



United States  
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Fruit and  
Vegetable  
Division

Processed  
Products Branch

# Grading Manual for Canned Applesauce

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Canned Applesauce  
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This manual is designed for Processed Products Branch Personnel of the U.S. Department of Agriculture. Its purpose is to give background information and guidelines to assist in the uniform application and interpretation of U.S. grade standards, other similar specifications and special procedures.

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### Sampling Procedures

Follow



1. Regulations (109-A-1)
2. Sampling Procedures (120-A-1)
3. Time Sampling (120-A-4)
4. Condition of Container (125-A-1)
5. In-Plant Inspection (160-A-1, 162-A-1)
6. Foreign Material (172-A-1)

### Non-Quality Procedures

Follow



1. Time Sampling (120-A-5)
2. Net Contents (128-A-10)
3. Vacuum (128-A-20)
4. Fill of Container (128-A-40)
5. Brix Measurement (128-A-50, 135-A-3)
6. General Inspection Instructions (130-A-1)

### Standard of Identity

Federal Food and Drug Standard of Identity has been promulgated for canned applesauce. Thoroughly acquaint yourself with the FDA's Standard of Identity for Canned Applesauce as contained in 21 CFR 145.110. This standard gives the legal definition of canned "applesauce," lists the optional ingredient(s) permitted, and gives the proper label statements.

### **Standard of Fill**

The FDA's Standard of Fill for Canned Applesauce requires the containers be filled not less than 90 percent of the total capacity of the container as determined by the general method for fill of containers prescribed in 21 CFR 130.12; except that in the case of glass containers having a total capacity of 192 mL (6-1/2 fluid ounces) or less, the fill is not less than 85 percent.

### **Brix Measurement**

General information pertaining to Brix measurements is contained in File Code 135-A-3 (Technical Inspection Procedures). Inspectors should be familiar with this information, particularly with respect to the use of the refractometer. The Brix measurements should be made as soon as possible after the containers have been opened to minimize evaporation. The Brix measurement is made by means of a refractometer, making any necessary correction for temperature. No other correction is necessary.

**CAUTION: Brix readings should not be taken on "hand refractometers" for acceptance or rejection purposes since these refractometers are generally not accurate enough.**

### **Stack-Burn; Detinning**

Immediately after processing, the containers are cooled either by immersion in a cold water bath or by cold water sprays. The temperature of the applesauce should be reduced to 95°-105°F. Temperatures lower than 95°F will not permit the tin containers to dry thoroughly which will contribute to exterior rusting condition. Stacking containers with an internal temperature in excess of 105°F will cause the applesauce to stack-burn resulting in a pinkish or brown discoloration and a caramelized flavor.

High vacuums are essential in canned applesauce to retard or prevent headspace detinning. Slight detinning that does not present an objectionable appearance and that does not affect the edibility of the applesauce should be ignored. There may be times when detinning is serious enough to take exception to the condition of container, even though the applesauce will not be affected. Detinning may become so extensive as to affect the color and flavor of the product.

Detinning in the headspace area has plagued the applesauce industry from time to time and has been a major cause of sizeable losses. Detinning may also be occasionally found in the interior side seam of tin containers. Detinning is generally confined to the No. 303 and larger container sizes with the No. 10 size suffering the most.

Studies have shown several possible causes for detinning with the presence of oxygen in the headspace, which acts as a detinning accelerator, being the most common cause. Consequently, it is important to obtain as high a vacuum as possible to void the headspace of as much oxygen as possible. If the vacuum is too high, excessive strain is exerted on the seams and panel of the container causing microleakage and often "paneling". These two problems have been discovered in No. 10 containers where vacuums of 20 to 26 inches were recorded.

Considerable work has been done with nitrogen closing (filling the headspace with nitrogen) of No. 303 and No. 10 containers which proved to be beneficial in preventing detinning. When the nitrogen flow closure is used, detinning is minimized or non-existent at internal vacuums of 5 - 10 inches. Although not yet widely used in the industry, some canners are using this method with success.

### **Mixed Lot of Regular & Chunky Styles**

Under normal packing practice regular style applesauce would not be mixed with chunky style applesauce. However, if a lot is inadvertently mixed the packer may wish to segregate the lot before offering for grading. In the event the packer declines the segregation grade the lot according to the style that it is offered for --- either regular style or chunky style.

