Burnish Precious Metal Preparations for Brush Application on Glass

1 General Information

Burnish preparations contain precious metal or precious metal compounds in solid, dispersed and dissolved forms, adhesive agents, as well as resin solutions as film formers.

Decorations produced with burnish preparations result in dull, brown surfaces after firing. Only after burnishing with a glass fiber brush, sand or similar auxiliary material does the typical silk matt brilliance arise.

Besides this optical effect, burnishing leads to a compacting of the precious metal particles in the surface and therefore to a distinctive improvement of the abrasion resistance. As a rule decorations produced with burnish preparations are more abrasion resistant than bright gold decorations.

Heraeus supplies burnish gold preparations for the decoration of glass with a precious metal content of 18 up to 30%. Depending on the precious metal content and the thickness of the layer, a gold film of approx. 0.3 up to 1.0 µm forms after firing.

2 Standard Firing Range

Glass Type	Firing Range	
Soda Lime Glass	520 - 620°C	(940 - 1150°F)
Lead Crystal Glass	480 - 540°C	(890 – 1004°F)

The firing result depends on the firing temperature, on the total firing time, the soak time and not least on the glass type. To achieve an optimized firing result, we therefore recommend the user to check under his own individual conditions.

3 Properties of the Preparations

The mayor 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.

We check the physical properties (e.g. viscosity) and also the application properties (e.g. brushability) of our precious metal preparations for brush application against a predefined standard before firing. After the firing under defined conditions, we check the ease of burnishing as well as the optical properties (properties of the surface and colour). Controlling each single production lot assures the highest product quality and lot-to-lot stability.

3.1 Processing

We deliver burnish gold preparations ready for use. They can be applied without thinning. Before the usage the preparations need to be shaken.

They distinguish themselves by their excellent application properties and sharp outline.

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Thinning may also be necessary after a longer processing time and the resulting solvent evaporation of the used preparation, or when decorating large areas.

3.2 Storage

Also burnish precious metal products are subject to an ageing process. As a rule, the viscosity increases with the storage time. Besides, burnish precious metal preparations typically show a settlement of the matting agent, therefore the materials need to be shaken before they are used.

Therefore, we recommend to use the preparations within 6 months. They should be stored at room temperature (approx. 20°C / 70°F).

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

3.3 Consumption

The material consumption depends on the thickness of the applied precious metal layer. Under our conditions, the consumption is approx. 0.30 g /100 cm² .

4 Properties Of Finished Decorations

The main properties of fired burnish precious metal decorations comprise a matt surface and precious metal tone as well as the 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.

However, the user must always test the products under his own individual conditions.

4.1 Silver Containing Precious Metal Preparations

To achieve lemonish, light yellow and yellow gold decorations, silver is added to the formulation of precious metal preparations. Silver containing precious metal decorations can change their appearance in the course of time, under certain unfavourable external circumstances. Especially the contact to cardboard boxes, high humidity and high temperature support the reaction of silver to silver sulphide. Therefore, the user must individually check the suitability of a silver containing preparation.

Products with a higher silver content we labeled as “silver containing”. We recommend to hermetically package items decorated with precious metal preparation we describe as “silver containing”, and to prevent direct contact with cardboard boxes. To exclude any risk, we recommend using yellow red gold preparations.

5 Application Information

5.1 Conditions Required For Good Results

- Work in a well ventilated room. Good printing conditions occur at a room temperature of 20 to 25°C.
- 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 object to be decorated is 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.

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5.2 Application Information In Detail

- Shake the bottle well before use.
- Heraeus supplies burnish precious metal preparations with a viscosity ready for use. They can be used without thinning. In some exceptions thinning cannot be avoided:
    - After long processing
    - During decoration of large areas.

  In these cases we recommend a thinning at 5 - 15% V 35 or V 39.
- Draw from the bottle only as much as you can consume in 15 or 30 minutes and close the bottle. Consider that the solvent evaporates in air and therefore the viscosity increases.
- Apply the preparation in a moderate thick layer onto the object to be decorated. A too thin layer influences the chemical and mechanical resistance of the fired decoration. In extreme cases it can lead to a surface without any gold character.
- A too thick layer can lead to cracking or to a matt surface.
- Ensure dust free surroundings during the application process and during drying. A wet surface is attractive to dust. After the drying, fire the decorated article as soon as possible.

5.3 Firing

- During the heating up phase, first of all the organic components of the preparation burn off. This process is completed at approx. 400°C (750°F). 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. In case the decorated article cools down too quickly, there is a danger of cracks in the glaze. If the rate of cooling is too fast, there may be a danger of damaging the article (cracks and broken glass).

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6 Frequent Faults, Their Causes And Ways Of Avoiding Them

Fault	Possible Cause	Remedy
blurred contours, running gold	too much thinning of the product	leave the bottle open for a while, so that some of the solvent can escape
	too much organic fumes in the furnace	reduce the number of objects in the furnace
preparation shows bad application condition	viscosity is too high after long application or long storage	thinning of the product with V 35 or V 39
spots, firing disturbance	contaminations as dust, finger marks or water drops	clean the object before decorating
	problems in the kiln such as • reduced atmosphere in kiln • insufficient ventilation • heat increase is too fast during critical phase between 200-400°C (390-750°F) • too many objects in the kiln	 • increase air addition • improve ventilation • reduce the heating speed • reduce the number of objects in the kiln
gold is cracking during firing or the decoration is difficult to burnish	the layer of the product is too thick	reduce the layer of the product
low mechanical resistance of the precious metal decoration	too thin a layer	increase the layer thickness
surface is too matt	insufficient burnishing	additional burnishing
fine pinholes	pinholes can be released by moisture on the surface of the decorated object taking objects from a cool store into a warm shop gives invisible condensation on the surface.	allow enough time so that the objects can adjust to the decoration room temperature

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	Colour	Product	Precious Metal Content	Glass	Lead Crystal (firing temperature max. 540°C / 1004°F)	Borosilicate Glass	Quartz Glass	Notes
	yellow	PG 5001	30%	●	●	□	□	Burnish gold paste, contains lead
	yellow	PG 1001/1 D	18%	●	□	□	□	Burnish gold paste
	platinum	PP 1000 D		●	□	□	□	Burnish platinum paste

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