INSTRUCTIONS FOR INSPECTION

of

CANNED MUSHROOMS

For Use of USDA Processed Foods Inspectors

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
FRUIT AND VEGETABLE DIVISION
PROCESSED PRODUCTS STANDARDIZATION AND INSPECTION BRANCH

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service
Fruit and Vegetable Division
Processed Products Branch

BRANCH NOTICE NO. 2651
February 1995

SUBJECT: **Instructions for Inspection of Canned Mushrooms, Corrected Pages**

TO: All Inspectors

Please remove from the Instructions for Inspection of Canned Mushrooms pages i, ii, iii, 7, 8, 31 and 32, replace them with the attached pages i, ii, 7, 8, 31, and 32 dated February 1995.

These pages have been changed to address the use of citric acid as a packing medium in canned mushrooms.

THIS BRANCH NOTICE MAY BE DISCARDED AFTER IT HAS SERVED ITS PURPOSE.

James R. Rodeheaver

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Branch Chief

Distribution:D
Agriculture:Washington

PREFACE

These instructions are designed primarily for Processed Fruit and Vegetable Inspectors of the U.S. Department of Agriculture. They are not intended to be a comprehensive treatise on the subject but give background information and guidelines to assist in the uniform application and interpretation of USDA grade standards and other similar specifications.

These instructions are revised as necessary without public notice and no mailing list is maintained as a public advisory of such changes.

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THIS INSTRUCTION DOES NOT ESTABLISH A NEW OR REVISED SUBSTANTIVE RULE

PRODUCTION

IMPORTANCE

Mushrooms rank among the minor vegetables in volume of production and consumption. From 1950, however, the production and consumption has increased steadily. For example, during 1946 through 1954 the annual per capita consumption in the United States was 7 ounces. In the packing year 1968-1969 the annual per capita consumption was 18 ounces. This latter figure compares with the annual per capita consumption in France of 35 ounces, although the total U.S. production far exceeds that of France.

RECENT TRENDS IN MUSHROOM PRODUCTION

In 1946 and 1947 the quantity of mushrooms used for soups exceeded that for canning or for the fresh market. Since then, the quantity of mushrooms used for canning has steadily increased (Table I).

During the 1970-1971 season, the total mushroom production in the United States was 206.81 million pounds, of which 128.58 million pounds, or 62 percent, was produced in Pennsylvania.

TABLE I

Percent of Total Production Sold to Various Outlets

Year	Total Production (Pounds)	Fresh (Percent)	Processed (Percent)
1946	62,788,000	32.0	68.0
1947	62,500,000	40.0	60.0
1948	65,000,000	30.8	69.2
1961-62	165,000,000	30.5	69.5
1968-69	189,000,000	29.7	70.3
1969-70	193,000,000	32.2	67.8
1970-71	206,810,000	28.2	71.8

PRODUCING AREAS

Mushrooms are produced largely in areas conveniently located with respect to a large market outlet for fresh mushrooms. Climate also helps to determine the areas of production. The Southern States are generally unsuited for the growing of this crop because it is difficult to maintain a low enough temperature for more than a few months each year without artificial air conditioning.

PRODUCING AREAS (Continuation)

In Pennsylvania, which is the largest mushroom producing area in the entire country, production centers around Kennett Square in the southeastern part of the State. This location is convenient for distribution to the major consuming centers of the northeast.

In New York, most of the crop is produced in Greene and Ulster Counties in the Hudson Valley between New York and Albany.

Production in Ohio is scattered through the whole State.

In Illinois, nearly all of the production is in the northeastern part of the State.

In Michigan, the two major producing areas are in the extreme southwestern portion of the State, and in Macomb County, just north of Detroit.

In California, practically all production is in coastal areas between San Francisco and San Diego.

Canned mushrooms and mushroom products are also packed in the States of Oregon, Washington, New Jersey, Delaware, and Maryland.

TYPES AND VARIETIES

All cultivated mushrooms belong to the species Agaricus campestris. Various bracket fungi, puffballs, and other fungi have been used as food, but none have been grown commercially in this country.

Mushrooms are classified as white, cream, or brown, depending on the color of the cap. Those grown for canning are almost exclusively of the white variety. In the East and Midwest the white variety is also the principal kind grown for fresh mushroom consumption, while in the West and in Canada a fair quantity of the cream variety is used.

GROWING REQUIREMENTS

Since mushrooms, like all fungi, do not possess chlorophyll with which to manufacture carbohydrates from CO_2 absorbed from the air, they must obtain carbohydrates and other nutrients by growing on organic material containing these ingredients.

Compost is the favorite growing medium in commercial mushroom houses.

GROWING REQUIREMENTS (Continuation)

Unlike plants possessing chlorophyll, mushrooms can grow in darkness. A cool, moist atmosphere is most favorable for their development. Caves and abandoned mines have been used extensively for the growing of mushrooms.

Most mushrooms are grown in houses constructed especially for the purpose. Cinder blocks are a favorite construction material. The houses should be well insulated against cold in winter and heat in summer, and should have heating facilities for use in winter and means for keeping the air moist when the outside humidity becomes low.

Most houses produce two distinct crops a year. Each crop consists of several "breaks". After the mushrooms are harvested the beds are covered with a new layer of "casing" soil and watered down for the next growth of mushrooms. After several such "breaks", the beds are cleaned out and filled with fresh compost. The entire cycle may be completed in as little as three months or even less, up to as long as seven months, depending largely on temperature.

Higher temperatures usually mean a greater proportion of small mushrooms.

Artificial air conditioning enables some growers to obtain three crops a year.

The months of October to May, inclusive, are the months of heaviest production. Harvesting is light during the warm weather months. A few growers maintain production during the summer by means of artificial air conditioning.

HARVESTING AND DELIVERY

Most canners grow the greater part of the mushrooms they use, purchasing the remainder of their requirements from other growers. Some canners grow for canning exclusively; others grow both for the fresh market and for processing.

