



## Decoration System Heraeus Matt Gold System for decals on porcelain and bone china

### 1 General Information

In the Heraeus Matt Gold System for decals first a layer of special underlay is printed. Secondly a bright gold, bright platinum or bright palladium paste is applied on top. Where the bright precious metal paste is printed on top of the underlay, the metal appearance is silk matt after firing. Where the bright precious metal paste rests directly on the glaze, the appearance after firing is shiny bright.

With the Heraeus Matt Gold System interesting bright and matt decorations can be achieved in a cost efficient system with the print of only a special underlay and a bright precious metal material.

### 2 Standard Firing Range

Substrate	Firing range
Porcelain	800 – 820°C
Bone China	780 – 820°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 bright precious metal pastes of the system we regularly check the viscosity, the printing characteristics, the outline of printed test decorations as well as the precious metal colour shade and the brightness of the decoration after firing on a defined test substrate.

In case of the special underlay, 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 bright precious metal pastes are supplied ready to use. They can be processed without any thinning. The testing of each produced lot assures the consistent quality of our pastes.

The special underlay needs to be pasted with the recommended pasting ratio and homogenized with a triple roll mill.

#### 3.2 Storage

##### Precious metal decal pastes

Printing pastes are subject to an ageing process. Therefore, we recommend using the material within 9 months. The material should be stored at room temperature (20°C). Cool storage – but no freezing – has a positive impact

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on the shelf life.

#### Special underlay

The special underlay powders 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.

#### Special medium

The special medium No. 238 should be used within 9 months time. The material should be stored at room temperature (20°C).

#### Finished decals

We recommend using decals within 3 months time. With time the softeners in the decal covercoat will reduce, decals tend to get brittle and the decal transfer will get more difficult if not completely impossible. The decals should be stored at room temperature (20°C), vertically and without stress onto the covercoat layer.

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

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 a Heraeus Matt Gold System 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 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 Matt Gold System designs on different substrates. However, the diversity of different types of glaze and firing conditions do 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 a majority of decorations created with the Heraeus Matt Gold System 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 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 with special medium No. 238: In case of the usage of the lead free underlay H 55033 we recommend a mixing ratio of 100 : 45-55 parts by weight (underlay : silk screening oil). If the lead containing special underlay H 5234 is getting used, a mixing ratio of 100 : 35-40 parts by weight should be used. The mixed paste needs to be homogenized with a triple roll mill.

Printing of the underlay paste with a 130-34 to 150-31 polyester screen.

Drying of the underlay: At room temperature (20°C) the drying will take at least 3 to 4 hours, maximum 24 hours. The underlay is ready for the print of the precious metal on top, if the surface of the underlay is dried to touch. The underlay should not be dried right through. As a rule, it should not be possible to smear the underlay by hand.

Important note! Do not print special underlay decals on stock. It is not possible to store decals printed with a special underlay in order to print the bright precious metal paste at a later time. The complete decal needs to be freshly printed.

Printing of the bright precious metal paste with a 120-34 to 130-34 polyester screen.

Drying over night at room temperature (20°C)

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

Screens and squeegees have to be cleaned directly after use. We recommend our screen cleaner V 34. This special screen cleaner prevents blocking of the fine screen structure and prolongs its lifespan.

### 5.3 Transfer of the decal

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.

### 5.4 Firing

During the first heating phase the organic components of the preparation burn off. This process is completed at approx. 400°C. The bright metal film is formed. A constant, slow temperature increase, enough oxygen and sufficient ventilation are decisive for the quality of the fired precious metal decoration.

The firing profile considerably influences the mechanical and chemical properties of the fired decoration.

The rate of cooling has no major influence on the quality of the gold decoration, unlike the firing temperature and soak time. However, the firing process should not be stopped too abruptly after the soak time. If the rate of cooling is too fast, there may be a danger of damaging the article.