### **Sweetened vs Unsweetened Type of Pack**

When a lot of canned applesauce is offered for grading and certification, the applicant should declare either orally or in writing the type of pack -- sweetened or unsweetened. If the applesauce is offered as sweetened and tests less than 14.5° brix, it is classified as SSTD. This lot should not be reoffered as unsweetened type. Be guided by 21 CFR 145.110 concerning labeling requirements.

Automatic filling equipment fills the containers volumetrically. Therefore, changes in filling temperature and soluble solids content of the product will affect the net weights. It is important that the fillers be kept in proper adjustment in order to obtain a desirable headspace which will have an effect on vacuum, and consequently, retain the quality of the applesauce.

It takes slightly more volume of unsweetened applesauce, compared with sweetened applesauce, to arrive at a given recommended net weight in a No. 10 container.

### **Flavor**

Since canned applesauce is produced from many varieties of apples or blends of varieties, a range in natural flavors and aromas can be expected. Some varieties of apples when used alone will not produce a good flavored applesauce. These varieties, however, may be used to some extent when blended with desirable varieties.

The presence of apple essences, which contribute the "fruity flavor" to applesauce, along with a proper sugar-acid balance is essential for a good flavor. The product must also be free from astringent or bitter flavors generally due to the use of green apples and flavors due to overripe apples, oxidation, fermentation, caramelization, ground or musty flavors, and any other undesirable flavors.

It is expected that unsweetened applesauce will be more tart than the sweetened type. Although a minimum of 9° Brix is specified in the grade standards for both Grade A and B (unsweetened type) the applesauce must be free from astringent or bitter flavors, and must have a good sugar-acid balance. Applesauce made from apples with a relatively high acid content should have a natural sugar content fairly well above the minimum 9° Brix in order to have a good sugar-acid balance for the unsweetened type. Conversely, applesauce that has a low Brix level equal to or approaching the minimum requirement should also have a relatively low acid content, but not so low as to provide for bland flavor, to be considered good flavor.

### SUGGESTED ORDER OF GRADING A SAMPLE UNIT

#### Regular (or Comminuted) Style

1. **Mix** contents of container(s) thoroughly after taking the net weight, vacuum, and headspace. The applesauce should be as close to room temperature as possible (68-72°F; 20-22°C). Do not check consistency when the product temperature is over 80°F. In taking vacuum, warm product will register lower vacuum than cold product.