Mushrooms are pulled from the beds with roots attached before the "veil" or membrane breaks open and exposes the "gills". Depending upon the contract between the packer and grower, the mushrooms may be delivered to the plant either with or without roots attached. In the latter case, the roots are [redacted] cut from the mushrooms in the growing houses by the harvestors. In either case they are placed in baskets holding from three to as much as ten pounds for delivery to the plant.

HARVESTING AND DELIVERY (Continuation)

Freshly harvested mushrooms with the root portion attached, will remain fresh longer than if the root portion has been removed. Mushrooms frequently grow in clusters which may contain from three to five or more units. The units may vary in size from tiny to large mushrooms in the same cluster which have developed from one root.

Mushrooms deteriorate rapidly after picking, becoming discolored and wilted. They should be delivered to the cannery promptly after picking. When mushrooms cannot be processed promptly after delivery to the cannery, they should be placed in a refrigerated room at a temperature of 36° to 37° F. until needed. Refrigeration permits the supplies to be carried overnight to begin canning operations the following morning, or late weekend deliveries may be carried over to Monday morning.

Mushrooms must be handled carefully at all times to avoid bruising, which results in dark discolored areas.

PREPARATION AND CANNING

GENERAL

The following description of a canned mushroom operation is reasonably typical. The order, methods, and equipment may vary from plant to plant.

CUTTING

After delivery to the plant, the mushrooms which cannot be processed immediately are placed in refrigerated storage until they can be processed.

The baskets of mushrooms are taken to the cutting line for removal of root stubs and stems. In most plants the cutting operation is performed mechanically, although some may still be cutting by hand. The stems may undergo one or two cuttings, depending on the style of mushrooms desired, whether whole or buttons.

In the case of whole mushrooms, only the root portion of the stem is removed by the mechanical cutters.

If the style of buttons is desired, the cutters first remove the root portion of the stem which is carried away for waste. The rest of the stem is then removed by cutting immediately below the veil. This portion of the stem is used in the style of stems and pieces.

WASHING, TRIMMING, AND SORTING

After cutting, both the caps and stems are conveyed under a spray washer which removes the clinging bits of casing soil or other dirt. The mushrooms then pass over an inspection belt where seriously blemished mushrooms may be trimmed or sorted out. Misshapen, blemished, trimmed, and broken mushrooms are sorted out and placed with other mushroom material for the stems and pieces style.

Mushrooms with partially open veils may be placed with the pieces material or may be added to the buttons or whole mushrooms intended for one of the sliced styles.

SIZING

Mushrooms intended for whole mushrooms or buttons are conveyed by means of water flume to the sizers.

The mushrooms may be sized in a revolving drum sizer submerged in water. Rotary size graders which are not immersed in water may also be used. A submerged sizer minimizes bruising and gives the mushrooms an additional washing. The caps float upward from the sizer and each size is floated off into a separate holding tank.

The buttons may be separated into six different sizes. The larger sizes are generally sliced and the smaller sizes packed as buttons.

Price lists of packers may quote sizes in terms of number of buttons per 8-ounce can as 20/40, 40/60, 60/80, or 100/120. The same size designations apply when the mushrooms are packed in smaller sized cans. For example, the 40/60 size would pack between 20 to 30 buttons in a 4-ounce can.

SLICING

Mushrooms intended for slicing are generally sliced prior to blanching; however, slicing may be performed after blanching. The mushrooms are passed through a mechanical slicer with circular knives which cut them into slices of predetermined thickness. A shaker screen removes the small pieces after slicing.

Three styles of sliced mushrooms are produced: 1) Sliced Whole; 2) Sliced Buttons; and 3) Random Sliced Whole.

"Sliced Whole" style is prepared by aligning the mushrooms prior to slicing so that the mushroom is sliced lengthwise from stem to apex.

SLICING (Continuation)

"Sliced Buttons" style is prepared by positioning the mushrooms prior to slicing so that the mushroom is sliced parallel to the longitudinal axis.

"Random Sliced Whole" style is prepared by slicing the mushroom in any direction.

BLANCHING

The mushrooms are flumed from the holding tanks or slicer to the blancher.

The purpose of blanching is to shrink the mushrooms in order to obtain the proper fill. Shrinkage is due to loss of mushroom juice. Mushrooms may shrink as much as 30 to 40 percent in size in blanching.

Mushrooms may be blanched by immersing in water at a temperature of 200° F. or more. The usual method, however, is to pass the mushrooms through a continuous steam blancher where they are exposed to live steam for a period of 5 to 8 minutes. In some cases the mushrooms may be filled into the cans and then blanched in the cans.

Since iron tends to discolor mushrooms, the blancher should be made of stainless steel or other non-corrosive metal.

During blanching, the color of some white varieties may change from near-white to a light tan or buff color.

FILLING AND WEIGHING

Whole or Button styles are generally filled into the can by hand while a semi-automatic filler is usually used for slices or stem and piece pack. After filling, the cans are moved by belt conveyor in front of the weighers, who weigh the individual cans and adjust the fill so that the finished product will meet the required minimum drained weight.

As a safety factor, weighers generally overfill the cans, usually in accordance with a schedule of overfill weights which vary according to can size and style of pack.

Cans may vary considerably in weight, particularly in the smaller sizes. Deficient drained weights have been found to be due in some cases to the use of an unusually light can as tare by the weigher. The weigher should choose a tare can of average weight.

BRINING AND COOKING

After weighing, a salt tablet which may also contain ascorbic acid is added and cans are moved under taps of hot water, the temperature of which may range from 190 to 200 degrees F. The taps are adjusted to fill cans to overflowing. A hot brine solution is sometimes used instead of the water and salt tablet. It is generally unnecessary to use an exhaust on the filled cans since a sufficiently high vacuum is obtained for most purposes by the addition of hot water.

After closing, the cans are processed in retorts under steam pressure. After processing, the cans may be cooled by water in the retort or a cooling tank. The cans should be cooled to 90 to 100 degrees F., which checks the cook but leaves cans warm enough to dry off readily and prevent rusting.

