



Selecting Weights and Certificates



Weight Selection

There are several shapes, designs and sizes available to meet your needs.

Selecting the proper weight for your application can be confusing given the number of weight classes, designs, and materials available. The following information can help in your weight selection process. A Troemner Sales Representative can also assist you in selecting the correct weight for your application. Please contact a Troemner Sales Representative at [800-249-5554](tel:800-249-5554) or visit our website at www.troemner.com to help you choose the proper weight for your application.

The following issues need to be considered when selecting weights:

1. Application Accuracy

The correct weight for an application should be more accurate than the precision of the weighing device, and must be more accurate than the required precision of your measurement result. It is recommended that a weight have an accuracy that is 1/3 of the measurement device readability and/or your measurement accuracy requirement.

2. Environment

Temperature and humidity can impact the stability of weights. We recommend stainless steel weights for applications in environments that have excess moisture, changes in

temperature or humidity, or are in corrosive environments. Stainless steel is much less prone to physical change as compared to cast iron or brass.

Cleanliness of the environment can impact how stable your weights will be over time. Environments with excessive airborne matter, such as dust, can impact the stability of weights. The smoother the surface of a weight, the easier it is to see foreign matter so it can be removed.

3. Reported Uncertainty on Calibration

The uncertainty reported on a calibration is just as important as the measured value itself. The uncertainty provides the statistical confidence that a laboratory has on its calibration process. The larger the uncertainty, the less confidence in the measured value. It is also important to realize that a measured value added to its associated uncertainty must be less than the tolerance for the weight to be considered within class tolerance.



Mass Calibration



Weight Certificates

4. Certification

Troemner offers a variety of calibration certificates to meet your specific needs. Certificates are described in detail in the "Certificate Options" section beginning on page 23.

5. Special Design or Construction

Troemner manufactures a variety of special application weights, such as weights with hooks or weights that can be stacked on a hanger in order to build up the total weight. Keep in mind that if you do not see what you need, please contact a Troemner Sales Representative at [800-249-5554](tel:800-249-5554) or troemner@troemner.com to discuss your special weight requirements.



Weight Specifications

General Information

Troemner offers the most comprehensive selection of precision weights and mass standards. Our weight selection includes every imaginable size, class, and type from 10,000 kg stainless steel weights to the extremely precise, highly polished one and two-piece stainless steel weights.

At Troemner, careful attention is paid to every detail of production. Weight bottoms are slightly recessed to expose the smallest possible area to wear. Weight heads and necks are precisely shaped to give a solid, sure grip to forceps or weight lifters. Troemner uses the finest materials available for the production of all of our weights and mass standards. For your most demanding applications, our precision weights are manufactured from Troemner Alloy 8, which is a specially developed stainless steel. Troemner Alloy 8 possesses closely controlled density (8.03 g/cm³), extremely low magnetic properties, good stability, and resistance to corrosion. We manufacture and calibrate weights to meet or exceed the highest tolerance standards of ANSI/ASTM, OIML, and NIST.

ANSI/ASTM E617

Standard Specification for Laboratory Weights and Precision Mass Standards

This specification covers various classes of weights and mass standards used in laboratories ranging from Class 000 to Class 7. Tolerances and design restrictions for each class are described in order that both individual weights and weight sets can be chosen for the appropriate applications. This specification also recognizes OIML R 111 that describes class E1, E2, F1, F2, M1, M2 and M3.

OIML R 111

Weights of Class E1, E2, F1, F2, M1, M2, M3

This international document describes the physical characteristics and metrological requirements of weights that are used for the verification of weights of a lower class of accuracy and with weighing instruments. This document includes a recommendation for seven classes of weights in tiers of uncertainty.

NIST Handbook 105-1

Specifications and Tolerances for Field Standard Weights

These specifications and tolerances are specific for reference and field standard weights (NIST Class F). Reference and field standard weights are used to test weighing devices where the weight of the item is required to determine the item's price. This document sets minimum requirements for standards used primarily to test commercial or legal for trade weighing devices for compliance with NIST Handbook 44. These devices include, but are not limited to, delicatessen scales, jewelry scales, postal and parcel post scales, and dairy product scales. This specification permits the use of a weight at its nominal value in normal testing operation, where the tolerance of the item under test is at least three times as great as the tolerance of the weight. This handbook also specifies the design, marking, adjusting cavities, and density of these weights. Any variation in design from Handbook 105-1 must be submitted to NIST for approval.

For more information visit www.troemner.com.





Selecting Weight Classes



Weight Applications by Class

In order to select the appropriate weight for your laboratory, you must first determine exactly how you intend to use the weight. Your unique application will help determine exactly which Troemner weight will suit your needs. Troemner's Tolerance Chart can be viewed on pages 19-20 or at www.troemner.com to assist you in selecting the appropriate weights.

