# The methods of analysis for goldbars and gold jewellery – Test gold reliably and safely

## 1. The problem with testing gold jewellery

The authenticity testing of gold jewellery is a major challenge. Due to the wide variety of geometries (rings, necklaces and earstuds, etc.) and the composition (different mixed gold alloys with different carat numbers), **it is impossible to determine gold jewellery exactly using just one test method**. The most common types of counterfeit jewellery areas follows:


a.) Counterfeit jewellery with base metals: This refers to the coating of a base metal with gold. This often occurs with rings or chains made of tungsten or tungsten carbide, whereby these materials almost perfectly imitate the density and thus the "feeling of heaviness" and feel of real goldjewellery. One variation is so-called "motorwaygold", an imitation made of mostly cheap steel or stainless steel coated with gold and often sold as real gold jewellery at motorway carparks.

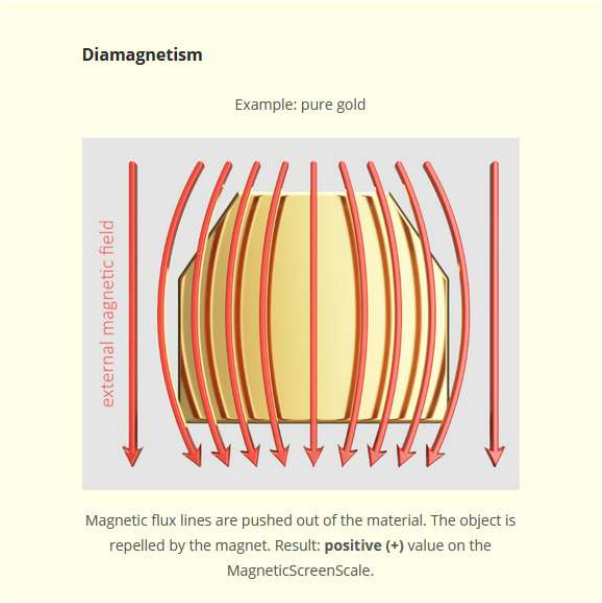
b.) Under-alloying / hallmarking fraud: If the gold content of an alloy is lower than specified by the hall marking/stamping, a not inconsiderable "surcharge" is paid when the piece of jewellery is purchased without being checked.

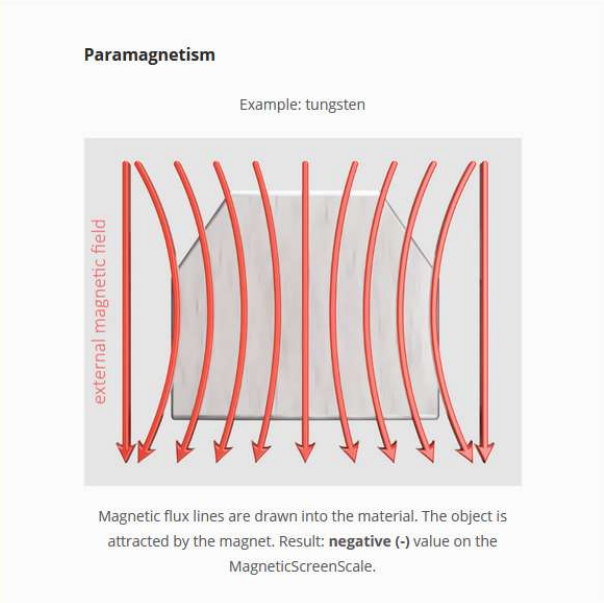
c.) This can also bedone in an evenmore sophisticated way, in that the surface of the piece of jewellery has the correct alloy and the underlying material is worth less foreign material or an inferior alloy.

## 2. The test methods for goldbars

### 2.1. MagneticScreenScale

A sustainable method for measuring bars and coins is to determine the so-called **magnetic susceptibility properties**. This makes it possible to determine, even through blisterpacks and packaging upto a certainthickness, whether the applied material exhibits the correct magnetic behaviour - para- or diamagnetic, i.e. attractive or repulsive. A so-called "tungstendetector" can be used to determine the presence of a potential foreignbody: a gold bar as a so-called diamagnet displaces a magnetic field, creating pressure on the measuring head of the scale and displaying a positive value. If a supposedly genuine finegold bar is placed on the scale and a negative value appears, in most cases iti s a fake.




### 2.2. Density ScreenScale

You can use the density scales to quickly and precisely determine the densityof all types of materials. **They are equally suitable for an alysing bars and gold jewellery to determine their purity and alloy composition** and to identify bars or pieces of jewellery that have been "stretched" or under-alloyed with silver or copper. The density is determine dusing the tried and tested method of Archimedes: To do this, the object is weighed with a sieve under water and once "normally". The density can be determined directly from the two different values. This gives you an insight into the quality and carat number of the gold or even an initial indication of the possible presence of forgeries. **Determining the authenticity and gold content of geometrically irregular objects such as pieces of jewellery is therefore no problem.**

## 3. Test methods for gold jewellery

### 3.1. Surface testing with test acids or X-ray fluorescence analysis

a.) **The gold line test with test acids**: The first, relatively simple and inexpensive step is to determine the gold content using gold test acids. In the line test, an abrasion is made from the surface of thegold piece to be tested on a so-called test stone. Depending on the test situation, different test acids are then applied to this abrasion in order to determine the carat number.

