



NIST Handbook 44 Accuracy Classes



Class	Value of the verification scale division (d or e <sup>1</sup> )	Number of scale <sup>4</sup> divisions (n)	
		Minimum	Maximum
<b>SI Units</b>			
I	Equal to or greater than 1 mg	50,000	-
II	1 to 50 mg, inclusive	100	100,000
	Equal to or greater than 100 mg	5000	
III <sup>2</sup>	0.1 to 4 g, inclusive	100	10,000
	Equal to or greater than 5 g	500	
III L <sup>3</sup>	Equal or greater than 2 kg	2000	10,000
III	Equal to or greater than 5 kg	100	1,200
<b>Inch-Pound Units</b>			
III	0.0002 lb to 0.005 lb, inclusive 0.005 oz to 0.125 oz inclusive Equal to or greater than 0.01 lb Equal to or greater than 0.25 oz	100	10,000
		100	
		500	
		500	
III L <sup>3</sup>	Equal to or greater than 5 lb	2000	10,000
III	Greater than 0.01 lb Greater than 0.25 lb	100	1,200
		100	

<sup>1</sup> For Class I and II devices equipped with auxiliary reading means (i.e., a rider, a vernier, or a least significant decimal differentiated by size, shape, or color), the value of the verification scale division "e" is the value of the scale division immediately preceding the auxiliary means.

<sup>2</sup> A scale marked "For prescription weighing only" may have a scale division not less than 0.01g

<sup>3</sup> The value of a scale division for crane and hopper (other than grain hopper) scales shall be not less than 0.2 kg (0.5 lb). The minimum number of scale divisions shall be not less than 1000.

<sup>4</sup> On a multiple range or multi-interval scale the number of divisions for each range independently shall not exceed the maximum specified for the accuracy class. The number of scale divisions, n, for each range is determined by dividing the scale capacity for each range by the verification scale division, e for each range. On a scale system with multiple load receiving elements and multiple indications, each element considered shall not independently exceed the maximum specified for the accuracy class. If the system has a summing indicator, the n<sub>sum</sub> for the summed indication shall not exceed the maximum specified for the accuracy class.





## U.S. Field Standard Weight Classification

### ***Specification and Tolerances for Field Standard Weights (NIST Handbook 105-1, Class F, Revised 1990)***

These specifications and tolerances are minimum requirements for standards used primarily to test weighing devices.

Key words: Field standard weights, specifications, test weights, tolerances, weights and measures inspection.

### **Introduction**

A Class F field standard weight (after this, called "weight") is intended to be used primarily to test commercial weighing devices for compliance with the requirements of NIST Handbook 44<sup>1</sup>. Class F weights may be used to test most accuracy Class<sup>2</sup> III scales, all scales of Class IIIIL or IIII, and scales not marked with a class designation.

A weight shall be verified to be within-tolerance prior to use. The within-tolerance status of a weight shall be rechecked as often as regulations or circumstances require, especially when damage to it is known or suspected.

### **General**

These specifications apply to new weights placed in service after the publication of this standard; the tolerances apply to all weights in service.

A weight in service prior to the publication of this standard that has maintained Class F tolerances between verification tests shall continue to be acceptable.

The specifications permit the use of a weight at its nominal value in normal testing operations, where the tolerance on the item under test is at least three times as great as the tolerance of the weight<sup>3</sup>.

### **A partial list of specifications from Handbook 105-1**

#### **1. Material**

- 1.1 A weight made of brass or a fabricated weight (such as a laminated weight or a weight of nonuniform density) shall not be placed in service after the publication date of this standard (1990).
- 1.2 A weight smaller than 5 grams/0.01 lb shall be constructed of stainless steel, tantalum, nickel-chromium alloy, aluminum alloy, or other material sufficiently resistant to corrosion and oxidation that the surface need not be protected or coated.

- 1.3 A weight of 5 grams/0.01 lb up to and including 5 kg/10 lb shall be constructed of material having a hardness of Rockwell B 80 or greater (such as 300-series stainless steel), and be resistant to abrasion, corrosion, denting, and chipping.
- 1.4 A weight larger than 5 kg/10 lb shall be constructed of materials such as iron, steel, or stainless steel, have a hardness of Rockwell B 80 or greater, and be resistant to abrasion, corrosion, denting, and chipping. Cast iron may be used for weights 10 kg/20 lb and larger. Body filler (e.g., fiberglass, putty, or plaster) shall not be used to correct a poor casting or finish.