The following guidelines explain the applications of the different classes of weights:

Troemner UltraClass Series

Available exclusively from Troemner, these weights are developed to meet the most demanding calibration needs with the ability to be adjusted. Consistent automated measurement means that Troemner UltraClass weights are the most precise two-piece weights available with weight tolerances that equal or exceed comparable ANSI/ASTM E617 and OIML R 111 class tolerances. Troemner UltraClass weights, 1 g through 20 kg, are made from our exclusive stainless steel, Troemner Alloy 8 (excluding Electronic Balance).

We guarantee for the life of all Troemner Alloy 8 Stainless Steel Precision Weights that they will maintain extremely low magnetic susceptibility. Troemner UltraClass weights combine high precision with the advantage of two-piece construction (1 g and larger) avoiding costly replacement issues associated with one-piece weights. UltraClass Platinum and UltraClass Gold come with free laser serialization and a corresponding NVLAP+ Accredited Certificate.



Two-piece construction means the weight is made of multiple pieces of stainless steel. The body of the weight is the primary piece and the knob of the weight is the secondary piece. The knob has a thread that screws into the body and is tightened. There is a cavity below the knob thread within the body which contains adjusting material, typically the same material from which the weight is made.

Troemner UltraClass weights and weight sets are available in a full range of weight denominations. UltraClass Platinum, UltraClass Gold, and UltraClass are available for Troemner Analytical Precision Weights, OIML Precision Weights and Electronic Balance Weights. Troemner UltraClass weights are two-piece alternatives to the one-piece weights with uncertainties slightly larger than the one-piece weights.

Troemner UltraClass Platinum - The weight tolerance is equal to ANSI/ASTM E617 Class 000 and Class E0*. This class is used as a primary standard for calibrating other reference standards and weights where the stability of the environment and careful handling are assured. This class is appropriate for calibrating high-precision analytical balances with a readability as low as 0.0001 mg.

Troemner UltraClass Gold - The weight tolerance is equal to ANSI/ASTM E617 Class 00 and meets or exceeds OIML R 111 Class E1. This class is used as a reference standard for calibrating other reference standards and weights where the stability of the environment and careful handling are assured. This class is appropriate for calibrating high-precision analytical balances with a readability as low as 0.001 mg.

Troemner UltraClass - The weight tolerance is equal to ANSI/ASTM E617 Class 0 and exceeds OIML R 111 Class E2. This class is used as a reference standard for calibrating other reference standards and is appropriate for calibrating high-precision analytical balances with a readability as low as 0.01 mg.



Laser etching

Troemner UltraClass Comparison Chart

Weight Class	Equivalent Class Tolerances	Material	Lifetime Guarantee	Positive Calibration Tolerance Guarantee	Standard Laser Serialization
UltraClass Platinum	ANSI/ ASTM Class 000 Class E0*	Alloy 8	X	X	X
UltraClass Gold	ANSI/ ASTM Class 00 OIML Class E1	Alloy 8	X	X	X
UltraClass	ANSI/ ASTM Class 0 & exceeds OIML Class E2	Alloy 8	X	X	

*E0 is a theoretical tolerance that is 50% of OIML R 111 Class E1

ANSI/ASTM E617 Classes

ANSI/ASTM Class 000 - Used as a primary reference for calibrating other reference standards and weights. Class 000 weights are intended to be used in metrology laboratories where the stability of the environment and careful handling are assured. Although very stable, one-piece construction Class 000 weights have no method of adjustment and are not suitable for general laboratory use. Class 000 is 1/3 the tolerance of Class 00 and the uncertainty is the best measurement reported in our NVLAP+ scope of accreditation which is guaranteed to be 1/3 the tolerance or better.

ANSI/ASTM Class 00 - Used as a primary reference for calibrating other reference standards and weights. Class 00 weights are intended to be used in metrology laboratories where the stability of the environment and careful handling are assured. Although very stable, one-piece construction Class 00 weights have no method of adjustment and are not suitable for general laboratory use. Class 00 weight tolerances are equal to OIML R 111 E1 tolerances and are tighter than Class 0. The uncertainty is guaranteed to be 1/3 the tolerance.

ANSI/ASTM Class 0 - Used as a primary reference for calibrating other reference standards and weights. Class 0 weights are intended to be used in metrology laboratories where the stability of the environment and careful handling are assured. Although very stable, one-piece construction Class 0 weights have no method of adjustment and are not suitable for general laboratory use. The uncertainty is guaranteed to be 1/3 the tolerance.

ANSI/ASTM Class 1 - Can be used as a reference standard in calibrating other weights and is appropriate for calibrating high-precision analytical balances with a readability as low as 0.1 mg to 0.01 mg.

