

# Technical Information

DF58



## Springtime100 - Intensive Lead Free Underglaze Colors for Earthenware, Vitreous China, Bone China, Stoneware, Porcelain and Tiles

In this Technical Information Ferro presents the springtime underglaze colors. This series comprises 18 intensive colors which are to a wide extent miscible with each other, so that many color shades can be obtained. The colors are particularly finely ground so that they are suitable for almost all application processes, e.g. direct and indirect screen printing (decals), spraying and hand painting. Springtime colors can be applied to both biscuit and greenware.

### Direct Screen Printing

The pasting ratio should be ten parts by weight of the color powder to four to six parts of the medium SC-PL 940. This medium is water soluble and has therefore the advantage that all equipment and screens can be cleaned with water.

We recommend polyester screens with 73-140 threads/cm (185-355 mesh/inch).

When using medium SC-PL 940, porous substrates can be overprinted with additional colors after a very short period of time. An intermediate drying step at elevated temperature is not required.

The finished prints can be glazed directly after printing. A heat treatment to remove organic binders is in many cases not necessary. The medium volatilises already at low temperatures without leaving any residues.

### Indirect Screen Printing (Decals)

We recommend a pasting ratio of ten parts per weight color powder to five to eight parts of the medium 80 820 or 80 595.

The printing should be done with polyester screens with 73-150 threads/cm (185-380 mesh/inch).

For cleaning equipment and screens we recommend cleaning oil 80 452.

On porous biscuit surfaces (e.g. earthenware or hard earthenware) as well as on non-porous surfaces (e.g. vitreous china or bone china) the adhesive effect of the dextrin is not sufficient for a satisfactory bond between the reverse side of the decal and the biscuit surface. For underglaze decoration of vitreous china and bone china this problem can be solved by using **Bondsol**; for earthenware, hard earthenware and stoneware we recommend the thixotropic agent **Emsol**.

The more porous the object to be decorated, the higher the viscosity of the Bondsol or Emsol product should be. Ferro supplies Bondsol and Emsol products with different viscosities.

### Spray Application

For spray application we offer the water soluble spray medium 80 520. In this case, all equipment can be cleaned with water as well.

Further detailed technical information on all mentioned media can be found in our **CerDePrint Media Guide**.

## Glazing

When glazing **flatware** (bone china, vitreous china, or earthenware) **without intermediate firing**, the glaze should be applied by spraying. We recommend pre-heating the objects up to 130-160 °C.

**Hollow ware with intermediate firing** is in most cases dip-glazed, so that above mentioned process description is not applicable.

The hardening-on fire at 740-850 °C is followed by dip glazing and gloss firing.

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

## Miscibility

All colors are widely intermixable. In any case, we recommend to test mixtures under the specific processing conditions prior to use.

The intense basic colors might be lightened by using White 19 1710.

## Transparent Fluxes and Additives

The colors of the Springtime100 series do not contain any flux addition. The quantity of added flux is variable according to the individual needs. The optimum compositions for the application on bone china, vitreous china, and earthenware are listed in table 2.

These mixtures contain a sufficient amount of adhesive flux that allows easy handling and glazing after the biscuit fire (750 °C, 2 h<sup>↑</sup>, 10 min, 2 h<sup>↓</sup>).

The following fluxes may be used:

- Lead free adhesive flux 10 4001, melting point 580 °C, surface tension 297 mN/m (calculated according to Dietzel).
- Lead containing adhesive flux 10 117, melting point 650 °C, surface tension 262 mN/m.

For the application on porcelain we recommend the colors marked in table 1 in combination with following fluxes:

- Lead free adhesive flux 10 1650, melting point 800 °C, surface tension 380 mN/m.
- Lead free adhesive flux 10 083, melting point 1200 °C, surface tension 208 mN/m.

## Heavy Metal Content

The cadmium free **Springtime100** colors are controlled lead and cadmium free with following upper limits: 100 ppm Pb and 600 ppm Cd. The cadmium containing colors are controlled lead free (<100 ppm Pb).

## Firing Conditions

Depending on the glaze, the colors are fired at 900-1250 °C (porcelain 1200–1400 °C). Color variations and firing stability of the colors are also influenced by the glaze. Please refer to the color system given in table 1 to determine the compatibility of the color and the glaze.

Unsuitable color/glaze combinations lead to color deviations or, in case of extreme incompatibility, even to blistering of the glaze.

