



**United States
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Service**

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Vegetable
Division**

**Fresh
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Branch**

United States Standards for Grades of Potatoes for Processing

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United States Standards for Grades of Potatoes for Processing ¹

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§51.3410 Grades.

(a) "U.S. No. 1 Processing" consists of potatoes which meet the following requirements:

(1) Basic requirements:

(i) Similar varietal characteristics;

(ii) Moderately firm; and,

(iii) Fairly well shaped.

(2) Free from:

(i) Freezing or freezing injury;

(ii) Blackheart;

(iii) Late Blight Tuber Rot;

(iv) Southern Bacterial Wilt;

(v) Bacterial Ring Rot;

(vi) Insects, worms or larvae;

(vii) Soft rot and wet breakdown; and,

(viii) Loose sprouts, dirt and foreign material.

(3) Free from damage by any cause.

(4) **Size.** Unless otherwise specified, individual potatoes shall be not less than 2 inches in diameter or 4 ounces in weight. Percentage(s) of a larger size(s) and/or a maximum size may be specified.

(b) "U.S. No. 2 Processing" consists of potatoes or usable pieces of potatoes which meet the following requirements:

(1) Basic requirements:

(i) Similar varietal characteristics;

(ii) Moderately firm; and,

(iii) Not seriously misshapen.

(2) Free from:

(i) Freezing or freezing injury;

¹Compliance with the provisions of these standards shall not excuse failure to comply with provisions of applicable Federal or State laws.

- (ii) Blackheart;
- (iii) Late Blight Tuber Rot;
- (iv) Southern Bacterial Wilt;
- (v) Bacterial Ring Rot;
- (vi) Insects, worms or larvae;
- (vii) Soft rot and wet breakdown; and,
- (viii) Loose sprouts, dirt and foreign material.

(3) Free from serious damage by any cause.

(4) **Size.** Unless otherwise specified, whole potatoes shall be not less than 1-1/2 inches in diameter, or usable pieces shall be not less than 4 ounces in weight. Percentage(s) of a larger size(s) and/or maximum size may be specified.

§51.3411 Usable piece.

"Usable Piece" means that portion of the potato remaining after trimming, or as it occurs in the sample.

- (a) Not have any unusable material;
- (b) Unless otherwise specified, weigh at least 4 ounces; and,
- (c) Must have at least 50% of peel remaining after trimming.

§51.3412 Unusable material.

"Unusable Material" consists of defective portions of potatoes, and potatoes which are frozen, affected by freezing injury, soft rot, wet breakdown, insects, worms, larvae, Blackheart, Late Blight Tuber Rot, Southern Bacterial Wilt, Bacterial Ring Rot, or which are seriously damaged by internal defects.

§51.3413 Size.

- (a) The minimum size, maximum size or range in size may be specified in connection with the grade in terms of diameter or weight.
- (b) Diameter means the greatest dimension in terms of inches or fractions of an inch measured at right angles to the longitudinal axis, without regard to the position of the stem-end.
- (c) Weight means the minimum or maximum weight measured in terms of whole ounces. When a maximum weight is specified, the potato shall not be considered as oversize until it weighs the next higher ounce.

§51.3414 Application of standards.

In the application of these standards to determine the percentages of potatoes in any lot which meet the requirements of the respective grades or size categories, tolerances do not apply.

However, for lots which are graded or pre-sorted for size or quality, offered for inspection and required to meet one of the grades, the following tolerances, by weight, are provided:

(a) For defects:

(1) **U.S. No. 1 Processing:** 10 percent for potatoes which fail to meet the requirements of this grade including not more than one-half of this tolerance, or 5 percent, for serious damage by any means, including therein not more than 2 percent for potatoes which are frozen or affected by soft rot or wet breakdown.

(2) **U.S. No. 2 Processing:** 10 percent for potatoes which fail to meet the requirements of this grade including not more than one-half of this tolerance, or 5 percent, for potatoes which are seriously damaged by internal defects occurring entirely within the vascular ring, including therein

not more than 2 percent for potatoes which are frozen or affected by soft rot or wet breakdown.

(b) For loose sprouts, dirt and foreign material: 2 percent.

(c) For off-size:

(1) **Undersize:** 3 percent when the minimum size specified is less than 2-1/4 inches in diameter or less than 5 ounces in weight; and 5 percent when the minimum size specified is 2-1/4 inches or more in diameter or 5 ounces or more in weight.