ANSI/ASTM Class 2 - Appropriate for calibrating high-precision top loading balances with a readability as low as 0.01 g to 0.001 g.

ANSI/ASTM Class 3 - Appropriate for calibrating balances with moderate precision and with a readability as low as 0.1 g to 0.01 g.



Troemner's Primary Standards Laboratory

ANSI/ASTM Class 4 - For calibration of semi-analytical balances and for student use.

ANSI/ASTM Class 5 - For student laboratory use.

ANSI/ASTM Class 6 - This class meets the specifications of OIML R 111 Class M2.

ANSI/ASTM Class 7 - For rough weighing operations in physical and chemical laboratories, such as force measuring apparatus.

Class E0*

Class E0* - Used as a primary reference for calibrating other reference standards and weights where the stability of the environment and careful handling are assured. Class E0* weights have no method of adjustment and are not suitable for general laboratory use. Class E0* is 1/2 the tolerance of E1 and the uncertainty is the best measurement reported in our NVLAP+ scope of accreditation which is guaranteed to be 1/3 the tolerance or better.

OIML R 111 Classes

OIML Class E1 - Used as a primary reference for calibrating other reference standards and weights where the stability of the environment and careful handling are assured. Class E1 weights have no method of adjustment and are not suitable for general laboratory use. The uncertainty is guaranteed to be 1/3 the tolerance.

OIML Class E2 - Can be used as a reference standard in calibrating other weights and is appropriate for calibrating high-precision analytical balances with a readability as low as 0.1 mg to 0.01 mg.

OIML Class F1 - Appropriate for calibrating high-precision top loading balances with a readability as low as 0.01 g to 0.001 g.

OIML Class F2 - For calibration of semi-analytical balances and for student use.

OIML Class M1, M2, M3 - Economical weights for general laboratory, industrial, commercial, technical and educational use. Typically fabricated from cast iron or stainless steel.

NIST Classes

NIST Class F - Primarily used to test commercial weighing devices by state and local weights and measures officials, device installers, and service technicians. Class F weights may be used to test most accuracy Class III scales, all scales of Class IIII or IIII, and scales not marked with a class designation.

Refer to Troemner's Tolerance Chart on pages 19-20 for specific information on the tolerance of each weight in a given class. Troemner's Uncertainty Chart and Tolerance Chart are also available on www.troemner.com for additional reference.



Tolerance Chart (Maximum Permissible Error)

International Organization of
Legal Metrology Recommendation R 111

Troemner UltraClass Series

	Class E0*	E1	E2	F1	F2	M1	M2	M3	UltraClass Platinum	UltraClass Gold	UltraClass
2000 kg				10 g	30 g	100 g	300 g	1000 g			
1000 kg			1.6 g	5	16	50	160	500			
500 kg			0.8	2.5	8	25	80	250			
300 kg											
200 kg			0.3	1	3	10	30	100			
100 kg			160 mg	0.5	1.6	5	16	50			
50 kg	12.5 mg	25 mg	80	250 mg	800 mg	2.5	8	25	13 mg	25 mg	63 mg
30 kg									7.5	15	38
25 kg									6.25	12.5	31
20 kg	5	10	30	100	300	1	3	10	5.0	10	25
10 kg	2.5	5.0	16	50	160	500 mg	1.6	5	2.5	5.0	13
5 kg	1.3	2.5	8.0	25	80	250	800 mg	2.5	1.3	2.5	6.0
3 kg									0.75	1.5	3.8
2 kg	0.5	1.0	3.0	10	30	100	300	1	0.5	1.0	2.5
1 kg	0.25	0.5	1.6	5.0	16	50	160	500 mg	0.25	0.5	1.3
500 g	0.13	0.25	0.8	2.5	8.0	25	80	250	0.13	0.25	0.60
300 g									0.075	0.15	0.38
200 g	0.05	0.10	0.3	1.0	3.0	10	30	100	0.05	0.10	0.25
100 g	0.025	0.05	0.16	0.5	1.6	5	16	50	0.025	0.05	0.13
50 g	0.015	0.03	0.10	0.3	1.0	3.0	10	30	0.015	0.030	0.060
30 g									0.014	0.026	0.037
20 g	0.013	0.025	0.08	0.25	0.8	2.5	8.0	25	0.013	0.025	0.037
10 g	0.010	0.020	0.06	0.20	0.6	2.0	6.0	20	0.010	0.020	0.025
5 g	0.008	0.016	0.05	0.16	0.5	1.6	5.0	16	0.005	0.010	0.017
3 g									0.005	0.010	0.017
2 g	0.006	0.012	0.04	0.12	0.4	1.2	4.0	12	0.005	0.010	0.017
1 g	0.005	0.010	0.03	0.10	0.3	1.0	3.0	10	0.005	0.010	0.017
500 mg	0.004	0.008	0.025	0.08	0.25	0.8	2.5		0.002	0.003	0.005
300 mg									0.002	0.003	0.005
200 mg	0.003	0.006	0.020	0.06	0.20	0.6	2.0		0.002	0.003	0.005
100 mg	0.003	0.005	0.016	0.05	0.16	0.5	1.6		0.002	0.003	0.005
50 mg	0.002	0.004	0.012	0.04	0.12	0.4			0.002	0.003	0.005
30 mg									0.002	0.003	0.005
20 mg	0.002	0.003	0.010	0.03	0.10	0.3			0.002	0.003	0.005
10 mg	0.002	0.003	0.008	0.025	0.08	0.25			0.002	0.003	0.005
5 mg	0.002	0.003	0.006	0.020	0.06	0.20			0.002	0.003	0.005
3 mg									0.002	0.003	0.005
2 mg	0.002	0.003	0.006	0.020	0.06	0.20			0.002	0.003	0.005
1 mg	0.002	0.003	0.006	0.020	0.06	0.20			0.002	0.003	0.005
0.5 mg	0.002	0.003	0.006						0.002	0.003	0.005
0.2 mg									0.002	0.003	0.005
0.1 mg									0.002	0.003	0.005
0.05 mg									0.002	0.003	0.005

