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Technical Information

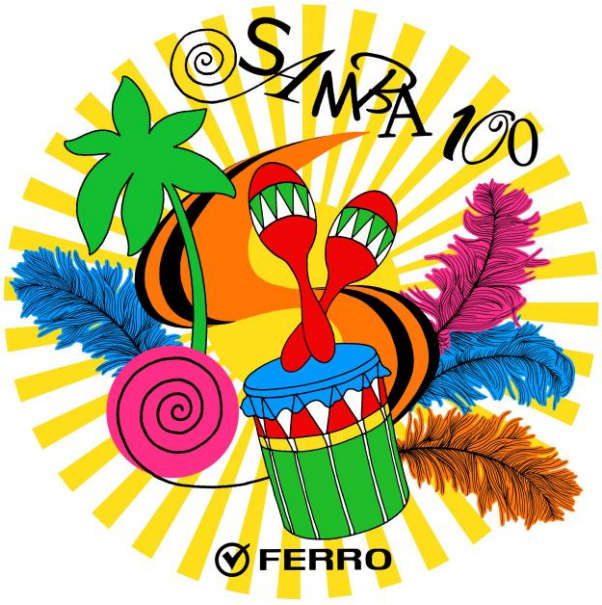
DF30

Performance Colors & Glass

SAMBA 100

Lead Free Onglaze Colors for Porcelain, Bone China, Vitreous China, Earthenware, and Enamel

In this leaflet, Ferro presents **SAMBA*100***, the next generation of our high pigmented onglaze colors. With a lead content of no more than 100 ppm, the colors of this series set new standards in the area of lead free onglaze decoration.



Even the smallest contamination during the production process may cause the excess of the 100 ppm limit, therefore Ferro cares for an accurate processing and precise quality control. Our high quality products easily fulfil the increased demands on heavy metal content.

Advantages of the SAMBA*100* Series

The **SAMBA*100*** colors offer numerous advantages:

- all colors fulfil the heavy metal release limits of EN 1388 1-2 as well as the Californian prop. 65 and the FDA, provided that application and firing is handled correctly.
- maximum possible color intensity even with thin color deposits
- low color consumption by using fine screens (e.g. for fine lines)
- improved flexibility in decoration designs by a wider color space
- new color shades
- excellent processing characteristics
- multi-purpose system: mixing or overprinting with different fluxes enables a wider application range than any other color series so far on the market
- economic and logistic advantages due to the use of only one color range for varying substrates and firing conditions.

SAMBA*100* Colors

Due to their strong pigmentation, the colors of this series are very intense and need to be overprinted with a flux to obtain a sufficient gloss. The cadmium free colors of this palette could also be mixed with a flux during processing. Although mixing with a flux reduces the intensity, it could possibly save the overprinting with flux and therefore a production step. Mixing with a flux instead of overprinting is especially useful when a design with decorating colors is combined with precious metal preparations. The proportion of flux addition should be determined under individual production conditions.

All available colors are shown in table 1 and fig. 1.

Cadmium Containing Supplementary Colors

The cadmium containing supplementary colors have to be processed without flux overprinting. They could be used on porcelain as well as on bone china. All available colors are listed in table 2 and fig. 1.

Fluxes

The fluxes mentioned in table 3 are intermixable and ensure in combination with the SAMBA*100* colors a broad variety of applications, depending on the design, substrate, and firing conditions. By adding the flux 10 1650 to SAMBA*100* colors, the colors of the Summerday series can be reproduced (see Technical Information DF07). The flux 10 1600 allows a reproduction of the Terra Nova colors.

The highest intensity is obtained by printing the colors without flux addition, just with an overprint of flux. Gloss and intensity can be fine-tuned by adding a higher or lower amount of fluxes.

Application

The colors of the SAMBA*100* range have excellent processing properties in all conventional decorating methods like screen printing (direct and indirect), spraying, machine lining and banding, and brush application. For cleaning all equipment and screens we recommend cleaning oil 80 452.

Color Deposit

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

Screen Printing (Direct and Indirect)

For direct and indirect screen printing, we recommend polyester screens with 100-140 threads/cm (255-355 mesh/inch) for colors and with 100-120 threads/cm (255-305 mesh/inch) for the flux.

On porcelain (C.T.E. approx. 40-45 x 10^{-7}/K), the color deposit should not exceed 24 µm, measured prior to firing, in order to avoid cracking or chipping. This thickness will be reached e.g. by a double printing with polyester screen 73 S and medium 80 820 (mixing ratio 100 parts color and 70 to 80 parts medium).

When printing colors on top of each other or overprinting colors with a flux, the total color deposit should not be thicker than the recommended value.

Applied on earthenware, bone china, and vitreous china, the maximum value of 24 µm may be exceeded.

In the information leaflets DF34 and DF14 further details to 4 or 7 process-color printing is given.

Spraying

Color suspensions for spraying application can be produced with oil-based media as well as with water-soluble media. Water containing color suspensions with **purple colors** should be consumed immediately and not be stored for a longer time.

Spray application requires flux addition to all colors except to the purple colors . For spray application of cadmium colors we recommend to use those from Carnival100 range.

Machine Banding and Lining

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

Machine banding and lining requires flux addition to all colors except to the purple colors and the cadmium containing supplementary colors.