USE OF ANTIOXIDANTS

A. Citric Acid and Ascorbic Acid

The FDA Standard of Identity for Canned Mushrooms requires that mushrooms packed with the addition of organic acids (other than vinegar), such as citric acid, be packed in fully enamel-lined cans. Canned mushrooms cannot be packed in vinegar (acetic acid). Some applicants have submitted for grading imported canned mushrooms with added citric acid packed in partially enamel-lined cans. Also see the section, "Certification" (Page 31 of this manual). Canned mushrooms packed with the addition of ascorbic acid, in amounts permitted in the FDA Standard of Identity for Canned Mushrooms [up to 132 milligrams for each 100 grams (37.5 milligrams for each ounce) of drained weight], do not require full enamel lining.

B. Relationships of pH to Antioxidants

The pH value of canned mushrooms is considered to be an important index of the possible adulteration of the product with certain acids of tin salts. Fresh mushrooms packed with no added acid usually show that if the pH value is 6.0 or more, no citric acid has been added. The addition of citric acid very noticeably affects pH, whereas, the addition of normal quantities of ascorbic acid does not reduce the pH very much.

Ascorbic acid in cans gradually diminishes through oxidation, whereas, the amount of citric acid changes very little over long periods of time.

A pH value below 6.0 may indicate the presence of CO_2 in the water, or the addition of acid or salts of tin. When the pH is found to be as low as 4.5, the product may be considered to be off-flavor.

FOOD AND DRUG REQUIREMENTS

Although the Food and Drug Administration has promulgated standards of fill and identity (including label statement of optional ingredients) for canned mushrooms, no minimum standards of quality have been promulgated specifically for this product.

Canned mushrooms are subject, however, to the same general requirements as other food products. They must be packed under sanitary conditions, must not be adulterated, or contaminated with decay, insects, or filth, and must be truthfully labeled.

REQUIRED LABEL STATEMENTS

In addition to the name of the commodity, "mushrooms", the style must be shown as "buttons", "whole", "stems and pieces", "slices" or "sliced", where applicable. The word "Random" in Random Sliced style (as in the USDA grade standards) is not required on labels, nor does it make any difference whether the style of pieces and stems is labeled Pieces and Stems or Stems and Pieces.

Salt in sufficient quantity to season may be added to the product. When salt has been added, the label must bear a declaration of the fact. Ascorbic acid not to exceed 37.5 milligrams per ounce of drained weight may be added without specific declaration on the label.

With respect to fill of container, a Drained Weight statement on the label is preferred by Food and Drug. However, a net weight statement in lieu of the drained weight statement is not considered illegal.

STANDARD OF FILL

The USDA grade standards outline in detail the Food and Drug requirements for standard of fill for canned mushrooms with respect to the mushroom ingredient.

These required minimum drained weights are prescribed in the grade standards for the most common container sizes in use in 1962. Occasionally, the industry may introduce new container sizes for which specific drained weight requirements are not included in the grade standards. For container sizes other than those specified, the minimum drained weight must be equal to a percentage of the water capacity of the can, as shown below:

Water Capacity of Container (ounces, Avoir.)	Minimum Drained Weight (Percent of Water Capacity)
Less than 11 oz.	56%
11 oz. or more, but less than 25 oz.	59%
25 oz. or more	62%

Water capacity is determined in accordance with the Food and Drug method outlined in "Title 21 Food and Drug, Part 10 General Regulations Relating to Definitions and Standards of Food". 1/

Containers which fail to meet the Food and Drug drained weight requirements (also as stated in the USDA grade standards) must bear the label declaration:

"BELOW STANDARD IN FILL"

1/ See Processed Products Inspectors' copy of Food and Drug "Part 27 Canned Fruits and Canned Fruit Juices, Definitions & Standards"

SPECIAL CONTAINER SIZES

In the case of mushrooms, the designation of can size is often misleading and differs from those used in other products. Thus, the designation of can sizes by ounces in connection with the word "mushroom" (as in 8 Z mushroom can) refers to the drained weight of mushrooms proper for the can size and not to the net weight of product nor fluid capacity of the container.

When a new container size is encountered for which specific drained weights are not specified it is necessary to determine the water capacity of such container and then calculate the applicable drained weight. Inspectors and supervisors are cautioned not to take the word of the packer, applicant, or container manufacturer as to the water capacity of any container for which drained weights are not specified.

INSPECTION OF THE PRODUCT

GENERAL

The United States Standards for Grades of Canned Mushrooms describes and establishes requirements for the various quality factors under the different grade classifications and should be followed in the inspection of the product, except when another specification is cited.

To uniformly apply the grade standards, be guided by the supervisor when in doubt as to the correct interpretation of any requirement. This is particularly important whenever unusual conditions are encountered or when any interpretation of a requirement will change the product from one grade to another. Quality requirements which involve judgement as to the extent to which the appearance and eating quality are affected should always be checked with the supervisor, unless certain of the proper interpretation. Refer to "General Inspection Procedures" Section 130 of the Inspectors' Instructions for procedures to follow when grading canned mushrooms.

MINIMUM EQUIPMENT AND INSPECTION MATERIAL.

The following list comprises minimum equipment and supplies needed for the inspection of canned mushrooms.

1. Scale and pan provided with counter weights for taking tare of container and weights for range of containers of the product to be inspected.

2. Trays, white, shallow for 16-ounce and smaller containers; deep trays for larger sizes.

MINIMUM EQUIPMENT AND INSPECTION MATERIAL (Continuation)

3. Vacuum gauge.

4. Headspace gauge.

5. Can opener.

6. Gram scales.

7. Ruler.

8. U.S. Standard No. 8 screen of proper diameter for container size for making drained weight determination.

9. Color guides.

10. Current U.S. Standards for Grades of Canned Mushrooms.

11. Federal Specifications or other applicable purchase specifications.

12. These Inspectors' Instructions and any supplemental instructions or memoranda on this product or related subject.

13. Inspection Papers, such as, applicant's information, contract instructions, score sheets, and applicable work sheets for preparing certificates for typing.