	ANSI/ASTM E617										NIST Handbooks**		
	000	00	0	1	2	3	4	5	6	7	105-1 F	44 Accept	44 Maint
2000 kg					10 g	20 g	40 g	100 g	200 g	300 g	200 g		
1000 kg					5	10	20	50	100	150	100		
500 kg					2.5	5	10	25	50	75	50		
300 kg					1.5	3	6.0	15	30	45	30		
200 kg					1	2	4.0	10	20	30	20		
100 kg					500 mg	1	2.0	5	10	15	10		
50 kg	13 mg	25 mg	63 mg	125 mg	250	500 mg	1.0	2.5	5	7.5	5.0		
30 kg	7.5	15	38	75	150	300	600 mg	1.5	3	4.5	3.0		
25 kg	6.25	12.5	31	62	125	250	500	1.2	2.5	4.5	2.5		
20 kg	5.0	10	25	50	100	200	400	1.0	2	3.8	2.0	750 mg	1500 mg
10 kg	2.5	5.0	13	25	50	100	200	500 mg	1	2.2	1.0	500	1000
5 kg	1.3	2.5	6.0	12	25	50	100	250	500 mg	1.4	0.50	400	800
3 kg	0.75	1.5	3.8	7.5	15	30	60	150	300	1.0	0.30	250	500
2 kg	0.5	1.0	2.5	5.0	10	20	40	100	200	750 mg	0.20	200	400
1 kg	0.25	0.5	1.3	2.5	5.0	10	20	50	100	470	0.10	120	250
500 g	0.13	0.25	0.60	1.2	2.5	5.0	10	30	50	300	70 mg	88	175
300 g	0.075	0.15	0.38	0.75	1.5	3.0	6.0	20	30	210	60	75	150
200 g	0.05	0.10	0.25	0.50	1.0	2.0	4.0	15	20	160	40	50	100
100 g	0.025	0.05	0.13	0.25	0.50	1.0	2.0	9	10	100	20	35	70
50 g	0.015	0.030	0.060	0.12	0.25	0.60	1.2	5.6	7	62	10	20	40
30 g	0.014	0.026	0.037	0.074	0.15	0.45	0.90	4.0	5	44	6.0	15	30
20 g	0.013	0.025	0.037	0.074	0.10	0.35	0.70	3.0	3	33	4.0	10	20
10 g	0.010	0.020	0.025	0.050	0.074	0.25	0.50	2.0	2	21	2.0	8	15
5 g	0.005	0.010	0.017	0.034	0.054	0.18	0.36	1.3	2	13	1.5	5	10
3 g	0.005	0.010	0.017	0.034	0.054	0.15	0.30	0.95	2.0	9.4	1.3	4	8
2 g	0.005	0.010	0.017	0.034	0.054	0.13	0.26	0.75	2.0	7.0	1.1	3	6
1 g	0.005	0.010	0.017	0.034	0.054	0.10	0.20	0.50	2.0	4.5	0.90	2	4
500 mg	0.002	0.003	0.005	0.010	0.025	0.080	0.16	0.38	1.0	3.0	0.72	1.5	3.0
300 mg	0.002	0.003	0.005	0.010	0.025	0.070	0.14	0.30	1.0	2.2	0.61	1.0	2.0
200 mg	0.002	0.003	0.005	0.010	0.025	0.060	0.12	0.26	1.0	1.8	0.54	0.8	1.5
100 mg	0.002	0.003	0.005	0.010	0.025	0.050	0.10	0.20	1.0	1.2	0.43	0.5	1.0
50 mg	0.002	0.003	0.005	0.010	0.014	0.042	0.085	0.16	0.50	0.88	0.35	0.4	0.8
30 mg	0.002	0.003	0.005	0.010	0.014	0.038	0.075	0.14	0.50	0.68	0.30	0.3	0.6
20 mg	0.002	0.003	0.005	0.010	0.014	0.035	0.070	0.12	0.50	0.56	0.26	0.2	0.4
10 mg	0.002	0.003	0.005	0.010	0.014	0.030	0.060	0.10	0.50	0.40	0.21	0.15	0.3
5 mg	0.002	0.003	0.005	0.010	0.014	0.028	0.055	0.080	0.20	0.17	0.17	0.05	0.1
3 mg	0.002	0.003	0.005	0.010	0.014	0.026	0.052	0.070	0.20	0.14	0.14	0.05	0.1
2 mg	0.002	0.003	0.005	0.010	0.014	0.025	0.050	0.060	0.20	0.12	0.12	0.05	0.1
1 mg	0.002	0.003	0.005	0.010	0.014	0.025	0.050	0.050	0.10	0.10	0.10	0.05	0.1
0.5 mg	0.002	0.003	0.005	0.010	0.014	0.025	0.050	0.050	0.10				
0.2 mg	0.002	0.003	0.005	0.010	0.014								
0.1 mg	0.002	0.003	0.005	0.010									
0.05 mg	0.002	0.003	0.005	0.010									



