

Selecting Weights & Certificates

Classes of Weights

Three main calibration weight classes systems:

OIML: The International Organization of Legal Metrology ([OIML](#)) is an international organization that provides standards and systems with the goal of harmonizing legal metrology procedures. From lowest (most accurate) to highest tolerance, the [OIML classes](#) are E1, E2, F1, F2, M1, M2, and M3. Most laboratory applications require OIML weights of Class F2 or below. OIML class weights are more commonly used outside the US in Europe and Latin America for example.



ASTM: [ASTM International](#) (formerly American Society for Testing and Materials) is a nonprofit non-governmental organization that develops voluntary consensus standards. It has developed 10 calibration weight classes as guided by document ASTM E 617: ASTM Class 000 thru ASTM Class 7. The higher the class number, the higher the level of tolerance (and less accurate) the weight will be. Most laboratory applications require ASTM weights of Class 4 or below. ASTM class weights are the most common type of calibration weights used in US laboratories.

NIST: National Institute of Standards and Technology ([NIST](#)) Class F weights are often used in industrial settings to verify Class III, Class IIII, and non-designated scales. They may also be used in warehouses and manufacturing settings to calibrate scales used for the shipping or production of large products. NIST Class F weights are not typically used in laboratories as they are not accurate enough to verify the scales used for most laboratory applications

Be aware manufacturers of calibration weights create their own class systems. For example, UltraClass, UltraClass Gold, and UltraClass Platinum. You can find reference on that manufacturer website to explain where these made up classes equate to in terms of ASTM and OIML tolerances charts.

Depending on your application, you may require that your calibration weights come with a certificate confirming that the lab testing the weights is accredited. There are two accredited bodies the certify calibration laboratories.

- **ISO/IEC 17025:** The International Organization for Standardization (ISO) is an independent non-governmental organization comprising a membership of 164 national standards bodies. The International Electrochemical Commission (IEC) is an international standards organization for electrotechnical fields. Together with other liaison organizations, they created the [ISO/IEC 17025 standards](#). This is the international reference to be used by testing and calibration laboratories that want to display their ability to provide reliable results.
- **NIST/NVLAP:** [NVLAP](#) refers to a calibration program developed by the National Voluntary Laboratory Accreditation Program (NVLAP) at the (NIST). It provides a means to assess calibration labs for competency, offering accreditation in various fields. It follows the international standard ISO/IEC 17025 (discussed above) when accrediting calibration laboratories.

Certified weights often have longer lead time as well, as the weights may need to be sent out for certification

How often weights should be tested and calibrated depends on their frequency of use and the necessary accuracy of the application. Weights that are improperly handled (without gloves or forceps) should also be tested more frequently or may need to be re-tested immediately depending on the sensitivity and / or legal requirements of the application.

Tolerance Levels

The following tables shows the tolerance levels for the different classes of weights, starting with OIML.

OIML R11							
Nominal Size	Class E1	Class E2	Class F1	Class F2	Class M1	Class M2	Class M3
	mg	mg	mg	mg	mg	mg	mg
5000 kg			250,000	80,000	250,000	800,000	2,500,000
2000 kg			10,000	30,000	100,000	300,000	1,000,000
1000 kg		1,600	5,000	16,000	50,000	100,000	500,000
500 kg		800	2,500	8,000	25,000	80,000	250,000
300 kg							
200 kg		300	1,000	3,000	10,000	30,000	100,000
100 kg		160	500	1,600	5,000	16,000	50,000
50 kg	25	80	250	800	2500	8000	25,000
20 kg	10	30	100	300	1000	3000	10,000
10 kg	5	16	50	160	500	1600	5000
5 kg	2.5	8	25	80	250	800	2500
2 kg	1	3	10	30	100	300	1000
1 kg	0.5	1.6	5	16	50	160	500
500 g	0.25	0.8	2.5	8	25	80	250
200 g	0.1	0.3	1	3	10	30	100
100 g	0.05	0.16	0.5	1.6	5	16	50
50 g	0.03	0.1	0.3	1	3	10	30
20 g	0.025	0.08	0.25	0.8	2.5	8	25
10 g	0.02	0.06	0.2	0.6	2	6	20
5 g	0.016	0.05	0.16	0.5	1.6	5	16
2 g	0.012	0.04	0.12	0.4	1.2	4	12
1 g	0.01	0.03	0.1	0.3	1	3	10
500 mg	0.008	0.025	0.08	0.25	0.8	2.5	
200 mg	0.006	0.02	0.06	0.2	0.6	2	
100 mg	0.005	0.016	0.05	0.16	0.5	1.6	
50 mg	0.004	0.012	0.04	0.12	0.4		
20 mg	0.003	0.01	0.03	0.1	0.3		
10 mg	0.003	0.008	0.025	0.08	0.25		
5 mg	0.003	0.006	0.02	0.06	0.2		
2 mg	0.003	0.006	0.02	0.06	0.2		
1 mg	0.003	0.006	0.02	0.06	0.2		