(2) **Oversize:** 10 percent.

§51.3415 Definitions.

"Similar varietal characteristics" means that the potatoes in any lot have the same general shape, color, and character of skin and color of flesh.

"Fairly well shaped" means that the potato is not materially pointed, dumbbell-shaped, or otherwise deformed.²

"Moderately firm" means that the potato is not seriously shriveled or flabby.²

"Not seriously misshapen" means that the potato is not seriously deformed and causing more than 10% waste when determining the non-peelable area directly due to shape.

"Soft rot or wet breakdown" means any soft, mushy or leaky condition of the tissue such as Leak, slimy soft rot, wet type Fusarium Tuber Rot, or wet breakdown following freezing injury or heat injury.

"Loose sprouts, dirt and foreign material" means unattached sprouts or sprouts that become detached during the grading of the sample, stems, vines, adhering dirt, loose dirt, stones, trash and other extraneous material.

"Damage" means any defect listed in §51.3416, or an equally objectionable variation of any one of these defects, any other defect, or any combination of defects, which cannot be removed without a loss of more than 5 percent of the total weight of the potato.

"Serious Damage" means any defect listed in §51.3416, or an equally objectionable variation of any of these defects, any other defect, or any combination of defects, which cannot be removed without a loss of more than 10 percent of the total weight of the potato.

"External Defects" are defects which can be detected externally. Cutting may be required to determine the extent of the injury.

"Internal Defects" are defects which cannot be detected without cutting the potato.

²USDA Visual Aid, POT-L 1 Jan 81. This publication may be examined in the Fruit and Vegetable Division, Fresh Products Branch, AMS, U.S. Department of Agriculture, South Building, Washington, DC 20250, or any field office of the Fresh Fruit and Vegetable Inspection Service. Copies of this visual aid may be purchased from the John Henry Company, P.O. Box 17099, Lansing, MI 48901 or United Fresh Fruit and Vegetable Association, N. Washington at Madison, Alexandria, VA 22314.

§51.3416 Classification of defects.

External Defects

Defects	Maximum allowed for U.S. No. 1 processing	Maximum allowed for U.S. No. 2 processing
Air cracks.....	5% waste.....	10% waste.
Blackleg.....	5% waste.....	10% waste.
Bruises.....	5% waste.....	10% waste.
Cuts.....	Smooth, not more than 10% of surface.	Smooth, not more than 1/3 of surface.
Enlarged lenticels, discolored or sunken.	5% waste.....	10% waste.
Flea Beetle.....		
Folded end.....	5% waste.....	10% waste.
Fusarium tuber rot.	5% waste.....	10% waste.
Grass, wireworm...	5% waste.....	10% waste.
Greening, light....	5% waste.....	10% waste.
Growth cracks.....	5% waste.....	10% waste.
	See Footnote	10% waste.
Grub.....	No. 2.	
Ingrown sprouts....	5% waste.....	10% waste.
Nematodes.....	5% waste.....	10% waste.
Rhizoctonia, solid or thick mounded.	5% waste.....	10% waste.
	Not more than 10% of surface.	Not more than 25% of surface.
Rodent, bird damage.		
Scab, pitted.....	5% waste.....	10% waste.
Scab, russet.....		
	5% waste.....	10% waste.
Scab, surface.....	25% of surface or 5% waste.	50% of surface or 10% waste.
Scab, surface (elephant hide).	25% of surface or 5% waste.	50% of surface or 10% waste.
Second growth.....	10% of surface	25% of surface or
Scaling, surface	or 5% waste.	10% waste.
cracks -- when	5% waste.....	10% waste.
cracked, thick and	10% of surface	25% of surface or
has depth.	or 5% waste.	10% waste.
Sunburn.....		
Sunken discolored areas	5% waste.....	10% waste.
	5% waste.....	10% waste.

²USDA Visual Aid, POT-L 1 Jan 81. This publication may be examined in the Fruit and Vegetable Division, Fresh Products Branch, AMS, U.S. Department of Agriculture, South Building, Washington, DC 20250, or any field office of the Fresh Fruit and Vegetable Inspection Service. Copies of this visual aid may be purchased from the John Henry Company, P.O. Box 17099, Lansing, MI 48901 or United Fresh Fruit and Vegetable Association, N. Washington at Madison, Alexandria, VA 22314.