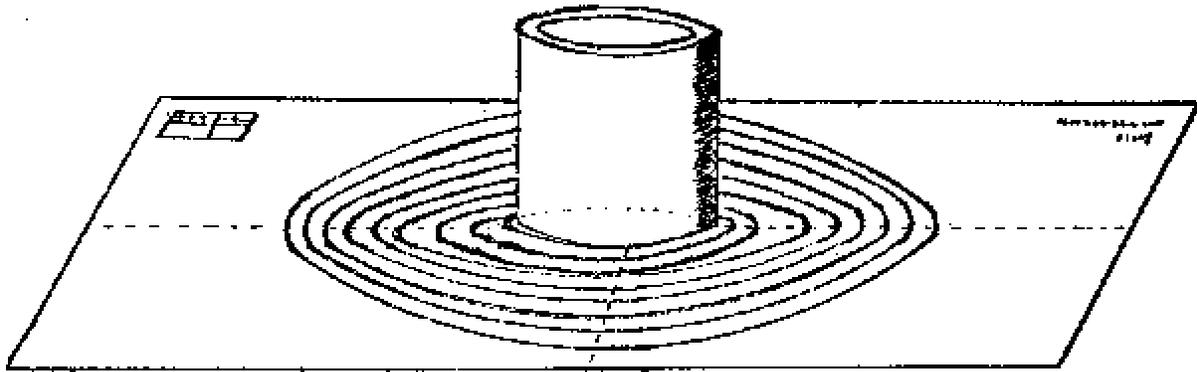


Figure 1 USDA Flow Sheet No. 1 & Cylinder

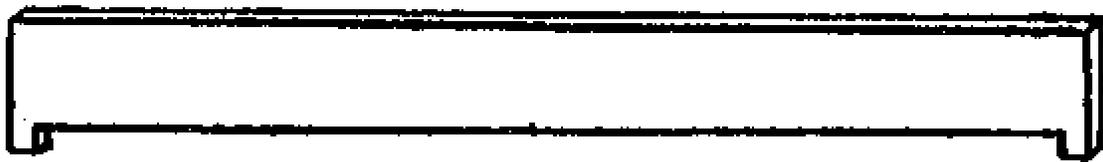


Figure 2 Notched scraper

## SUGGESTED ORDER OF GRADING A SAMPLE UNIT

### Regular (or Comminuted) Style - Continuation

2. **Place** the clean, dry cylinder directly over the center of the USDA flow sheet on a flat surface under approved lighting conditions, **aligning** the inside diameter of the cylinder with the center circle.
3. **Transfer** the well-mixed sample to the cylinder so the applesauce will fill the cylinder **level full**.
4. Optionally, in the case of No. 10 containers, first transfer a well-mixed sample to a 600 mL beaker or other suitable container (No. 303 or No. 2-1/2 can) sufficient to fill the beaker or container before transferring the applesauce to the cylinder as previously described in step 3 of this procedure.
5. **Remove** any excess applesauce with a spatula or other suitable instrument leveling off the top.

**NOTE: Do not remove any free liquid that accumulates around the bottom of the cylinder.**

6. With a smooth even motion, **lift** the cylinder straight up, allowing the applesauce to spread freely; let stand for one minute, then **take** reading immediately.
7. While timing for consistency, **evaluate** color. This must be done immediately as applesauce tends to oxidize rapidly. Color can be evaluated while the applesauce is still in a mound. The grade standards provide for three color types: natural, spice flavored, and artificially colored. Consideration must be given to the specific color type of the product when evaluating the factor of color. Also, be alert for abnormal color brought on by "stack burn" (pinkish or brown discoloration) and "detinning" (gray or dull).

### **Grade A:**

- a. **Natural** - the canned applesauce is bright, practically uniform, typical of the variety or blend of varieties used, with no discoloration due to oxidation or scorching.

## SUGGESTED ORDER OF GRADING A SAMPLE UNIT

### Regular (or Comminuted) Style - Continuation

- b. Spice flavored** - the canned applesauce has characteristic color imparted by the particular spice or blend of spices used.
- c. Artificially colored** - the color is bright and distinct.

Canned applesauce that falls into the Grade A classification maybe assigned a score of 18 to 20 points.

### Grade B:

- a. Natural** - the canned applesauce is dull, reasonably uniform, typical of the variety or varieties used; slightly brown, slightly pink, or slightly grey.
- b. Spice flavored** - the color imparted by added spice may be slightly affected by pink or grey color, but is not off color.
- c. Artificially colored** - the color is reasonably bright and distinct.

Canned applesauce that falls into the Grade B classification maybe assigned a score of 16 or 17 points and should not be graded above U.S. Grade B regardless of the total score for the product.

- 8. **Determine** the consistency (extent of flow) by **averaging** the readings taken at the four quadrants of the flow sheet. (Readings are taken at the edge of the applesauce exclusive of any free liquid).
- 9. **Determine** the amount of free liquid, if any, by **measuring** the liquid from the edge of the applesauce at the four quadrants and **averaging** these measurements.

**Grade A** The applesauce has good consistency. Good consistency means the product does not flow more than 6.5 cm (2.5 in); and there is not more than 0.7 cm (0.3 in) free liquid present. Canned applesauce that has a good consistency may be assigned a score of 18 to 20 points.

## SUGGESTED ORDER OF GRADING A SAMPLE UNIT

### Regular (or Comminuted) Style - Continuation

**Grade B** The applesauce has reasonably good consistency. Reasonably good consistency means the product does not flow more than 8.5 cm (3.3 in); and there is not more than 1 cm (0.4 in) free liquid present. Canned applesauce that has a reasonably good consistency may be assigned a score of 16 or 17 points and should not be graded higher than U.S. Grade B regardless of the total score for the product.

10. With the aid of the spreader, **spread** the sample unit of applesauce (used for evaluating consistency) over the flow sheet in an even layer, holding the spreader in a vertical position to maintain the even maximum depth allowed by the spreader.

With a pair of tweezers or other suitable instrument, **pick out** all scoreable defects from the sample unit. **Remove** any excess apple particles from the scoreable defects and **place** these defects on the measurement chart in the corner of the flow sheet. **Pick out** all **noticeable** specks that may be beneath the surface of the applesauce to determine whether they are scoreable. If any defect is not readily noticeable from a distance of approximately 18 inches then it is not scoreable. **Count** the dark stamens that may be present in the sample unit.