#### **2. Finish**

- 2.1 The surface finish of a new weight machined from round bar stock shall have a roughness average of 0.80 micrometers (32 microinches) or better, determined by use of a hand-held surface roughness indicator (available from several manufacturers) or more accurate method, and be free of scratches, dents, and chipped corners or edges, determined by visual examination. A beaded or blasted finish (with roughness average 1.25 micrometers (50 microinches) or better) is acceptable on a cube weight to facilitate gripping.
- 2.2 A weight 5 kg/10 lb or less shall not have a surface coating.
- 2.3 A weight larger than 5 kg/10 lb constructed of materials susceptible to corrosion or tarnishing shall have a protective surface coating. A light coat of sprayed-on flat aluminum paint is recommended. Lacquer is also acceptable. Epoxy paint or plated surfaces are not acceptable. A coating is recommended for the bottom of a weight, particularly if the bottom is recessed. If paint or lacquer is used, it shall be hard and resistant to chipping. Cast metric and avoirdupois field standards shall be color coded (i.e. gold for metric and silver for avoirdupois) to differentiate the weights.

<sup>1</sup> NIST Handbook 44, Specifications Tolerances, and Other Technical Requirements for Weighing and Measuring Devices. (See current edition.)

<sup>2</sup> See Handbook 44, Section 2, Scales Code.

<sup>3</sup> See Handbook 44, Appendix A, par. 3.2.



## Weight Tolerances

## Metric

Denomination Metric	105-1 F g & mg
5000 kg	500 g
3000 kg	300 g
2000 kg	200 g
1000 kg	100 g
500 kg	50 g
300 kg	30 g
200 kg	20 g
100 kg	10 g
50 kg	5.0 g
30 kg	3.0 g
25 kg	2.5 g
20 kg	2.0 g
10 kg	1.0 g
5 kg	500 mg
3 kg	300 mg
2 kg	200 mg
1 kg	100 mg
500 g	70 mg
300 g	60 mg
200 g	40 mg
100 g	20 mg
50 g	10 mg
30 g	6.0 mg
20 g	4.0 mg
10 g	2.0 mg
5 g	1.5 mg
3 g	1.28 mg
2 g	1.12 mg
1 g	0.90 mg
500 mg	0.72 mg
300 mg	0.61 mg
200 mg	0.54 mg
100 mg	0.43 mg
50 mg	0.35 mg
30 mg	0.29 mg
20 mg	0.26 mg
10 mg	0.21 mg
5 mg	0.17 mg
3 mg	0.14 mg
2 mg	0.12 mg
1 mg	0.10 mg

## Avoirdupois Weight Tolerances

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## POUNDS

Denomination Metric	105-1 F g & mg
10,000 lb	450 g
5000 lb	230
3000 lb	140
2500 lb	110
2000 lb	91
1000 lb	45
500 lb	23
100 lb	4.5
50 lb	2.3
40 lb	
30 lb	1.4
25 lb	1.1
20 lb	910 mg
15 lb	
10 lb	450
9 lb	
8 lb	
7 lb	
6 lb	
5 lb	227
4 lb	
3 lb	136
2 lb	91
1 lb	70
0.5 lb	45
0.3 lb	27
0.2 lb	18
0.1 lb	9.1
0.05 lb	4.5
0.03 lb	2.7
0.02 lb	1.8
0.01 lb	1.5
0.005 lb	1.17
0.003 lb	0.99
0.002 lb	0.87
0.001 lb	0.70
0.0005 lb	
0.0003 lb	
0.0002 lb	
0.0001 lb	
0.00005 lb	
0.00003 lb	
0.00002 lb	
0.00001 lb	

## OUNCES

Denomination Metric	105-1 F mg
12 oz	
10 oz	
8 oz	45
6 oz	
5 oz	
4 oz	23
3 oz	
2 oz	11
1 oz	5.4
1/2 oz	2.8
1/4 oz	1.7
1/8 oz	1.3
1/16 oz	1.1
1/32 oz	0.87
1/64 oz	0.69
0.5 oz	2.6
0.3 oz	1.8
0.2 oz	1.6
0.1 oz	1.3
0.05 oz	1.0
0.03 oz	0.85
0.02 oz	0.75
0.01 oz	0.60
0.005 oz	
0.003 oz	
0.002 oz	
0.001 oz	
0.0005 oz	
0.0003 oz	
0.0002 oz	
0.0001 oz	

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Tolerances have been converted from avoirdupois to metric and rounded to two significant figures.

**NIST 105-1 Class F**

Tolerances are based on the 1975 revised tolerance structure used by State Weights & Measures.