Uncertainties Chart

Uncertainties listed below are for NVLAP+ Accredited calibrations only.

	Troemner CMC**	Class 000 Class E0*	UltraClass Platinum	Class 00 Class E1	UltraClass Gold	Class 0	UltraClass	Class E2	Class 1	Class 2
2000 kg										5 g
1000 kg										3.2
500 kg										1.2
200 kg										0.46
100 kg										0.44
50 kg	2.0 mg	3.0 mg	6.0 mg	6.0 mg	12 mg	15 mg	21 mg	21 mg	25 mg	25 mg
30 kg	1.2	1.8	3	3	6	9	12		15	15
25 kg	0.97	1.6	3	3	3	7	10		12	12
20 kg	0.76	1.2	2.5	2.5	5	6	8	6	10	10
10 kg	0.37	0.4	1	1	2	3	4	3	5	5
5 kg	0.18	0.16	0.5	0.5	1	1.5	3	1.5	2.5	2.5
3 kg	0.11	0.08	0.5	0.5	1	0.9	1.2		1.5	1.5
2 kg	0.072	0.080	0.25	0.25	0.5	0.6	0.8	0.6	1	1
1 kg	0.035	0.050	0.15	0.15	0.3	0.3	0.4	0.3	0.5	0.5
500 g	0.018	0.040	0.060	0.060	.12	0.15	0.2	0.15	0.25	0.25
300 g	0.012	0.030	0.060	0.060	.12	0.090	0.12		0.15	0.15
200 g	0.0073	0.012	0.025	0.025	0.050	0.060	0.08	0.06	0.1	0.1
100 g	0.0038	0.003	0.010	0.010	0.020	0.030	0.04	0.03	0.05	0.05
50 g	0.0022	0.0020	0.007	0.007	0.014	0.015	0.02	0.015	0.025	0.025
30 g	0.0026	0.0020	0.0070	0.0070	0.0140	0.0090	0.012		0.015	0.015
20 g	0.0013	0.0020	0.0060	0.0060	0.0120	0.0080	0.01	0.008	0.015	0.015
10 g	0.0011	0.0015	0.0050	0.0050	0.0100	0.0060	0.008	0.006	0.01	0.01
5 g	0.0009	0.001	0.0030	0.0030	0.0060	0.0040	0.005	0.004	0.007	0.007
3 g	0.0014	0.001	0.003	0.003	0.006	0.004	0.005		0.006	0.006
2 g	0.00075	0.001	0.003	0.003	0.006	0.004	0.005	0.004	0.006	0.006
1 g	0.00054	0.0008	0.0025	0.0025	0.005	0.004	0.005	0.004	0.006	0.006
500 mg	0.00049	0.0005	0.0005	0.0009	0.0009	0.001	0.001	0.001	0.0025	0.0025
300 mg	0.00072	0.0005	0.0005	0.0009	0.0009	0.001	0.001		0.0025	0.0025
200 mg	0.00040	0.0005	0.0005	0.0009	0.0009	0.001	0.001	0.001	0.0025	0.0025
100 mg	0.00040	0.0005	0.0005	0.0009	0.0009	0.001	0.001	0.001	0.0025	0.0025
50 mg	0.00023	0.0005	0.0005	0.0009	0.0009	0.0010	0.001	0.001	0.0025	0.0025
30 mg	0.00020	0.0005	0.0005	0.0009	0.0009	0.0010	0.001		0.002	0.002
20 mg	0.00020	0.0005	0.0005	0.0009	0.0009	0.0010	0.001	0.001	0.002	0.002
10 mg	0.00020	0.0005	0.0005	0.0009	0.0009	0.0010	0.001	0.001	0.002	0.002
5 mg	0.00020	0.0005	0.0005	0.0009	0.0009	0.0010	0.001	0.001	0.002	0.002
3 mg	0.00020	0.0005	0.0005	0.0009	0.0009	0.0010	0.001		0.002	0.002
2 mg	0.00020	0.0005	0.0005	0.0009	0.0009	0.0010	0.001	0.001	0.002	0.002
1 mg	0.00020	0.0005	0.0005	0.0009	0.0009	0.0010	0.001	0.001	0.002	0.002
0.5 mg	0.00020	0.0005	0.0005	0.0009	0.0009	0.0010	0.001	0.001	0.002	0.002
0.2 mg	0.00020	0.0005	0.0005	0.0009	0.0009	0.0010	0.001	0.001	0.002	0.002
0.1 mg	0.00020	0.0005	0.0005	0.0009	0.0009	0.0010	0.001	0.001	0.002	0.002
0.05 mg	0.00020	0.0005	0.0005	0.0009	0.0009	0.0010	0.001	0.001	0.002	0.002

