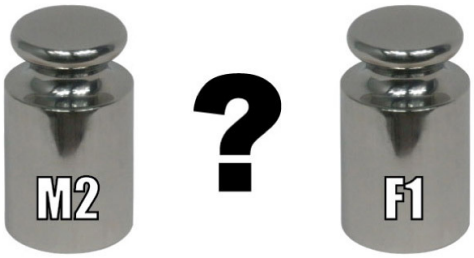
# Choosing the correct mass




## *Preamble*

This article will help you to specify a mass or mass set by determining

- The capacity of the mass, or your mass testing range(Kg) for mass sets
- The class (accuracy)

There are other considerations like material type, magnetism, and buoyancy but you will find these issues are secondary and our product range is streamlined to meet your requirement once you have selected the class (accuracy) of the mass(es).

> E.g. Choosing an inspectors class 2 mass you will only have the option to buy Stainless Steel. It has density (8000kg/m$^3$),high polish to help buoyancy & magnetism (80µT).All these properties are well within the specification for this class.

The exception might be if you want the long term stability offered by a stainless steel mass when the class you selected uses cast iron.. The decision then becomes commercial. That said, let's get on with the methodology of making your selection…

## *Tell us about your application*

There are typically three reasons our clients buy masses.

1. Checking or calibration of scales for Quality assurance, scale calibration or simple maintenance.
2. Trade stamping or checking of scales to meet Australian government standard.
3. Dead loading for safety considerations.

Calibration certificates are optional extras. We will cover these certificates at the end of this article.

## *1. Masses to check or calibrate scales*

### Which accuracy

First you need to decide on the accuracy you require.

Method 1- Finding the resolution or count increments of the scale and halving it is regarded as standard practice for determining the weight tolerance you require.

E.g. a 6000g x 1g scale has a resolution of 1 g so the accuracy needed to calibrate it would be 0.5g (or 500mg).

Method 2. In Australia we have a method of testing scales & weighing equipment for "trade use" or "government stamping". If you line up with this standard then you will need to determine the accuracy class of your scale. Refer section #2. Masses to Government standards . below.

## What size mass

The rulebook says you should test or calibrate a scale at close to the scales maximum capacity as possible and at four to five other points. Assuming we are choosing just the one mass we **suggest the mass is at least 80% of the scale capacity**.

Check or calibrate a 6000g scale using at least 80% of the scales capacity we calculate a 4200g mass. Because masses are made in preferred sizes we recommend a 5Kg (5000g) mass.

However, there is also a case for choosing a weight that is **close to the capacity of the items you usually weigh** on the scale. This is a lower cost option as cost increases with mass size, often disproportionately.

If the scale was used to weigh 1Kg packets and you are using a 6000g scale you might purchase a 1000g (1 Kg) weight.

## Which mass do I choose

You have the accuracy and size of the weight you require so you can look up the following table and select the matching **class** of weight. The class is the column header. We use the OIML table because it is an internationally recognized standard. The table shows the tolerance of each mass and you should **choose a tolerance equal or better than the accuracy you require.**

In our example we chose a 5000g weight, with accuracy 0.5g (500mg). From the table this is a class M1 mass and we have highlighted the table to identify the mass selected. The selected weight is specified by the **capacity** (in our example this is 5000g) and the **class** (in our example class M1).

TIP Consider the mass sets, there is a mass set for most applications and they contain masses designed to check your scale across it's range. They usually represent the best value.

