

# Technical Information

## DF38

Performance Pigments and Colors

## Metallic 100 – Lead Free and Cadmium Free Metallic Colours for Porcelain, Bone China, Vitreous China, Earthenware and Enamel

In this technical information leaflet Ferro presents the Metallic 100 series, the latest generation of our metallic colours. With a maximum lead content < 100 ppm, this series sets new standards for lead free onglaze decoration. The colours have excellent processing characteristics in all conventional decorating methods like screen printing (direct and indirect), lining and banding, spraying as well as hand painting. All available colour shades can be found in table 2 and fig. 1.

### Screen Printing (Direct and Indirect)

We recommend for the coarser colours polyester screens with 49 – 77 threads/cm (125 - 195 mesh/inch) or stainless steel screens VA 110 - VA 115 (180 - 280 mesh/inch). The finer colours should be printed with polyester screens with 77 to 100 threads/cm or stainless steel with 270 to 325 mesh/inch. Table 2 lists the coarser colours, that fire with a stronger metallic effect, as well as the finer colours, that have less metallic effect but a smoother surface.

The colour layer should not be too thick on porcelain in order to avoid cracking of the colours.

### Machine Lining and Banding

Colour suspensions applied with brushes, steel- or neoprene-rollers are generally based on water-soluble media.

### Spraying

Colour suspensions for spraying application can be produced with oil-based media as well as with water-soluble media.

For all standard methods, Ferro offers suitable media and covercoats. Further detailed technical information can be found in our **CerDePrint Media Guide**.

The colours should be stored in a dry place. Opened containers should be closed carefully. To ensure that the colours have not absorbed any humidity, we recommend drying the colour powder at approx. 130 °C prior to mixing.

### Miscibility

All colours are all intermixable. Very interesting shades can be obtained by mixing Metallic 100 colours with our lead and cadmium free **Samba 100** series. These mixtures can also be used on porcelain. The mixing ratio should be approx. 85 parts of colours of the Metallic 100 series and 15 parts of the Samba 100 colours. Fig. 2 shows some mixing examples. However, we recommend to test the mixtures under the individual processing conditions prior to use.

### Firing Conditions

Table 1 shows the firing conditions for various substrates.

**Table 1: Firing conditions**

Substrate	Firing Conditions
Porcelain	Normal firing: 800 - 820 °C Fast firing: 830 – 880 °C
Bone China	Normal firing: 800 - 820 °C Fast firing: 800 – 880 °C
Vitreous China	800 - 850 °C
Earthenware	Normal firing: 780 - 820 °C
Enamel	780 - 820 °C

### Resistance

The alkali and acid resistance of fired colour layers is influenced by the thickness of the layer, the firing conditions, and the glaze.

Correctly fired, decorations produced with metallic colours of the range *Metallic 100* show a rather smooth surface for this kind of decorated material. This supports a good abrasion fastness and dishwasher resistance of the decoration. For a further improvement of the surface and of the resistance, the metallic colours can be overprinted with the special flux 10 55050 (for temperatures higher than 830 °C).

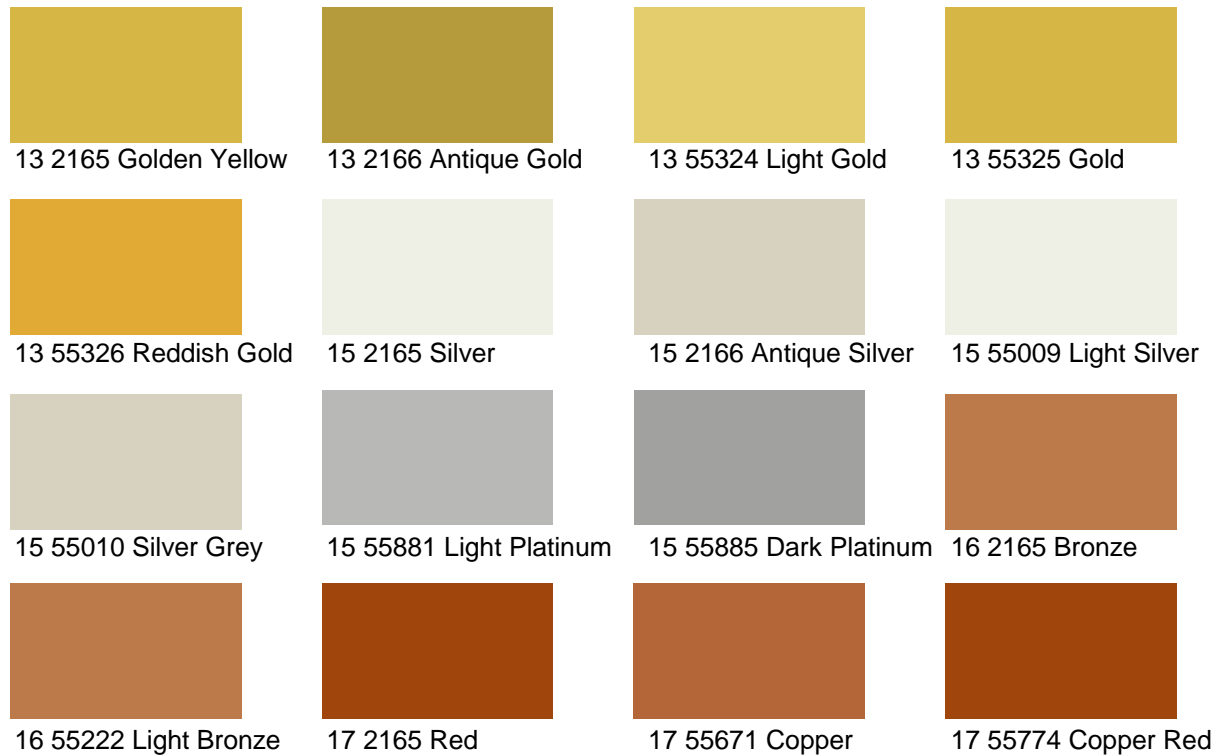
The colours of the **Metallic 100** series show in laboratory tests and under industrial conditions on a variety of different substrates no visible acid or alkali attack (tested with 3% hydrochloric acid, 20 °C, 5 h, as well as with 0.5 % Calgonite solution, 77 °C, 24 h).