**Grade A** Not more than 3 dark stamens; not more than 0.5 cm<sup>2</sup> (0.08 in<sup>2</sup>) of seed particles, peel, discolored apple particles, and carpel tissue but not more than 0.25 cm<sup>2</sup> (0.04 in<sup>2</sup>) of medium and dark colored particles. Canned applesauce that falls into this classification may be assigned a score of 18 to 20 points.

## SUGGESTED ORDER OF GRADING A SAMPLE UNIT

### Regular (or Comminuted) Style - Continuation

- Grade B** Not more than 5 dark stamens; not more than 1.0 cm<sup>2</sup> (0.16 in<sup>2</sup>) of seed particles, peel, discolored apple particles, and carpel tissue but not more than 0.5 cm<sup>2</sup> (0.08 in<sup>2</sup>) of medium and dark colored particles. Canned applesauce that falls into this classification may be assigned a score of 16 or 17 points and should not be graded above U.S. Grade B regardless of the total score for the product.
11. **Evaluate** the "finish" of the canned applesauce. "Finish" refers to the texture and tenderness of the apple particles; the evenness of the division of apple particles in regular (or comminuted) style. This factor is influenced by the apple varieties, maturity of the apple, the cook time and temperature, and the size of the screen openings of the finishers. The "finish" is called "salvy" or "pasty" when the granular structure of the sauce has been destroyed.
- Grade A** The apple particles are evenly divided, not lumpy, pasty, or salvy. Canned applesauce that falls into this classification may be assigned a score of 18 to 20 points.
- Grade B** The apple particles are evenly divided, slightly salvy or pasty. Canned applesauce that falls into this classification may be assigned a score of 16 or 17 points and should not be graded above U.S. Grade B regardless of the total score for the product.
12. **Evaluate** the flavor. A proper combination of various apple characteristics is essential to a high quality applesauce flavor. Specifically these are:
- a. A good sugar-acid balance; and
  - b. Apple essences which provides the "fruity flavor," bouquet and aroma.

## SUGGESTED ORDER OF GRADING A SAMPLE UNIT

Regular (or Comminuted) Style - Continuation

**Grade A** The canned applesauce has good distinct apple flavor and sugar-acid balance. For the **unsweetened** type, the product may be slightly tart or slightly bland and free from astringent flavor. For the **sweetened** type, the product may be slightly tart to sweet and free from astringent flavor. For the **spice flavored** type, the product has a flavor that is distinct and characteristic of the added spice(s) or flavoring(s) but not strong. Canned applesauce that falls into this classification may be assigned a score of 18 to 20 points.

**Grade B** The canned applesauce has reasonably good distinct apple flavor and sugar-acid balance. For the **unsweetened** type, the product may be moderately tart, may be bland and with slightly astringent flavor. For the **sweetened** type, the product may be tart, not excessively sweet, slightly astringent. For the **spice** flavored type, the flavor derived from added flavoring(s) or spice(s) may be slightly weak or strong but not objectionable. Canned applesauce that falls into this classification may be assigned a score of 16 or 17 points and should not be graded above U.S. Grade B regardless of the total score for the product.

**NOTE:** The Brix measurement is an analytical requirement. Minimum brix for unsweetened type in Grades A and B is 9.0°. Minimum Brix for sweetened type in Grade A is 15.5° and 14.5° in Grade B.

SUGGESTED ORDER OF GRADING A SAMPLE UNIT

Chunk (or Chunky) Style

1. **Mix** contents of container(s) thoroughly after taking the net weight, vacuum, and headspace. The applesauce should be as close to room temperature as possible (68-72°F; 20-22°C). Do not check consistency when the product temperature is over 80°F. In taking vacuum, warm product will register lower vacuum than cold product.

