



United States
Department of
Agriculture

Agricultural
Marketing
Service

Fruit and
Vegetable
Division

Processed
Products
Branch

Canned Tomatoes

(Including Stewed Tomatoes)

Grading Manual

This manual is designed for Processed Products Branch personnel of the U.S. Department of Agriculture. Its purpose is to give supplementary 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	Regulations (109-A-1) Sampling Procedures (120-A-1) Time Sampling (120-A-4) In-Plant Inspection (160-A-1; 160-A-5) Condition of Container (125-A-1) Foreign Material (172-A-1) Good Manufacturing Practices (159-A-2)
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(Drained Weight) 128-A-30

NONQUALITY PROCEDURES

Follow	General Instructions (130-A-1)
	Vacuum (128-A-20)
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	Inspection by Variables (140-A-1)

PRODUCT DESCRIPTION AND STYLES

Canned tomatoes are graded according to the products and styles for which they are offered and it is the responsibility of the inspector to assign the appropriate product and style to the lot. Canned tomatoes and canned stewed tomatoes are included under the FDA Standard of Identity for Canned Tomatoes (21 CFR 155.190). They may be packed in tomato juice, tomato puree, or tomato paste. The styles of canned tomatoes include whole, halves, wedges, sliced, and diced styles. Although the U.S. standards for grades of canned tomatoes provide for grades of canned tomatoes which are less than 80% by weight "whole or almost whole" there are special FDA requirements for labels for "whole canned tomatoes" (21 CFR 155.190). Tomato products such as "crushed" and "concentrated crushed canned tomatoes" are not considered a style of canned tomatoes under the current grade standards.

DRAINED WEIGHT

Drained weight is a prerequisite quality factor for canned tomatoes. Historically, canned tomatoes have been marketed, in part, based on the weight of the tomato units after the packing medium has been drained and drained weight continues to be an important factor in determining quality for canned tomatoes. There are two minimum average drained weight levels - one requirement level for U.S. Grades A and B , and one requirement level for U.S. Grade C. There is also a FDA minimum drained weight requirement for quality in the Standard of Identity for Canned Tomatoes (which is 50 percent of the water capacity of the container).

The method for determining drained weights for canned tomatoes is the same as described in the Standards of Identity except for the use of the U.S. Standard Number 8 circular sieve for the specific styles of "sliced" and "diced". USDA approves of the use of the U.S. Standard Number 8 circular sieve for these styles since these styles expose more internal tissue (placenta) that is likely to drain through a larger sieve size. The use of the Number 8 sieve provides drained weights that are more representative for these two styles. The Number 2 circular sieve shall be used for all other styles.

FLAVOR AND ODOR

Flavor and odor is a prerequisite quality factor and is classified as being either "normal" or "off." Special considerations apply for canned tomatoes that contain vegetable ingredients and spices, low sodium, "no salt," and other special packs. Canned stewed tomatoes are expected to have a different flavor and odor due to the added garnishes. An excessive amount of these ingredients may overpower the flavor and odor of the stewed tomatoes and may not meet the "normal" flavor expected for canned stewed tomatoes. Special dietary packs that are low in sodium or contain no added salt should be considered "normal" for that type of pack. Good judgement is required when evaluating flavor. When checking flavor and odor, the grader should sample the packing media (juice, puree, or paste) as well as selected tomato units.

Some of the off-flavors to be aware of in canned tomatoes are rancid and flat-sour off-flavors. There is a tolerance or deviant rate for off-flavor. Sample units that have an off-flavor or odor are given a Substandard grade. If the off-flavor is due to excessive salt, no salt, flat-sour, or other condition that does not render this product inedible, consider the sample unit a quality deviant in a Grade C lot and a worse-than-a-deviant in a Grade A or B lot.

FLAVOR AND ODOR (Continued)

These worse-than-a-deviant sample units are allowed on an "infrequent" basis (1 in 48 containers) as outlined in File Code 165-A-27. "Inedible" worse-than-a-deviant sample units are allowed only on an "accidental" basis (1 in 150 containers).

CHARACTER AND WHOLENESS

Character is a scoreable quality factor in all styles of canned tomatoes. It describes the level of quality of the tomato units based on the firmness and resilience of the tomato units to retain shape. Normally, firmness and good character are indicated by the tendency of the units to retain their shape. The tomato tissue resists slight applied pressure when handled.

Wholeness is a scoreable quality factor in "whole style" only. It refers to the level of quality for wholeness in whole tomatoes based on the definitions in the U.S. grade standards. Often the quality factors of wholeness and character are of the same quality level and are interrelated. However, whole tomatoes may have differing levels of quality when grading by the definitions and guidelines for these two quality factors.

Special consideration must be given for "character" in "no salt" canned tomatoes. This special dietetic pack is not subject to the interpretations normally applied to canned tomatoes. "Low sodium" canned tomatoes are expected to comply with the requirements.

Canned Tomatoes
April 1990

SUGGESTED ORDER OF GRADING A SAMPLE UNIT

WHOLE STYLE

Cans of tomatoes should be handled as carefully as possible because rough handling affects such quality factors as "wholeness," "character," and "drained weight." Preliminary steps include recording the codes, labels, net weights, vacuum, head space, etc. for the containers. Tare the screen to be used to determine the drained weights.

The diameter of the sieve used is 20.3 centimeters (8 inches) if the quantity of the contents of the container is less than 1.4 kilograms (3 pounds) or 30.5 centimeters (12 inches) if such quantity is 1.4 kilograms or more. The meshes of such sieve are made by so weaving wire of 1.4 mm (0.054 inch) diameter as to form square openings 11.3 mm by 11.3 mm (0.446 inch by 0.446 inch).