## 6 Typical defects, root causes and countermeasures

Defect	Possible cause	Countermeasure
Blurring or smearing metal contours.	The special underlay was not dry to touch.	Increase drying time of the underlay. It must be dried to touch when the gold is printed on top.
	The special underlay was pasted with too much medium.	Reduce the parts by weight of medium. Consider recommended mixing ratios.
The underlay chips off.	The special underlay was not dry to touch.	Increase drying time of the underlay. It must be dried to touch when the gold is printed on top.
The decal is brittle and tears apart during the application.	Decal was stored for too long.	Observe instructions for max. storage. Check storage conditions.
Inhomogeneous surface of the decoration.	Special underlay was not sufficiently homogenized.	Homogenize the paste with a triple roll mill.
Pinholes in the fired decoration.	Not enough medium was mixed with the underlay.	Increase the amount of medium used. Consider recommended mixing ratios.
	Special underlay was not sufficiently homogenized.	Homogenize the paste with a triple roll mill.
Cracks in the fired decoration.	The underlay was printed in a too thick layer.	Use a finer screen. Please follow the screen recommendations.
	Use of an unsuitable precious metal preparation for the glaze of the decorated substrate.	Please follow our product recommendations.
	Decal has been stretched too much.	Less extension of the decal during application.
	Steeping water was too cold and/or the decal was transferred onto a cold object.	Steeping water should be warmed up a little. It is particularly recommended to warm up the object to be decorated eg. with an infrared radiator.
Low mechanical resistance of the precious metal decoration.	Firing temperature is too low.	Increase the firing temperature.
	The printed layer of the product is too thin / too much thinner was used.	We recommend printing the precious metal paste with a 120-34 to 130-34 polyester screen.
The precious metal decoration bordering to the underlay shows a hazy surface.	Decoration was fired in a fast firing cycle and the selected underlay and precious metal paste did not fit to this procedure.	For fast firing we recommend the use of the underlays H 5234 and H 55033.
	<ul style="list-style-type: none"> <li>• Firing temperature was too high.</li> <li>• Soak time was too long.</li> </ul>	<ul style="list-style-type: none"> <li>• Reduce the peak firing temperature</li> <li>• Reduce the soak time</li> <li>• Reduction of the total firing cycle.</li> </ul>

Defect	Possible cause	Countermeasure
Spotty precious metal surface on top of the underlay.	Unsuitable product combination was used.	Test an alternative underlay resp. precious metal preparation.
	Precious metal paste was printed orange skinny.	Take care to print the precious metal paste smoothly. Check your printing condition (squeegee).
Flaking	Special underlay was mixed with an unsuitable medium.	Use special medium No. 238.
	Special underlay was dried through.	Shorten the drying time. Please follow the instructions on drying the special underlay.
	Decals were printed with a special underlay then stored and printed with the bright gold paste at a later date.	Do not print special underlay for reserve stocks.
	Substrate was not clean.	Clean the object before decorating.
	Water or air bubbles under the decal.	Press decal carefully with squeegee and leave to dry.
	The printed layer of the product is too thick.	Reduce the layer of the product by using a finer screen.
	Reaction with bordering incompatible colours.	Tests with critical colours (eg. red colour shades) should be carried out beforehand.
Stained or dull precious metal surface.	Printed precious metal layer was too thin.	Print thicker precious metal layer. Please follow screen recommendations.
	Unsuitable precious metal product was used.	Please consider product recommendations.
	Problems with the kiln, e.g.: <ul style="list-style-type: none"> <li>• reduced atmosphere in the kiln</li> <li>• insufficient ventilation</li> <li>• too many objects in the kiln</li> <li>• heat increase is too fast during critical phase between 300 and 400°C</li> <li>• firing temperature was too high</li> </ul>	<ul style="list-style-type: none"> <li>• increase air addition</li> <li>• improve the ventilation</li> <li>• reduce the number of objects in the kiln</li> <li>• reduce the heating speed</li> <li>• reduce the firing temperature, carry out firing tests</li> </ul>
	Glue residues on the surface of the decal.	Wipe off the decal with a damp sponge.
	Organic components burn off, attack the platinum film and lead to a dull precious metal surface.	Increase air addition in the kiln, reduce the number of objects in the kiln, increase the distance between the objects in the kiln, change the position of the objects in the kiln.