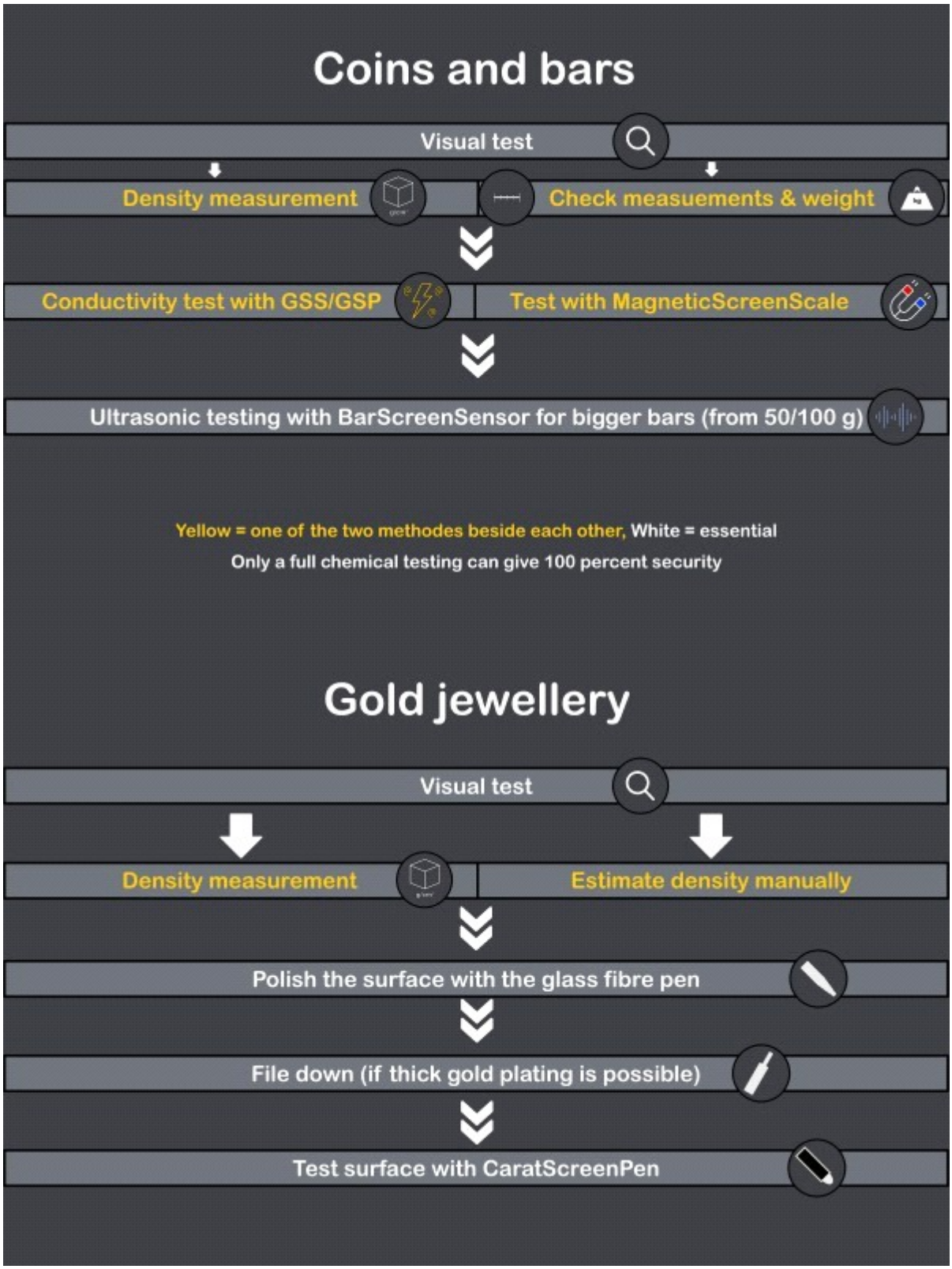
b.) **X-ray fluorescence analysis (XRF)**: This determines the exact elemental composition of the jewellery on thesurface. This method is very expensive (approx. EUR 15,000 - 45,000) and is purely superficial: the maximum penetration depth is only 0.010 mm. This means that only thin gold plating (decorativeorflashgoldplating) can be penetrated, but not hard lustre or even thicker goldplating.

### 3.2. Electrochemical testing using the "CaratScreenPen"

The CaratScreenPen uses an **electrochemical process to determine the purity and fine gold content on the surface of gold and platinum jewellery**. The measuring tip forms a so-called **"galvaniccell"** on contact with the object lying on the measuring surface. This results in a certain electrochemical behaviour, whichi s registered by the measuring tip and processed by thedevice. The value determined correlates with the carat number, which is output after a few seconds in the unit "K" (carat). However, the CaratScreenPen only analyses the condition of the surface. It is possible to examine the core of the respective object, but only to the depth at which you have filed or scratched the piece of jewellery.

### 3.3. Conclusion on the testing of gold jewellery

Due to the large numberof different types of gold alloys and jewellery geometries, the testing of jewellery is more demanding than that of gold bars, for example. However, many forgeries can already be recognised with superficial methods, the use of a "CaratScreenPen" and/or a density scale. **It is always advisable to use a combination of at least two methods (density and conductivity).** Magnetic scales, on the other hand, are not suitable for checking jewellery due to the unfavourable geometry of the jewellery (exception: watchcases, watchcovers or similar).


Coins and bars
Visual test
Density measurement
Check measuements & weight
Conductivity test with GSS/GSP
Test with MagneticScreenScale
Ultrasonic testing with BarScreenSensor for bigger bars (from 50/100 g)
Yellow = one of the two methodes beside each other, White = essential
Only a full chemical testing can give 100 percent security
Gold jewellery
Visual test
Density measurement
Estimate density manually
Polish the surface with the glass fibre pen
File down (if thick gold plating is possible)
Test surface with CaratScreenPen