



Decorating System Gold/Platinum-under-Flux for Porcelain (Direct Screen Printing and Decals)

1 General Information

Bright precious metal preparations have a layer thickness of approximately 0.1 µm. This extremely thin precious metal layer has to meet the everyday requirements with regard to its abrasion and dishwasher durability. Despite considerable improvements in dishwasher resistance, unprotected bright precious metal surfaces will eventually be damaged by mechanical wear. A coating of protective flux is able to make a lasting improvement to the abrasion durability of the bright precious metal layer. The flux coating has to form a protective layer over the precious metal film without having an adverse effect on the appearance and colour shade of the fired layer. A further advantage is an end to the sensibility of precious metal decorations to finger prints. The system consists of a bright precious metal paste, a flux and a medium. It is easy and reliable to use and can be used for direct screen printing as well as for the production of decal transfer prints.

Processing Procedure:

First of all, the bright precious metal paste is printed onto the decal paper. Then the special flux is printed on top and the covercoat is applied. The decal is transferred to the porcelain and fired in the usual manner.

In order to achieve an ideal decoration with high brilliance and abrasion durability, carefully matched decorating materials (special flux, special medium and precious metal paste) are needed.

Particularly crucial is also the correct choice of silk screen and firing temperature.



2 Firing Range

The firing range of the decoration is determined essentially by the protective flux used:

Product	Firing Range		
Flux F 080802, lead free, transparent	820	-	860°C
Flux F 090802, contains lead, silk matt	800	-	860°C
Flux F 130802, contains lead, silk matt	800	-	860°C

The statements concerning our products correspond to our current knowledge and experience. It is the obligation of the purchaser to examine the usefulness of the products in its intended use in each individual case. In order to prevent production losses the user has to test the preparations in connection with every other material being involved in the production process and has to be satisfied that the intended result can be consistently produced.

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3 Processing

All selected precious metal pastes have good printing properties. Fine lines and sharp contours can be easily printed. All the selected pastes can be used for the Heraeus Matt Gold System. This means they can be printed on top of the lead free special underlay H 55033, for example. A decoration produced according to the Heraeus Matt Gold System can be completely protected with one of the listed protective fluxes.

4 Storage

Since bright precious metal products contain precious metal organically bound, there is no sedimentation. However, bright precious metal products are subject to an ageing process. As a rule, the viscosity increases with the storage time. Therefore, we recommend that the preparations should be used within 6 months. They should be stored at room temperature (c. 20°C / 70°F).

Storage at 7-14°C / 45-57°F reduces the increases of viscosity during storage.

5 Properties of Finished Decorations

The main properties of the fired bright precious metal decoration are characterized by their brilliance and the precious metal colour shade, their dishwasher durability and also their mechanical and chemical resistance.

These properties are influenced by a number of factors. To achieve a high quality decoration it is essential to use high-grade preparations. The quality of the fired decoration, however, depends upon the interaction between the preparations, the application, the porcelain glaze and the firing conditions. Varying one factor – for example the firing conditions – will affect the characteristics of the fired decoration.

We process bright precious metal preparations under defined conditions. Then we determined the properties of the finished decorations. The following data gives an indication to the achievable quality features of the finished decorations manufactured with bright precious metal preparations. However, the user must always test the products under their own individual conditions.

5.1 Mechanical Resistance

The mechanical abrasion durability of flux protected precious metal decorations surpasses the resistance of a purely precious metal film considerably. In a cutting test with a knife weighed down by 1 kg, over 5000 revolutions can be achieved without damaging the surface. Only with high pressure and sharp pointed objects can the flux surface be scratched.

5.2 Dishwasher Durability

All details as to whether decorations are dishwasher durable are to be regarded as approximate values, as test results vary widely according to the type of dishwasher, washing program, washing-up detergent, water quality and firing conditions.

Heraeus tests whether finished decorations are dishwasher durable, roughly following the test-washing program of the Technical Standards Committee for Material Testing (Fachnormenausschuss Materialprüfung) 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.

Precious metal decorations protected by various protective fluxes have achieved the following durability in dishwasher tests:

Bright precious metal decoration under protective flux F 080802: > 500 dishwasher cycles
Bright precious metal decoration under protective flux F 090802: > 500 dishwasher cycles
Bright precious metal decoration under protective flux F 130802: > 500 dishwasher cycles

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5.3 ASTM-Resistance

In compliance with ASTM C556-88, the plate is immersed into a 0.5% sodium carbonate solution at 95°C ($\pm 1^\circ\text{C}$). Every two hours the plate is removed from the solution and rubbed with a cloth. The decoration is examined for any damage and then the plate is returned to the solution for a further two hours. The ASTM test has been successfully passed if the decoration shows no damage after 3 x 2 hours in the test solution and after respective rubbing with a cloth.