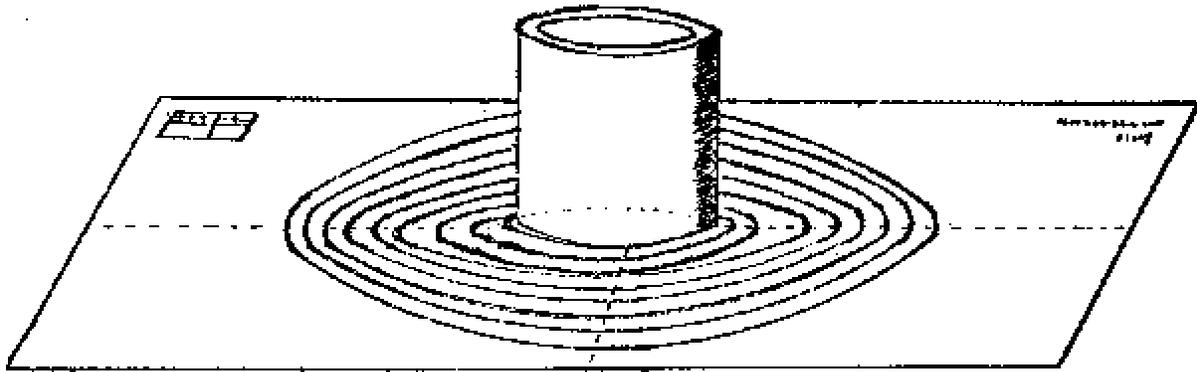


Figure 3 USDA Flow Sheet No. 1 & Cylinder

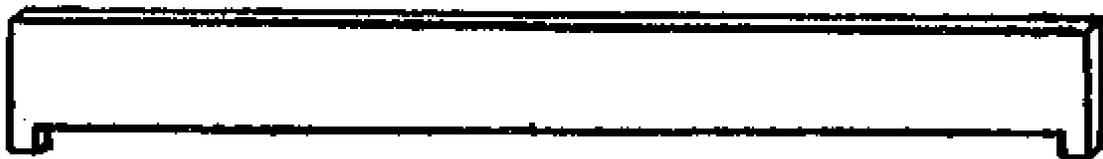


Figure 4 Notched scraper

## SUGGESTED ORDER OF GRADING A SAMPLE UNIT

### Chunk (or Chunky) Style - Continuation

2. **Place** the clean, dry cylinder directly over the center of the USDA flow sheet on a flat surface under approved lighting conditions, **aligning** the inside diameter of the cylinder with the center circle.
3. **Transfer** the well-mixed sample to the cylinder so the applesauce will fill the cylinder **level full**.
4. Optionally, in the case of No. 10 containers, first **transfer** a well-mixed sample to a 600 mL beaker or other suitable container (No. 303 or No. 2-1/2 can) sufficient to fill the beaker or container before transferring the applesauce to the cylinder as previously described in step 3 of this procedure.
5. **Remove** any excess applesauce with a spatula or other suitable instrument leveling off the top.

**NOTE: Do not remove any free liquid that accumulates around the bottom of the cylinder.**

6. With a smooth even motion, **lift** the cylinder straight up, allowing the applesauce to spread freely; let stand for one minute, then take reading immediately.
7. While timing for consistency, **evaluate** color. This must be done immediately as applesauce tends to oxidize rapidly. Color can be evaluated while the applesauce is still in a mound. The grade standards provide for three color types: natural, spice flavored, and artificially colored. Consideration must be given to the specific color type of the product when evaluating the factor of color. Also, be alert for abnormal color brought on by "stack burn" (pinkish or brown discoloration) and "detinning" (gray or dull).

### **Grade A:**

- a. **Natural** - the canned applesauce is bright, practically uniform, typical of the variety or blend of varieties used, with no discoloration due to oxidation or scorching.

## SUGGESTED ORDER OF GRADING A SAMPLE UNIT

### Chunk (or Chunky) Style - Continuation

- b. Spice flavored** - the canned applesauce has characteristic color imparted by the particular spice or blend of spices used.
- c. Artificially colored** - the color is bright and distinct.

Canned applesauce that falls into the Grade A classification maybe assigned a score of 18 to 20 points.

### Grade B:

- a. Natural** - the canned applesauce is dull, reasonably uniform, typical of the variety or varieties used; slightly brown, slightly pink, or slightly grey.
- b. Spice flavored** - the color imparted by added spice may be slightly affected by pink or grey color, but is not off color.
- c. Artificially colored** - the color is reasonably bright and distinct.

Canned applesauce that falls into the Grade B classification maybe assigned a score of 16 or 17 points and should not be graded above U.S. Grade B regardless of the total score for the product.

- 8. **Determine** the consistency (extent of flow) by **averaging** the readings taken at the four quadrants of the flow sheet. (Readings are taken at the edge of the applesauce exclusive of any free liquid).
- 9. **Determine** the amount of free liquid, if any, by **measuring** the liquid from the edge of the applesauce at the four quadrants and **averaging** these measurements.

**Grade A** The applesauce has good consistency. Good consistency means the product does not flow more than 7.5 cm (2.95 in); and there is not more a slight amount of free liquid present. Canned applesauce that has a good consistency may be assigned a score of 18 to 20 points.

