1°	4.28	3.62	5.23	3.62
47.2°	4.29	3.63	5.24	3.63
47.3°	4.30	3.64	5.26	3.64
47.4°	4.31	3.65	5.27	3.65
47.5°	4.32	3.65	5.28	3.65
47.6°	4.33	3.66	5.29	3.66
47.7°	4.34	3.67	5.30	3.67
47.8°	4.35	3.68	5.31	3.68
47.9°	4.35	3.68	5.32	3.68
48.0°	4.36	3.69	5.33	3.69

Explanation and Methods of Analyses

§52.1320 Definitions of terms as used in these standards.

- (a) **Oranges** means oranges of the sweet orange group (*Citrus sinensis*) and the Mandarin group (*Citrus reticulata*), except tangerines.
- (b) **Reconstituted juice** means the product obtained by mixing thoroughly 3 parts by volume of distilled water and one part by volume of frozen concentrated blended grapefruit juice and orange juice.
- (c) **Reconstitutes properly** means that the reconstituted juice shows no material separation of colloidal or suspended matter, leaving a zone of definitely clear liquid without any turbidity, after standing four (4) hours at a temperature of not less than 68 degrees Fahrenheit in a clear glass tube or cylinder (such as a 50 ml. graduated cylinder).
- (d) **Acid** means the percent by weight of acid (calculated as anhydrous citric acid) in frozen concentrated blended grapefruit juice and orange juice.
- (e) **Brix value** in frozen concentrated blended grapefruit juice and orange juice is the refractometric sucrose value determined in accordance with the International Scale of Refractive Indices of Sucrose Solutions and to which the applicable correction for acid is added. (See Table III for corrections.)

Table III¹ – Corrections for Obtaining Brix Value

Citric Acid, Anhydrous (percent by weight)	Correction to be Added to Refractometer Sucrose Value to Obtain Degree Brix Value
2.0	0.39
2.2	0.43
2.4	0.47
2.6	0.51
2.8	0.54
3.0	0.58
3.2	0.62
3.4	0.66
3.6	0.70
3.8	0.74
4.0	0.78
4.2	0.81
4.4	0.85
4.6	0.89
4.8	0.93
5.0	0.97
5.2	1.01
5.4	1.04
5.6	1.07

¹ Source: "Refractometric Determination of Soluble Solids in Citrus Juices." by J.W. Stevens and W.E. Baier, from the Analytical Edition of Industrial and Engineering Chemistry, Vol. II, Page 447, Aug. 15, 1939.

§52.1321 Explanation of analyses.

- (a) The measurement of Brix value is determined on the thawed concentrate in accordance with the refractometric method for sugars and sugar products, outlined in the **Official Methods of Analysis of the Association of Official Agricultural Chemists**.
- (b) **Acid**, calculated as anhydrous citric acid, is determined by titration with standard sodium hydroxide solution, using phenolphthalein as indicator.
- (c) **Recoverable oil** is determined by the following method:

METHOD

(1) Reagents.

Standard bromide-bromate solution – prepared and standardized to 0.099N in accordance with Chapter 42, Standard Solutions in the current

edition of the AOAC¹. For 1 use, add 1 volume of standard solution to 3 volumes of water to make 0.0247N solution. 1 ml. of 0.0247N solution supplies bromine to react with 0.00085g., or 0.0010 ml., of *d*-limonene. The solutions are stable for 6 months.

2-Propanol – Reagent grade ACS (American Chemical Society).

Dilute hydrochloric acid – prepared by adding 1 volume of concentrated acid to 2 volumes of water.

Methyl orange indicator – 0.1 percent in water.

(2) Apparatus.

Electric heater – with recessed refractory top, 500-750 watts.

Still, all glass – 500 ml. distillation flask with 24/40 standard taper neck; 200 mm. Graham condenser with 28/15 receiving socket and drip tip; connecting bulb and adapter as shown in Figure 1.

Burette – 10 ml. or 25 ml. graduated to 0.1 ml., with easily controllable flow to permit both rapid and dropwise titration.

(3) Determination.

- (i)** Pipette 25 ml. of well-mixed sample (juice or reconstituted juice) into the distillation flask containing carborundum chips or glass beads, and add 25 ml. of 2-Propanol.
- (ii)** Distill into a 150 ml. beaker. Continue distilling until solvent ceases to reflux then remove the flask from the heater.
- (iii)** Add 10 ml. of dilute hydrochloric acid and 1 drop of indicator. (An alternative method would be to prepare a solution containing 5 ml. of indicator and 1,000 ml. of dilute hydrochloric acid – then add 10 ml. of this acid-indicator mix to the 150 ml. beaker.)
- (iv)** Titrate with the dilute bromate solution while stirring. The major portion of the titrant may be added rapidly, but the endpoint must be approached at about 1 drop per second. Disappearance of color indicates the endpoint.
- (v)** Determine the reagent blank by titrating three separate mixtures of 25 ml. 2-Propanol and 10 ml. of dilute hydrochloric acid with

¹ "AOAC" refers to the Official Methods of Analysis published by the Association of Official Analytical (formerly Agricultural) Chemists. Copies may be obtained from this Association at Box 540, Benjamin Franklin Station, Washington, D.C. 20044

indicator – without refilling the burette. Divide the total ml. of titrant used by three to obtain the average blank. Subtract the average blank thus obtained from the ml. of the titrant used to titrate the distillate.