All test decorations protected with protective fluxes F 080802, F 090802 and F 130802 have proved to be ASTM durable.

5.4 Acid Resistance

We test acid resistance by placing a decorated test substrate in a 4% acetic acid solution at $22 \pm 2^\circ\text{C}$ for 5 hours. We then examine the stability of brightness and colour brilliance of the colour decoration.

In our tests, all colours displayed unchanged brightness after 5 hours in the acetic acid solution.

5.5 Heavy Metal Release

The heavy metal release of decorations is tested by an independent test institute according to DIN EN 1388-1-2. This means that the decoration surface to be examined is exposed to the attack of an acetic acid solution with a volume concentration of 4% in darkness for 24 hours at a temperature of $22 \pm 2^\circ\text{C}$. Subsequently, the mass concentration of lead and cadmium in the extraction solution are determined.

All fluxes proved to be resistant according to DIN EN 1388-1-2.

6 Processing

6.1 Choosing the Flux and Precious Metal Paste

The temperature and the desired effect are above all decisive when choosing a suitable flux.

F 080802 is recommended for higher temperatures, particularly 860°C fast fire, and is characterized by its ability to give a bright yellow appearance to the bright precious metal layer under the flux.

The brightness of the fired decoration can be modified by small changes in the firing temperature and the thickness of the flux covering. Follow-up treatment of the fired surface is not necessary.

F 090802 produces a very fine silk matt effect, similar to powdered gold, with a slightly reddish precious metal colour shade. By printing the flux partially over the precious metal surface a fine contrast between a matt and a bright precious metal surface can be achieved. This is similar to the Heraeus Matt Gold System.

For use on porcelain GGP 2552-10% is the preferred choice. GGP 2536, GGP 2538 or GGP 2544 can be used up to a firing temperature of 820°C.

6.2 Printing the Bright Precious Metal Paste

It is recommended to print the bright precious metal paste with 120-31 to 130-34 polyester screens.

6.3 Mixing and Printing the Flux Coating

The fluxes are mixed with Medium NR. 258 in a ratio of 100:100 by weight and homogenised with a triple roll mill. The paste is printed preferably with 100-40 to 77-50 polyester screens.

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6.4 Printing the Covercoat

We recommend the covercoat L406 and a 32-120 polyester screen (or a comparable screen).

6.5 Firing the Precious Metal Layer

First of all the decal is transferred to the substrate in the conventional manner. After drying, the decoration is fired in a standard fire of 780-820°C and 10-15 mins. at peak temperature, or alternatively in an 860°C fast fire with a maximum 5 mins. at peak temperature.

7 Frequent Faults, Their Causes and Ways of Avoiding Them

Fault	Possible Cause	Remedy
The precious metal layer is cracked.	Temperature is too high or the peak time is too long.	Check firing conditions. If necessary reduce firing temperature and/or peak time.
The flux is difficult to print. Screen pattern appears on precious metal layer.	Viscosity of the flux paste is too high.	Add more screen printing medium.
The flux coating does not "stand" exactly. The contours spread out.	Viscosity of the flux paste is too low.	Use less screen printing medium.
The fired precious metal layer is brownish matt.	Firing temperature is too high or unsuitable flux or bright gold paste was used.	Check firing conditions. Reduce firing temperature and/or peak time. Alternatively use Flux F080802. Check bright precious metal paste.
The fired precious metal layer is matt.	Firing temperature is too low.	Check firing conditions.
	Flux layer is too thin.	We recommend 100-40 to 77-50 polyester screens.

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8 Products

Precious Metal Preparations

Colour	Product	Precious Metal Content	ASTM-resistant	Microwave-resistant	Sanitary ware	Remarks
yellow	GGP 1220	10+12%				Bright Gold Paste
white platinum	GPP 4529					Bright Platinum Paste

Flux

Number of Colour	Firing temperature approx.	Appearance after Firing	Lead free (< 300 ppm)	Cadmium free (< 200 ppm) resistant DIN EN 1388-1-2	Remarks
F 080802	820°C - 850°C *) 840°C - 860°C **)	transparent	●	●	bright
F 090802	820°C - 850°C *) 840°C - 860°C **)	silk matt		●	only suitable for gold preparations
F 130802	820°C - 850°C *) 840°C - 860°C **)	silk matt		●	only suitable for platinum preparations

*) Firing range (normal firing)

**) Firing range (fast firing)

Auxiliary Materials

Covercoat

L 406

Medium

Nr. 258

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