# bright gold paste

## GGP 1230-8% H for decal printing

Heraeus Precious Coatings is a global manufacturer of precious metal decoration products for ceramics and glass. Heraeus profits from over 100 years experience in ceramic and glass decoration designs, which has always made the department a pioneer in the development of precious metal colours. Modern precious metal preparations have to meet high demands on different types of substrates – such as on porcelain, tiles, drinking glasses, flacons and bottles. Decorations have to achieve good mechanical and chemical resistance such as dishwasher durability.The products supplied by Heraeus Precious Coatings include: Bright gold and platinum products, silk-matt gold and platinum products, burnish gold and platinum products, lusters and metallo-organic preparations for technical use.

### 1 General information

GGP 1230-8% H is the lower percentage, yellowish screen printing paste for decals glass. Decal pastes are also suitable for direct sceenprinting on glass. Precious metal decorations created by decals generally do not reach the adhesion and dishwasher durability one can achieve with a direct printed paste – wet paste and thermoplastic. Decal pastes are mostly used for the decoration of substrates with a form not suitable for a direct printing decoration. Typical items of decoration are drinking glasses and giftware items.

### 2 Standard firing range

| Substrate | Firing range [°C] |
|---|---|
| soda lime glass | 520-620 |
| borosilicate glass | 580-620 |

The firing result depends on the firing temperature, the total cycle time, the soak time, the chemistry of the glass and a possible coating. To achieve an optimal firing result, we recommend firing tests under the users own individual conditions.




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### 3 Properties of the product

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 decal pastes 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 decal pastes ready to use. GGP 1230-8% 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

Printing pastes are subject to an ageing process. Therefore, we recommend using 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.*

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### 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, the quality of the print, the material deposit, the quality of the decal paper, the correct application of the decal and of course the firing conditions. The main properties of fired bright precious metal decorations comprise brilliance and precious metal tone, dishwasher resistance, scratch resistance and resistance against chemical attack. We have processed the bright precious metal preparations under standard test 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. They must, however, always be checked by the user under his own individual conditions.

### 4.1 Dishwasher resistance

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. Precious metal decorations by decal on glass do not achieve the dishwasher durability of a direct screen printed precious metal decoration, especially not the level of a thermoplastic print. The decal paper, even the smoothest, does not allow the same good connection to the substrate like a direct printed material.

Decorations with GGP 1230-8% H might not achieve 200 cycles in dishwasher regularly.

### 4.2 Abrasion resistance

Gold decorations applied with decals printed with GGP 1230-8% H achieved a reasonable scratch resistance.

### 4.3 Oxidation resistance

GGP 1230-8% H has yellowish gold colour shade and contains a moderate quantity 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 at the reverse side

Precious metal decorations on glass often show a red discoloration at their back. The tendency to this kind of red discoloration is strongly influenced by the glass chemistry and the firing conditions. In our tests, decoration created with GGP 1230-8% H showed a yellowish back on many glasses. Nevertheless it is vital for the user to check the material on their own glasses and firing conditions.

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### 5 Application of the material

#### 5.1 Preparation for the decoration

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

#### 5.2 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.

#### 5.3 Production of decals

- Apply an appropriate quantity of the preparation on the screen, so that the screen will be flooded with one squeegee motion. We recommend applying not too much paste. 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 of the screen. During longer breaks, the screen has to be cleaned with our screen cleaner V 34 before the resumption of printing.
- As a general rule, the precious metal paste is printed at first. We recommend for the printing of the bright gold paste a 120-34 to 140-34 polyester screen.
- After drying, additional decoration colours can be printed. 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 (especially precious metal products react sensitively with cadmium containing colours).
- The complete mofif needs to be covered with layer of covercoat. After drying, the decal can be transferred to the object to be decorated.

#### 5.4 Transfer of the decal

- The decals are soaked in slightly warmed water (20 to 30°C). If the water is too cold the decals do not release well from the decal paper. Is the water too warm, the decals might get too soft.
- It is important to change with water quite regularly.
- It is essential to remove the water between decal and substrate by a careful squeeging of the decal. Trapped water could fire off explosively and create defects in the metal film. Additionally we recommend cleaning the surface of the applied decal with a sponge, in order to remove all dextrin rests on top of the decal.
- The decorated ware should be dried before firing at room temperature (20 to 22°C) for 16 to 24 hours.

#### 5.5 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 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).

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### 6 Typical defects, root causes and countermeasures

| Defect | Possible Cause | Counter measure |
|---|---|---|
| Stripes in the printing precious metal decoration | The squeegee shows possibly scratches | Squeegee exchange, or grind off the old one |
| Squashed printing format | The squeegee has not enough pressure or is warn out (rounded off) | Squeegee exchange, or grind off the old one |
| Blurred contours, running precious metal | Too much thinning of the product | Leave the pot open for a while, so that some of the solvent can evaporate |
| Spots | Contamination as dust, finger marks or water drops | Clean the object before decorating |
| Pin holes | Glue residues under or on the decal | Frequent changing of the steep water. Wipe off the decal with a damp sponge |
| Matt firing result | Problems in the kiln such as:<br>a) Furnace atmosphere reduction<br>b) Insufficient ventilation<br>c) Too quick heat up in the critical phase between 200-400°C<br>d) Too many objects in the kiln | a) Increase air addition<br>b) Improvement of the ventilation<br>c) Reduce the heating speed<br>d) Reduce the number of objects in the kiln |
| Precious metal is cracking during firing | a) Contamination of the substrate surface causes cracking<br>b) Water residues under the decal<br>c) The layer of the product is too thick | a) Clean the substrate before application<br>b) Careful pressing of the decal by the squeegee and drying<br>c) Reduce the layer of the product |

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| Defect | Possible Cause | Counter measure |
|---|---|---|
| Cracking of the decoration | a) Decal extension was too high<br>b) Steeping water is too cold and / or transfer of the decal onto a cold object | a) Do no extend the decal so much. If necessary, use an elastic screen printing covercoat and take care of the following information<br>b) Steeping water should be warmed up a little. It is of great importance to warm up the object to be decorated e.g. with a infrared radiator |
| Low mechanical resistance of the precious metal decoration | a) Too low firing temperature<br>b) The layer of the product is too thin | a) Increase the firing temperature<br>b) Use a 120-34 to 140-34 polyester screen / 350 to 425 mesh steel screen |
| Gold decoration has shrinked / retreated from a bordering colour | Cd containing colour might be directly bordering or even overlapping | Ideally Cd-colours should not directly border precious metals. If this cannot be prevented, please keep a certain distance or print a non-Cd-colour in between metal and Cd-colour. |
| Red / very dark back of the precious metal decoration | a) Precious metal preparation is not suitable for the glass type<br>b) Chemical composition of the glass<br>c) application of the precious metal decoration on the glass (rule of thumb: the closer to the rim, the more is the tendency of the precious metal film to create darker / red back...especially regarding molten glasses)<br>d) Coating of glass | a) -<br>c) Choose a more suitable preparation from the product list. Consider for our recommendations regarding the backside of the preparation.<br>d) Eventually, the organic coating of glass is to be removed by prefiring |

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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.