* NVLAP Laboratory Code 105013-0

* E0 is a theoretical tolerance that is 50% of OIML R 111 Class E1

** Calibration and Measurement Capability (best measurement)

	Class 3	Class F1	Class F2	Class 4	Class 5	Class M1	Class 6	Class 7	Class F	Class M2 & M3
2000 kg	5 g	5 g	10 g	10 g	10 g	10 g	50 g	100 g	50 g	
1000 kg	3.2	3.2	5	5	5	15	25	50	25	
500 kg	1.2	1.2	2.5	2.5	2.5	8.0	12	25	12	
200 kg	0.46	0.46	1.0	1.0	1.0	3.0	5.0	10	5.0	
100 kg	0.44	0.44	0.5	0.5	0.5	1.5	2.5	5	2.5	
50 kg	25 mg	25 mg	25 mg	200 mg	200 mg	200 mg	500 mg	500 mg	500 mg	500 mg
30 kg	15			120	120		300	300	300	
25 kg	12			100	100		250	250	250	
20 kg	10	10	10	80	80	80	200	200	200	200
10 kg	5	5	5	40	40	40	100	100	100	100
5 kg	2.5	2.5	2.5	20	20	20	50	50	50	50
3 kg	1.5			12	12		30	30	30	
2 kg	1	1.0	1	8	8	8	20	20	20	20
1 kg	0.5	0.50	0.50	4	4	4	10	10	10	10
500 g	0.25	0.25	0.25	2	2	2	7	7	7	7
300 g	0.15			1.2	1.2		6	6	6	
200 g	0.1	0.10	0.10	0.8	0.8	0.8	4	4	4	4
100 g	0.05	0.05	0.05	0.4	0.4	0.4	2	2	2	2
50 g	0.025	0.025	0.025	0.24	0.24	0.24	1	1	1	1
30 g	0.015			0.18	0.18		0.6	0.6	0.6	
20 g	0.015	0.015	0.015	0.14	0.14	0.14	0.4	0.4	0.4	0.4
10 g	0.01	0.010	0.010	0.1	0.1	0.1	0.2	0.2	0.2	0.2
5 g	0.007	0.0070	0.007	0.07	0.07	0.07	0.15	0.15	0.15	0.15
3 g	0.006			0.06	0.06		0.13	0.13	0.13	
2 g	0.006	0.0060	0.0060	0.05	0.05	0.05	0.11	0.11	0.11	0.11
1 g	0.006	0.0060	0.0060	0.04	0.04	0.04	0.09	0.09	0.09	0.09
500 mg	0.0025	0.0025	0.0025	0.01	0.01	0.01	0.04	0.04	0.04	0.04
300 mg	0.0025			0.01	0.01		0.04	0.04	0.04	
200 mg	0.0025	0.0025	0.0025	0.01	0.01	0.01	0.04	0.04	0.04	0.04
100 mg	0.0025	0.0025	0.0025	0.01	0.01	0.01	0.04	0.04	0.04	0.04
50 mg	0.0025	0.0025	0.0025	0.01	0.01	0.01	0.04	0.04	0.04	
30 mg	0.002			0.01	0.01		0.04	0.04	0.04	
20 mg	0.002	0.002	0.0020	0.01	0.01	0.01	0.04	0.04	0.04	
10 mg	0.002	0.002	0.0020	0.01	0.01	0.01	0.04	0.04	0.04	
5 mg	0.002	0.002	0.0020	0.01	0.01	0.01	0.02	0.02	0.02	
3 mg	0.002			0.01	0.01		0.02	0.02	0.02	
2 mg	0.002	0.002	0.0020	0.01	0.01	0.01	0.02	0.02	0.02	
1 mg	0.002	0.002	0.0020	0.01	0.01	0.01	0.02	0.02	0.02	
0.5 mg	0.002	0.002	0.0020	0.01	0.01	0.01	0.02	0.02	0.02	
0.2 mg	0.002	0.002	0.0020	0.01	0.01	0.01	0.02	0.02	0.02	
0.1 mg	0.002	0.002	0.0020	0.01	0.01	0.01	0.02	0.02	0.02	
0.05 mg	0.002	0.002	0.0020	0.01	0.01	0.01	0.02	0.02	0.02	