Media

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

Storage

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 and Compatibility

All SAMBA*100* colors with the exception of the cadmium containing colors are generally intermixable. The cadmium containing colors can only be mixed with one another, but not with cadmium free colors or with a flux.

Iron Red 17 1659 should not be used with the flux 10 1600.

In any case, we recommend to test mixtures under the specific processing conditions prior to use.

Firing Conditions

The firing range in fast firing conditions (60 to 90 minutes) lies between 860 and 900 °C, in normal firing conditions between 820 and 850 °C.

The color 12 1654 is best suitable for the use on bone china; on porcelain the color might become matt.

The color 18 1650 may show variations in intensity under unfavourable firing conditions.

It is absolutely necessary to apply lead free colors on lead free glazes. Due to the reactions between color and glaze the surface of lead containing glazes may be altered chemically during firing and considerable amounts of lead can be released. Lead free products should not be fired together with those containing lead as the resulting emissions could have adverse effects on the heavy metal release. Lead free colors could then be contaminated with lead.

Acid and Alkali Resistance

The alkali and acid resistance of fired color layers is influenced by the thickness of the layer, the firing conditions, and the glaze. The colors of the **SAMBA*100*** range show in laboratory tests and under industrial conditions with one exception, see below, no visible acid attack and only a slightly visible alkali attack (tested with 3% hydrochloric acid, 20 °C, 5 h, as well as with 0.5% Calgonite solution, 77 °C, 16 h).

Cobalt Blue 12 1654: According to our tests a slight acid attack was visible.

Heavy Metal Release and Heavy Metal Content

The cadmium free **SAMBA*100*** 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.

All colors of the series SAMBA*100* fulfil the heavy metal release limits of EN 1388 1-2 as well as the Californian prop. 65 and the FDA.

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.

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

Fig. 1: The available SAMBA*100* colors


11 1650 Chrome Green


11 1651 Blue Green


11 1653 Green


12 1650 Light Blue


12 1651 Cyan


12 1652 Dark Blue


12 1653 Sky Blue


12 1654 Cobalt Blue


12 1655 Cyan


12 1657 Blue

13 1650 Lemon Yellow

13 1651 Yellow


13 1652 Golden Yellow

13 1655 Yellow


14 1650 Intense Black


14 1652 Black


15 1650 Neutral Grey

15 1651 Blue Grey


16 1650 Light Brown


16 1651 Dark Brown


17 1656 Orange


17 1657 Intensive Red


17 1658 Dark Red


17 1659 Iron Red


18 1650 Violet


72 1650 Cobalt Blue


77 1640 Rose


77 1641 Magenta


77 1642 Dark Purple


77 1643 Pink


77 1644 Maroon


77 1645 Dark Maroon


77 1650 Purple


77 1651 Light Purple

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 SAMBA*100* colors

Product No.	Color Shade	Pantone® Code[1]
11 1650	Chrome Green	364 c
11 1651	Blue Green	3292 c
11 1653 [2]	Green	362 c
12 1650	Light Blue	632 c
12 1651	Cyan	314 c
12 1652	Dark Blue	308 c
12 1653	Sky Blue	2727 c
12 1654	Cobalt Blue	285 c
12 1655	Cyan (4 color process)	307 c
12 1657	Blue	637 c
13 1650	Lemon Yellow (4 color process)	101 c
13 1651	Yellow	122 c
13 1652	Golden Yellow	137 c
13 1655 [2]	Yellow	116 c
14 1650	Intense Black	Black 2c 2x
14 1652	Black	Black c
15 1650	Neutral Grey	424 c
15 1651	Blue Grey	429 c
16 1650	Light Brown	153 c
16 1651	Dark Brown	1685 c
17 1656 [2]	Orange	151 c
17 1657 [2]	Intensive Red	172 c
17 1658 [2]	Dark Red	1795 c
17 1659	Iron Red	484 c
18 1650	Violet	251 c
19 1650	White	
19 1651	Opaque White	
19 1652	Mixing White	
72 1650	Cobalt Blue	2756 c
77 1640 [3]	Rose	203 c
77 1641 [3]	Magenta (4 color process)	207 c
77 1642 [3]	Dark Purple	208 c
77 1643 [3]	Pink	197 c
77 1644 [3]	Maroon	702 c
77 1645 [3]	Dark Maroon	201 c
77 1650	Purple	7420 c
77 1651	Light Purple	7634 c

Pantone® is a registered trade mark of Pantone Inc.
[1] The above mentioned **Pantone®** code is only a guideline for the color shade.
[2] Cadmium containing colors
[3] These colors fire to a glossy surface with and without a flux coat.

Table 2: Fluxes

Product No.	C.T.E. ($x10^{-7}$/°K)	Softening Point	Product	Field of Application
10 1600	80	640 °C	Transparent flux	**Mixing and coating flux** for earthenware, bone china, vitreous china, enamel
10 1650	70	660 °C	Transparent flux	**Mixing and coating flux** for porcelain, earthenware, bone china, vitreous china, enamel
10 1652*	65	620 °C	Transparent flux	**Coating flux** for porcelain, earthenware, bone china, vitreous china, enamel

* For cadmium containing decorations, we recommend to use 10 1652 as coating flux.