

Technical Information

DF12

SpringtimeII – Intensive Lead Free Underglaze Colours for Earthenware, Vitreous China, Bone China, Stoneware, Porcelain, and Tiles

In this Technical Information Ferro presents the **SpringtimeII** underglaze colours. This series consists of 23 intensive colours which are to a wide extent miscible with each other, so that many colour shades can be obtained. The SpringtimeII colours are particularly finely ground so that they are suitable for almost all application processes like direct and indirect screen printing (decals), pad printing, spray application and hand painting. SpringtimeII can be applied to both biscuit and greenware.

Direct Screen Printing

The pasting ratio should be ten parts by weight of the colour 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 colours 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 colour 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 the **underglaze decoration without intermediate firing** we recommend glaze lacquer 83 2014. In case of unfavourable atmospheric conditions, the glaze lacquer 87 2015 should be used.



Please note that these glaze lacquers contain lead. The glaze lacquers should be printed with polyester screens with 19 threads/cm (48 mesh/inch). The dried film deposit prior to firing should be approx. 55-65 µm.

For the **underglaze decoration with hardening-on firing** we recommend covercoat 83 2028. It should be printed with polyester screens with 21-24 threads/cm (53-60 mesh/inch). The dry lacquer deposit should be approx. 30-35 µm. The covercoat 83 2028 is very hard and inflexible after drying; only on contact with Bondsol or Emsol it becomes elastic.

For cleaning all 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 is not sufficient in order to achieve 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**; für Steingut, 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 used Bondsol or Emsol product should be. Ferro supplies Bondsol and Emsol products with different viscosities.

The underglaze decoration of **flatware without hardening-on firing** has to be done as follows:

1. As usual the decals are soaked in water and thoroughly wetted.
2. Bondsol or Emsol is thinly applied to the areas to be decorated by means of a sponge or a brush.
3. The decals are applied wet onto the freshly prepared areas and thoroughly squeezed.
4. The squeezed water slime should be removed with a wet cloth or sponge.
5. The decorated objects should be dried for 24 hours at minimum 20 °C prior to **spray glazing** and gloss firing. Before spray glazing, the objects must be pre-heated to about 130 to 160 °C.

The underglaze decoration of **flatware with hardening-on firing** differs only in the last step:

- 5.a The decorated objects have to be dried 24 hours at minimum 20 °C prior to glazing, afterwards the hardening –on fire is done at 740-850 °C.

Under particular circumstances the underglaze decoration of **hollow ware without hardening-on firing** is possible:

- The hollow ware has to be glazed inside.
- The surface decoration is done according to the description "Underglaze decoration without hardening-on firing".
- In underglaze decoration without hardening-on firing, spray glaze application is required in general.

When applying underglaze decoration on **hollow ware with hardening-on firing**, following guidelines should be noticed:

- The application of the underglaze decals is done only with 87 4039 Bondsol.
- After drying the decals (24 hours at 20 °C), the intermediate firing takes place at 740 to 850 °C statt, followed by dip glazing and gloss firing.

Pad Printing

For the underglaze pad printing process we recommend the thermoplastic medium 80 4084. The pasting ratio should be ten parts of colour to five to seven parts of medium. As a thinner 80 4085 may be used.

The depth of engraving for nylon should be between 60 and 120 µm, for steel maximum 60 µm. A printing temperature of 65-70 °C is ideal.

For cleaning all equipment and screens we recommend cleaning oil 80 890.

Spray Application

For spray application we offer the water dilutable 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 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 widely intermiscible. In any case, we recommend to test mixtures under the specific processing conditions prior to use.

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

Transparent Fluxes and Additives

The Springtime// colours 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 ↑, 10 min, 2 h ↓).

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 10 177, melting point 610 °C, surface tension 264 mN/m.

For the application on porcelain we recommend the colours 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.

Firing Conditions

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

Unsuitable colour/glaze combinations lead to colour 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.

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.

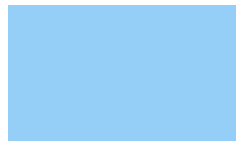
Fig. 1: Colour samples of the SpringtimeII series



11 1711 Olive Green



11 1715 Blue Green



12 1710 Turquoise



12 1711 Night Blue



12 1712 Royal Blue



13 1710 Pastel Orange



13 1713 Lemon Yellow



13 1715 Intensive Yellow



13 1716 Intensive Orange



14 1710 Deep Black



14 1711 Graphite



15 1710 Stone Grey



15 1712 Silver Grey



16 1710 Nut Brown



16 1711 Orange Brown



17 1710 Pink Red



17 1711 Rose



17 1712 Salmon Red



17 1714 Copper Red



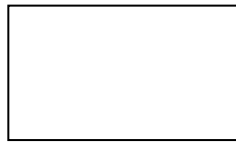
17 1715 Intensive Red, Lgt.