- (vi) Multiply the remainder by 0.004 to obtain the percent recoverable oil by volume in the juice sample.
- (vii) The ml. of recoverable oil per 100 grams of the concentrate is determined as follows:

$$\text{mL recoverable oil per 100 grams concentrate} = \frac{\text{percent oil by volume recovered} \times 4}{\text{specific gravity of the concentrate}}$$

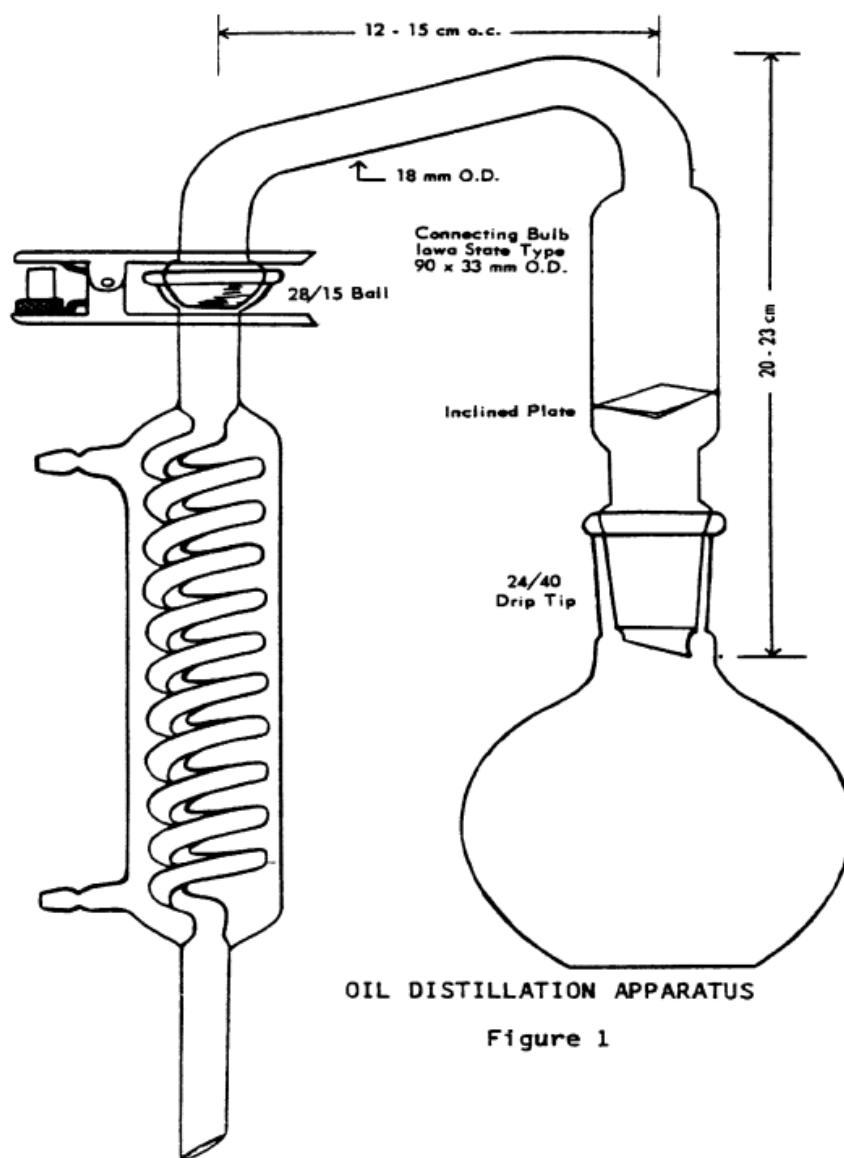


Figure 1

- (d) **Free and suspended pulp** is determined by the following method: Graduated centrifuge tubes with a capacity of 50 ml. are filled with the reconstituted blended grapefruit juice and orange juice and placed in a suitable centrifuge. The speed is adjusted, according to diameter, as indicated in Table IV, and the juice is centrifuged for exactly 10 minutes. As used herein, **diameter** means the over-all distance between the bottoms of opposing centrifuge tubes in operating position. After centrifuging, the milliliter reading at the top of the layer of pulp in the tube is multiplied by 2 to give the percentage of pulp.

Diameter (inches)	Approximate Revolutions per Minute
10	1,609
10 ½	1,570
11	1,534
11 ½	1,500
12	1,468
12 ½	1,438
13	1,410
13 ½	1,384
14	1,359
14 ½	1,336
15	1,313
15 ½	1,292
16	1,271
16 ½	1,252
17	1,234
17 ½	1,216
18	1,199
18 ½	1,182
19	1,167
19 ½	1,152
20	1,137

Lot Inspection and Certification

§52.1322 Ascertaining the grade of a lot.

The grade of a lot of the processed product covered by these standards is determined by the procedures set forth in the **Regulations Governing Inspection and Certification of Processed Fruits and Vegetables, Processed Products Thereof, and Certain Other Processed Food Products** (§§ 52.1 to 52.87).

Score Sheet

§52.1323 Score sheet for frozen concentrated blended grapefruit juice and orange juice.

Size and kind of container			
Container mark or identification			
Label			
Liquid measure (Fl. ounces)			
Brix value of concentrate (corrected for acid)			
Anhydrous citric acid (% by weight)			
Brix value to acid ratio (-:1)			
Recoverable oil (ml./100 grams)			
Free and suspended pulp (%)			
Reconstituted properly (yes) (no)			
Appearance of fresh juice (yes) (no)			
Factors		Score Points	
Color	20	"A"	17-20
		"B"	14-16 <u>1/</u>
		"SStd"	0-13 <u>1/</u>
Absence of defects	40	"A"	34-40
		"B"	28-33 <u>1/</u>
		"SStd"	0-27 <u>1/</u>
Flavor	40	"A"	34-40
		"B"	28-33 <u>1/</u>
		"SStd"	0-27 <u>1/</u>
Total Score		100	
Grade			

1/ Indicates limiting rule.