### Heavy Metal Release and Heavy Metal Content

The colours of the *Metallic 100* series are controlled lead and cadmium free, with following upper limits: 100 ppm Pb and 600 ppm Cd. This ensures that the limits for heavy metal release according to EN 1388 1-2 as well as the Californian prop. 65 and the FDA requirements will be fulfilled. However, it is still necessary that the end user tests the heavy metal release according to the relevant standard procedures for all products manufactured under his technical production conditions.

It is absolutely necessary to apply the colours on lead free glazes. Due to the reaction between colour and glaze the surface of lead containing glazes may be altered chemically during firing, and considerable amounts of lead are released.

Our safety data sheets, which are available for every product, provide you with useful advice for working with our products.

**Fig. 1: Colour samples of the Metallic 100 series**

While every attempt has been made to reproduce colours exactly, the samples printed here may differ slightly from the finished ceramic products.

**Table 2: The available Metallic 100 colour shades**

Product No.	Colour Shade	Pantone® Code*	Product Type
13 2165	Golden Yellow	141 c M	coarser colours with stronger metallic effect
13 2166	Antique Gold	7403 c M	
15 2165	Silver	7534 c M	
15 2166	Antique Silver	7235 c M	
16 2165	Bronze	722 c M	
17 2165	Red	167 c M	
13 55324	Light Gold	1215 c M	finer colours with smoother surface
13 55325	Gold	1245 c M	
13 55326	Reddish Gold	8962 c M	
15 55009	Light Silver	472 c M	
15 55010	Silver Grey	420 c M	
15 55881	Light Platinum	8001 c M	
15 55885	Dark Platinum	877 c M	
16 55222	Light Bronze	876 c M	
17 55671	Copper	8900 c M	
17 55774	Copper Red	8902 c M	

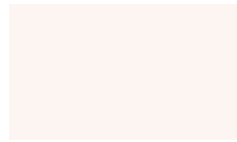
\* The above mentioned Pantone® code is only a guideline for the colour shade.

Pantone® is a registered trade mark of Pantone Inc.

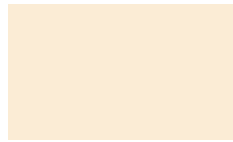
**Fig. 2: Mixing examples with colour 15 2165 and a selection of Samba 100 colours**



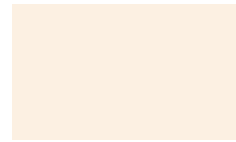
85 weight-% 15 2165  
15 weight-% 77 1642



85 weight-% 15 2165  
15 weight-% 18 1650



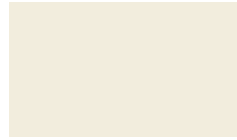
80 weight-% 15 2165  
20 weight-% 17 1605



80 weight-% 15 2165  
20 weight-% 17 1606



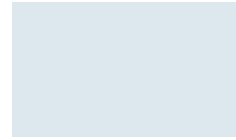
85 weight-% 15 2165  
15 weight-% 16 1651



85 weight-% 15 2165  
15 weight-% 15 1650



85 weight-% 15 2165  
15 weight-% 14 1650



85 weight-% 15 2165  
15 weight-% 12 1654



85 weight-% 15 2165  
15 weight-% 12 1652



85 weight-% 15 2165  
15 weight-% 11 1651



85 weight-% 15 2165  
15 weight-% 11 1650

The information and statements contained herein are provided free of charge. They are believed to be accurate at time of publication, but Ferro makes no warranty with respect thereto, including but not limited to any results to be obtained or the infringement of any proprietary rights. Use or application of such information or statements is at user's sole discretion, without any liability on Ferro's part. Nothing herein shall be construed as a license of or recommendation for use that infringes upon any proprietary rights. All sales are subject to Ferro's General Conditions of Sale and Delivery.