**Table 1 -Mass Lookup Table** (5kg, M1 mass is highlighted)

| OIML (±mg) | | | | | | |
|---|---|---|---|---|---|---|
| **Weight class** | **E1** | **E2** | **F1** | **F2** | **M1** | **M2** |
| 2000kg | | | 10000 | 30000 | 100000 | 300000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1000kg | | 1600 | 5000 | 16000 | 50000 | 160000 |
| 500kg | | 800 | 2500 | 8000 | 25000 | 80000 |
| 200kg | | 300 | 1000 | 3000 | 10000 | 30000 |
| 100kg | | 160 | 500 | 1600 | 5000 | 16000 |
| 50kg | 25 | 80 | 250 | 800 | 2500 | 8000 |
| 20kg | 10 | 30 | 100 | 300 | 1000 | 3000 |
| 10kg | 5 | 16 | 50 | 160 | 500 | 1600 |
| 5kg | 2.5 | 8 | 25 | 80 | 250 | 800 |
| 2kg | 1 | 3 | 10 | 30 | 100 | 300 |
| 1kg | 0.5 | 1.6 | 5 | 16 | 50 | 160 |
| 500g | 0.25 | 0.8 | 2.5 | 8 | 25 | 80 |
| 200g | 0.1 | 0.3 | 1 | 3 | 10 | 30 |
| 100g | 0.05 | 0.16 | 0.5 | 1.6 | 5 | 16 |
| 50g | 0.03 | 0.1 | 0.3 | 1 | 3 | 10 |
| 20g | 0.025 | 0.08 | 0.25 | 0.8 | 2.5 | 8 |
| 10g | 0.02 | 0.06 | 0.2 | 0.6 | 2 | 6 |
| 5g | 0.016 | 0.05 | 0.16 | 0.5 | 1.6 | 5 |
| 2g | 0.012 | 0.04 | 0.12 | 0.4 | 1.2 | 4 |
| 1g | 0.01 | 0.03 | 0.1 | 0.3 | 1 | 3 |
| 500mg | 0.008 | 0.025 | 0.08 | 0.25 | 0.8 | 2.5 |
| 200mg | 0.006 | 0.020 | 0.06 | 0.2 | 0.6 | 2 |
| 100mg | 0.005 | 0.016 | 0.05 | 0.16 | 0.5 | 1.6 |
| 50mg | 0.004 | 0.012 | 0.04 | 0.12 | 0.4 | |
| 20mg | 0.003 | 0.010 | 0.03 | 0.1 | 0.3 | |
| 10mg | 0.003 | 0.008 | 0.025 | 0.08 | 0.25 | |
| 5mg | 0.003 | 0.006 | 0.02 | 0.06 | 0.2 | |
| 2mg | 0.003 | 0.006 | 0.02 | 0.06 | 0.2 | |
| 1mg | 0.003 | 0.006 | 0.02 | 0.06 | 0.2 | |

### My accuracy is not in the table

In the event that the accuracy for the capacity you selected is not in the table you should choose the best accuracy supported and get a certificate of accuracy where the actual weight of the selected mass will be stated. Generally the class of mass required is E2.

## *2. Masses to Government standards*

### What accuracy or class do I need?

The masses must comply with the relevant government standard. We support 3 classes (1,2,3) and we manufacture to "Inspectors" tolerances. Often the class of the scales you are testing have a plate affixed and the class is represented on the plate by a I, II, III symbol. In general the classes relate as follows

**Table 2 - Weighing instrument classes**

| | |
|---|---|
| Class 1 | High precision balances (RARE) |
| Class 2 | Balances and analytical scales (laboratory environment) |
| Class 3 | General trade instruments, floor scales, retail scales, bench scales, etc. |
| Class 4 | Aircraft baggage scales, waste scales (use class 3 masses) |

*For more details refer national measurements act 19999*

**The accuracy needs to meet or exceed the class of scale you are testing**. If you have a 60Kg x 20g scale it is class 3. So you will specify your accuracy as "class 3". For your information you look at table 3 below you can see the tolerances and weights relating to each class.

## Australian Standard vs OIML standard.

The following table cross references the OIML labeling with the Australian standard.

**Table 3 – OIML look up table reference to Australian standards.**

| OIML R111-1 Comparison Chart to Australian NMI Inspectors Class 1, Class 2 & Class 3 Tolerances. | | | |
|---|---|---|---|
| **Denomination** | **Class 1** | **Class 2** | **Class 3** |
| 2000kg | | | M1 |
| 1000kg | | | M1 |
| 500kg | | | M1 |
| 200kg | | | M1 |
| 20kg | E2 | F1 | M1 |
| 10kg | E2 | F1 | M1 |
| 5kg | F1 | F1 | M1 |
| 2kg | F1 | F2 | M2 |
| 1kg | F1 | F2 | M2 |
| 500g | F2 | F2 | M2 |
| 200g | F2 | M1 | M2 |
| 100g | F2 | M1 | M2 |
| 50g | M1 | M1 | |
| 20g | F2 | M1 | |
| 10g | F2 | M1 | |
| 5g | F2 | M1 | |
| 2g | F2 | F2 | |
| 1g | F2 | F2 | |
| 500mg | F2 | F2 | |
| 200mg | F2 | F2 | |
| 100mg | F1 | F2 | |
| 50mg | F1 | F2 | |
| 20mg | F1 | F2 | |
| 10mg | F1 | F2 | |
| 5mg | F1 | F2 | |
| 2mg | F1 | F1 | |
| 1mg | F1 | F1 | |

## What size mass

The regulations for testing scales for "trade use" are well defined. Basically the rule book says you should test or calibrate a scale at close to the scales maximum capacity as possible and test at least four other points. Assuming we are choosing just the one mass we **suggest the mass is at least 80% of the scale capacity**.

> So to check or calibrate a 6000g scale using at least 80% of the scales capacity we calculate a 4200g mass. Because masses are made in preferred sizes we recommend a 5Kg (5000g) mass.