Certificate Options

Variety of Weight Certificates

Troemner's calibration and certificate options are designed to provide the customer a range of choices in measurement precision, quality of data, and compliance to calibration and quality standards.

The choices are as follows:

NVLAP⁺ Accredited Mass Code Report of Mass Values

Troemner Mass Code Report of Mass Values is available for one-piece weights in ANSI/ASTM E617 Class 000, 00, 0 and Class E0*, OIML R 111 E1, and E2, and is the same report one would receive if weights were calibrated directly by NIST. This calibration delivers uncertainties which are the lowest available by a commercial laboratory matching those of many National Metrology Institutes. Troemner utilizes a calibration software program provided by NIST to perform a calibration that involves a series of interdependent comparisons. Troemner's primary standards are used for this calibration procedure. The calibration provides a high level of confidence that the measurements are in statistical control. This multi-page report of mass values is very detailed and includes statistical analysis including all measurement results, uncertainty calculations, as well as F and t test values. This certificate also includes Density Determination and Magnetic Susceptibility Determination Calibrations.

NVLAP⁺ Accredited Primary Reference Certificate

This certificate is available for one-piece weights in ANSI/ASTM Class 000, 00, 0 and Class E0*, OIML R 111 E1 and E2, and contains all of the information as the standard NVLAP⁺ Accredited Certificate as well as the Density Determination and Magnetic Susceptibility Determination Calibrations. Troemner's secondary standards are used for this calibration procedure.

NVLAP⁺ Accredited Certificate

The NVLAP⁺ Accredited Certificate provides compliance in both measurement process and data reported to the customer to meet a variety of standards including NVLAP Handbook 150-2, ISO/IEC 9000, ISO/IEC 17025, FDA, GMP, GLP, DOD, ANSI/NCSL Z540-1, and nuclear requirements. Troemner's NVLAP Laboratory Code is 105013-0. The NIST administered National Voluntary Laboratory Accreditation Program (NVLAP⁺) approves, through periodic audits, all processing and weighing procedures, as well as certificate format and content. Calibration procedures vary by tolerance class requested. For example, for higher accuracy classes such as Troemner UltraClass Series, ANSI/ASTM Class 000, 00, 0, and 1, Class E0*, OIML R 111 Class E1, E2, and F1, Troemner performs a multiple weighing procedure utilizing our secondary working standards to determine the mass of a customer's weight.

NVLAP⁺ Accredited Density Determination Calibration

Troemner's mass metrology laboratory can determine the actual density of one-piece mass standards that range in size from 1 g through 5 kg. Troemner is the only private NIST/NVLAP⁺ accredited laboratory in the United States for this mass calibration service. Troemner provides this service to reduce the uncertainty of calibrating one-piece precision ANSI/ASTM Class 000, 00, and 0 and Class E0*, OIML R 111 Class E1, and E2 weights. The process is highly recommended for one-piece weights used as reference standards. Utilizing a balance, a series of measurements are compared to a NIST traceable density standard immersed in water to determine the density value. The data found in this certificate will enable you to make the proper buoyancy corrections when performing calibrations on other weights. This certificate provides you with the information you need for working in true mass. Density Determination Calibration is also included in the NVLAP⁺ Accredited Mass Code Report of Mass Values and the NVLAP⁺ Accredited Primary Reference Certificate.

* NVLAP Laboratory Code 105013-0

*E0 is a theoretical tolerance that is 50% of OIML R 111 Class E1

NVLAP+ Accredited Magnetic Susceptibility Determination Calibration

Troemner has the capability of measuring the magnetic field intensity and the potential magnetic susceptibility of stainless steel one-piece mass standards sized 1 g through 10 kg. Troemner is the only private accredited laboratory in the world for this mass calibration service. This process is recommended for one-piece weights used as reference standards to demonstrate the weights meet the required specifications for magnetism. Magnetic Susceptibility Determination Calibration is also included in the NVLAP+ Accredited Mass Code Report of Mass Values and the NVLAP+ Accredited Primary Reference Certificate.