1. After completing the preliminary steps, carefully **empty** the contents onto a tilted screen of the proper mesh (U.S. No. 2) and diameter. **Examine** the interior lining of the empty can and **record** the overall condition of the container.
2. **Determine** the drained weight of the sample unit using the following method:
 - a. The tomatoes should be drained for precisely two (2) minutes. The tomatoes should not be moved or disturbed; **exception**, for stewed tomatoes, carefully **rotate** the inclined screen 180 degrees after the product has drained for one minute and **allow** to drain for an additional minute. Two minutes from the time drainage begins, weigh the sieve and drained tomatoes.
 - b. **Record** the drained weight to the nearest 1/10th (0.1) ounce on the score sheet. The weight so found, less the weight of the dry sieve, shall be considered to be the drained weight. **Check** the drained weight observed by comparing the weight to the minimum drained weight average for a lot. **Apply** the criteria for individual containers described in the U.S. grade standards for drained weight. If the weight is low, **circle** the weight on the score sheet and **notify** the plant representative, if applicable (moving lot).
 - c. For tomatoes packed in paste or puree, **remove** the packing media carefully prior to grading for quality.

WHOLE STYLE (Continued)

3. As the tomatoes are draining and immediately thereafter, **evaluate** the tomatoes for "wholeness" applying the definitions for "whole and almost whole" (§ 52.5164) and the tolerances in the U.S. grade standards (Table III). **Record** the score points for "wholeness" on the score sheet.
 - a. **WHOLENESS DEFINITIONS:**
Whole, almost whole;

The contour is not affected; OR
Units may be cracked or split but not to the extent that there is material loss of seeds or placenta; AND
Units restore to approximate original shape during handling
 - b. Percentage allowed for each Grade (by weight):

Grade A = 80% Whole or almost whole
Grade B = 70% Whole or almost whole
Grade C = Less than 70% Whole or almost whole
(Substandard is not applicable)
4. Having established the score for wholeness, **examine** the units applying the criteria for "character" which include the definitions for "character" in the U.S. grade standards, the tolerances in Table III), and the following guide:
 - a. **Examine** for excessively soft units. Excessively soft units **MAY** disintegrate upon handling **AND** have signs of sloughing or erosion of the outer surface tissue. In addition, upon handling, excessively soft units yield readily to slight pressure and surface tension is insufficient for retention of the unit's shape.
 - b. **Record** the score for character on the score sheet.
 - c. **CHARACTER DEFINITIONS:**
Character/Excessively soft;

Units may disintegrate upon handling; AND
Units have signs of sloughing (tissue erosion) or ragged edges;
AND
Units yield readily to slight pressure (unable to retain shape).

WHOLE STYLE (Continued)

- d. Percentage of units in the container allowed for each Grade (by count):

Grade A= 15% excessively soft 1/
Grade B= 25% excessively soft
Grade C= More than 25% excessively soft.

Normal firmness and good character in canned tomatoes are determined by handling. The tendency to retain shape and surface tension is evident in the tomato units when they are handled. The tomato tissue resists applied pressure (slight) when handled. Special consideration must be given for "character" in "no salt" canned tomatoes. This special dietetic pack is subject to the interpretations outlined above, allowing for the effect caused by the absence of salt. "Low sodium" canned tomatoes are expected to meet the requirements as well.

5. **Determine** the color of the surface area of the tomato units using the officially approved plastic color comparator for "USDA Tomato Red;" the acceptable minimum percentages for tomato red, yellow, and green in the U.S. grade standards (Table III); and the procedure to determine "Minimum Red" for canned tomatoes (if applicable).
- a. The use of proper light in evaluating color is essential. Improper or insufficient light may cause the color to vary sufficiently to change the grade. A northern exposure, avoiding direct sunlight is preferable, but the equivalent of clear daylight or good artificial daylight is acceptable. Properly installed lights designed to provide a color and spectral quality of illumination equivalent to daylight from a moderately overcast north sky at around 7500 degrees Kelvin is recommended. Macbeth Examolites are examples of proper light fixtures for use in color determinations.
- b. The USDA Tomato Red color comparator should be used to compare the redness of the tomato units' surface area.

1/ Or one unit in containers with less than eight tomatoes.

WHOLE STYLE (Continued)

HELPFUL HINT:It is helpful to visualize the whole tomato unit as a sphere that has been quartered (top view), then halved (side view) into eight equally sized sections. As you visually combine the yellow surface areas from the total surface area, imagine aggregating all the yellow color on one of the equally sized sections. Five (5) percent yellow color would represent about 4/10ths of the surface area of one section (or a little less than 1/2 of the section). If other whole tomato units have little or no yellow color, the overall average of yellow color in the sample unit is lowered proportionally. No vivid green color is permitted in Grade A or Grade B.

- c. **"Minimum Red"** for canned tomatoes is the minimum color acceptable for U.S. Grade C. To determine this color in Grade C samples, **segregate** 50 percent by weight of the **least red** tomato units from the drained tomatoes. **Comminute** the segregated portion to a uniform mixture without removing or breaking seeds. **Fill** the mixture into a black container to a depth of at least one (1) inch. **Free** the mixture of air bubbles and skim off all visible seeds from the surface. **Compare** the color of the mixture with the blended color of combinations of the concentric Munsell color discs for Minimum Red for Canned Tomatoes of equivalent diameter, or the color equivalent of such discs as described in § 52.5164 of the U.S. grade standards for canned tomatoes.
6. **Determine** the absence of defects and **record** the score on the score sheet using the definitions in § 52.5164 for "defects," "blemished," "discolored," "extraneous vegetable material (EVM)," "objectionable core material," "peel," Tables II and III of the U.S. grade standards, and the following additional guides:
 - a. Defects specifically mentioned in the U.S. standards are those most commonly found in canned tomatoes. Any other defect which affects appearance or edibility of the product is considered as well.
 - b. Peel is considered a defect whether attached to the tomato units or loose in the sample unit (the exception, of course, would be in canned unpeeled tomatoes). When measuring peel, **spread out** the peel and **measure** the surface area of each piece then **add** the total surface area for peel in the sample unit using Table II in the grade standards.