DRAINED WEIGHTS

A. General

The drained weights prescribed in the USDA grade standards are those required under the Federal Food, Drug, and Cosmetic Act. The method for ascertaining the drained weights is also prescribed in the grade standards and is the same as that prescribed in the Food and Drug standard of fill for canned mushrooms.

Inspectors should be guided by the procedure that follows in ascertaining drained weights in order to minimize the introduction of unnecessary error in the drained weight results.

B. Drained Weight Procedure

Tare the dry sieves to the scale being used.

Place one hand on the completely loosened container lid, grasping the body of the container with the other hand. In one continuous motion tilt the container until the lip of the open can end just touches the mesh of the slightly inclined sieve; with the expelled lid remaining upright and stationary on the screen, draw the container away from the lid, permitting the product to flow out slowly, distributing it as evenly as possible over the screen. Make sure that all of the product is emptied onto the screen, leaving none adhering to the bottom or sides of the container.

Permit the product to drain for exactly two minutes, rotating the sieve approximately 180 degrees at the end of one minute to permit any packing media which collects on the flange on the inside edge of the screen to drain off.

Do not stir or otherwise disturb the product on the screen in any manner during this draining period.

Weigh the product and record to the nearest tenth (0.1) ounce. Since the sieve was previously tared, the weight registered on the scale will be the weight of the product only.

Ascertain the drained weights for each sample unit in the sample in the manner prescribed. It is only necessary to shake off the excess packing media that may adhere to the sieve between drained weight determinations. It is not necessary to retare the sieves after the first tare adjustment of the scale.

Calculate the average drained weight for the sample when one or more, but not all, of the sample units fail to meet the prescribed drained weight for the container size.

C. Compliance with Drained Weight Requirements

A lot of canned mushrooms will be considered as meeting the specified drained weight requirements if the following criteria are met:

1. If the word "minimum" is stated on the label in conjunction with the drained weight declaration; or if a minimum drained weight is implied, all the sample units in the sample must be equal to or greater than the specified drained weight requirement. Such statements as the following would imply minimum drained weight:

Example: Minimum Drained Weight 8 oz.
or
Drained Weight not less than 8 oz.
or
Drained Weight 8 oz. or over.

C. Compliance with Drained Weight Requirements (Continuation)

2. If the word "minimum" is not stated on the label in conjunction with the drained weight declaration; or a minimum drained weight is not implied, the average drained weight of all the sample units in the sample must be equal to or greater than the drained weight requirement (designated as avg. in Table II of this instruction); and

3. The number of sample units which fail to meet the required minimum drained weight for individuals (designated as Indv. in Table II of this instruction) does not exceed the applicable acceptance number specified in the single sampling plan contained in the Regulations Governing Inspection and Certification of Processed Fruits and Vegetables and Related Products.

Canned mushrooms that fail to meet the drained weight requirements as outlined herein are certified as "Below Standard in Fill".

NOTE: [See applicable inspector's "General Inspection Instruction File" for further certification information with respect to Substandard Fill.]

TABLE II

Drained Weight Requirements for Canned Mushrooms

Container size of Designation	Minimum Drained Weight, Ounces (Avoirdupois)		
	All Styles	Sliced Style including Stems & Pieces	Whole Buttons
	(Avg.) 2/	(Indv.) 1/	(Indv.) 1/
2z mushrooms	2.0	1.8	1.7
2-1/2z glass	2.5	2.3	2.2
3z mushrooms	3.0	2.7	2.7
4z mushrooms	4.0	3.7	3.6
8z mushrooms	8.0	7.6	7.5
Jumbo	16.0	15.4	15.3
No. 10	68.0	66.7	66.5

1/ "Indv." means minimum drained weight for individual containers.
2/ "Avg." means the minimum average drained weight from all the containers in the sample.

PRODUCT DESCRIPTION

The product description contained in the grade standards is an excerpt from the Federal Food and Drug Definitions and Standard of Identity for Canned Vegetables which pertains specifically to canned mushrooms. The definitions and standard of identity require that canned mushrooms be prepared from sound, succulent, fresh mushrooms by proper trimming, washing and sorting. This means that:

1. With respect to soundness, the finished product must be practically free from decay or rot;

2. With respect to succulence and freshness, the finished product may not be prepared from frozen, dehydrated, or otherwise processed mushrooms or from mushrooms that have been held in cold storage until they have become stale; and

3. With respect to trimming, washing, and sorting, the root portion of the mushroom must be removed by cutting; the mushrooms must be washed in clean potable water to remove casing soils and any fungicides or insecticides that may be present; and the mushrooms must be properly sorted to remove any rot, decay, or insect damaged units and foreign material.

Water is the only packing media permitted under the Food and Drug Standards of Identity for canned mushrooms without label qualification. Salt and monosodium glutamate may be added as seasoning ingredients, but must be declared on the label.

The Definitions amd Standard of Identity specifically prohibit the use of certain additives and seasoning ingredients in canned mushrooms such as:

Citric Acid
Vinegar
Spice
Refined Sugar (Sucrose)
Refined Corn Sugar (Dextrose)

COLOR TYPES

The grade standards provide for three separate color types of mushrooms. Two of these types, the white and the cream, are in the same category. No distinction is made between these two types due to the similarity in color of the finished product. In the raw state, there is a very distinct difference, the white mushrooms being almost snow white in color, and the cream mushrooms being a cream color. During and after processing, however, color changes occur in both the white and cream types to the extent that the color appearance of the two types is very similar.

COLOR TYPES (Continuation)

In the inspection and certification of canned mushrooms, no effort should be made to distinguish between the white and cream types. For color types, inspection documents and certificates should show "white or cream".

Inspectors should have little or no trouble distinguishing the brown color type mushrooms from the white and cream types. Separate provision is made for the brown color type in the grade standards and should be recorded on the inspection documents and certificates accordingly.

