Testing The Authenticity of Gold Bullion

Forgery has long been a concern in the bullion industry, with recent incidents such as gold bars filled with tungsten reportedly discovered in the vault of a major Swiss bank. When purchasing from reputable dealers who conduct professional testing, or buying directly from trusted mints and refineries, the risk of encountering counterfeit bullion is reduced.

However, as the value of gold and silver continues to rise, so too does the risk of counterfeit bullion entering the market.

Fake silver bullion is less common, primarily due to silver's lower monetary value compared to gold or collectible items. Counterfeit jewellery is generally more prevalent than forged investment bullion.
Larger gold bars are more susceptible to tampering and forgery, as their higher value can be seen as a justification for the effort. Tungsten is the most used metal for counterfeit gold bullion due to its similar density to gold, although its brittleness makes stamping difficult unless it is coated with a sufficiently thick layer of real gold.

Modern bullion coins often feature intricate reliefs and advanced security elements, such as holographic images visible only under UV light, or with specialised lenses. These features are difficult to replicate and add an extra layer of confidence for buyers. While such coins and bars may carry a slight premium, the added security can enhance buyers' peace of mind and improve resale liquidity when compared to less sophisticated products.

The reliability of gold and silver testing methods varies, and only a few are truly conclusive. While a combination of basic tests can quickly identify obvious counterfeits, accurately determining purity or detecting sophisticated forgeries often requires precise measurements and professional-grade equipment.
Importantly, some testing methods are destructive. This can act as a deterrent, given that someone attempting to pass off a counterfeit may hesitate or refuse a test, raising further suspicion.

There are various ways to test bullion, particularly gold. Broadly, these fall into two categories:

- Do it yourself (DIY)
- Professional assessment

Fortunately, gold and silver possess distinct chemical and physical properties that make forgery challenging. Basic testing methods are often reliable for detecting many common counterfeits. For a higher level of certainty, professional testing can determine the exact chemical composition of a bullion item with exceptional accuracy.

Ultimately, the best way to be confident in your bullion's authenticity is to buy from trusted sources and store it in a secure facility that prevents substitution or tampering. If that costs a bit more, the added security is well worth the investment.

DIY

These tests can be performed easily at home, or in the field without specialised equipment, making them accessible to most bullion buyers.

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Visual

The first step is a careful visual examination of the bullion. Using a jeweller's loupe, check for signs of wear or tarnish (pure gold does not tarnish). Compare the design details to a known original, paying attention to the sharpness and clarity of the relief. Although this method is not conclusive, it can effectively filter out obvious fakes and poor-quality copies.

Size and weight

Authentic bullion coins and bars are manufactured to precise specifications, meaning any counterfeit must match the genuine item's weight and dimensions. Gold is one of the densest metals, with a density of 19.32 grams per cubic centimetre, while silver is less dense at 10.49 grams per cubic centimetre (but nonetheless denser than many common base metals).

This density makes counterfeiting particularly challenging. An imitation that matches the weight may not have the exact size of the original, and vice versa. Typically, a fake coin or bar with the correct weight will often be slightly larger, whereas one with the correct size will usually be underweight.

A quick and effective method to spot obvious fakes is to compare the diameter and thickness of the coin or bar against its weight. For coins, a Fisch Tester[1] can be helpful in weeding out basic counterfeits based on size and weight. Jewellers' callipers can also provide precise measurements of width and thickness, while portable bullion scales offer accurate weight readings.

All these tools – portable scales, callipers, and Fisch Testers – are relatively affordable and can serve as a strong first line of defence against counterfeit bullion.

Unglazed ceramic test

Gently rub the gold bullion against an unglazed ceramic surface. If the streak left behind is gold-coloured, it likely indicates a high gold content. However, if the streak appears black or dark grey, this indicates that item is not gold or has a low gold purity.

Magnetic testing

Gold and silver are non-magnetic metals. Passing a strong magnet over a bullion item can quickly reveal if any magnetic materials are present. If the item is attracted to the magnet, it contains other metals and is not pure gold or silver.

However, this method is not foolproof. Many other types of non-magnetic metals exist, so while a magnetic response confirms a fake, the absence of magnetism does not guarantee authenticity. Furthermore, some official gold coins are alloyed with other metals to increase hardness and durability, meaning they may fail the magnet test but still contain the specified amount of pure gold.

As with other DIY testing methods, the magnet test is best used in combination with additional verification techniques.

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Ping testing

When struck with another metal, both gold and silver produce a distinct, high-pitched ringing or chiming sound that lasts about 1 to 2 seconds, often called a 'ping.' In contrast, base metals typically emit a dull sound that is shorter in duration. This difference can help identify genuine bullion by ear.

Experienced dealers are highly consistent in distinguishing genuine gold and silver from imitations using the ping test, and even novices can quickly master this with a little practice.

There are smartphone apps available that analyse the resonance or frequency of the sound produced when coins are struck. These apps serve as a handy, portable tool to help potentially identify counterfeit coins by comparing their acoustic signature to genuine examples.

