



## Decoration System Two Fire Etching Imitation System for Porcelain

### 1 General Information

In an original etching decoration first parts of the substrate glaze need to be removed by the use of hydrofluoric acid. In the second step the precious metal gets applied. At the lower parts, where the glaze has been removed, the bright precious metal shows a silk matt appearance, on top of the glaze a bright appearance.

The Heraeus Two-Fire-Etching-Imitation-System allows to produce a similar optical effect without the need to work with aggressive acid. It combines a decal application of underlay and relief (first firing) with the usage of a liquid bright gold, bright platinum or bright palladium applied by brush (second firing).

### 2 Standard Firing Range

Substrate	Firing range
Decal with underlay plus bright relief	800 – 830°C
Liquid bright gold, platinum or palladium	750 – 760°C

The firing result depends on the firing temperature, the total cycle time, the soak time as well as the glaze chemistry of the substrate decorated. To achieve an optimal firing result, we recommend firing tests under the users own individual conditions.

### 3 Properties of the preparations

The product composition and the production process determine the major product characteristics of the components of the decoration system. Testing each production lot guarantees a constant product quality.

With regard to the liquid bright gold we check the viscosity and the application properties comparing them with the defined standard. After the firing, we check the optical appearance – glossiness and gold colour shade. Controlling each single production lot assures the highest product quality and lot-to-lot stability.

In case of the special underlay and the relief, we test the grain sizes and the grain size distribution of each produced lot, the behaviour of the materials when pasted and the fired result in a test firing.



#### 3.1 Processing

Heraeus liquid bright precious metals are supplied ready to use. They can be processed without any thinning. The testing of each produced lot assures the consistent quality of our products.

The special underlay and the bright relief need to be pasted with the recommended pasting ratios and should be homogenized with a triple-roll-mill.

#### 3.2 Storage

##### Liquid bright precious metals

Liquid bright precious metals are subject to an ageing process. Therefore, we recommend using the material

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within 9 months. The material should be stored at room temperature (20°C). Cool storage – but no freezing – has a positive impact on the shelf life.

### Special underlay and bright relief

The special underlay and the relief are both colour powders which basically have no storage limitation. One needs to take care that they are stored in dry environment. Exposure to humidity can lead to problems during the pasting with the special medium.

### **3.3 Consumption of precious metal**

The material consumption depends on the thickness of the applied precious metal layer. Under our conditions, the consumption is approx. 0,15 to 0,30g/100 cm<sup>2</sup>.

## **4 Properties of finished decorations**

Major characteristics of an imitation etch decoration are the brilliance of the metal film, the metal colour shade, the resistance of the decoration in dishwashing machines as well as the mechanical and chemical resistance.

These characteristics are determined by a number of factors. High quality products and the fine matching of the components (underlay, relief and precious metal preparation) are necessary to achieve a good fired result. Apart from the components the application, the glaze of the substrate and the firing conditions also play an important role. The variation of one factor, for example the firing conditions, can significantly affect the fired result.

We have tested the etch imitation system introduced in this technical information sheet on different Bone China substrates. However, the diversity of different types of glaze and firing conditions worldwide does not allow simple general statements about the achievable decoration quality. All mentioned test results relate to our specific tests only. The system needs to be tested under the user's own individual conditions.

### **4.1 Dishwasher resistance**

All details as to whether decorations are dishwasher resistant or durable are to be regarded as approximate values, as test results vary widely according to the type of dishwasher, washing programme, washing-up detergent, water quality and firing conditions. To avoid defective production, the user should test the colours in connection with materials involved in further processing and determine whether the desired dishwasher proof or resistant decorations are achieved.

Heraeus tests whether finished decorations are dishwasher resistant or durable, roughly following the test-washing programme of the Technical Standards Committee for Material Testing (Fachnormenausschuss Materialprüfung, FNM) in a Miele continuous dishwasher. If a decoration withstands 500 washing cycles essentially without damage, we designate it as dishwasher durable. If it withstands 1000 washing cycles, we designate it as dishwasher resistant.

In our tests, etching imitation decorations reached the level of dishwasher durability.

### **4.2 Abrasion resistance**

Test decorations showed a good mechanical resistance. Tests under ones own individual conditions are essential.

## **5 Application recommendations**

### **5.1 Preparation of the substrate to be decorated**

Make sure that the surface of the object to be decorated is clean and dry. Dust, fingerprints and water condensation can affect the decoration while firing.

Take care that the objects to be decorated are not taken from a cold store into a warm shop. A fine condensation film may occur, which is not visible to the naked eye. This results in firing disturbance (pinholes) in the fired precious metal decoration. Allow enough time so that they can adjust to the decoration room temperature.