STYLES

The grade standards provide descriptions and objective requirements for the styles of canned mushrooms most commonly packed in this country. Other styles of lesser importance may also be packed occasionally, such as "minced", but are not provided for in the grade standards or considered as a style for canned mushrooms in the Federal Food and Drug Definitions and Standards of Identity.

The Federal Food and Drug Definitions and Standards of Identity for canned mushrooms provides for only one sliced stlye with no reference to the direction of the slice. For the purpose of establishing definitions and standards of identity for canned mushrooms, it was the intent of the industry and the Food and Drug Administration to permit the use of whole mushrooms, buttons, or a mixture of both in the preparation of the sliced style with no limitations as to the direction of the slice.

In actual industry practice, however, more than one sliced style is packed, each serving a definite purpose. The styles of sliced whole and sliced buttons are considered as premium packs, used more for garnish or decorative purposes, and are meant to be competitive in market value with each other. The style of random sliced whole is considered by many canners as a "relief" style to aid the plant in increasing production to get rid of a "glut" or over supply of mushrooms which is brought about by unseasonable warm weather. This latter style is intended to be used in the same manner as the style of stems and pieces as an ingredient in various sauces, gravies, and other foods. The chief difference between the random sliced whole, and stems and pieces styles is the amount of detached stem material permitted in the former style. In the case of the style of sliced whole, it is not uncommon to find some units with stems 1/8 inch or less in length. In the style of sliced buttons, it is not uncommon to find a few sliced units with attached stems which are more than 1/8 inch in length. For whole style some units may be present with attached stems less than 1/8 inch in length. Also, in the style of buttons, some whole mushrooms may be present with attached stems longer than 1/8 inch in length but not longer than 1/4 inch in length.

STYLES (Continuation)

In order to provide for uniformity in determining compliance with a specific style, the following guide will be applicable in addition to the requirements specified in the grade standards:

1. Whole - Not more than 15 percent, by count, of the units may possess stems 1/8 inch or less in length measured as specified in the grade standards;

2. Buttons - Requirements as specified in the grade standards;

3. Sliced Whole - Not more than 15 percent, by weight, of the sliced units (with attached stem material) may possess attached stem material which is 1/8 inch or less in length;

4. Random Sliced Whole - No limitations as to whether prepared from whole mushrooms or buttons or a mixture thereof. Other requirements as specified in the grade standards;

5. Sliced Buttons - Not more than 15 percent, by weight, of the sliced units may possess attached stem material which is more than 1/8 inch in length but not longer than 1/4 inch;

6. With respect to the requirements for styles specified in the grade standards as well as those specified herein, a sample unit that fails to meet such requirements is considered a deviant; and

7. The number of deviants in the sample does not exceed the acceptance number for the applicable sample size in the single sampling plan contained in the Rules and Regulations Governing Inspection Inspection of Processed Fruits and Vegetables, and Related Products.

STYLES (Continuation)

A lot of canned mushrooms that fails to meet the acceptance criteria for a specified style as specified herein shall be designated as follows with respect to style:

Failure to meet Single style of:	Reason for Failure	Designate as:
Whole; Buttons	Excessive units possess stems which are more than 1/8 inch (or 1/4 inch) in length, or 1/8 inch or less in length - as applicable.	Mixture of styles; Whole and Buttons (specify predominant style first).
Sliced Whole	Excessive random sliced units and/or detached stem material exceeds 5% but not more than 15%, by weight.	Random sliced whole.
	Detached stem material exceeds 15%, by weight.	Stems and Pieces.
	Excessive sliced units that possess attached stem material which is 1/8 inch or less in length.	Mixture of styles; sliced whole and sliced buttons. (specify predominant style first).
Random sliced Whole	Excessive detached stem material.	Stems and Pieces.
Sliced Buttons	Excessive sliced units that possess stem material which is more than 1/8 inch in length	Mixture of styles; sliced buttons and sliced whole. (specify predominant style first).

COLOR

A. General

The grade standards describe the minimum color requirements for the different color types under the various grade classifications. USDA color guides which illustrate the minimum limits for color in the A and B grade classifications are made available to each inspection field office as well as to the mushroom canning industry except Hawaii and Puerto Rico. Such color guides will aid inspectors in objectively evaluating the factor of color.

In evaluating color of canned mushrooms, consideration must be given to the overall color appearance of the product as well as to the color of the individual units. In the case of the styles of whole and buttons, only the surface of the caps are considered for color. In the case of the sliced styles, including sliced units in the style of stems and pieces consideration must be given to the surface of the cap as well as to the gills.

Separate color requirements for cap surface and gills are provided for in the different grade classifications. In addition to the minimum color requirements for the cap surface and the gills, the grade standards specify that the contrast in color between the cap surface and the gills does not more than slightly affect the overall appearance for Grade A and does not seriously affect in Grade B.

Generally, 30 days or more are required after packing for the color to become stabilized in canned mushrooms which are packed without the addition of ascorbic acid. With the use of ascorbic acid, however, the color will stabilize in less time.

The limiting rule on color applies in both the Grade B and Substandard classifications. There should be no "Substandard" color in Grade A.

B. Instructions for using USDA Canned Mushroom Colors

1. Explanation

The USDA Colors for Canned Mushrooms are intended as an aid to provide greater uniformity in the interpretation of the color requirements for the different grade classifications specified in the United States Standards for Grades of Canned Mushrooms. The grades provide for degrees of uniformity as well as separate descriptions of the minimum color requirements for caps and gills of the mushrooms.

COLOR (Continuation)

The colors -- USDA 1 through USDA 5 -- consist of separate plastic slats (1" x 5"). They represent basic minimum colors for "White or Cream" color type mushrooms as:

	USDA 1	USDA 2	USDA 3	USDA 4	USDA 5
WHOLE and BUTTON styles					
Caps	Grade A	Grade A	- - -	Grade B	- - -
OTHER styles					
Caps (or portions). . . .	Grade A	Grade A	- - -	Grade B	- - -
Gills.	- - -	- - -	Grade A	- - -	Grade B

---- See page 22 for allowances for the respective grades ----

2. Making color comparisons

The evaluation of color should be made under adequate lighting conditions, preferably under constant laboratory lighting that approximates diffused north daylight (about 7500 degrees Kelvin).