WHOLE STYLE (Continued)

- c. **Look** for blemished and discolored defects using the same Table as a guide. Blemishes per pound of canned tomatoes, mean an average of one-fourth (1/4) square inch per pound in U.S. Grade C for example. Blemishes include scarred raised scabby tissue, dark tough areas around the core, dark tissue around the blossom ends, and any other well-defined unsightly objectionable areas. Defects or imperfections are discolored portions such as sunburn areas, cloudy spots, and internal browning.
- d. Cloudy spots that are large, whitish, and unsightly or pale yellow are considered a discolored portion. Internal browning (tomato mosaic) is considered discolored if it slightly affects the appearance of the product. Internal browning that materially affects the appearance is scored as "blemished."
- e. **Determine** the amount of objectionable core material. It is core material that has stem scars over one-fourth (1/4) inch in diameter AND has tough or fibrous material associated with the core is considered objectionable. The best way to test is by chewing suspected units. Tomatoes with smaller stem scars may also contain tough and fibrous material and suspected units should be tested by chewing as well. To allow for normal variation in "coreless " tomatoes at least 90% by count of the entire sample shall have tomatoes with little or no objectionable core material. Lots with more than 10% by count of objectionable core material in the entire sample is graded "Substandard." Objectionable core material is further classified as:

Trace - Less than 3% by count
Slight - 3% but less than 7% by count
Moderate - 7% but not more than 10% by count
- f. Extraneous vegetable material (EVM) includes harmless material such as stems, calyx bracts, tomato leaves, internal sprouted seeds, and other material not necessarily related to the tomato plant. EVM is a prerequisite factor and can determine the overall grade for defects. Included in the APPENDIX of this manual are charts to help graders interpret the scoring subsystem for EVM.

WHOLE STYLE (Continued)

One(1) EVM point is allowed in each 100 ounce increment of product for Grade A; **two (2)** EVM points are allowed in Grade B; and **four (4)** EVM points in Grade C. The factors are weighted as follows:

Each 1/16 square inch of flat material (bract, leaf, etc.) equals one (1) EVM point.

Each 1/2 inch in length of tomato vine or other round tomato vegetable material equals four (4) EVM points.

Each stem (with/without) bract equals four (4) EVM points.

Each tomato containing sprouted internal seeds over 5/16ths inch equals one (1) EVM point.

To calculate the number of EVM points allowed in a sample, **divide** the total net weight of the sample representing the lot by 100. This is the number of EVM points allowed for Grade A in the sample. This number multiplied by two (2) is the number of EVM points allowed in Grade B. The number of EVM points allowed in Grade A for this sample multiplied by four (4) is the number of EVM points allowed in Grade C.

Example: 21 sample units comprise a sample of Number 10 cans of whole tomatoes with a total net weight of 2,142 ounces. The total ounces, 2,142 divided by 100 equal 21.42 EVM points allowed in Grade A for stems, sepal bracts, and internal sprouted seeds.

The grader found:	3 stems	(12 points)
	6/16 sq. in. sepals	(6 points)
	3 tomatoes with	
	int. sprouted	
	seeds	<u>(3 points)</u>
		21 points

The sum of this example is less than the 21.42 points allowed for Grade A therefore it meets the EVM lot tolerance for U.S. Grade A for EVM. Several Tables located in the APPENDIX can be used to quickly determine the EVM points allowed in a sample lot.

WHOLE STYLE (Continued)

7. **Evaluate** the prerequisite quality factor of flavor and odor of the canned tomatoes. Grades A, B, and C require "normal" flavor.

A dietetic pack is processed without added salt. No exception should be made for the absence of salt in this type of pack. In dietetic pack, flavor is based on tomato flavor and odor in the absence of salt. Regular pack is expected to contain salt. No salt in regular pack is not "normal"; it is off-flavor. Excessive salt, that is objectionable, is off-flavor for regular pack. The flavor of stewed tomatoes may vary depending on the other vegetables and spices. This is considered "normal" unless the flavor is objectionable.

Off-flavor in regular pack, that **does not render the product inedible** (excessive salt, flat sour, etc.) can be considered a quality deviant in a Grade C lot and "worse-than-a-deviant" in a Grade A or Grade B lot. These "worse-than-a-deviant" sample units are allowed on an "infrequent" basis (1 in 48 containers) as outlined in File Code 165-A-27. Off-flavor **that renders the product inedible** (due to bacteriological spoilage) is considered "worse-than-a-deviant" in Grades A, B, and C. These "worse-than-a-deviant" sample units are allowed on an "accidental" basis (1 in 150 containers).

8. **Total** the score points for the sample unit and **assign** the grade for individual containers. **Continue** to grade the sample units that comprise the lot using the procedure outlined above. **Circle** the quality factors that have caused the sample unit to be down-graded and **notify** the plant representative, if applicable (moving lot).
9. **Perform** other analyses such as mold count, insect infestation, foreign material, and salt determinations as appropriate or required, and **record** the results.
10. **Determine** the grade for drained weight of the lot based on the lot average. **Apply** the rules for meeting the average minimum drained weight requirements in the U.S. grade standards. Based on all the data collected, **determine** lot compliance and **assign** the appropriate grade for the lot.

Canned Tomatoes
June 1990

SUGGESTED ORDER OF GRADING A SAMPLE UNIT

HALVES and WEDGES STYLES

Cans of tomatoes should be handled as carefully as possible because rough handling affects such quality factors as "character" and "drained weight." Preliminary steps include recording the codes, labels, net weights, vacuum, head space, etc. for the containers.