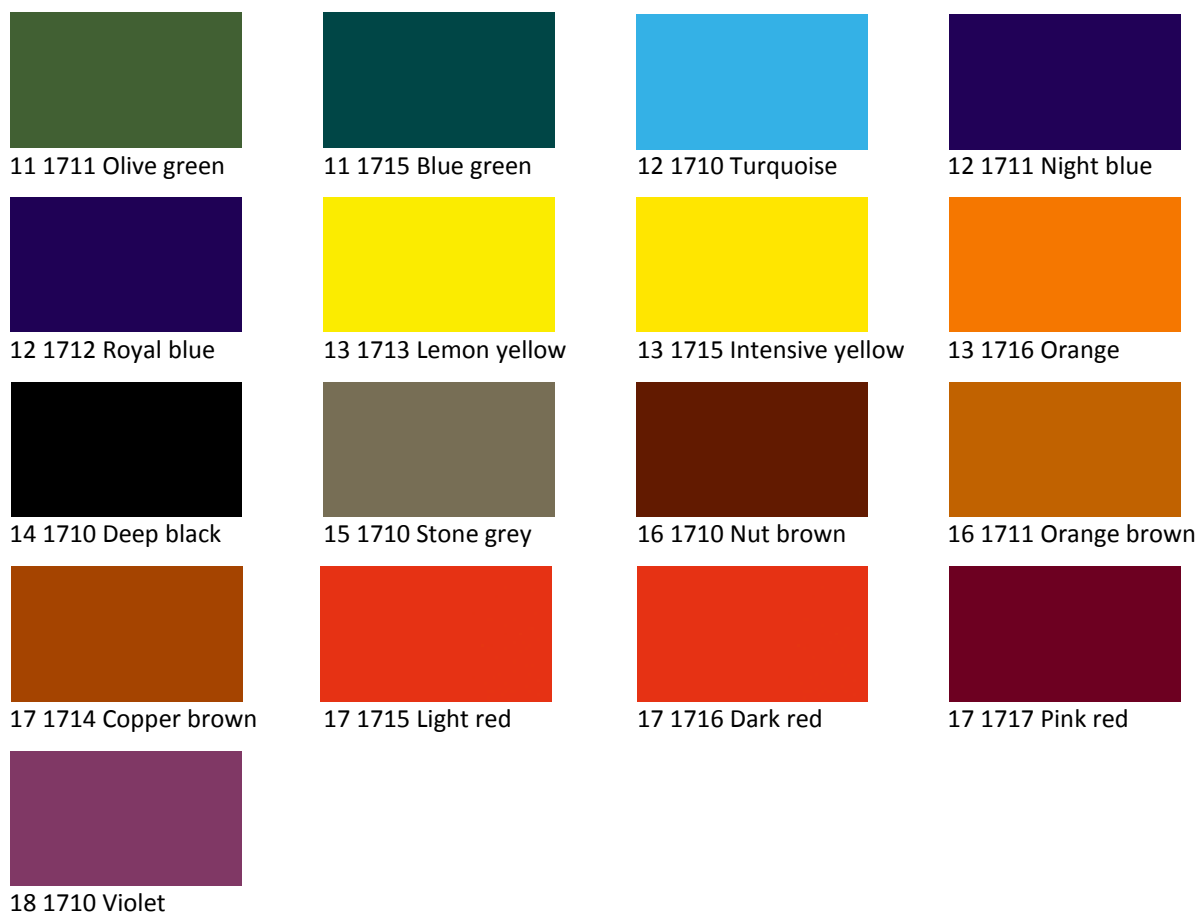
## Resistance

The resistance of the underglaze decoration is determined by the glaze used. When decorating tableware that comes into contact with food, therefore lead free glazes should be used.

Ferro supplies lead free glazes and frits for vitreous china, bone china and earthenware. Kilns, in which lead containing glazes have been fired in the past, have dissolved lead in the kiln lining and might contaminate lead free glazes.

Attention: The fine ground stains of the Springtime100 and InstantColor series are glaze stains which are not especially tested for underglaze applications.