Color of the Canned Mushrooms should be evaluated as soon as possible after the containers have been opened.

3. Care of colors

The colors are made of a plastic material and should be handled with care to avoid scratching. They should be cleansed by rinsing in clear, warm water and dried with a soft cloth immediately after using. No abrasive cleanser should be used. They should be stored in a cool, dark place when not in actual use.

4. Licensed supplier for colors

These color guides may be purchased, and prices are available from the licensed supplier:

Magnuson Engineers, Inc.
1010 Timothy Drive
San Jose, CA 95133

COLOR (Continuation)

5. Obtaining addition copies of Instructions and Standard

Additional copies of these instructions and the United States Standards for Grades of Canned Mushrooms are available upon request from:

Processed Products Standardization
and Inspection Branch
Fruit & Vegetable Division, C&MS
U. S. Department of Agriculture
Washington, D. C. 20250

COLOR (Continuation)

MAXIMUM ALLOWANCES FOR COLOR VARIATION
- - White or Cream Color Types - -

GRADE A

	WHOLE and BUTTON Styles	ALL OTHER Styles
	(by count)	(by weight)
CAPS --- Darker and more tannish than USDA 1 -- or -- More greyish-green than USDA 2	10%	10% or 10% But no more than total of 10% such caps and gills combined
GILLS --- Darker in tannish-grey than USDA 3	---	

GRADE B

	WHOLE and BUTTON Styles	ALL OTHER Styles
	(by count)	(by weight)
CAPS --- More grey than USDA 4 but no darker or no more brownish-grey than USDA 3	10%	10%
-- and --	-- and --	-- and --
Darker and more brown than USDA 4	5%	5%
-- or --	-- or --	-- or --
Darker and more brown than USDA 4 ,	10%	10% But no more than total of 10% such caps and gills combined
GILLS --- Darker and more tannish-grey than USDA 5		10%

The color of caps is based on surface of the cap or any portion of cap.

When the cap and gills of a sliced unit vary from the color limits, such unit is considered in the allowance for either caps or gills, but not both.

The foregoing allowances supplement the descriptive requirements for uniformity and typical color for the respective grades in the United States Standards for Grades of Canned Mushrooms.

UNIFORMITY OF SIZE AND SHAPE

Mushrooms intended for the styles of whole, buttons, sliced whole, or sliced buttons are very carefully size graded. A high degree of uniformity may be obtained by the methods of sizing in general use in the canning industry.

Mushrooms intended for the styles of random sliced whole or stems and pieces are not size graded. Since this latter style consists chiefly of pieces of stems and caps, and may contain sliced units as well as whole mushrooms and buttons, it would not be reasonable to expect any degree of uniformity of size and shape. Consequently, this factor is not scored for the style of stems and pieces.

A. Whole and Buttons

Consideration is given to the uniformity of shape among the individual units, to the uniformity of size with respect to diameters among the individual units, and the manner in which the stem has been cut.

In addition to the allowances specified in the grade standards for variation in diameters, the following allowances for variation in shape and irregular cut stems will be applicable:

Grade A -- Not more than 10 percent, by count, of the units may be irregular in shape, and/or may possess stems which have been irregularly cut such that the appearance of the unit is seriously affected.

Grade B -- Not more than 15 percent, by count, of the units may be irregular in shape, and/or may possess stems which have been irregularly cut such that the appearance of the unit is seriously affected.

NOTE: A unit that is irregular in shape and possesses an irregularly cut stem that seriously affects the appearance of the unit is scored as one or the other irregularity but not both.

UNIFORMITY OF SIZE AND SHAPE (Continuation)

B. Sliced Whole, Sliced Buttons

For these two styles, consideration is given to the uniformity of shape among the individual units as well as uniformity of diameters of the center slices. Inspectors are cautioned that only the center slices, as defined in the grade standards, are considered in evaluating uniformity of diameter for these styles.

In addition to the allowances for variation of diameter specified in the grade standards, the following allowances for irregular shaped units are applicable.

Grade A -- Not more than 10 percent, by weight, of the units may be irregular in shape.

Grade B -- Not more than 15 percent, by weight, of the units may be irregular in shape.

Inspectors should note the partial limiting rule applicable to the factor of uniformity of size and shape. Canned mushrooms that score into the Grade B range for this factor but are otherwise Grade A, may still be classified as Grade A provided the total score is not less than 90 points. Canned mushrooms that score into the Substandard range for this factor, however, may not be classified above Grade B, and only then if all other factors are Grade B or better and the total score is not less than 80 points.

DEFECTS

Table III, which follows this section, is designed to assist inspectors in assigning score points to the factor of defects. Careful consideration should be given to the effect that a particular defect or a combination of defects may have on the overall appearance of the product.

The following supplemental explanations of the various defects are intended to further assist inspectors in properly classifying as to type:

A. Crushed or Broken

In order to be considered crushed, a whole mushroom, button, or sliced unit must be crushed to the extent that the original shape has been destroyed. Units that have been "crowded" in the container to the extent that the original shape has been changed but may be restored are not considered as crushed.

DEFECTS (Continuation)

A broken unit is a unit that has been severed into two or more entirely separate parts. Two or more pieces from broken units that may be pieced together so as to approximate one whole unit (one whole mushroom, one whole button, or one whole slice, as applicable) is considered as one "broken unit". A unit that is only partially broken (i.e. not separated into two or more entirely separate parts) is not considered broken.

B. Damaged mushrooms

1. Discoloration

The presence of very light staining or surface discoloration which does not extend into the flesh of the mushroom should be considered only under the factor of color.

Discoloration may be caused by bruising of the flesh in rough handling or by contact with the soil in which the mushrooms are grown or by oxidation when the mushrooms are not handled promptly after picking. Discoloration may also be due to pathological injury caused by the development of fungus (brown spot) or bacterial spot which may result in the development of yellow or brown spots (rust) or pits on the cap or stem. When such pathological injury has progressed to the stage that decay or rot is present it is to be considered as foreign material.