1. After completing the preliminary steps, carefully **empty** the contents on to a tilted screen the proper mesh (U.S. No. 2) and diameter. **Examine** the interior lining of the empty can and **record** the overall condition of the container. **Tare** the screen to be used to determine the drained weights.
2. **Determine** the drained weight of the sample unit using the following method:
 - a. The tomatoes should be drained for precisely two (2) minutes. The tomatoes should not be moved or disturbed; **exception**, for stewed tomatoes, carefully **rotate** the inclined screen 180 degrees after the product has drained for one minute and allow to drain for an additional minute.
 - b. **Record** the drained weight to the nearest 1/10th (0.1) ounce on the score sheet. The weight so found, less the weight of the dry sieve, shall be considered to be the drained weight. **Check** the drained weight observed by comparison to the minimum drained weight average for a lot. **Apply** the criteria for individual containers described in the U.S. grade standards for drained weight. If the weight is low, **circle** the weight on the score sheet and **notify** the plant representative if applicable (moving lot).
 - c. For tomatoes packed in paste or puree, **remove** the packing media carefully prior to grading for quality.
3. As the tomatoes are draining and immediately thereafter, **evaluate** the tomatoes for "character" applying the definitions for "excessively soft" (§52.5164) and the tolerances in the U.S. grade standards (Table III), and the following guide:
 - a. **Examine** for excessively soft units. Excessively soft units **MAY** disintegrate upon handling **AND** have signs of sloughing or erosion of the outer surface tissue. In addition, excessively soft units yield readily to slight pressure and surface tension is insufficient for retention of the unit's shape.

HALVES and WEDGES STYLES (Continued)

b. **Record** the score for character on the score sheet.

c. **CHARACTER DEFINITIONS:**
Character/Excessively soft;

Units may disintegrate upon handling; AND
Units have signs of sloughing (tissue erosion); AND
Units yield readily to slight pressure.

d. Percentage of units allowed for each Grade (by count):

Grade A= 15% excessively soft
Grade B= 25% excessively soft
Grade C= More than 25% excessively soft.
Substandard not applicable

Normal firmness and good character in canned tomatoes are determined by handling. The tendency to retain shape and surface tension is evident in the tomato units when they are handled. The tomato tissue resists applied pressure (slight) when handled. Special consideration must be given for "character" in "no salt" canned tomatoes. This special dietetic pack is subject to the interpretations outlined above, allowing for the effect caused by the absence of salt. "Low sodium" canned tomatoes are expected to meet the requirements as well.

4. **Determine** the color of the outer surface area of the tomato units using the officially approved plastic color comparator for "USDA Tomato Red"; the acceptable minimum percentages for tomato red, yellow, and green in the U.S. grade standards (Table III); and the procedure to determine "Minimum Red" for canned tomatoes (if applicable).

a. The use of proper light in evaluating color is essential. Improper or insufficient light may cause the color to vary sufficiently to change the grade. A northern exposure, avoiding direct sunlight is preferable, but the equivalent of clear daylight or good artificial daylight is acceptable. Properly installed lights designed to provide a color and spectral quality of illumination equivalent to daylight from a moderately overcast north sky at around 7500 degrees Kelvin is recommended. Macbeth Examolites are examples of proper light fixtures for use in color determinations.

HALVES and Wedges STYLES (Continued)

- b. The USDA Tomato Red color comparator should be used to compare the redness of the tomato units' surface area.

HELPFUL HINT: It is helpful to visualize the half or wedge of tomato unit as a portion of a sphere that has been quartered (top view), then halved (side view) into eight equally sized sections. As you visually combine the yellow surface areas from the total surface area, imagine aggregating all the yellow color on one of the equally sized sections. Five (5) percent yellow color would represent about 4/10ths of the surface area of one section (or a little less than 1/2 of the section). If other whole tomato units have little or no yellow color, the overall average of yellow color in the sample unit is lowered proportionally. No vivid green color is permitted in Grade A or Grade B.

- c. **"Minimum Red"** for canned tomatoes is the minimum color acceptable for U.S. Grade C. To determine this color in Grade C samples, **segregate** 50 percent by weight of the least red tomato units from the drained tomatoes. **Comminute** the segregated portion to a uniform mixture without removing or breaking seeds. **Fill** the mixture into a black container to a depth of at least one (1) inch. **Free** the mixture of air bubbles and skim off all visible seeds from the surface. **Compare** the color of the mixture with the blended color of combinations of the concentric Munsell color discs for Minimum Red for Canned Tomatoes of equivalent diameter, or the color equivalent of such discs as described in §52.5164 of the U.S. grade standards for canned tomatoes.

- 5. **Determine** the absence of defects and **record** the score on the score sheet using the definitions in §52.5164 for "defects," "blemished," "discolored," "extraneous vegetable material (EVM)," "objectionable core material," "peel," Tables II and III of the U.S. grade standards, and the following additional guides:

- a. Defects specifically mentioned in the U.S. standards are those most commonly found in canned tomatoes. Any other defect which affects appearance or edibility of the product is considered as well.