ASTM E617-13 (METRIC)

Nominal Size	Class 000	Class 00	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
	mg	mg	mg	mg	g & mg	g & mg	g & mg	g & mg	g & mg	g & mg
5000 kg					25 g	50 g	100 g	250 g	500 g	750 g
3000 kg					15	30	60 g	150	300	450
2000 kg					10	20	40 g	100	200	300
1000 kg					5	10	20 g	50	100	150
500 kg					2.5	5	10 g	25	50	75
300 kg					1.5	3	6.0 g	15	30	45
200 kg					1	2	4.0 g	10	20	30
100 kg					500 mg	1	2.0 g	5	10	15
50 kg	13 mg	25 mg	63 mg	125 mg	250	500 mg	1.0 g	2.5	5	7.5
30 kg	7.5	15	38	75	150	300	600 mg	1.5	3	4.5
25 kg	6.25	12.5	31	62	125	250	500	1.2	2.5	4.5
20 kg	5	10	25	50	100	200	400	1	2	3.8
10 kg	2.5	5	13	25	50	100	200	500 mg	1	2.2
5 kg	1.3	2.5	6	12	25	50	100	250	500 mg	1.4
3 kg	0.75	1.5	3.8	7.5	15	30	60	150	300	1
2 kg	0.5	1	2.5	5	10	20	40	100	200	750 mg
1 kg	0.25	0.5	1.3	2.5	5	10	20	50	100	470
500 g	0.13	0.25	0.6	1.2	2.5	5	10	30	50	300
300 g	0.075	0.15	0.38	0.75	1.5	3	6	20	30	210
200 g	0.05	0.1	0.25	0.5	1	2	4	15	20	160
100 g	0.025	0.05	0.13	0.25	0.5	1	2	9	10	100
50 g	0.015	0.03	0.06	0.12	0.25	0.6	1.2	5.6	7	62
30 g	0.014	0.026	0.037	0.074	0.15	0.45	0.9	4	5	44
20 g	0.013	0.025	0.037	0.074	0.1	0.35	0.7	3	3	33
10 g	0.01	0.02	0.025	0.05	0.074	0.25	0.5	2	2	21
5 g	0.005	0.01	0.017	0.034	0.054	0.18	0.36	1.3	2	13
3 g	0.005	0.01	0.017	0.034	0.054	0.15	0.3	0.95	2	9.4
2 g	0.005	0.01	0.017	0.034	0.054	0.13	0.26	0.75	2	7
1 g	0.005	0.01	0.017	0.034	0.054	0.1	0.2	0.5	2	4.5
500 mg	0.002	0.003	0.005	0.01	0.025	0.08	0.16	0.38	1	3
300 mg	0.002	0.003	0.005	0.01	0.025	0.07	0.14	0.3	1	2.2
200 mg	0.002	0.003	0.005	0.01	0.025	0.06	0.12	0.26	1	1.8
100 mg	0.002	0.003	0.005	0.01	0.025	0.05	0.1	0.2	1	1.2
50 mg	0.002	0.003	0.005	0.01	0.014	0.042	0.085	0.16	0.5	0.88
30 mg	0.002	0.003	0.005	0.01	0.014	0.038	0.075	0.14	0.5	0.68
20 mg	0.002	0.003	0.005	0.01	0.014	0.035	0.07	0.12	0.5	0.56
10 mg	0.002	0.003	0.005	0.01	0.014	0.03	0.06	0.1	0.5	0.4

Nominal Size	Class 000	Class 00	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
3 mg	0.002	0.003	0.005	0.01	0.014	0.026	0.052	0.07	0.2	
2 mg	0.002	0.003	0.005	0.01	0.014	0.025	0.05	0.06	0.2	
1 mg	0.002	0.003	0.005	0.01	0.014	0.025	0.05	0.05	0.1	
0.5 mg	0.002	0.003	0.005	0.01	0.014	0.025	0.05	0.05	0.1	
0.3 mg	0.002	0.003	0.005	0.01	0.014	0.025				
0.2 mg	0.002	0.003	0.005	0.01	0.014					
0.1 mg	0.002	0.003	0.005	0.01						
0.05 mg	0.002	0.003	0.005							