## Which mass do I choose

You have the accuracy and size of the weight you require so you can look up the following table and select the matching **class** of weight. The class is the column header..

> In our example we chose a 5000g weight, with accuracy 0.5g (500mg). From the table this is a class 3 mass and we have highlighted the table to identify the mass selected. The selected weight is specified by the **capacity** (in our example this is 5000g) and the **class** (in our example it is class 3).

TIP Consider the mass sets, there is a mass set for most applications and they contain masses designed to check your scale to across it's range. They usually represent the best value.

The following table reproduced from Australian National Measurements regulations, schedule 9 shows available masses and tolerances.

**Table 3 - Inspectors Class Mass Tolerance Chart** (5kg, class 3 mass highlighted)

| Australian National Measurement Regulations Schedule 9 Inspectors Class 1, Class 2 & Class 3 Tolerances. | | | |
|---|---|---|---|
| **Weight** | **Class 1** | **Class 2** | **Class 3** |
| 2000kg | | | ±140g |
| 1000kg | | | ±70g |
| 500kg | | | ±35g |
| 200kg | | | ±14g |
| 20kg | ±80mg | ±160mg | ±1.55g |
| 10kg | ±40mg | ±80mg | ±1.1g |
| 5kg | ±28mg | ±55mg | ±780mg |
| 2kg | ±18mg | ±35mg | ±500mg |
| 1kg | ±13mg | ±25mg | ±350mg |

| | | | |
|---|---|---|---|
| 500g | ±9mg | ±18mg | ±250mg |
| 200g | ±6mg | ±11mg | ±160mg |
| 100g | ±4mg | ±8mg | ±110mg |
| 50g | ±3mg | ±5mg | |
| 20g | ±2mg | ±3.5mg | |
| 10g | ±1.5mg | ±2.5mg | |
| 5g | ±1mg | ±2mg | |
| 2g | ±0.6mg | ±1mg | |
| 1g | ±0.4mg | ±0.8mg | |
| 500mg | ±0.3mg | ±0.6mg | |
| 200mg | ±0.2mg | ±0.35mg | |
| 100mg | ±0.15mg | ±0.25mg | |
| 50mg | ±0.1mg | ±0.2mg | |
| 20mg | ±0.06mg | ±0.1mg | |
| 10mg | ±0.04mg | ±0.08mg | |
| 5mg | ±0.03mg | ±0.06mg | |
| 2mg | ±0.02mg | ±0.035mg | |
| 1mg | ±0.02mg | ±0.025mg | |
| | | | |

### Regulation 13 certificates

If you are using your Inspectors class mass(es) for trade work you will need to be issued with a regulation 13 certificate as evidence that the masses have been tested and comply with the Australian standards.

You should be aware that the cost to include multiple masses on a single certificate is significantly cheaper than individual certificates for each mass.

Also note that a regulation 13 certificate is a certificate of compliance that the masses are within the tolerances set by the standards. There is none of the data you might expect from a calibration certificate. Some states will accept a NATA calibration certificate as evidence of compliance.

## *3. Masses for dead loading or safe load testing.*

It is worth knowing that all our cast iron test masses are made to an exacting standard which includes surface finish, and dimensional tolerances. The process results in a percentage of reject weights that can't be certified but in every other respect are accurate test masses. They just don't look as pretty. These are perfect for dead load applications and may be purchased at a discount to their premium quality brothers. Of course a NATA certificate or our own calibration certificate can also be issued stating the mass weight along with the trace ability of the testing equipment.

If you require government certification or manufacture to OIML standards then this application allows quite wide tolerances on accuracy and our lowest class of masses **M1** or **inspectors class 3** would be more than satisfactory.

## *Certificates*

Choosing the certificates also depends on your application of the test weights. There are 4 options available to you.

1. No certificate. Same weight, just no certificate.

2. Our own Calibration certificate. The weight is tested and a report issued outlining the mass(es) weight, special markings, tolerance, trace ability to mass standards and the uncertainty of the testing. This certificate is not suitable if you are using the mass to certify scales "legal for trade"

3. Regulation 13 certificates that signify the weight(s) are compliant with the government standards and may be used for testing "legal for Trade" scales. This certificate does not show actual mass values, it is not a calibration report.

4. NATA certificate which is a calibration report issued by a NATA certified authority outlining the mass(es) weight, special markings, tolerance, trace ability to mass standards and the uncertainty of the testing.
   *Note this certificate should allow the mass to be used to stamp scales but we have had some issues with government inspectors accepting this and you should talk to our sales team before ordering NATA certificates*.

## *Buying your mass or mass set.*

Discuss your application with our sales team, they will make you aware of changing legislation, custom options and best value masses for your application and timelines to test and generate certificates.