



Bright Precious Metal Preparations for Direct Screen Printing on Porcelain and Bone China

1 General Information

Heraeus supplies bright precious metal pastes for direct screen printing on porcelain and bone china with different precious metal content. Depending on the precious metal content and the thickness of the precious metal application, a precious metal film of approx. 0.1 µm forms after firing.

2 Firing Range

Substrate Type	Firing Range
• Porcelain	780°C (1440°F) - 880°C (1620°F)
• Bone China	750°C (1380°F) - 880°C (1620°F)
• Vitreous China	750°C (1380°F) - 850°C (1560°F)

3 Properties of the Preparations

The major characteristics of a Heraeus precious metal preparation are determined by its production recipe. From each produced lot we take a sample and check defined characteristics.

In case of screen printing preparations we check the viscosity, printing characteristics, a sharp outline of the applied material as well as the colour shade and the optical appearance of the fired decoration in comparison to the "standard" of this product. The control of each lot assures a high product quality and the consistency of the characteristics from lot to lot.

3.1 Processing

Bright precious metal preparations are delivered ready to use. They can be applied without thinning. The check of each lot guarantees a constant quality of the pastes.

3.2 Storage

Since bright precious metal products contain precious metal organically bound, there is no sedimentation. Also bright precious metal products are subject to an ageing process. As a rule, the viscosity increases with the storage time. Therefore, we recommend to use the preparations within 12 months. They should be stored at room temperature (approx. 20°C / 70°F).

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



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3.3 Consumption

The material consumption depends on the printing parameters (screen fabric, coating, squeegee position, squeegee pressure). Under our conditions, the consumption is approx. 0.15 to 0.30 g / 100 cm².

4 Achievable Properties of Finished Decorations manufactured with Bright Precious Metal Preparations

The main properties of fired bright precious metal decorations comprise brilliance and precious metal tone, as well as resistance to mechanical and chemical attack.

These properties are influenced by a number of factors. The high quality of the preparation used is an absolute prerequisite for manufacturing high-quality decorations. The quality of a fired decoration, however, derives from the interplay of preparation, application, substrate surface and firing conditions. A variation in one factor – for instance, the firing conditions, has an influence that leads to altered properties of the fired decoration.

We processed the bright precious metal preparations under defined conditions. Then we determined the properties of the finished decorations. The following data indicate achievable quality features for the finished decorations manufactured with bright precious metal preparations. However, the user must always test the products under his own individual conditions.

4.1 Mechanical resistance

The mechanical resistance of a precious metal decoration is influenced by the chemical composition of the used precious metal preparation and also by the substrate surface, the firing conditions and the layer thickness of the fired precious metal layer.

4.2 Dishwasher resistance/-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 programme, washing-up detergent, water quality and firing conditions.

Heraeus tests whether finished decorations are dishwasher durable, roughly following the test-washing programme 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.

5 Application Recommendation

Work in a well ventilated room. Good printing conditions occur at a room temperature of 20 to 25°C and a relative humidity of 60 to 70%.

5.1 Basic Information on Products, Screens and Squeegees

- Heraeus supplies precious metal preparations with a viscosity ready for use. In general, thinning is not necessary. In case the pastes have an increased viscosity after a long storage time, the printing properties can be improved with an addition of maximum 5 - 10% of thinner V 170. The thinner has to be stirred in very well. We recommend using a triple roll mill for an optimum homogenisation.
- For printing the bright gold- and bright platinum paste, a 120-35 to 140-35 polyester screen or a 350 - 400 mesh steel screen should be used.
- For a good printing result, it is important to have a well sharpened squeegee (hardness: 60-75° shore).

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5.2 Conditions required for good Results

- 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, and therefore have to be removed before application.
- Take care that the objects to be decorated are not taken from a cold store into a warm shop. It is possible that a fine condensation film will form. Result: Firing disturbance (pinholes) in the fired precious metal decoration. Allow enough time so that they can adjust to the decoration room temperature.

5.3 Printing

- Apply an appropriate quantity of the preparation onto the screen, so that the screen will be „flooded“ with one squeegee motion. We recommend applying a small amount of paste because it is better to add fresh paste during the printing procedure. This way, the viscosity increase caused by the evaporation of the solvent from the precious metal paste during printing can be minimized.
- During shorter printing breaks (a few minutes), the screen should be continuously flooded, to prevent the paste from drying and blocking the screen. During longer breaks, the screen has to be cleaned with our screen cleaner V 34 before printing is restarted.
- If precious metal products and colours are adjacent, the registration of the prints is very important because an incompatibility reaction with the colours is possible (precious metal products particularly react with red colours that contain cadmium).
- After drying of the precious metal preparation (approx. 4 - 6 hours at room temperature) - additional decoration colours can be applied.