## 5.2 Production of the underlay/relief decals

Work in a well-ventilated room. The room temperature is recommended to be between 20 and 25°C with a relative humidity of 60 to 70%.

Pasting of the special underlay H 55080 with silk screening medium in a ratio 100:60 parts by weight (underlay : medium). The paste needs to be well homogenized with a triple roll mill.

Printing of the underlay paste with a 130-34 to 165-27 polyester screen.

Drying over night at room temperature (20°C)

Pasting of the special bright relief, either H 30152 or H54002 with medium in a ratio of 100:60-70 parts by weight (bright relief : medium). The paste needs to be homogenized with a triple roll mill.

Printing of the bright relief paste. We recommend using a 180 mesh stainless steel screen.

Drying over night at room temperature (20°C)

Printing of the covercoat. We recommend using a 32-120 polyester screen.

## 5.3 Transfer of the underlay/relief decal and firing

The decals are soaked in slightly warmed water (20 to 30°C). If the water is too cold the decals do not release well from the decal paper. Is the water too warm, the decals might get too soft. It is important to change with water quite regularly.

It is essential to remove the water between decal and substrate by a careful squeegeeing of the decal. Trapped water could fire off explosively and create defects in the metal film. Additionally we recommend cleaning the surface of the applied decal with a sponge, in order to remove all dextrin rests on top of the decal.

The decorated ware should be dried before firing at room temperature (20 to 22°C) for 16 to 24 hours.

Firing of the decal at a temperature of 800 – 830°C (=first fire)

## 5.4 Completion of the one fire etching imitation decoration

Brushing of the liquid bright precious metal material on top of underlay and relief. Please consider the recommended liquid precious metal preparations introduced in section 7.

Firing of the decorated items. As second firing we recommend a peak temperature of about 750 – 760°C.

The second firing must be at a lower temperature otherwise the precious metal layer might show cracks after firing. Fine line or flat designs are less likely to crack. Test firings to find the optimal firing conditions considering the specific substrate glaze and the design are strongly recommended.

## 6 Typical defects, root causes and counter measures

Defect	Possible Cause	Countermeasure
Inhomogeneous surface	Layer of the printed special underlay might be too thin.	We recommend printing the underlay with a 130-34 to 165-27 polyester screen.
Cracks in the fired precious metal film.	The relief layer might have been too thick in combination with an unsuitable second firing.	Please check the thickness of the relief layer. We recommend using for the printing of the relief a 180 mesh stainless steel screen. For the second firing we recommend a peak temperature of only 750 – 760°C.
Chip off of parts of the underlay/relief.	Water residue and air bubbles had not been perfectly removed and explosively burned off during the initial decal firing.	Take good care when in the application of the underlay/relief decal. Rests of water needs to be completely removed.
Screen structure can be seen in the decoration.	Underlay was not dry enough before the print of the relief.	Drying over night at room temperature (20°C).
The bright relief chips off.	The bright relief was printed too thin.	We recommend printing the bright relief with a 180 mesh stainless steel screen.
	Wrong medium was used.	Double check the medium used. We used in our tests Ferro's Nr. 221.

## 7 Products

Product	Appearance	Major characteristics
<b>Bright gold and bright platinum pastes</b>		
GG 346-10% H	light yellow	Good detergent durability, suitable for the Etching Imitation System
GG 347-10% H	light yellow	Good detergent durability, suitable for the Etching Imitation System
GG 347-12% H	light yellow	Good detergent durability, suitable for the Etching Imitation System
GG 1539-10% H	yellow red	Good ASTM and detergent resistance, oxidation insensitive, suitable for the Etching Imitation System
GG 501/11 H	yellow red	Good ASTM and detergent resistance, oxidation insensitive, suitable for the Etching Imitation System
GP 350 H	platinum	Low viscos liquid bright palladium, low metal content, excellent price/value ratio
GP 3309/1 H	platinum	Dishwasher resistant, good ASTM and Calgonite resistance, oxidation insensitive, do NOT shake before usage!
GP 1404/5 H	platinum	Good detergent resistance, oxidation insensitive, suitable for the Etching Imitation System
GP 1404/6 H	platinum	Good detergent resistance, oxidation insensitive, suitable for the Etching Imitation System
<b>Matt underlay</b>		
H 55080	matt white	Lead free matt underlay for porcelain
<b>Bright relief</b>		
H 30152	transparent	lead free bright relief for the 2-Fire-Etching-Imitation-System
H 54002	transparent	lead free bright relief for the 2-Fire-Etching-Imitation-System

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