Internal Defects		
Defects	Maximum allowed for U.S. No. 1 processing	Maximum allowed for U.S. No. 2 processing
Occurring outside of or not entirely confined to the vascular ring		
Internal Black Spot,	5% waste.....	10% waste.
Internal	5% waste.....	10% waste.
Discoloration,	5% waste.....	10% waste.
Vascular Browning,	5% waste.....	10% waste.
Fusarium Wilt, Net	5% waste.....	10% waste.
Necrosis, Other	5% waste.....	10% waste.
Necrosis, Stem End	5% waste.....	10% waste.
Browning.	5% waste.....	10% waste.
Occurring entirely within the vascular ring		
Hollow Heart or Hollow Heart with Discoloration.	Area affected not to exceed that of a circle 7/8 inch in diameter in a 10 ounce potato. ¹	Area affected not to exceed that of a circle 1-1/4 inches in diameter in a 10 ounce potato. ¹
Light Brown Discoloration (Brown Center).	Area affected not to exceed that of a circle 7/8 inch in diameter in a 10 ounce potato. ¹	Area affected not to exceed that of a circle 1-1/4 inches in diameter in a 10 ounce potato. ¹
Internal Brown Spot and similar discoloration (Heat Necrosis).	Not more than the equivalent of 3 scattered spots 1/8 inch in diameter in a potato 6 ounces in weight or 2- 1/2 inches in diameter, or correspondingly lesser or greater number of spots in smaller or larger potatoes.	Not more than the equivalent of 6 scattered spots 1/8 inch in diameter in a potato 6 ounces in weight or 2- 1/2 inches in diameter or correspondingly lesser or greater number of spots in smaller or larger potatoes.

¹Note: Or correspondingly lesser or greater areas in smaller or larger potatoes.

§51.3417 Optional test for specific gravity.

Tests to determine specific gravity shall be made in accordance with the procedures set forth in this section.

(a) The potatoes used for such determinations shall be:

- (1) Taken at random from a composite sample drawn from containers representative of the lot.
- (2) A comparable sample from a bulk load or storage bin.
- (3) From a portion of the divided sample initially drawn or submitted for determination of grade or contract compliance.
- (4) Representative of the lot with respect to size and quality.

The specific gravity for any lot of potatoes shall be the average of at least 3 corrected readings on separate tests from the composite sample. Specific gravity may also be determined, if requested, in accordance with size classifications or weighted value in proportion to size and/or grade separations in the lot.

(b) Specific gravity shall be determined by either;

(1) Calculation from the weights of the sample in air and in water made with USDA approved equipment. The reading obtained from each test shall be corrected for temperature variations using Table I.

(2) A hydrometer specifically designed for determining the specific gravity of potatoes.³

The pulp temperature of the potatoes and the temperature of water shall be recorded immediately before testing and the specific gravity reading corrected using Table I.

Table I.-- Correction Factors for Specific Gravity of Potatoes⁴
[Corrected to zero at 50° F potato temperature and 50° F water temperature]

Tuber temp	38°	40°	45°	50°	55°	60°	65°	70°	75°	80°
38°.....	-.0021	-.0020	-.0018	-.0018	-.0020	-.0023	-.0029	-.0038	-.0047	-.0056
40°.....	-.0017	-.0016	-.0014	-.0014	-.0016	-.0019	-.0025	-.0034	-.0043	-.0052
45°.....	-.0009	-.0008	-.0006	-.0006	-.0008	-.0011	-.0017	-.0026	-.0035	-.0044
50°.....	-.0003	-.0002	0000	0000	-.0002	-.0005	-.0011	-.0020	-.0029	-.0038
55°.....	+.0001	+.0002	+.0004	+.0004	+.0002	-.0001	-.0007	-.0016	-.0025	-.0034
60°.....	+.0004	+.0005	+.0007	+.0007	+.0005	+.0002	-.0004	-.0013	-.0022	-.0031
65°.....	+.0005	+.0006	+.0008	+.0008	+.0006	+.0003	-.0003	-.0012	-.0021	-.0030
70°.....	+.0006	+.0007	+.0009	+.0009	+.0007	+.0004	-.0002	-.0011	-.0020	-.0029

³The hydrometer is available from the Potato Chip/Snack Food Association, Crystal Square-3, Suite 903, 1735 Jefferson Davis Highway, Arlington, VA 22202.

