MASSCAL Calibration Masses and Weights

- Stainless Steel - Class E2, F1, F2 - highly polished masses
- Stainless Steel - plain cylindrical Class F1 balance calibration masses
- Brass - Economy, Class M1 and NMI Inspector's Class 2
- Cast Iron - Trade and NMI Inspector's Class 3 masses
- Cast Iron - Nickel plated NMI Inspector's Class 3 masses

- Masses can be purchased either individually or as a boxed set
- Available from 1mg to 20kg
- Slotted kilogram, Newton and brass masses available
- Special value industrial brass masses made to order (Bakers weights)
- Flat circular brass masses (Post office style)

*******Please specify class of mass or intended application when requesting prices*******

Mass Tolerance and Selection Chart

	Polished Stainless Steel			Brass			Cast Iron	
Class of mass → **↓ Nominal Value**	O.I.M.L. Class E2 ± mg	O.I.M.L. Class F1 ± mg	O.I.M.L. Class F2 ± mg	NMI Inspector's Class 2 ± mg	NMI Approved Knob + mg	O.I.M.L. Class M1 ± mg	NMI Inspectors Class 3 ± mg	NMI Approved Trade + mg
20kg				667	560	1000	2000	3400
10kg	15	50	150	333	400	500	1000	2400
5kg	7.5	25	75	167	280	250	533	1700
2kg	3.0	10	30	67	220	100	200	1300
1kg	1.5	5	15	33	130	50	107	760
500g	0.75	2.5	7.5	16.7	90	25	53	540
200g	0.30	1.0	3.0	6.70	60	10	20	340
100g	0.15	0.5	1.5	3.30	40	5	11	240
50g	0.10	0.30	1.0	2.00	28	3.0		
20g	0.080	0.25	0.8	1.70	18	2.5		
10g	0.060	0.20	0.6	1.30	12.5	2.0		
5g	0.050	0.15	0.5	1.10	9	1.5		
2g	0.040	0.12	0.4	0.80	5.5	1.2		
1g	0.030	0.10	0.3	0.67	4	1.0		
500mg	0.025	0.08	0.25	0.53	3	0.8		
200mg	0.020	0.06	0.20	0.40	2	0.6		
100mg	0.015	0.05	0.15	0.33	1.3	0.5		
50mg	0.012	0.04	0.12	0.27	0.9	0.4		
20mg	0.010	0.03	0.10	0.20	0.6	0.3		
10mg	0.008	0.025	0.08	0.17	0.4	0.25		
5mg	0.006	0.020	0.06	0.13	0.3	0.20		

2mg	0.006	0.020	0.06	0.13	0.2	0.20		
1mg	0.006	0.020	0.06	0.13	0.1	0.20		

How to select the most suitable mass for your application

What class do I need?

To select a mass from the wide range of classes, tolerances and materials available, the most important aspect to consider is the accuracy required by your application. This will usually determine the tolerance and material required. If you are not sure of the accuracy required, then consider the readability of the balance or scale you will be using the mass with, and take this as the required accuracy. Now using the chart above, choose an appropriate mass class with a tolerance about one half of your required accuracy. If the mass is to be used to calibrate a balance, then choose a mass with a tolerance approximately one half of the balance readability. For some high resolution analytical balances, it may not be possible to choose a mass with a small enough tolerance. In this case choose the best tolerance available (E2) and order a NATA calibration certificate which will state the actual value of the mass.

Cast Iron, brass or Stainless Steel?

Some times we are asked if a lower class mass (cast iron or brass) can be adjusted to a better tolerance rather than purchase a more expensive mass. As the material the mass is manufactured from determines the daily and long term stability, adjusting to a tighter tolerance is not recommended as the mass will soon drift out of tolerance.

Cast iron masses will vary in mass value due to moisture absorption (even from the atmosphere), corrosion (rust) and wear. Even small daily/weekly and seasonal variations can be expected. They are highly magnetic so will be effected by magnetic fields from electric motors and electronic balances etc. With typical light use, cast iron masses will retain their mass value to within ½ to ¼ of the original tolerance over a one year period. Good clean dry storage will improve this. With regular use, the mass variation may fall below the original tolerance, due to wear, within less than one year. Cast iron masses are adjustable, so have your masses checked and readjusted regularly to maintain the tolerance. Cast iron masses should be re-calibrated annually.

Brass masses have better short term (daily to monthly) mass stability than cast iron, but will vary with time due to wear and corrosion of the brass and lead adjusting slug. With light use and good storage and handling, they will retain their value to within ½ to ¼ of the original tolerance over many years. As brass is a soft material, regular use will cause the mass value to reduce more quickly through wear. Brass masses are essentially non magnetic, but can be effected slightly by magnetic fields. Brass masses should not be used as precision reference standards due to daily mass variations with atmospheric air density (air buoyancy), wear and contamination. They should not be used to calibrate precision balances. Brass masses should be re-calibrated annually.

Masscal precision stainless steel masses are manufactured to a correct nominal density of 8000 kg/m^3 to minimise daily mass variations due to air buoyancy effects. The mass is highly polished to minimise the surface area for long term stability and to provide an easily cleaned surface. With light use, careful handling and good storage, these masses will retain their value to within a small fraction of the E2 tolerance over many years. Daily use may cause larger masses to fall below the E2 tolerance within a few years. Masscal polished stainless steel reference masses are manufactured from selected grade stainless steel for it's low magnetic properties, and are essentially non magnetic, but may be effected slightly by magnetic fields. They are not stamped with their nominal value to aid in cleaning the highly polished surface. Nominal value stamping is available if required.

Masscal stainless steel cylindrical balance calibration masses are essentially non magnetic and corrosion resistant, as per the polished stainless masses, but the plugged cavity which alters the density, and the unpolished surface, will not provide the same mass stability of a solid polished mass. These masses should not be used as precision primary reference standards. Stainless steel masses should be calibrated every three years. Masses used on a more regular basis may need more regular attention.

What is Air Buoyancy?

The internationally accepted method for measuring mass is to compare an unknown mass with a standard mass of a known density by weighing in air. Now weighing in air creates a problem, as objects of differing density are buoyed up by the surrounding air, much the same as heavy objects become lighter in water. For example, if a one litre bottle of water is lowered by a string into water, it will feel lighter as it is submerged. In this case the bottle is almost fully buoyed up by the water. As we are all fully submerged in air, what affect can the air have? Well if a 1kg brass mass (density 8400 kg/m^3) is made to exactly balance a 1kg stainless steel standard mass (8000 kg/m^3) today, then tomorrow when the atmospheric air pressure and temperature (density) have changed, the masses will no longer balance. This is because the brass and stainless steel masses are buoyed up in the air by differing amounts, as the buoyancy is proportional to air density. By convention, it is taken that the standard density for standard masses shall be 8000 kg/m^3, and all other masses are compared to this. This is called the conventional mass and is different to the true mass by a small amount. Unfortunately this means that the conventional mass of weights with a density other than 8000 kg/m^3, will vary daily with air density changes. Buoyancy corrections can be made if the air density is measured each time the mass is used if required, but this can be a lengthy task. Fortunately the buoyancy effect is small and in the case of cast iron and brass, is very small compared to the tolerance. Provided these masses are used with consideration of their tolerance, buoyancy will never be a problem. However, these masses are not recommended as precision reference standards or for the calibration of precision analytical balances. For Masscal stainless steel masses, the density is nominally 8000 kg/m^3, so buoyancy can be neglected in all but the most precise measurements.