HALVES and WEDGES STYLES (Continued)

- b. Peel is considered a defect whether attached to the tomato units or loose in the sample unit (the exception, of course, would be in canned unpeeled tomatoes). When measuring peel, **spread** out the peel and **measure** the surface area of each piece then **add** the total surface area for peel in the sample unit using Table II in the grade standards.
- c. **Look** for blemished and discolored defects using the same Table as a guide. Blemishes per pound of canned tomatoes, mean an average of one-fourth (1/4) square inch per pound in U.S. Grade C for example. Blemishes include scarred raised scabby tissue, dark tough areas around the core, dark tissue around the blossom ends, and any other well-defined unsightly objectionable areas. Defects or imperfections are discolored portions such as sunburn areas, cloudy spots, and internal browning.
- d. Cloudy spots that are large, whitish, and unsightly or pale yellow are considered discolored. Internal browning (tomato mosaic) is considered a discolored portion if it slightly affects the appearance of the product. Internal browning that materially affects the appearance is scored as "blemished."
- e. **Determine** the amount of objectionable core material. It is core material that has stem scars over one-fourth (1/4) inch in diameter AND has tough or fibrous material associated with the core is considered objectionable. The best way to test is by chewing suspected units. Tomatoes with smaller stem scars may also contain tough and fibrous material and suspected units should be tested by chewing as well. To allow for normal variation in "coreless" tomatoes at least 90% by count of the entire sample shall have tomatoes with little or no objectionable core material. Lots with more than 10% by count of objectionable core material in the entire sample is graded "Substandard." Objectionable core material is further classified as:

Trace - Less than 3% by count

Slight - 3% but less than 7% by count

Moderate - 7% but not more than 10% by count

HALVES and WEDGES STYLES (Continued)

- f. Extraneous vegetable material (EVM) includes harmless material such as stems, calyx bracts, tomato leaves, internal sprouted seeds, and other material not necessarily related to the tomato plant. EVM is a prerequisite factor and can determine the overall grade for defects. Included in the APPENDIX of this manual are charts to help graders interpret the scoring subsystem for EVM.

One (1) EVM point is allowed in each 100 ounce increment of product for Grade A; **two (2)** EVM points are allowed in Grade B; and **four (4)** EVM points in Grade C. The factors are weighted as follows:

Each 1/16 square inch of flat material (bract, leaf, etc.) equals one (1) EVM point.

Each 1/2 inch in length of tomato vine or other round tomato vegetable material equals four (4) EVM points.

Each stem (with/without) bract equals four (4) EVM points.

Each sprouted internal seed over 5/16ths inch equals one (1) EVM point.

To calculate the number of EVM points allowed in a sample, **divide** the total net weight of the sample by 100. This is the number of EVM points allowed for Grade A in the sample. This number multiplied by two (2) is the number of EVM points allowed in Grade B. The number of EVM points allowed in Grade A for this sample unit multiplied by four (4) is the number of EVM points allowed in Grade C.

Example: 21 sample units comprise a sample of Number 10 cans of whole tomatoes with a total net weight of 2,142 ounces. The total ounces, 2,142 divided by 100 equal 21.42 EVM points allowed in Grade A for stems, sepal bracts, and internal sprouted seeds.

HALVES and WEDGES STYLES (Continued)

The grader found: 3 stems	(12 points)
6/16 sq. in. sepals	(6 points)
3 int. sprouted	
seeds over 5/16"	(3 points)
	21 points

The sum of this example is less than the 21.42 points allowed for Grade A therefore it meets the EVM lot tolerance for U.S. Grade A for EVM. Several Tables located in the APPENDIX can be used to quickly determine the EVM points allowed in a sample lot.

6. **Evaluate** the prerequisite quality factor of flavor and odor of the canned tomatoes. Grades A, B, and C require "normal" flavor.

A dietetic pack is processed without added salt. No exception should be made for the absence of salt in this type of pack. In dietetic pack, flavor is based on tomato flavor and odor in the absence of salt. Regular pack is expected to contain salt. No salt in regular pack is not "normal"; it is off-flavor. Excessive salt, that is objectionable, is off-flavor for regular pack. The flavor of stewed tomatoes may vary depending on the other vegetables and spices. This is considered "normal" unless the flavor is objectionable.

Off-flavor in regular pack, **that does not render the product inedible** (excessive salt, flat sour, etc.) can be considered a quality deviant in a Grade C lot and "worse-than-a-deviant" in a Grade A or Grade lot. These "worse-than-a-deviant" sample units are allowed on an "infrequent" basis (1 in 48 containers) as outlined in File Code 165-A-27.

Off-flavor **that renders the product inedible** (due to bacteriological spoilage) is considered "worse-than-a-deviant" in Grades A, B, and C. These "worse-than-a-deviant" sample units are allowed on an "accidental" basis (1 in 150 containers).

7. **Total** the score points for the sample unit and **assign** the grade for individual containers. **Continue** to grade the sample units that comprise the lot using the procedure outlined above.
8. **Perform** other analyses such as mold count, insect infestation, foreign material, and salt determinations as appropriate or required, and **record** the results.

HALVES and WEDGES STYLES (Continued)

9. **Determine** the grade for drained weight of the lot based on the lot average. **Apply** the rules for meeting the recommended average minimum drained weight requirements in the U.S. grade standards. Based on all the data collected, **determine** lot compliance and **assign** the appropriate grade for the lot.

Canned Tomatoes
April 1990

SUGGESTED ORDER OF GRADING A SAMPLE UNIT

SLICED and DICED STYLES

Cans of tomatoes should be handled as carefully as possible because rough handling affects such quality factors as "character" and "drained weight." Preliminary steps include recording the codes, labels, net weights, vacuum, head space, etc. for the containers. **Tare** the screen to be used to determine the drained weights.

The drained weight of "sliced" and "diced" canned and stewed tomatoes is determined by using a U.S. Standard No. 8 circular sieve. The diameter of the sieve is 20.3 centimeters (8 inches) if the quantity of the contents of the container is less than 1.4 kilograms (3 pounds) or 30.5 centimeters (12 inches) if such quantity is 1.4 kilograms or more. The sieve contains 8 meshes to the inch [0.0937-inch (2.38 mm), $\pm 3\%$, square openings].