⁴To apply correction factor, change, actual specific gravity reading by adding or subtracting the appropriate factor according to the plus or minus sign.

75°.....	+0.0007	+0.0008	+0.0010	+0.0010	+0.0008	+0.0005	-0.0001	-0.0010	-0.0019	-0.0028
80°.....	+0.0008	+0.0009	+0.0011	+0.0011	+0.0009	+0.0006	0000	-0.0009	-0.0018	-0.0027
85°.....	+0.0009	+0.0010	+0.0012	+0.0012	+0.0010	+0.0007	+0.0001	-0.0008	-0.0017	-0.0026
90°.....	+0.0010	+0.0011	+0.0013	+0.0013	+0.0011	+0.0008	+0.0002	-0.0007	-0.0016	-0.0025
95°.....	+0.0011	+0.0012	+0.0014	+0.0014	+0.0012	+0.0009	+0.0003	-0.0006	-0.0015	-0.0024
100°....	+0.0012	+0.0013	+0.0015	+0.0015	+0.0013	+0.0010	+0.0004	-0.0005	-0.0014	-0.0023

When requested to convert the weight in water of 5000 gram samples used in the weight in air versus weight in water method of specific gravity determinations, the conversion to total solids shall be based on Table II.

Table II. -- Specific Gravity Conversion Chart for 5,000 Grams of Potatoes

Water Weight	Specific Gravity	Total Solids
300.....	1.0638	17.2
310.....	1.0661	17.7
320.....	1.0684	18.2
322.....	1.0688	18.3
324.....	1.0693	18.4
326.....	1.0697	18.5
328.....	1.0702	18.6
330.....	1.0707	18.7
332.....	1.0711	18.8
334.....	1.0716	18.9
336.....	1.0720	19.0
338.....	1.0725	19.1
340.....	1.0730	19.2
342.....	1.0734	19.3
344.....	1.0739	19.4
346.....	1.0743	19.5
348.....	1.0748	19.6
350.....	1.0753	19.7
352.....	1.0757	19.8
354.....	1.0762	19.9
356.....	1.0766	20.0
358.....	1.0771	20.1
360.....	1.0776	20.2
362.....	1.0780	20.3
364.....	1.0785	20.4
366.....	1.0790	20.5
368.....	1.0794	20.6

370.....	1.0799	20.7
372.....	1.0804	20.8
374.....	1.0808	20.9
376.....	1.0813	21.0
378.....	1.0818	21.1
380.....	1.0822	21.2
382.....	1.0827	21.3
384.....	1.0832	21.4
386.....	1.0836	21.5
388.....	1.0841	21.6
390.....	1.0846	21.7
392.....	1.0851	21.8
394.....	1.0855	21.9
396.....	1.0860	22.0
398.....	1.0865	22.1
400.....	1.0870	22.2
402.....	1.0874	22.3
404.....	1.0879	22.4
406.....	1.0884	22.5
408.....	1.0888	22.6
410.....	1.0893	22.7
412.....	1.0898	22.8
414.....	1.0903	22.9
416.....	1.0908	23.0
418.....	1.0912	23.1
420.....	1.0917	23.2
422.....	1.0922	23.4
424.....	1.0926	23.5
426.....	1.0931	23.6
428.....	1.0936	23.7
430.....	1.0941	23.8
432.....	1.0946	23.9
440.....	1.0965	24.4
450.....	1.0989	24.9
460.....	1.1013	25.4
470.....	1.1040	26.0

Whenever the recorded water weight for an individual reading falls between two sets of numbers as indicated in Table II, the next higher reading shall be used.

§51.3418 Optional test for fry color.

Fry color may be determined in accordance with contract specifications by using the Munsell Color Standards for Frozen French Fried Potatoes, Third Edition, 1972, 64 - 1.⁵ Select a minimum of twenty (20) potatoes at random from the official sample. Slice each potato from stem to blossom-end into 1/2 square inch strips. Unless otherwise specified, fry center cut strips in oil for a minimum of 3 minutes at 350°F or 2-1/2 minutes at 375°F.

⁵Munsell Color Standards for Frozen French Fried Potatoes, Third Edition, 1972, 64 - 1, may be purchased from the Munsell Color Co., 2441 North Calvert St., Baltimore, MD 21218.