



Burnish Precious Metal Preparations for Direct Screen Printing and Production of Decals 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 a binding system.

Decorations produced with burnish preparations result in dull, brown surfaces after firing. 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.

The typical silk matt character arises only after burnishing with a glass fibre brush, sand or similar auxiliary materials.

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.

2 Standard Firing Range

Glass Type	Firing Range
Soda Lime Glass	520 - 620°C (940 - 1150 °F)

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

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.

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 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.

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.

3.2 Consumption

The material consumption depends on the thickness of the applied precious metal layer. Under our conditions, the consumption is approx. 0.2 to 0.4 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 Recommendations

Work in well ventilated room. Good printing conditions occur at a room temperature of 20 to 25°C (68 to 77°F).

5.1 Basic Information On Products, Screens And Squeegee

- Heraeus supplies burnish gold pastes in 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 5-10% of thinner V 170. The thinner has to be stirred in very well. We recommend using a triple roll mill for optimum homogenisation.
- In order to reach their printing properties, screen printing pastes are thixotropic. In some cases, the preparations reach their typical processing viscosity only under mechanical stress. This means only under a certain print speed. With thixotropic pastes, sharp outlines are possible and therefore especially fine decorations can be printed.
- For printing the burnish gold paste, a 90-40 to 100-40 polyester screen or a 300-350 mesh steel screen should be used.
- Important for a good printing result is a well sharpened squeegee (hardness: 60 -75° shore).

5.2 Application Information

- Stir up the burnish gold paste.
- 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. In this way, the viscosity increase caused by the evaporation of the solvent from the precious metal paste during the printing can be minimised.
- During shorter printing breaks (few minutes), the screen should be continuously flooded, to prevent the paste from drying and blocking of the screen. During longer breaks, the screen has to be cleaned with our screen cleaner V 34 before printing is restarted.
- Generally, the precious metal paste is printed at first. After drying, additional decoration colours can be applied.
- If precious metal products and colours are adjacent, the registration of the prints is very important because

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an incompatibility reaction with the colours is possible (precious metal products particularly react with red colours that contain cadmium).

- As screen printing covercoat, we recommend L 406. This film stable, non block resistant standard covercoat with a solids content of approx. 42 % is also available as a thixotropic version. Please refer to our product programme and technical information sheets regarding further special screen printing covercoats.
- After drying, the decal can be transferred to the object to be decorated.

5.3 Transfer Of Decals Onto The Object To Be Decorated

- The decals to be transferred have to be steeped in water (water temperature: 20 to 30°C (68 to 86°F). Decals can be released faster from the decal paper if the steep water is slightly heated.
- Is the steep water too cold, decals are released only with difficulty from the decal paper and during transfer of the decal, cracking of the precious metal decoration can occur. If the steep water is too warm, the decals become too weak and are difficult to apply accurately. There is also a tendency for the covercoat film to shrink during drying.
- The steep water should be changed regularly. If the steep water is polluted with too much dextrin residues from the decal paper, spots or pinholes may appear after firing.
- The transferred and adjusted decal has to be pressed carefully onto the object with a squeegee. The squeegee should be used from the centre to the edge of the decal to allow water residues, dextrin residues and air bubbles to escape.
- Afterwards the surface of the decal should be cleaned with a damp sponge. Dextrin residues on the decal may lead to faults in the fired precious metal decorations (spots).
- Before firing, the decorated ware should be dried at room temperature (20 to 22°C /68 to 72°F) for 16 to 24 hours.

5.4 Firing Of The Decoration

- During the first heating phase, the organic components of the preparation burn off. This process is completed at approx. 400°C (750°F). The film has formed. A constant, slow increase in temperature, 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 the soak time. 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

Faults	Possible Cause	Remedy
streaks in the printing precious metal decoration	the squeegee is possibly scratched	exchange or sharpen the squeegee
squashed print	the squeegee is not sharp or it is worn out	exchange or sharpen the squeegee
blurred contours, running gold	too much thinning of the product	leave the pot open for a while, so that some of the solvent can evaporate
spots, pin holes, matt firing result	Objects were soiled by dust, finger marks or water drops before printing	clean the object before decorating
	dextrin residues under or on the decal	frequent changing of the steep water. Wipe off the decal with a damp sponge
	problems in the kiln such as: <ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> increase air addition improve ventilation reduce heating speed <ul style="list-style-type: none"> reduce the number of objects in the kiln
gold cracks during firing or is difficult to burnish	contamination of the substrate surface causes cracking	clean the substrate before application
	water residues under the decal	careful pressing of the decal by the squeegee and drying
	the layer of the product is too thick	reduce the layer of the product
cracking of the decoration	decal extension was too great	Avoid too much extension of the decal. If necessary use an elastic screen printing covercoat
	steeping water is too cold and / or transfer of the decal onto a cold object	steeping water should be warmed up a little.
low chemical and mechanical resistance of the precious metal decoration	the layer of the preparation is too thin	use a 90-40 polyester screen or a 300 mesh steel screen
	too much a thinning	leave the pot open for a while for evaporation
	too low a firing temperature	increase firing temperature
dark firing result and insufficient adhesion of the gold	furnace atmosphere reduction prevent the optimum development of the precious metal surface	improve the fresh air supply and the air addition

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7 Burnish Gold Preparations For Direct Screen Printing and Production Of Decals For Glass

Colour	Product	Precious Metal Content	Glass	Lead Crystal (firing temperature max. 540°C/1004°F)	Coated Glass	Notes* **
light yellow	PGP 6001	23%	●			lemon yellow firing result
light yellow	PGP 6001	18%	●			-

These products may contain silver.

* For further information please refer to "Definitions"

** Burnish precious metal preparations need to be stirred well before use

8 Burnish Platinum Preparation For Direct Screen Printing and Production Of Decals For Glass

Colour	Product	Precious Metal Content	Glass	Lead Crystal (firing temperature max. 540°C/1004°F)	Coated Glass	Notes* **
white	BS 113	65%	●			burnish silver paste, suitable for induction coatings

* For further information please refer to "Definitions"

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