1. After completing the preliminary steps, carefully **empty** the contents on to a tilted screen the proper mesh (U.S. No. 8) and diameter. **Examine** the interior lining if the empty can and **record** the overall condition of the container.
2. **Determine** the drained weight of the sample unit using the following method:
 - a. The tomatoes should be drained for precisely two (2) minutes. The tomatoes should not be moved or disturbed; **exception**, for stewed tomatoes, carefully **rotate** the inclined screen 180 degrees after the product has drained for one minute and **allow** to drain for an additional minute. Two minutes from the time drainage begins, **weigh** the sieve and drained tomatoes.
 - b. **Record** the drained weight to the nearest 1/10th (0.1) ounce on the score sheet. The weight so found, less the weight of the dry sieve, shall be considered to be the drained weight. **Check** the drained weight observed by comparison to the minimum drained weight average for a lot. **Apply** the criteria for individual containers described in the U.S. grade standards for drained weight. If the weight is low, **circle** the weight on the score sheet. **Notify** the plant representative if applicable (moving lot).
 - c. For tomatoes packed in paste or puree, remove the packing media carefully prior to grading for quality.

SLICED and DICED STYLES (Continued)

HELPFUL HINT: If the lot consists of Number 10 cans (or larger) you are permitted to base the quality factors on a subsample of 32 ounces from each container. The thirty-two ounces must be selected randomly.

3. As the tomatoes are draining and immediately thereafter, **evaluate** the tomatoes for "character" applying the definitions for "excessively soft" (§52.5164) and the tolerances in the U.S. grade standards (Table III), and the following additional guide:

a. **Examine** for excessively soft units. Excessively soft units **MAY** disintegrate upon handling **AND** have signs of sloughing or erosion of the outer surface tissue. In addition, excessively soft units yield readily to slight pressure and surface tension is insufficient for retention of the unit's shape.

b. **Record** the score for character on the score sheet.

c. **CHARACTER DEFINITIONS:**
Character/Excessively soft;

Units may disintegrate upon handling; AND
Units have signs of sloughing (tissue erosion) or ragged edges;
AND
Units yield readily to slight pressure (unable to retain shape).

d. Percentage of units in the container allowed for each Grade:

Sliced Style, By count; Diced Style, By weight;

Grade A= 15% excessively soft
Grade B= 25% excessively soft
Grade C= More than 25% excessively soft.
Substandard not applicable

SLICED and DICED STYLES (Continued)

Normal firmness and good character in canned tomatoes are determined by handling. The tendency to retain shape and surface tension is evident in the tomato units when they are handled. The tomato tissue resists applied pressure (slight) when handled. Special consideration must be given for "character" in "no salt" canned tomatoes. This special dietetic pack is subject to the interpretations outlined above, allowing for the effect caused by the absence of salt. "Low sodium" canned tomatoes are expected to meet the requirements as well.

4. **Determine** the color of the **outer surface area only** of the tomato units using the officially approved plastic color comparator for "USDA Tomato Red"; the acceptable minimum percentages for tomato red, yellow, and green in the U.S. grade standards (Table III); and the procedure to determine "Minimum Red" for canned tomatoes (if applicable).
 - a. The use of proper light in evaluating color is essential. Improper or insufficient light may cause the color to vary sufficiently to change the grade. A northern exposure, avoiding direct sunlight is preferable, but the equivalent of clear daylight or good artificial daylight is acceptable. Properly installed lights designed to provide a color and spectral quality of illumination equivalent to daylight from a moderately overcast north sky at around 7500 degrees Kelvin is recommended. Macbeth Examolites are examples of proper light fixtures for use in color determinations.
 - b. The USDA Tomato Red color comparator should be used to compare the redness of the tomato units' surface area.

HELPFUL HINT: It is helpful to segregate a representative and random portion of the units with the surface area clearly visible. Determine the percentages of USDA Tomato red surface area and the percentages for yellow and green. As you visually combine the yellow surface areas, remember no vivid green color is permitted in Grade A or Grade B.

SLICED and DICED STYLES (Continued)

- c. **"Minimum Red"** for canned tomatoes is the minimum color acceptable for U.S. Grade C. To determine this color in Grade C samples, **Segregate** 50 percent by weight of the **least red** tomato units from the drained tomatoes. **Comminute** the segregated portion to a uniform mixture without removing or breaking seeds. **Fill** the mixture into a black container to a depth of at least one (1) inch. **Free** the mixture of air bubbles and skim off all visible seeds from the surface. **Compare** the color of the mixture with the blended color of combinations of the concentric Munsell color discs for Minimum Red for Canned Tomatoes of equivalent diameter, or the color equivalent of such discs as described in §52.5164 of the U.S. grade standards for canned tomatoes.
5. Determine the absence of defects and **record** the score on the score sheet using the definitions in Section 52.5164 for "defects," "blemished," "discolored," "extraneous vegetable material (EVM)," "objectionable core material," "peel," Tables II and III of the U.S. grade standards, and the following additional guides:
 - a. Defects specifically mentioned in the U.S. standards are those most commonly found in canned tomatoes. Any other defect which affects appearance or edibility of the product is considered as well.
 - b. Peel is considered a defect whether attached to the tomato units or loose in the sample unit (the exception, of course, would be in canned unpeeled tomatoes). When measuring peel, **spread** out the peel and **measure** the surface area of each piece then **add** the total surface area for peel in the sample unit using Table II in the grade standards.
 - c. **Look** for blemished and discolored defects using the same Table as a guide. Blemishes per pound of canned tomatoes, mean an average of one-fourth (1/4) square inch per pound in U.S. Grade C for example. Blemishes include scarred raised scabby tissue, dark tough areas around the core, dark tissue around the blossom ends, and any other well-defined unsightly or objectionable areas. Defects or imperfections are discolored portions such as sunburn areas, cloudy spots, and internal browning.