Materials, Styles, Construction, Classes and Applications



The materials and styles used to create calibration weights vary depending on the weight and application use. Most weights are single piece cast molded construction sometime referred to as Type 1, but more precise weights require a two-piece construction referred to as Type II. A two-piece weight consists of a knob that screws into the body of the weight. There is a cavity below the thread, containing adjusting material that allow a certified calibration laboratory to add or subtracted to adjust and certified weigh to accuracy and tolerance standards.

Cast Iron (Larger in size)

Cast iron test weights are commonly used as field standards to test industrial weighing devices, to test non-marked scales without class designation, and to check for acceptable tolerances. Cast iron test weights are painted gold if measured in metric units or silver if measured in avoirdupois units. Most test weights come with an adjusting cavity for sealing.

○ Styles



Grip/Pipe Handle

Slotted

Nesting Slab

○ **Construction:** Single Piece - Cast Molded

○ Classes

- ASTM Class 6 and 7 (previously sold as NIST Class F)
- OIML Class M1 and M2

○ Application use:

- Test weight as field standard for industrial devices

- Non marked scales without NTEP class designations
- Crude daily check for acceptable tolerances

- **Stainless steel (Med in size)**

Stainless steel calibration weights are used for testing and certifying NTEP class designated scales and balances. Most weights if Type II have a sealing cavity for adjustment, and the nominal value is marked on the test weight with an optional serial number stamp. Stainless steel weights are manufactured in accordance with ASTM E 617-13 specifications and tolerances. ASTM Class 0 test weights are not individually marked with their weight value or individually serialized per ASTM E 617-13

- **Styles**



Electronic Balance
Cylindrical
Type I or II
Metric/Avoirdupois

Precision Balance
Screw Knob
Type II
Avoirdupois

Knob
Type I
Metric (OIML)

Leaf

- **Construction:** One Piece (Type 1) or Two Piece (Type II) with sealing cavity. Single-piece cylindrical test weights are Type I, Electronic balance weights and precision weight are Type I. ASTM Class 0 and OIML Class E1 and E2, and F1 and F2 with a one-piece construction. Avoirdupois is another way of say imperial system used in the UK and US.
- **Classes**
 - ASTM Class 0-7
 - OIML Class E1, E2, F1, F2
- **Application use:**
 - Test weights are used to calibrate Class I and II balances ASTM Class 4, 5, 6
 - Testing and certifying for Class III scales and balances ASTM Class 6 & 7 (previously sold as for NIST Class F)
 - Tolerance Testing
 - Verification Checks

- **Aluminum (Small in size size)**

- **Styles** include cylindrical, leaf, dish, flat, wire.

- **Classes**

ASTM Class 4,5,6, and 7 (previously sold as for NIST Class F)



Cylindrical

Dish

Leaf

Wire

- **Construction:** Cylindrical can be Type I or II, but the rest are only one piece
- **Classes**
 - ASTM Class 0-7
 - OIML Class E1, E2, F1, F2, M1, M2
- **Application use:**
 - Test weights are used to calibrate Class I and II balances ASTM Class 4, 5, 6
 - Tolerance Testing
 - Verification Checks

Qualifying the weights you need

1. Are you replacing any existing weights or weight sets?
 - a. If yes, what is part number
 - b. What is configuration 5-2-2-1 or 5-3-2-1 do you need?
 - c. What is the style OIML or ASTM?
 - d. What type of documentation do you require?
2. Do you need this weight to be legal for trade?
3. What tolerance are you looking for?
4. Is your tolerance be driven by the equipment under testing, the application, internal specification, documentation requirement or another source?
5. Do you need ISO/IEC 17025 and ISO 9000 laboratory documentation?
6. If you do not need ISO/IEC 17025 and ISO 9000 laboratory documentation, do you need traceability to NIST?
7. Do you need true mass value?
8. Do you need a book version of the Calibration Report?
9. If you do not need any documentation, you still have the option of an Statement of Accuracy if desired by manufacturer.

Weights and weight sets should be recertified on a managed periodic basis. The recertification period is determined by a number of factors, including but not necessarily limited to, the environment, frequency of use, demands of the process, quality of the weighing devices in question, age of the weights in question and handling during use.