2. Mechanical injury

Trimming on the cap of whole mushrooms or buttons which destroys the contour of the cap should be classified as a defect. Knife marks on stems or cuts which give a ragged appearance to the stem should also be classified in this category. Knife marks resulting from the preparation of sliced whole or sliced button mushrooms are not considered as mechanical injury.

C. Serious damage

When dark brown or black discolored areas extend into the flesh such discolored areas should be classified as damage and may be scored as damaged or seriously damaged, depending upon the extent of the effect upon the appearance or eating quality of the unit. No more than an occasional stem should show dark discoloration or deep staining from contact with the mushroom growing bed.

Damage to mushrooms caused by discoloration, mechanical damage, pathological injury, or damage by other means causing damage to the extent that the appearance or eating quality of the unit is seriously affected should be classified as serious damage.

DEFECTS (Continuation)

Separate allowances are provided in the grade standards for crushed or broken and damaged under each of the grade classifications. The allowances provided for damaged and seriously damaged, however, are inclusive. For example, the maximum allowances permitted in Grade A provide for a grand total of 10 percent by weight as follows:

> 5 percent, by weight, may be crushed or broken; and in addition, a total of 5 percent, by weight, may be damaged and seriously damaged; but no more than 1 percent, by weight, may be seriously damaged.

The grade standards further provide that even though the product is within the limitations for the specified allowances, if the defects that are present either singly or in combination affect the appearance of the product in excess of the degree permissible for the indicated grade, the product must be assigned the score points within the grade classification indicated by the appearance rather than the specified allowances.

TABLE III

SCORING GUIDE AND SUMMARY OF ALLOWANCE FOR DEFECTS

Grade Classification	Score Points	Maximum Allowances			
		All Styles except stems & pieces	All Styles		
		Crushed or broken	Damaged & seriously damaged		Seriously damaged 1/
		(Percent by weight)	(Percent by weight)		(Percent by weight)
A	30	0	0	But no more than	0
	29	1	1		0
	28	3	3		0.5
	27	5	5		1
B	26	6	6	But no more than	1.2
	25	8	8		1.5
	24	10	10		2.0
SStd	0-23	Fails to meet requirements for Grade B			

1/ One unit in a container is permitted to be seriously damaged: Provided, that the total number of such seriously damaged units in all of the containers comprising the sample is within the percentage permitted for such defect.

DEFECTS (Continuation)

D. Extraneous material

The grade standards do not provide allowances for harmless extraneous material. Since mushrooms are grown under highly controlled conditions it is not likely that such extraneous material as weeds, blades of grass or other harmless vegetable material would be encountered in the finished product.

Occasionally, however, certain extraneous materials are encountered in canned mushrooms. In this respect in order to establish guidelines for good commercial practice, harmless extraneous material in canned mushrooms may be defined as that material related to the mushroom plant or to the growing of the mushroom which is harmless, and by its very nature, when present within certain limitations is not objectionable. Such material may include but is not limited to:

1. Attached or loose root material with no adhering grit, soil, or compost; and

2. Small pieces of straw.

For the purpose of ascertaining the grade of a sample when harmless extraneous material is present in canned mushrooms, the following administrative guide is applicable:

Harmless extraneous material	Grade A	Grade B	SStd.
Attached or loose root material with no adhering grit, soil, or compost	Average of 1 piece per approx. 100 oz. net contents. 1/	Average of 2 pieces per approx. 100 oz. net contents. 1/	Fails Grade B
Small pieces of straw	Average of 1 inch in length per approx. 100 oz. net contents. 1/	Average of 1-1/2 inches in length per approx. 100 oz. net contents. 1/	Fails Grade B

1/ Equivalent to the net weight of a No. 10 can.

FOREIGN MATERIAL

The best of commercial practices does not give absolute assurance that foreign material will be completely eliminated from the finished product. However, when good processing procedures are practiced, such material can be held to a minimum to the extent that its presence will not affect the appearance or eating quality of the product.

Foreign material in canned mushrooms may be considered as any material that seriously affects the appearance or eating quality of the product (except that which is considered a defect and allowances provided for in the grade standards), and any other material which by its very nature, is objectionable. Such material includes but is not limited to:

1. Grit, soil or compost;
2. Wood splinters;
3. Rot or decay;
4. Insects or insect fragments; and
5. Maggots.

Most of the aforementioned foreign material may be detected upon visual examination during the regular grading process. An exception would be the presence of maggots (See Methods of Analysis "Extraction and Microscopic Examination for Maggots in Canned Mushrooms")

CHARACTER

Mushrooms which have been harvested and canned promptly should be tender and have a noticeable crispness of texture when chewed. Toughness of the mushrooms, together with a stale flavor, is indicative of raw stock which has been held for several days under unfavorable storage conditions before canning.

Mushrooms for canning should be harvested while the veils are closed. Frequently, the veil in whole mushrooms may be partially broken open during the blanching operation or during processing. Open veils are scored only in the styles of Whole and Buttons. Inspectors are cautioned to use good judgement in classifying a whole mushroom or button as to open or closed veils. The grade standards define a closed veil by specifying that the membrane which extends from the inner edge of the cap to the stem practically covers the gills. This means, to be considered a closed veil, there may be a rupture in the veil that is only slightly noticeable-probably was due to blanching rather than maturity. The larger sized mushrooms may possess slightly longer ruptures than the small sizes and still be no more than slightly noticeable. In order to provide for uniformity in scoring open veils, be guided by the following:

CHARACTER (Continuation)

Consider a unit to possess an open veil if the length of the veil opening exceeds:

1/8 inch for No. 0 and No. 1 mushrooms;
3/16 inch for No. 2 and No. 3 mushrooms; and
1/4 inch for No. 4 and larger.

In the case of a single unit which possesses more than one opening, the combined lengths of such openings should not exceed the above guide for a single opening.

