



Thermoplastic Bright Gold Paste GGP 6101/10-TH H

1 General Information

GGP 6101/10-TH H is thermoplastic bright gold paste for direct screenprinting on glass. While the material can be used at conventional glass firing temperatures between 560 to 640°C, it has been especially developed for higher temperature fast firing up to 700°C in very short firing cycles, so that the tension of a drinking glass is not broken (required for example for British pub glasses). The materials' composition supports an early and quick burnoff of the organics in the short firing.

2 Standard Firing Range

Substrate	Firing range
Soda-lime-glass (standard firing)	560 – 640°C
Soda-lime-glass (fast firing)	Up to 700°C, very short firing cycle

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 a firing test under the users 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 lot produced, we take a sample and check defined characteristics.

In case of screen-printing preparations, before firing, we check the physical properties (e. g. viscosity, thixotropy) and the printing properties compared to a predefined standard. After firing under standard firing conditions, we check the gold colour shade and the adhesion to the substrate. Controlling each single production lot assures the highest product quality and lot-to-lot consistency.

3.1 Processing

We supply bright precious metal preparations for thermoplastic screen printing ready to use. GGP 6101/10-TH H has a thixotropic nature, means the typical printing viscosity is reached at certain printing speed, when the thixotropy is temporarily broken. The applied material hardens instantly and assure a sharp outline of the print.

3.2 Storage

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

3.3 Consumption

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 cm².

4 Properties of finished decorations

The properties of finished decorations are influenced by a number of factors which interact with each other: The precious metal preparation used, possible bordering colours, application, substrate, possible substrate treatment

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and last but not least the firing conditions. We processed GGP 6101/10-TH H under defined, standard test conditions and run certain tests of the achieved precious metal decoration.

4.1 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 programme, washing-up detergent, water quality and firing conditions. Heraeus tests the dishwasher durability of glass decorations under defined test conditions in a Winterhalter Gastronom GS 29 with an automatic proportion of the detergent and the clear rinse.

Precious metal decorations on glass usually do not achieve the resistance of a similar decoration on ceramics. If a decor withstands 200 wash cycles under our conditions essentially without damage, we designate it as dishwasher durable.

Test decorations prepared with GGP 6101/10-TH H had been dishwasher durable.

4.2 Abrasion resistance

In tests decorations created with GGP 6101/10-TH H showed a good abrasion resistance.

4.3 Oxydation resistance

As a yellowish gold GGP 6101/10-TH contains a certain amount of silver. Under unfavourable conditions silver containing precious metal decorations can tarnish in the course of time. Especially the contact to cardboard boxes, high humidity and high temperature support the reaction of silver to silver sulphide.

4.4 Precious metal colour shade at the reverse side

Precious metal decorations on glass often show a reddish discoloration on the reverse side. The tendency to this kind of red discoloration is strongly related to the chemical formulation of the glass, but also influenced by the precious metal product used and the kiln atmosphere during firing.

Under our test conditions GGP 6101/10-TH H showed no reddish discoloration on the reverse side.

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 Application of the paste

- Work in a well-ventilated room. Good printing conditions occur at a room temperature of 20 to 25°C.
- For printing GGP 6101/10-TH H 400 to 500 mesh stainless steel screens are recommended to be used.
- For a good printing result, it is important to have a well sharpened squeegee (hardness: 60-75° shore).
- To print thermoplastic bright gold paste the screen needs to be heated to a temperature of 65 to 75°C.
- Mostly the material chunks are pre-melted. The pre-melting temperature should not be higher than the recommended screen temperature.

5.3 Firing

- During the first heating phase the organic components of the preparation burn off. This process is completed at approx. 400°C. The gold film is formed. A constant, slow temperature increase, enough oxygen and

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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 (cracks and broken glass).

6 Typical defects, root causes and countermeasures to prevent them

Defect	Possible cause	Countermeasure
Streaks in the printed precious metal film	The squeegee is possibly scratched	Exchange or sharpen the squeegee
Squashed print	The squeegee is not sharp enough or it is worn out	Exchange or sharpen the squeegee
Spots, firing disturbance	Objects were soiled by dust, finger marks or water drops before printing	clean the object before decorating
	problems in the kiln such as: • furnace atmosphere reduction • insufficient ventilation • too quick heat up in the critical phase between 200-400°C • too many objects in the kiln	• increase air addition • improve ventilation • reduce the heating speed • reduce the number of objects in the kiln
Fired result is blotchy or matt	Screen used is too coarse; printed layer is too thick	we recommend a 400-500 mesh steel screen.
Blurred outline after firing (spreading or running)	too many objects in the kiln	reduce the number of objects in the kiln
Paste will not print properly	Screen temperature was too high. Product has been stored for too long.	Remove product from the screen (=> recycling). Cleaning the screen and print with fresh preparation. Be sure that the screen temperature is 65 -75°C
Precious metal flakes off during firing	Printed layer was too thick.	Reduce thickness of applied film.
Fine pinholes	moisture on the objects before decoration leads to firing faults (pinholes)	give the ware enough time to acclimate to the temperature of the decoration shop and so a possible condensation film to evaporate

Defect	Possible cause	Countermeasure
low mechanical resistance of the precious metal decoration	firing temperature was too low	increase firing temperature
	printed layer is too thin	Use 425-500 mesh steel screen to print thermoplastic precious metal preparations
screen is clogged	Product is not sufficiently molten	Stop printing and allow the product to melt thoroughly. Check screen temperature. We recommend pre-melting thermoplastic precious metal preparations in a drying cabinet at 80°C / 175°F.
	Localized cooling of the screen	Check the screen's heating system.
red/very dark backside of the precious metal decoration	coating of the glass	Eventually, the organic coating of glass is to be removed by pre-firing
	Kiln atmosphere	Eventually adjust the firing profile