UKAS++ Accredited Certificate

UKAS++ Weight Calibration meets the requirements of the United Kingdom Accreditation Service which encompass ISO/IEC 17025, and EN450001 requirements. Troemner is a UKAS++ Accredited Calibration Laboratory Number 0516. UKAS++ approves, through periodic audits, all processing and weighing procedures, as well as certificate format and content. Calibration procedures vary by tolerance class requested. The contents of the UKAS++ Accredited Certificate of Calibration are the same as the contents of the NVLAP+ Accredited Calibration Certificate.

The NVLAP+ and UKAS++ Accredited Certificates include:

- Date of calibration
- Serial number and ID number
- Equipment and standards used during the calibration and their calibration due dates
- Accuracy class
- True mass value (mass in a vacuum)
- Conventional mass value ("As Found" and "As Left" for recalibration)
- Conventional mass correction ("As Found" and "As Left" for recalibration)

- Uncertainty of the measurement process for each weight
- Environmental conditions during test
- Construction and assumed density of weights
- Weight calibration procedures used
- Statement of traceability to NIST
- Helpful list of terms and definitions

Traceable Certificate

The Traceable Certificate is designed for those laboratories and companies that require traceability, but do not need to meet any stringent regulatory requirements. The Traceable Certificate measurement process is based on a single standard and utilizes one series of comparisons.

Information includes:

- Date of calibration
- Serial number and ID number
- Accuracy class
- The nominal value of the weight
- Mass correction, tolerance and uncertainty
- As Found and As Left tolerance status
- Statement of traceability to NIST

Statement of Accuracy

Every Troemner Weight and Weight Set, with the exception of Economical Stainless Steel, Stainless Steel Test Weights and Cast Iron Weights, where a certificate is not ordered, is supplied with a Statement of Accuracy. This statement guarantees that the product has been manufactured to meet the tolerance specifications for its class.

Note: The Statement of Accuracy Does Not Provide Traceability and is Not Suitable for Quality or Regulatory Requirements.

* NVLAP Laboratory Code 105013-0

** A UKAS Accredited Calibration Laboratory No. 0516

* E0 is a theoretical tolerance that is 50% of OIML R 111 Class E1

** As found data is not provided with new weights



Certificate Options

Certificate Options Comparison Chart

The chart below depicts the varying features among the certificate options of an individual weight or weight set.

	NVLAP+ Accredited Mass Code Report of Mass Values	NVLAP+ Accredited Primary Reference Certificate	NVLAP+ Accredited Certificate	UKAS** Accredited Certificate	Traceable Certificate
Name, Address, P.O. Number	X	X	X	X	X
Date of Calibration	X	X	X	X	X
Serial Number	X	X	X	X	X
Equipment and Standards Used					
Balance – Calibration Due Dates	X	X	X	X	
Standards – Calibration Due Dates	X	X	X	X	
Standards – Corrections	X				
Accuracy Class	X	X	X	X	X
Nominal Value	X	X	X	X	X
Conventional Mass Value					
“As Found Data” *	X	X	X	X	
“As Left Data”	X	X	X	X	
Conventional Mass Correction					
“As Found Data” *	X	X	X	X	X
“As Left Data”	X	X	X	X	X
True Mass Value (Mass in a Vacuum)					
“As Found Data” *	X	X	X	X	
“As Left Data”		X	X	X	
Density Determination	X	X			
Magnetic Susceptibility Determination	X	X			

	NVLAP+ Accredited Mass Code Report of Mass Values	NVLAP+ Accredited Primary Reference Certificate	NVLAP+ Accredited Certificate	UKAS** Accredited Certificate	Traceable Certificate
Uncertainty of Measurement Process	X	X	X	X	X
Environmental Conditions During Test	X	X	X	X	
Construction and Density of Weights	X	X	X	X	X
Calibration Procedures Used	X	X	X	X	
Statement of Traceability to NIST	X	X	X	X	X
Measurement Assurance Data	X				
Helpful List of Terms and Definitions		X	X	X	
One Series of Comparisons Using a Single Standard			ANSI/ASTM Class 5,6 OIML Class M1, M2 NIST Class F		All Classes
Multiple Comparisons Using a Check Standard	One-Piece Weights ANSI/ASTM Class 000, 00, 0 Class E0*, OIML R 111 Class E1, E2		ANSI/ASTM Class 0, 1, 2, 3, 4 OIML Class E1, E2, F1, F2		
Comparison Method Data	X				
Meets ISO/IEC 17025, FDA, GMP, DOD, ANSI/NCSL Z540-1, NCR 10CFR50 Appendix B	X	X	X	X	