SLICED and DICED STYLES (Continued)

- d. Cloudy spots that are large, whitish, and unsightly or pale yellow are considered discolored. Internal browning (tomato mosaic) is considered a discolored portion if it slightly affects the appearance of the product. Internal browning that materially affects the appearance is scored as "blemished".
- e. **Determine** the amount of objectionable core material. It is core material that has stem scars over one-fourth (1/4) inch in diameter AND has tough or fibrous material associated with the core is considered objectionable. The best way to test is by chewing suspected units. Tomatoes with smaller stem scars may also contain tough and fibrous material and suspected units should be tested by chewing as well. To allow for normal variation in "coreless" tomatoes at least 90% by count of the entire sample shall have tomatoes with little or no objectionable core material.

Lots with more than 10% by count of objectionable core material in the entire sample is graded "Substandard." Objectionable core material is further classified as:

Trace - Less than 3% by count
Slight - 3% but less than 7% by count
Moderate - 7% but not more than 10% by count
- f. Extraneous vegetable material (EVM) includes harmless material such as stems, calyx bracts, tomato leaves, internal sprouted seeds, and other material not necessarily related to the tomato plant. EVM is a prerequisite factor and can determine the overall grade for defects. Included in the APPENDIX of this manual are charts to help graders interpret the scoring subsystem for EVM.

SLICED and DICED STYLES (Continued)

One (1) EVM point is allowed in each 100 ounce increment of product for Grade A; **two (2)** EVM points are allowed in Grade B; and **four (4)** EVM points in Grade C. The factors are weighted as follows:

Each 1/16 square inch of flat material (bract, leaf, etc.) equals one (1) EVM point.

Each 1/2 inch in length of tomato vine or other round tomato vegetable material equals four (4) EVM points.

Each stem (with/without) bract equals four (4) EVM points.

Each sprouted internal seed over 5/16ths inch equals one (1) EVM point.

To calculate the number of EVM points allowed in a sample, **divide** the total net weight of the sample by 100. This is the number of EVM points allowed for Grade A in the sample. This number multiplied by two (2) is the number of EVM points allowed in Grade B. The number of EVM points allowed in Grade A for this sample multiplied by four (4) is the number of EVM points allowed in Grade C.

Example: 21 sample units comprise a sample of Number 10 cans of whole tomatoes with a total net weight of 2,142 ounces. The total ounces, 2,142 divided by 100 equal 21.42 EVM points allowed in Grade A for stems, sepal bracts, and internal sprouted seeds.

The grader found:	3 stems	(12 points)
	6/16 sq. in. sepals	(6 points)
	3 int. sprouted seeds over 5/16"	(3 points)
		21 points

The sum of this example is less than the 21.42 points allowed for Grade A therefore it meets the EVM lot tolerance for U.S. Grade A for EVM. Several Tables located in the APPENDIX can be used to quickly determine the EVM points allowed in a sample lot.

SLICED and DICED STYLES (Continued)

6. **Evaluate** the prerequisite quality factor of flavor and odor of the canned tomatoes. Grades A, B, and C require "normal" flavor.

A dietetic pack is processed without added salt. No exception should be made for the absence of salt in this type of pack. In dietetic pack, flavor is based on tomato flavor and odor in the absence of salt. Regular pack is expected to contain salt. No salt in regular pack is not "normal"; it is off-flavor. Excessive salt would be off-flavor for regular pack. The flavor of stewed tomatoes may vary depending on the other vegetables and spices. This is considered "normal" unless the flavor is objectionable.

Off-flavor in regular pack, **that does not render the product inedible** (excessive salt, flat sour, etc.) can be considered a quality deviant in a Grade C lot and "worse-than-a-deviant" in a Grade A or Grade B lot. These "worse-than-a-deviant" sample units are allowed on an "infrequent" basis (1 in 48 containers) as outlined in File Code 165-A-27.

Off-flavor **that renders the product inedible** (due to bacteriological spoilage) is considered "worse-than-a-deviant" in Grades A, B, and C. These "worse-than-a-deviant" sample units are allowed on an "accidental" basis (1 in 150 containers).

7. **Total** the score points for the sample unit and **assign** the grade for individual containers. **Continue** to grade the sample units that comprise the lot using the procedure outlined above.
8. **Perform** other analyses such as mold count, insect infestation, foreign material, and salt determinations as appropriate or required, and **record** the results.
9. **Determine** the grade for drained weight of the lot based on the lot average. **Apply** the rules for meeting the recommended average minimum drained weight requirements in the U.S. grade standards. Based on all the data collected, **determine** lot compliance and **assign** the appropriate grade for the lot.

Canned Tomatoes
June 1990

Canned Tomatoes
April 1990

APPENDIX

NET CONTENTS FOR CANNED TOMATOES IN OUNCES (APPROXIMATE)

Number of
containers:

	8oz	300	303	#2	#2 1/2	#10
1	8.3	14.5	16.0	20.5	28.0	102.0
2	16.5	29.0	32.0	41.0	56.0	204.0
3	24.8	43.5	48.0	61.5	84.0	306.0
4	33.0	58.0	64.0	82.0	112.0	408.0
3	24.8	43.5	48.0	61.5	84.0	306.0
4	33.0	58.0	64.0	82.0	112.0	408.0
5	41.5	72.5	80.0	102.5	140.0	510.0
6	49.5	87.0	96.0	123.0	168.0	612.0
7	57.8	101.5	112.0	143.5	196.0	714.0
8	66.0	116.0	128.0	164.0	224.0	816.0
9	74.3	130.5	144.0	184.5	252.0	918.0
10	82.5	145.0	160.0	205.0	280.0	1,020.0
11	90.8	159.5	176.0	225.5	308.0	1,122.0
12	99.0	174.0	192.0	246.0	336.0	1,224.0
13	107.3	188.5	208.0	266.5	364.0	1,326.0
14	115.5	203.0	224.0	287.0	392.0	1,428.0
15	123.8	217.5	240.0	307.5	420.0	1,530.0
16	132.0	232.0	256.0	328.0	448.0	1,632.0
17	140.3	246.5	272.0	348.5	476.0	1,734.0
18	148.5	261.0	288.0	369.0	504.0	1,836.0
19	156.8	275.5	304.0	389.5	532.0	1,938.0
20	165.0	290.0	320.0	410.0	560.0	2,040.0
21	173.3	304.5	336.0	430.5	588.0	2,142.0
22	181.5	319.0	352.0	451.0	616.0	2,244.0
23	189.8	333.5	368.0	471.5	644.0	2,346.0
24	198.0	348.0	384.0	492.0	672.0	2,448.0
25	206.3	362.5	400.0	512.5	700.0	2,550.0
26	214.5	377.0	416.0	533.0	728.0	2,652.0
27	222.8	391.5	432.0	553.5	756.0	2,754.0
28	231.0	406.0	448.0	574.0	784.0	2,856.0
29	239.3	420.5	464.0	594.5	812.0	2,958.0

NUMBER OF STEMS ALLOWED IN U.S. GRADE A (EA 1.0 Stem = 4 points)

Number of
containers:

	8oz	300	303	#2	#2 1/2	#10
1	0.02	0.04	0.04	0.05	0.07	0.2
2	0.04	0.07	0.08	0.1	0.1	0.5
3	0.06	0.1	0.1	0.1	0.2	0.7
4	0.08	0.1	0.1	0.2	0.2	1.0
5	0.1	0.1	0.2	0.2	0.3	1.2
6	0.1	0.2	0.2	0.3	0.4	1.5
7	0.1	0.2	0.2	0.3	0.5	1.8
8	0.1	0.3	0.3	0.4	0.5	2.0
9	0.2	0.3	0.3	0.4	0.6	2.3
10	0.2	0.3	0.4	0.5	0.7	2.5
11	0.2	0.4	0.4	0.5	0.7	2.8
12	0.2	0.4	0.4	0.6	0.8	3.0
13	0.2	0.4	0.5	0.6	0.9	3.3
14	0.3	0.5	0.5	0.7	1.0	3.5
15	0.3	0.5	0.6	0.7	1.0	3.8
16	0.3	0.5	0.6	0.8	1.1	4.0
17	0.3	0.6	0.6	0.8	1.2	4.3
18	0.3	0.6	0.7	0.9	1.2	4.6
19	0.3	0.7	0.7	0.9	1.3	4.8
20	0.4	0.7	0.8	1.0	1.4	5.1
21	0.4	0.7	0.8	1.0	1.4	5.3
22	0.4	0.8	0.8	1.1	1.5	5.6
23	0.4	0.8	0.9	1.1	1.6	5.8
24	0.5	0.8	0.9	1.2	1.6	6.1
25	0.5	0.9	1.0	1.2	1.7	6.3
26	0.5	0.9	1.0	1.3	1.8	6.6
27	0.5	1.0	1.1	1.4	1.9	6.9
28	0.5	1.0	1.1	1.4	1.9	7.1
29	0.6	1.0	1.1	1.5	2.0	7.4

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NUMBER OF 1/16 IN INCREMENT SEPALS ALLOWED IN GRADE A (EA 1/16"= 1 pt.)

Number of
containers:

(In the absence of any stems)

	8oz	300	303	#2	#2 1/2	#10
1						1.0
2						2.0
3						3.0
4					1.0	4.0
5				1.0	1.0	5.0
6			1.0	1.0	1.0	6.0
7		1.0	1.0	1.0	2.0	7.0
8		1.0	1.0	1.0	2.0	8.0
9		1.0	1.0	1.0	3.0	9.0
10		1.0	1.0	2.0	3.0	10.0
11	1.0	1.0	1.0	2.0	3.0	11.0
12	1.0	1.0	2.0	2.0	3.0	12.0
13	1.0	2.0	2.0	3.0	3.0	13.0
14	1.0	2.0	2.0	3.0	4.0	14.0
15	1.0	2.0	3.0	3.0	4.0	15.0
16	1.0	2.0	3.0	3.0	4.0	16.0
17	1.0	3.0	3.0	3.0	4.0	17.0
18	1.0	3.0	3.0	3.0	5.0	18.0
19	1.0	3.0	3.0	4.0	5.0	19.0
20	1.0	3.0	3.0	4.0	5.0	20.0
21	1.0	3.0	3.0	4.0	6.0	21.0
22	1.0	3.0	3.0	4.0	6.0	22.0
23	2.0	3.0	3.0	4.0	6.0	23.0
24	2.0	3.0	3.0	5.0	6.0	24.0
25	2.0	3.0	4.0	5.0	7.0	25.0
26	2.0	3.0	4.0	5.0	7.0	26.0
27	2.0	4.0	4.0	5.0	7.0	27.0
28	3.0	4.0	4.0	6.0	8.0	28.0
29	3.0	4.0	4.0	6.0	8.0	29.0

TO CALCULATE EVM POINTS:

To use these tables, **add** the points for sepal bracts, stems (including stems with bracts attached), and sprouted internal seeds (if applicable); then **look up** the total net weight in ounces for the lot. Divide total net weight by 100 to determine number of total points allowed in Grade A.

Compare the total number of points found in sample units with the total allowed. If the number found is less than the number allowed, the lot is Grade A for EVM. You must also consider the requirements for blemishes, peel, objectionable core material, and other related defects before you can give a grade for defects.

To determine the total amount of points allowed for U.S. Grades B and C, **use** the following:

U.S. Grade B : Multiply the number of points permitted for the lot in Grade A by 2.

U.S. Grade C : Multiply the number of points permitted for the lot in Grade A by 4.