

# Technical Information

## DF05

Performance Pigments and Colors

## Impression*Plus* – High Temperature Fast Firing Colours for Porcelain

In this Technical Information Ferro presents the Impression*Plus* series. It comprises 38 basic colours with high chemical and mechanical resistance.

The decorating colours of the Impression*Plus* range have excellent processing properties in all conventional decorating methods like screen printing (direct and indirect), spraying, machine lining and banding, and brush application.

### Screen Printing

We recommend polyester screens with 73 - 140 threads/cm (186 - 360 mesh/inch) or stainless steel screens VA 100-140 (260 – 360 mesh/inch).

The colours 17 1451 Pink, light and 17 1452 Pink need a higher colour deposit to improve firing stability.

### Spraying

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

### Machine Banding and Lining

Colour suspensions applied with brushes, steel- or neoprene-rollers are generally based on water-soluble media. We supply colour pastes that should be adjusted to the correct processing viscosity by adding distilled water and/or spirit. 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, with very few exceptions, are intermiscible. In any case, we recommend to test mixtures under the specific processing conditions prior to use.

The exceptions are mixtures with 12 2201 Cobalt Blue and 14 1450 Black, these are not compatible. The firing stability of mixtures with 12 2201 Cobalt Blue and 17 1452 Pink is only limited.

The colours **77 1910 Magenta**, **77 1911 Rose**, and **77 1912 Purple** can only be mixed with one another. When printing together with other colours, they should always be printed as final layer. If this is not possible, application tests should be made prior to production.

For creation of pastel shades of the colours **13 1454**, **16 1452**, **17 1455**, **17 1456**, **13 2204**, **17 2204**, and **17 2205** we recommend mixtures with the flux 10 136, for all other colours of the *ImpressionPlus* range the flux 10 115 should be used. Mixtures with **White 19 1451** are not colour stable in combination with certain colours, e.g. chrome oxide containing ones. For very light colours, **Opaque White 19 1450** should be used.

### Firing Conditions

Under fast firing conditions (60 to 90 minutes) the firing temperature should be between 1150 and 1200 °C, with an optimum firing temperature on hard paste china of 1180 °C.

Due to its high thermal shock resistance, porcelain is able to withstand fast heating and cooling. To obtain a uniform result, the body must be exposed directly to the thermal radiation in the kiln. The use of kiln furniture might disturb the heat transfer and thus the temperature of the fired pieces is not high enough.

The kiln atmosphere must be oxidizing. When firing longer cycles or using soft glazes, the temperature has to be lowered, otherwise the pigments will be dissolved in the glaze.

For 12 2201 Cobalt Blue we recommend a temperature higher than 1180 °C.

### Colour Deposit

The maximum colour deposit depends on the firing cycle, the body, the glaze, and the form of the decorated surface as well as on the composition of the colours and the sintering grade of the colour in combination with the glaze. Too thin layers may result in an uneven, matt surface; too thick layers of colour may lead to chipping or cracking.

On porcelain (linear c.t.e. approx.  $40\text{-}45 \cdot 10^{-7}/\text{K}$ ), the total colour layer, measured prior to firing, should not exceed 24µm.

When printing colours on top of each other or overprinting them with a flux the total colour deposit should not exceed the recommended maximum value.

### Acid and Alkali Resistance

The alkali and acid resistance of fired colour layers is influenced by the thickness of the layer, the firing conditions, and the glaze. The colours of the *ImpressionPlus* range show in laboratory tests and under industrial conditions 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

The colours of the series *ImpressionPlus* have been tested according to **EN 1388 1-2** (4% acetic acid, 22 °C, 24 h). The heavy metal release was **below** the detection limit of the AAS of 0,020 mg/dm<sup>2</sup> for lead oxide and 0,001 mg/dm<sup>2</sup> for cadmium oxide.

All *ImpressionPlus* colours fulfil the limits for heavy metal release according to EN 1388 1-2 as well as the Californian prop. 65 and the FDA requirements.

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

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

**Fig. 1: Colour samples of the Impression*Plus* colours**

11 1453 Yellow Green



11 1454 Light Green



11 1455 Water Green



11 1456 Grass Green



11 1457 Blue Green



11 1458 Russian Green



12 1451 Turquoise



12 1452 Middle Blue



12 1453 Delft Blue



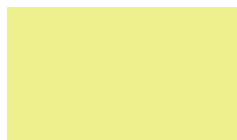
12 1915 Sky Blue



12 1916 Cyan



12 2201 Cobalt Blue



13 1451 Light Yellow



13 1452 Lemon Yellow



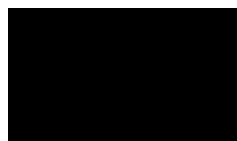
13 2203 Intense Yellow



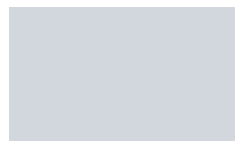
13 1454 Mandarin



13 2204 Intense Orange



14 1450 Black



15 1450 Blue Grey



15 1451 Grey



16 1452 Rosewood



16 1453 Olive



16 1454 Yellow Brown



16 1455 Chestnut



16 1456 Dark Brown



17 1451 Light Pink



17 1452 Pink



17 1455 Light Red



17 1456 Coral



17 2204 Red



17 2205 Intense Red



18 1450 Red Violet



18 1451 Blue Violet



77 1910 Magenta



77 1911 Rose



77 1912 Purple

**Table 1: The ImpressionPlus colours**

Reference	Colour Shade	Pantone® Code <sup>1</sup>
11 1453	Yellow Green	372 c
11 1454	Light Green	353 c
11 1455	Water Green	3248 c
11 1456	Grass Green	364 c
11 1457	Blue Green	323 c
11 1458	Russian Green	3305 c
12 1451	Turquoise	637 c
12 1452	Middle Blue	2716 c
12 1453	Delft Blue	659 c
12 1915	Sky Blue	2935 c
12 1916	Cyan	3015 c
12 2201	Cobalt Blue	2765 c
13 1451	Light Yellow	100 c
13 1452	Lemon Yellow	3935 c
13 2203	Intense Yellow	108 c
13 1454	Mandarin	136 c
13 2204	Intense Orange	165 c
14 1450	Black	Black 5c 2X
15 1450	Blue Grey	643 c
15 1451	Grey	415 c

Reference	Colour Shade	Pantone® Code <sup>1</sup>
16 1452	Rosewood	163 c
16 1453	Olive	722 c
16 1454	Yellow Brown	159 c
16 1455	Chestnut	1685 c
16 1456	Dark Brown	1545 c
17 1451	Light Pink	182 c
17 1452	Pink	1945 c
17 1455	Light Red	1665 c
17 1456	Coral	171 c
17 2204	Red	179 c
17 2205	Intense Red	1805 c
18 1450	Red Violet	2573 c
18 1451	Blue Violet	2645 c
19 1450	Opaque White	-
19 1451	White	-
77 1910	Magenta	207 c
77 1911	Rose	204 c
77 1912	Purple	
10 1600	Mixing Flux	-
10 115	Overprinting Flux	-

<sup>1</sup> The above mentioned Pantone® code is only a guideline for the colour shade. Pantone® is a registered trade mark of Pantone Inc.

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.