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

**Fig. 1: Color samples of the Springtime100 series**

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

**Table 1: The colors of the Springtime100 series**

| Reference                   | Color Shade      | Pantone® Code <sup>1</sup> | System        | Hints and Recommendations            |
|-----------------------------|------------------|----------------------------|---------------|--------------------------------------|
| <b>11 1711</b>              | Olive Green      | 575 c                      | Cr-Al         | for glazes low in zinc and magnesium |
| <b>11 1715</b> <sup>3</sup> | Blue Green       | 547 c                      | Co-Cr-Al      | for glazes low in zinc and magnesium |
| <b>12 1710</b> <sup>3</sup> | Turquoise        | 298 c                      | Zr-V-Si       | for all glazes                       |
| <b>12 1711</b> <sup>3</sup> | Night Blue       | 2758 c                     | Co-Al         | for all glazes                       |
| <b>12 1712</b> <sup>3</sup> | Royal Blue       | 2745 c                     | Co-Si         | for all glazes                       |
| <b>13 1713</b>              | Lemon Yellow     | 3965 c                     | Zr-Pr-Si      | for all glazes                       |
| <b>13 1715</b>              | Intensive Yellow | 108 c                      | Zr-Pr-Si      | for all glazes                       |
| <b>13 1716</b> <sup>2</sup> | Orange           | 165 c                      | Zr-Si-Cd-Se-S | for all glazes                       |
| <b>14 1710</b> <sup>3</sup> | Deep Black       | Black c                    | Co-Ni-Fe-Cr   | for all glazes                       |
| <b>15 1710</b> <sup>3</sup> | Stone Grey       | 7536 c                     | Sn-Sb-V       | for all glazes                       |
| <b>16 1710</b> <sup>3</sup> | Nut Brown        | 483 c                      | Zn-Cr-Fe      | for glazes rich in zinc              |
| <b>16 1711</b>              | Orange Brown     | 153 c                      | Zn-Al-Cr-Fe   | for glazes rich in zinc              |
| <b>17 1714</b>              | Copper Brown     | 1675 c                     | Zr-Fe-Si      | for all glazes                       |
| <b>17 1715</b> <sup>2</sup> | Light Red        | 179 c                      | Zr-Si-Cd-Se-S | for all glazes                       |
| <b>17 1716</b> <sup>2</sup> | Dark Red         | 1805 c                     | Zr-Si-Cd-Se-S | for all glazes                       |
| <b>17 1717</b>              | Pink Red         | 492 c                      | Ca-Sn-Si-Cr   | glazes low in zinc and rich in lime  |
| <b>18 1710</b>              | Violet           | 688c                       | Sn-Cr         | glazes low in zinc and rich in lime  |
| <b>19 1710</b> <sup>3</sup> | White            |                            | Zr-Si         | for all glazes                       |

<sup>1</sup> The above mentioned **Pantone®** code is only a guideline for the color shade.

**Pantone®** is a registered trade mark of Pantone Inc.

<sup>2</sup> Cadmium containing colors.

<sup>3</sup> These colors are suitable for high temperature firing on porcelain.

**Table 2: Recommendations for mixtures of Springtime100 with an adhesive flux**

| Reference | Color Shade     | Quantity of Color | Quantity of Flux | Additives                 |
|-----------|-----------------|-------------------|------------------|---------------------------|
| 11 1711   | Olive Green     | 45%               | 25%              | 30 % china clay, calcined |
| 11 1715   | Blue Green      | 70%               | 30%              |                           |
| 12 1710   | Turquoise       | 80%               | 20%              |                           |
| 12 1711   | Night Blue      | 68%               | 20%              | 12 % china clay, calcined |
| 12 1712   | Royal Blue      | 68%               | 20%              | 12 % china clay, calcined |
| 13 1713   | Lemon Yellow    | 80%               | 20%              |                           |
| 13 1715   | IntensiveYellow | 80%               | 20%              |                           |
| 13 1716   | Orange          | 80%               | 20%              |                           |
| 14 1710   | Deep Black      | 75%               | 25%              |                           |
| 15 1710   | Stone Grey      | 80%               | 20%              |                           |
| 16 1710   | Nut Brown       | 70%               | 30%              |                           |
| 16 1711   | Orange Brown    | 80%               | 20%              |                           |
| 17 1714   | Copper Brown    | 80%               | 20%              |                           |
| 17 1715   | Light Red       | 80%               | 20%              |                           |
| 17 1716   | Dark Red        | 80%               | 20%              |                           |
| 17 1717   | Pink Red        | 80%               | 20%              |                           |
| 18 1710   | Violet          | 80%               | 20%              |                           |
| 19 1710   | White           | 80%               | 20%              |                           |

**Limitation of Warranty and Liability**

Ferro believes that the information contained in this document is accurate at the time of its publication. Ferro makes no warranty with respect to the information contained in this document. The information in this document is not a product specification, either in whole or in part. Your use of the information contained in this document and your purchase and use of this Ferro product are at your sole discretion. Downstream users are responsible for determination of the suitability of this product and for testing in specific applications. Nothing in this document shall be construed as a license for use that infringes upon any property rights of any third party. Please refer to the Safety Data Sheet (SDS) for safe use, handling and disposal information. All sales by Ferro to you are subject to Ferro's Terms and Conditions of Sale, as amended from time to time and available at [www.ferro.com](http://www.ferro.com). In the event this document conflicts with Ferro's Terms and Conditions of Sale, Ferro's Terms and Conditions of Sale shall control.