



Bright Precious Metal Preparations for Lining on Porcelain, Bone China and Earthenware

1 General Information

Heraeus supplies bright precious metal preparations for the decoration by lining machine on porcelain, Bone China and earthenware, 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.

Generally it is to differentiate between the following lining machine systems:

- Lining by brush
- Lining by metal wheel
- Lining by roller system neoprene

By lining with a metal wheel or brush, fine lines of 1-2 mm width can be achieved. Liquid preparations are necessary.

Using a roller system neoprene, precious metal lines of up to 10 mm width can be produced. This system is often used for decorating outer edges of objects, eg. cups or plates. Slow drying lining pastes of high viscosity are required.

Important quality features of preparations for lining are

- the flow and the coverage (even after few rotations a sufficient precious metal layer has to be applied)
- the colour of the precious metal
- the brilliance of the fired precious metal decoration
- the mechanical and chemical resistance of the precious metal decoration after firing

2 Firing Range

Substrate Type	Firing Range
Porcelain	780 (1440°) - 880°C (1620°F)
Bone China	750 (1380°) - 880°C (1620°F)
Vitreous China	750 (1380°) - 850°C (1560°F)
Earthenware	650 (1200°) - 740°C (1360°F)

3 Characteristics

3.1 Mechanical Resistance

(see information in our product overview)

3.2 Chemical 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 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.

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.

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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.

3.3 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 (c. 20°C / 70°F).

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

3.4 Consumption

Under our conditions, the consumption is approx. 0.16 to 0.20 g / 100cm².

4 Application Recommendation

4.1 Conditions required for good Results

- Work in a well-ventilated room. Good printing conditions occur at a room temperature of 20 to 25°C / 68 to 77°F and a relative humidity of 60 to 70%.
- 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. A fine condensation film might form. Result: Firing disturbance (pinholes) in the fired precious metal decoration. Allow enough time so that they can adjust to the decoration room temperature.

4.2 Processing

- 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 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.
- Only 3/4 of the reservoir of the lining machine should be filled with the precious metal preparation. Refill with fresh preparation from time to time.

During the application, the solvent evaporates. Regular refilling with fresh bright precious metal preparation ensures constant viscosity.

- Optimal lining conditions are to be checked by the user under his own individual conditions. The following parameters should be optimized:

Fixing the roller hardness

With increasing width of the precious metal band, rollers with low hardness should be used. In our tests, the following roller hardnesses have proved to be good:

- Thin lines: approx. 50 Shore
- Wide lines: approx. 40 Shore

Fixing the angle of the roller or the metal wheel

The choice of the optimum angle is of great importance for good coverage of the applied preparation onto the object.

Rotations

The number of necessary rotations is influenced by the lining machine used (two or one rollers, brush or metal wheel) and by the preparation. Normally, 2 to 4 rotations are enough for a sufficiently strong and homogenous precious metal layer.

Preparation Fluidity

The optimum preparation fluidity out of the reservoir onto the roller or the metal wheel has to be defined by the user considering his own individual conditions. If too much preparation flows out of the reservoir, the precious metal line tends to fray. A too thick layer can result in cracking, boiling up and matt areas of the precious metal decoration. If too little preparation is released, needless rotations are necessary to reach a homogenous precious metal film. A too thin precious metal film has influence on the chemical and mechanical resistance of the fired decoration.

- Take care of dustfree surroundings during the application and the drying. The wet surface is extremely sensitive to dust. After drying, the decoration is not as dust sensitive as before, but the objects should be fired as soon as possible.

Using heat radiators or infrared lamps, the drying time can be reduced to few minutes.

4.3 Firing of the Decoration

- During the heating up phase, first of all the organic components burn off. This process is completed at approx. 400°C (750°F). The precious metal film is formed. A constantly slow increase in temperature and enough oxygen by sufficient ventilation is decisive for the quality of the fired precious metal decoration.
- The maximum firing temperature and the soak time have an important influence on the adhesion of the fired decoration. As a rough rule of thumb: The higher the firing temperature the better the adhesion.

4.4 Cleaning of the Lining Machine

After finishing the application, the reservoir should be cleaned as well as the metal wheel, the brush or the roller.

We recommend cleaners V 35 or V 39.

5 Frequent Faults, their Causes and Ways of avoiding Them

Faults	Possible cause	Remedy
rough edge to the precious metal line	too much preparation was applied onto the object	reduce preparation and/or number of rotations
	the metal wheel is not adjusted correctly	modify the angle of the metal wheel
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
	too much organic fume in the kiln	reduce the number of objects in the kiln and/or improve the ventilation
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 is cracking after firing	contamination of the surface causes chip off	clean the substrate before decorating
	the layer of the product is 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
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 warm 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
bulg formation during application with neoprene roller	neoprene roller is too hard	use of a less hard neoprene roller
	paste was thinned too much	let the solvent evaporate or add fresh preparation
weak, copper precious metal film	too thin precious metal layer	increase the preparation flowability or the number of rotations
precious metal film is dull but the abrasion resistance is good	too high firing temperature or too long soak time	modify the firing conditions (lower temperature and/or shorter soak time)

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Faults	Possible cause	Remedy
matt firing result	too thick product layer. Possible causes: <ul style="list-style-type: none"> • too high preparation fluidity • too many rotations per lined object • preparation flows into hollows in the lined area and causes a too thick layer 	<ul style="list-style-type: none"> • reduce preparation fluidity • reduce the number of rotations • use of a less flowing product with higher viscosity

6 Bright Gold Preparations for Lining Machine on Porcelain

Colour	Product	Precious Metal Content	ASTM-resistant	microwave-resistant	Sanitary Ware	Notes
yellow	GGP 350/PM	10+12%				for neoprene roll
reddish yellow	GGP 2530	8+10+12%				for neoprene roll
reddish yellow	GG 501	9-12%				for metal wheel <i>new!</i>
reddish yellow	GG 3500	12%				for neoprene roll <i>new!</i>
reddish yellow	GGP 2517/MW	9%		•		for neoprene roll, excellent resistance to abrasion

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7 Bright Gold Preparations for Lining Machine on Bone China

Colour	Product	Precious Metal Content	ASTM-resistant	microwave-resistant	Sanitary Ware	Notes
yellow	GGP 2320/1	15%				-
reddish yellow	GGP 2320	15%				-
reddish yellow	GGP 2530	8+10+12%				-
reddish yellow	GGP 2317	10%				-
reddish yellow	GGP 2517/MW	9%		●		very scratch and abrasion resistant

8 Bright Platinum Preparations for Lining Machine on Porcelain

Colour	Product	Precious Metal Content	ASTM-resistant	microwave-resistant	Sanitary Ware	Notes
white platinum	GP 3600 C	12,8%				for Netsch-brushing system <i>new!</i>
white platinum	GP 2501 A	4,8%				for neoprene roll <i>new!</i>

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