17 1716 Intensive Red, Drk.



18 1710 Violet



19 1710 White

Table 1: The Springtime// colours

Reference	Colour Shade	Pantone® Code ¹	System	Hints and Recommendations
11 1711 ³	Olive Green	575 c	Cr-Al	for glazes low in zinc and magnesium
11 1715 ³	Blue Green	547 c	Co-Cr-Al	for glazes low in zinc and magnesium
12 1710 ³	Turquoise	298 c	Zr-V-Si	for all glazes
12 1711 ³	Night Blue	2758 c	Co-Al	for all glazes
12 1712 ³	Royal Blue	2745 c	Co-Si	for all glazes
13 1710 ²	Pastel Orange	150 c	Zr-Si-Cd-Se-S	for all glazes
13 1713	Lemon Yellow	3965 c	Zr-Pr-Si	for all glazes
13 1715 ²	Intensive Yellow	108 c	Zr-Si-Cd-Se-S	for all glazes
13 1716 ²	Intensive Orange	165 c	Zr-Si-Cd-Se-S	for all glazes
14 1710 ³	Deep Black	Black c	Co-Cr-Fe-Ni	for all glazes
14 1711	Graphite	Black 7 c	Fe-Cr	for lead containing glazes low in zinc
15 1710 ³	Stone Grey	7536 c	Sn-Sb-V	for all glazes
15 1712 ³	Silver Grey	7544 c	Sn-Sb	for all glazes
16 1710 ³	Nut Brown	483 c	Zn-Cr-Fe	for glazes rich in zinc
16 1711	Orange Brown	153 c	Fe-Cr-Al-Zn	for glazes rich in zinc
17 1710	Pink Red	492 c	Sn-Ca-Si-Cr	for glazes low in zinc and rich in lime
17 1711	Rose	493 c	Sn-Ca-Si-Cr	for glazes low in zinc and rich in lime
17 1712 ^{2,3}	Salmon Red	7417 c	Zr-Si-Cd-Se-S	for all glazes
17 1714	Copper Red	1675 c	Zr-Fe-Si	for all glazes
17 1715 ²	Intensive Red Light	179 c	Zr-Si-Cd-Se-S	for all glazes
17 1716 ²	Intensive Red Dark	1805 c	Zr-Si-Cd-Se-S	for all glazes
18 1710	Violet	688c	Sn-Cr	for glazes low in zinc and rich in lime
19 1710 ³	White		Zr-Si	for all glazes

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

² Cadmium containing colours.

³ These colours are suitable for high temperature firing on porcelain.

Table 2: Recommendations for mixtures of SpringtimeII colours with an adhesive flux

Reference	Colour Shade	Quantity of Colour	Quantity of Flux	Additives
11 1711	Olive Green	45%	25%	30 % 69627 or feldspar
11 1715	Blue Green	70%	30%	
12 1710	Turquoise	80%	20%	
12 1711	Night Blue	68%	20%	12 % calcined china clay 69627 or calcined china clay
12 1712	Royal Blue	68%	20%	12 % calcined china clay 69627 or calcined china clay
13 1710	Pastel Orange	80%	20%	
13 1713	Lemon Yellow	80%	20%	
13 1715	Intensive Yellow	80%	20%	
13 1716	Intensive Orange	80%	20%	
14 1710	Deep Black	75%	25%	
14 1711	Graphite	75%	25%	
15 1710	Stone Grey	80%	20%	
15 1712	Silver Grey	80%	20%	
16 1710	Nut Brown	70%	30%	
16 1711	Orange Brown	80%	20%	
17 1710	Pink Red	80%	20%	
17 1711	Rose	80%	20%	
17 1712	Salmon Red	80%	20%	
17 1714	Copper Red	80%	20%	
17 1715	Intensive Red Light	80%	20%	
17 1716	Intensive Red Dark	80%	20%	
18 1710	Violet	80%	20%	
19 1710	White	80%	20%	

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.