SUMMARY OF SCORE SHEET

Before preparing the certificate, the score sheet should be carefully analyzed to see that the ratings and notations are in good order. Sign and date the score sheet.

CERTIFICATION

In the certification of a lot of canned mushrooms that fails to meet the acceptance criteria for the specified style, the grade certificate should show in the body opposite "Style" that the lot fails requirements for the particular style, the reason for failing, and state whether the lot is a mixture of styles or meets requirements for a different style than for which the lot was offered. Flag the grade statement with "See Style Above".

EXAMPLE: Lot Offered for Buttons - Fails.
In the body of the certificate:

Style: Fails to meet requirements for the style of Buttons account presence of excessive whole mushrooms.
Mixture of Styles - Whole and Buttons.

Grade Statement:

Grade: U.S. Grade A or U.S. Fancy
Average Score: 91 points.
"SEE STYLE ABOVE"

EXAMPLE: Lot Offered for Sliced Whole - Fails.
In the body of the certificate:

Style: Fails requirements for the style of Sliced Whole account detached stem material exceeds 5 percent, by weight.
Meets requirements for the style of Random Sliced Whole.

(or)

Style: Fails requirements for the style of Sliced Whole account presence of excessive sliced buttons.
Mixture of Styles - Sliced Whole & Sliced Buttons.

Grade Statement: Same as above.

Canned mushrooms, which do not meet the FDA Standard of Identity for added citric acid packed in cans lacking full enamel lining, should be certified as follows:

Under Grade Statement:

Grade: Fails Standard of Identity for Canned Mushrooms account addition of citric acid in cans lacking full enamel lining.

METHODS OF ANALYSIS

Extraction and Microscopic Examination for Maggots in Canned Mushrooms

1. Explanation

Maggots in canned mushrooms have not been recognized as a problem in our inspection of this product. However, recently it has been established that maggots, under certain conditions, may be present in canned mushrooms. Maggots are more likely to be found in stems and pieces style, and in a product having a poor appearance (presence of pathological injury, external or internal dark brown or black spots).

2. Sampling Rates

All lots of mushrooms offered for inspection should be examined for maggots. The number of samples checked for maggots should be as follows:

Drawn for Quality	Examine for Maggots
3	1
6	1
13 or more	Same as deviant number

If maggots are found during the examination of sample units, refer to the acceptance criteria found in File Code 172-A-1, Table 1.

When a history has been established for an individual plant, the frequency of maggot determinations, if the data warrants it, may be reduced. For example: When 10 consecutive lots are free of maggots, the frequency of analyses may be reduced to one analysis for each four lots examined.

3. Method

(a) Reagents and Apparatus

(i) Crystal Violet -- saturated aqueous solution or crystal.
(ii) Sodium Hypochlorite solution (NaOCl) -- commercial product containing Ca. 5.25% (Hilex, Chlorox, Etc.)
(iii) Aerator -- rubber slip on kitchen aerator with lower screen removed.
(iv) High speed blender with voltage regulator for controlling speed.
(v) 8-inch sieves, Nos. 20, 40, and 140.
(vi) Stereoscopic wide-field microscope (20X magnification with additional magnification to 40X for verification).

METHODS OF ANALYSIS (Continuation)

(b) Sample preparation

The standard analytical sample is 100 grams of product plus the screened-off material from a proportionate amount of packing media. For container sizes smaller than 4-oz. mushroom can, combine the contents of enough cans to make 100 grams. The entire contents of a 4-oz. can should be taken for the sample.

For larger can sizes, 100 grams of drained product is used plus the screened material from a proportionate amount of the drained liquid.

EXAMPLE: A 16-oz. can of product will contain about 8-oz. of packing media.

Pour approximately 4-oz. of the product and 4-oz. of drained liquid onto an 8-mesh screen. The drained liquid and any material passing through the screen should be dyed, filtered, and examined separately. Any maggots or mites found in this examination should be included in the total count. For analysis of the product, 100 g. of the drained material should be taken.

(c) Extraction and examination

(i) Place 100 g. drained mushrooms into high speed blender cup.
(ii) Add 300 ml H_2O and operate blender at speed of 3,000-3,500 rpm for 30-35 seconds.

This step is very critical and a voltage regulator will have to be used with the blender. Usually a setting of about 30-35 on a Varivac voltage regulator will produce the correct speed. Care must be exercised to avoid overpulping the product. If this occurs, excessive plant material will accumulate on the filter papers making it impossible to find the maggots. Attain proper speed quickly by boosting setting 1.5 to 2 times the desired setting on the variable transformer for a few seconds at the start. Fragments of the blended mushrooms should be no longer than a small raisin. Some mushrooms, particularly soft broken pieces, require a minimum of blending. Larger firm whole units may require longer. Through experience, the analyst will learn when the blending is complete.

METHODS OF ANALYSIS (Continuation

(iii) Pour mixture into a 600 ml beaker and add 15 ml saturated aqueous crystal violet or approximately 100 mg of powdered crystal violet, stir and heat to boiling.

(iv) Pour stained mixture into a nested set of 8-inch Nos. 20, 40, and 140 sieves.

(v) Rinse tissue 2-3 minutes with spray of tap water from aerator and discard material on No. 20 sieve.

(vi) Wash mushroom tissue and maggots, if any, on the No. 40 and 140 sieves to edge of sieve and remove excess stain with tap water from aerator.

(vii) Using wash bottle containing NaOCl solution and gentle spray of tap water from aerator, alternately spray tissue with water and NaOCl solution until stain has been removed from mushroom tissue.

(viii) Hold a forward-tilted sieve over beaker; wash material into beaker by directing a spray of water through the back side of the sieve into beaker.

Several small washings are desirable, resulting in an accumulation of about 300 ml water in the beaker. Avoid spilling any material in this transfer.

(ix) Transfer contents of beaker to ruled filter paper, with suction.

Avoid obscuring maggots and/or mites with mushroom tissue. Use as many papers as are necessary to avoid piling up too much material on a single paper.

(x) View prepared filter paper under microscope and record result.