Thermal conductivity

Silver is a remarkable metal; it is highly reflective, dense, and possesses excellent thermal and electrical conductivity.

For instance, if one places an ice cube on a pure silver bar or coin, it will immediately begin to melt as heat is rapidly transferred. When holding that silver object in your hand, you will notice a quick drop in temperature when it comes into contact with the ice.

The advantage of tests like these is that they are non-destructive and easy to perform, but they are not conclusive and typically require further tests to confirm the metal's purity.

Acid testing

Exposing gold to specific types of acid (typically nitric or hydrochloric) and observing any changes in colour can help distinguish genuine items from fakes, and provide an indication of purity. Ultimately, pure gold will not discolour when exposed to these acids. Testing kits for this method are widely available and commonly used but have obvious downsides.

While acid testing is widely considered an accurate testing method, it is somewhat destructive and only provides an approximate indication of purity. As such, it is less favoured for gold or items with aesthetic value. For silver, however, acid testing is generally more reliable for confirming purity compared to methods like magnetism or sound testing.

This approach can cause discoloration and aesthetic damage. Although this may be acceptable for pure bullion, it will likely compromise items with aesthetic or collectible value.
A gentler variation of this approach involves applying vinegar or lemon juice to the gold. When left on pure gold for at least 15 minutes, there should be no reaction or colour change. However, if other metals are present, a noticeable colour change may occur.

An even less invasive method is to gently rub the gold on a touchstone, then test the golden smear left on the stone using acid, and compare it to a known control sample.

Toothpaste test

Rub a small section of the gold object with toothpaste, then wash and dry it. Pure gold will not discolour, while impure gold may show black spots or other discolouration. Similar effects can also be observed when using liquid foundation makeup or baking soda as alternatives.

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Burning

Hold a gold coin with tongs over a butane lighter flame for about a minute, then cool it under running water. Pure gold will brighten, but will not burn or darken. In contrast, coins containing other metals may change colour or darken when exposed to heat. This method can be destructive when used on counterfeit items.

Specific Gravity (relative density) test

Pure gold has a density of 19.32 grams per millilitre (g/ml), while pure silver has a density of 10.49 g/ml.
A gravity test can be carried out using the following steps:

1. Weigh the gold coin or bar on a calibrated scale placed on a flat surface.
2. Fill a measuring cylinder halfway with distilled water, place it on a flat surface, and record the initial water level.
3. Carefully place the gold bullion into the cylinder. Before it touches the bottom or sides, record the new submerged water level.
4. Calculate the water displacement by subtracting the initial level from the new one.
5. Divide the weight of the bullion by the volume of water displaced to determine the density in grams per millilitre (g/ml).

Alternatively, compare the weight of the gold item in air with its weight when fully submerged in water to calculate its specific gravity[2]. Divide the weight in air by the difference between the air weight and the submerged weight. For pure gold, the result should be close to 19.3. Lower readings typically indicate reduced purity. Tables correlating specific gravity to gold purity are widely available online.

Any significant difference between expected and actual values may suggest the presence of other materials and the absence of pure gold.

This non-destructive test offers a useful estimate of purity but cannot reveal the exact nature of impurities. It is also less reliable for silver. For precise composition analysis, X-ray fluorescence (XRF) or professional acid testing is required.

<u>Professional testing</u>

Professional testing is inexpensive and the most accurate, and so should be the default approach.

X-ray Fluorescence (XRF) spectrometer

This device identifies the elements in a material by measuring the energy and intensity of emitted X-rays. The results can be compared to those of pure reference materials to determine if they match.

This method offers a very high level of accuracy, detecting the presence of rogue elements and precisely measuring the concentration of gold. It also has the advantage of being completely non-destructive.

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Ultrasound machines

These machines measure the speed at which sound travels through a material of defined thickness/weight. As each metal has its own distinct wave or speed, this can be compared to the result from the tested material to vouch for authenticity.

There are several such products on the market, and many are relatively low priced. However, for a high degree of accuracy, professional machines should be used.

Resistivity testing

Pass an electrical current through the metal and measure the drop in voltage. Using Ohm's Law, this allows you to calculate the electrical resistance, revealing how well the metal conducts electricity. The result can then be compared to that of known pure gold or silver samples.

This non-destructive and relatively accurate method can be performed easily using widely available basic kits designed to measure electrical resistance.

That said, this test cannot determine the exact concentration of impurities. It can only indicate their likely presence, and so for greater precision, specialist equipment is needed.

Fire Assay

Either a sample of the metal, in powder form or the entire object, can be melted and then tested for purity. This method provides a very high degree of accuracy, but is destructive and can permanently alter or destroy the item.

Once again, if you buy from a reputable dealer or mint the chances of fake products is very low. Most do it yourself tests can eliminate crude fakes but are not conclusive. We do not recommend reliance on any one of these tests and avoid those that damage or compromise the object in any way.

If you encounter fake products, please let us know where so we can alert and protect the community.

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