5.4 Cleaning of Screen and Squeegee

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

6 Frequent Faults, their Causes and Ways of avoiding Them

Fault	Possible Cause	Remittance
blurred contours, running precious metal	too much thinning of the product	leave the bottle open for a while, so that some of the solvent can evaporate
	the thinner was too fat or drying to slow	leave the bottle open for a while, so that some of the solvent can evaporate
	too much organic fumes in the furnace	reduce the number of objects in the furnace
preparation shows bad application	viscosity is too high after long application or long storage	thinning of the product with V 35 or V 39
spots, firing disturbance	contamination as dust, finger marks or water condensation	clean and warm the object before decorating
	problems with the furnace <ul style="list-style-type: none"> • furnace atmosphere reduction • insufficient ventilation • too quick heat up in the critical phase between 300-400°C (570-750°C) • too many objects in the furnace 	<ul style="list-style-type: none"> • air addition to the furnace • improve of the ventilation reduce the speed of the heat up • reduce the number of the objects in the furnace
precious metal chips off after firing	contamination of the surface causes chip off	clean the substrate before decorating
	the layer of the product it too thick	reduce the layer of the product
	too much thinning of the product, runs give thick layers which chip off after firing	less thinning of the product
	the product was thinned with a too slow drying thinner, runs give thick layers which chip off after firing	use less fat thinner .
low mechanical resistance of the precious metal decoration	too low firing temperature	increase the firing temperature
	the layer of the product is too thin	increase the layer thickness
fine pinholes	pinholes can be release by moisture on the surface of the decorated object. Taking objects from a cool store into a worm shop gives invisible condensation on the surface. Note this cannot be wiled off. It reforms immediately.	allow enough time for the ware to reach shop temperature

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7 Bright Gold Preparations for Direct Screen Printing on Porcelain

Colour	Product	Precious Metal Content	ASTM-resistant	microwave-resistant	Sanitary Ware	Notes
light yellow	GGP 2538	10+12%				wide firing range, very scratch-resistant, suitable for the Heraeus "silk matt gold system"
light yellow	GGP 1215	8+10+12%				suitable for the Heraeus "silk matt gold system"
yellow	GGP 1213	9+10+12%				suitable for the Heraeus "silk matt gold system"
yellow	GGP 2571	12%	●			excellent chemical resistance (ASTM, Calgonite, dishwasher)
yellow	GGP 2536	10%				wide firing range, very scratch-resistant, suitable for the Heraeus "silk matt gold system"
yellow	GGP 2552	10%				suitable for the Heraeus "gold-under-flux-system"
yellow	GGP 2556	10%				suitable for the Heraeus "gold-under-flux-system" as well as for the "silk matt gold system"
yellow	GGP 2560	10%				suitable for the Heraeus "gold-under-flux-system" as well as for the "silk matt gold system"
yellow	GGP 2569					firing stable up to max. 820°C / 1508°F
yellow	GGP 2570					-
yellow	GGP 2572	10%	●			excellent chemical resistance (ASTM, Calgonite, dishwasher), suitable for the Heraeus "silk matt gold system"
yellow	GG 5566	7+10%	●			dishwasher resistant, suitable for fast firing up to 880°C new!
yellow	GGP 2527	7%				-
reddish yellow	GGP 1220	8+10+12%				suitable for the Heraeus "silk matt gold system"
reddish yellow	GGP 2555	12%	●	<input type="checkbox"/>	<input type="checkbox"/>	excellent chemical resistance (ASTM, Calgonite, dishwasher)
reddish yellow	GGP 2516/MW	9%		●		very scratch-resistant
reddish yellow	GGP 2565	7%				-
reddish yellow	GGP 2531/MW	7%		●		very scratch-resistant

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8 Bright Gold Preparations for Direct Screen Printing on Bone China

Colour	Product	Precious Metal Content	ASTM-resistant	microwave-resistant	Sanitary Ware	Notes
light yellow	GGP 2341	12%				suitable for the decoration on cobalt blue
yellow	GGP 2536	10+12%				suitable for the Heraeus "silk matt gold system", on soft glazes only suitable for firing range 780-800°C / 1436-1472°F
yellow	GGP 1211	10+12%				suitable for the Heraeus "silk matt gold system"
reddish yellow	GGP 1220	10+12%				suitable for the Heraeus "silk matt gold system"

9 Bright Platinum Preparations for Direct Screen Printing on Porcelain

Colour	Product	Precious Metal Content	ASTM-resistant	microwave-resistant	Sanitary Ware	Notes
white	GPP 1241	11%				suitable for the Heraeus "silk matt gold system"
white platinum	GPP 4520	10%	●			dishwasher-resistant, suitable for the Heraeus "silk matt gold system"
white platinum	GPP 1240	8%				suitable for the Heraeus "silk matt gold system"
white platinum	GPP 4530	8%				suitable for the Heraeus "silk matt gold system"
white platinum	GPP 4529	8%				suitable for the Heraeus "flux-on-platinum-system", ASTM-resistant
white platinum	GPP 4522	8%	●			-
platinum	GPP 4516	11%	●			-

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Colour	Product	Precious Metal Content	ASTM-resistant	microwave-resistant	Sanitary Ware	Notes	
platinum	GP 5566	8%				-	<i>new!</i>
platinum	GP 5530	7%				-	<i>new!</i>
platinum	GP 5590	7%				-	<i>new!</i>
platinum	GPP 4514					-	

10 Bright Platinum Preparations for Direct Screen Printing on Bone China

Colour	Product	Precious Metal Content	ASTM-resistant	microwave-resistant	Sanitary Ware	Notes
white platinum	GPP 1240/3	8%				suitable for the Heraeus "silk matt gold system"
platinum	GPP 4308	8%				-
platinum	GPP 4512	8%				-

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