## SUGGESTED ORDER OF GRADING A SAMPLE UNIT

### Chunk (or Chunky) Style - Continuation

**Grade B** The applesauce has reasonably good consistency. Reasonably good consistency means the product does not flow more than 9.5 cm (3.75 in); and there is not more than a moderate amount of free liquid present. Canned applesauce that has a reasonably good consistency may be assigned a score of 16 or 17 points and should not be graded higher than U.S. Grade B regardless of the total score for the product.

10. With the aid of the spreader, **spread** the sample unit of applesauce (used for evaluating consistency) over the flow sheet in a even layer, holding the spreader in a vertical position to maintain the even maximum depth allowed by the spreader.

With a pair of tweezers or other suitable instrument, **pick out** all scoreable defects from the sample unit. **Remove** any excess apple particles from the scoreable defects and **place** these defects on the measurement chart in the corner of the flow sheet. **Pick out** all **noticeable** specks that may be beneath the surface of the applesauce to determine whether they are scoreable. If any defect is not readily noticeable from a distance of approximately 18 inches then it is not scoreable. **Count** the dark stamens that may be present in the sample unit.

**Grade A** Not more than 3 dark stamens; not more than 0.5 cm<sup>2</sup> (0.08 in<sup>2</sup>) of seed particles, peel, discolored apple particles, and carpel tissue but not more than 0.25 cm<sup>2</sup> (0.04 in<sup>2</sup>) of medium and dark colored particles. Canned applesauce that falls into this classification may be assigned a score of 18 to 20 points.

**Grade B** Not more than 5 dark stamens; not more than 1.0 cm<sup>2</sup> (0.16 in<sup>2</sup>) of seed particles, peel, discolored apple particles, and carpel tissue but not more than 0.5 cm<sup>2</sup> (0.08 in<sup>2</sup>) of medium and dark colored particles. Canned applesauce that falls into this classification may be assigned a score of 16 or 17 points and should not be graded above U.S. Grade B regardless of the total score for the product.

## SUGGESTED ORDER OF GRADING A SAMPLE UNIT

### Chunk (or Chunky) Style - Continuation

11. **Evaluate** the "finish" of the canned applesauce. "Finish" refers to the texture and tenderness of the apple particles; the proportion of chunks or pieces of apples in relation to fine apple particles in chunk (or chunky) style. This factor is influenced by the apple varieties, maturity of the apple, the cook time and temperature, and the size of the screen openings of the finishers.

**Grade A** There is a high proportion of apple chunks. Any fine apple particles present do not more than moderately affect the appearance or eating quality of the product. Canned applesauce that falls into this classification may be assigned a score of 18 to 20 points.

**Grade B** There is a fairly high proportion of apple chunks. Any fine apple particles present do not seriously affect the appearance or eating quality of the product. Canned applesauce that falls into this classification may be assigned a score of 16 or 17 points and should not be graded above U.S. grade B regardless of the total score for the product.

12. **Evaluate** the flavor. A proper combination of various apple characteristics is essential to a high quality applesauce flavor. Specifically these are:

- a. A good sugar-acid balance; and
- b. Apple essences which provides the "fruity flavor," bouquet and aroma.

**Grade A** The canned applesauce has good distinct apple flavor and sugar-acid balance. For the **unsweetened** type, the product may be slightly tart or slightly bland and free from astringent flavor. For the **sweetened** type, the product may be slightly tart to sweet and free from astringent flavor. For the **spice** flavored type, the product has a flavor that is distinct and characteristic of the added spice(s) or flavoring(s) but not strong. Canned applesauce that falls into this classification may be assigned a score of 18 to 20 points.

SUGGESTED ORDER OF GRADING A SAMPLE UNIT

Chunk (or Chunky) Style - Continuation

**Grade B** The canned applesauce has reasonably good distinct apple flavor and sugar-acid balance. For the **unsweetened** type, the product may be moderately tart, may be bland and with a slightly astringent flavor. For the **sweetened** type, the product may be tart, not excessively sweet, slightly astringent. For the **spice flavored** type, the flavor derived from added flavoring(s) or spice(s) may be slightly weak or strong but not objectionable. Canned applesauce that falls into this classification may be assigned a score of 16 or 17 points and should not be graded above U.S. grade B regardless of the total score of the product.

**NOTE:** The Brix measurement is an analytical requirement. Minimum Brix for unsweetened type in Grades A and B is 9.0°. Minimum Brix for sweetened type in Grade A is 15.5° and 14.5° in Grade B.