Defect	Possible Cause	Countermeasure
Cracks.	Firing temperature is too high and/or firing cycle is too long.	In our tests we achieved good fired results with firing temperatures of 800-820°C. A good fired result depends on the combination of the glaze of the article to be decorated, the firing temperature and the firing cycle. Firing test under ones owns individual firing conditions are essential.
	Underlay and relief paste was too old when both were processed.	Please generally work with freshly pasted underlay and relief paste.
Bad adhesion, dull and matt precious metal decoration.	Firing temperature is too low and / or firing cycle is too short.	In our tests we achieved good fired results with firing temperatures of 800-820°C. A good fired result depends on the combination of the glaze of the article to be decorated, the firing temperature and the firing cycle. Firing test under ones own individual firing conditions are essential.

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Product	Appearance	Major characteristics
<b>Bright gold and bright platinum pastes</b>		
GGP 2538-10%	light yellow	Suitable for porcelain decoration. Good detergent durability, suitable for the Heraeus Matt Gold System and the One Fire Etching Imitation System
GGP 2538-12%	light yellow	Suitable for porcelain decoration. Good detergent durability, suitable for the Heraeus Matt Gold System and the One Fire Etching Imitation System
GGP 1215-10% H	light yellow	Suitable for porcelain decoration. Good detergent durability, suitable for the Heraeus Matt Gold System
GGP 1215-12% H	light yellow	Suitable for porcelain decoration. Good detergent durability, suitable for the Heraeus Matt Gold System
GGP 1213-10% H	light yellow	Suitable for porcelain and bone china decoration. Good detergent durability, suitable for the Heraeus Matt Gold System
GGP 2536-10% H	yellow	Suitable for porcelain and bone china decoration. Good detergent durability, good ASTM and Calgonite resistance, suitable for the Heraeus Matt Gold System and the One Fire Etching Imitation System
GGP 2555-12% H	yellow	Suitable for porcelain decoration. Good detergent durability, good ASTM and Calgonite resistance, suitable for the Heraeus Matt Gold System, the One Fire Etching Imitation System and the Gold under Flux System
GGP 2556-10% H	yellow	Suitable for porcelain decoration. Good detergent durability, good ASTM resistance, suitable for the Heraeus Matt Gold System, the One Fire Etching Imitation System and the Gold under Flux System
GGP 3022D-12% H	yellow	Suitable for porcelain decoration. Good detergent durability, good ASTM and Calgonite resistance, suitable for the Heraeus Matt Gold System and the One Fire Etching Imitation System, oxidation insensitive
GPP 1240 H	platinum	Suitable for porcelain and bone china decoration. Bright platinum paste, dishwasher durability at higher fast firing, oxidation insensitive, suitable for the Heraeus Matt Gold System and the Etching Imitation System
GPP 4520 H	platinum white	Suitable for porcelain decoration. Bright palladium paste, good detergent resistance, suitable for Heraeus Matt Gold System, the One Fire Etching Imitation System and the Gold under Flux System
GPP 4522 H	platinum white	Suitable for porcelain decoration. Bright palladium paste, slightly lower percentage version compared with GPP 4520 H, good detergent resistance, suitable for Heraeus Matt Gold System, the One Fire Etching Imitation System
GPP 4605 H	platinum white	Suitable for porcelain decoration. Bright palladium paste, good detergent resistance, suitable for Heraeus Matt Gold System and the One Fire Etching Imitation System
GPP 4308 H	platinum yellow	Suitable for bone china and porcelain decoration. Bright platinum paste for bone china decoration, good detergent durability, good Cascade resistance, oxidation insensitive, suitable for the Heraeus Matt Gold System and the One Fire Etching Imitation System
<b>Matt underlay</b>		
H 5234	matt white	Lead containing, low lead releasing matt white underlay for the Heraeus Matt Gold System
H 55033	matt white	Lead free matt white underlay for the Heraeus Matt Gold System
<b>Special medium</b>		
No. 238	transparent	Special medium for the pasting of the matt underlay.

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