

SELECTION 16M 540-600°C

Lead- and cadmium-free, low firing, non-resistant metallic glass colors

1. General Information and Color chart

SELECTION 16M series is a range of lead- and cadmium-free, intermixable, low firing, non-resistant metallic and interference metallic glass colors for bottles and cosmetic containers.

Options for this series: Please refer to their individual technical information.

SELECTION 16: Lead- and cadmium-free glass colors.



SELECTION 16M 540-600 °C Lead-and cadmium-free glass metallic and interference metallic colors for bottles, cosmetic containers.

Table 1

Product No.	Color tone	Pantone No. / interference color on 16 74 black	Intermixable	Lead free(<300ppm)	Cadmium free (<100ppm)	Acid resistant, DIN 1388-1-2 *1	Alkali resistant, ASTM C556-88 *2	Fine particle size *3	Coarse particle size *4	Glass	Earthenware	Remarks
Metallic colors												
16M 11	white silver		✓	✓	✓			✓		✓	✓	fine particle size, mixing base for color metallic
16M 48	white silver		✓	✓	✓				✓	✓	✓	mixing base for color metallic
16M 49	lemon gold	8640C	✓	✓	✓			✓		✓	✓	
16M 2	lemon gold	8641C	✓	✓	✓			✓		✓	✓	very intensive color, high temperature stand able
16M 15	lemon gold	871C	✓	✓	✓			✓		✓	✓	fine particle size
16M 3	copper	876C	✓	✓	✓			✓		✓	✓	fine particle size
16M 5	red copper	8903C	✓	✓	✓			✓		✓	✓	fine particle size,
Interference metallic colors												
16M 24	orange gold	-/8660C	✓	✓	✓			✓		✓	✓	fine particle size
16M 28	yellow green	-/8703C	✓	✓	✓				✓	✓	✓	very intensive color, high temperature stand able
16M 29	green	-/8323C	✓	✓	✓			✓		✓	✓	fine particle size
16M 34	blue	-/8182C	✓	✓	✓			✓		✓	✓	fine particle size
16M 37	blue	-/8183C	✓	✓	✓				✓	✓	✓	very intensive color, high temperature stand able
16M 38	lilac	-/8103C	✓	✓	✓			✓		✓	✓	fine particle size
16M 41	red	-/8063C	✓	✓	✓			✓		✓	✓	fine particle size
Special colors for 16M colors												
16 22	underlay white		✓	✓	✓					✓	✓	underlay white
16 74	black	process blackC	✓	✓	✓					✓	✓	underlay black

*1: DIN EN 1388-1-2 : The test pieces are immersed in a 4% acetic acid solution for 24 hours at 22±2°C.

*2: ASTM C556-88 : The test pieces are immersed in a 0.5 % sodium carbonate solution in water at 95°C for 2, 4 and 6 hours.

*3: average 8-10 μ m, biggest 30 μ m, can be printed up to 250 mesh (100T)

*4: average 12-18 μ m, biggest 60 μ m, can be printed up to 200 mesh (80T)

2. Firing Conditions

Normal firing is from 540–600°C in a cycle of 60–150 minutes, cold-to-cold, with 10 minutes for soaking. The best firing condition depends on firing speed and type of ware and kiln.

3. Application

SELECTION 16M colors are suitable for screen-transfer printing, direct printing, spraying, pad printing and hand painting.

4. Coefficient of Thermal Expansion (C.O.E.)

Product	Thermal Expansion (C.O.E.)
SELECTION 16M colors (average)	Varies between $9-9.3 \times 10^{-6}/^{\circ}\text{C}$

If **SELECTION 16M** colors are applied in very thick layers, the colors could crack or chip off, depending on the type of ware and thickness of the colors. We recommend you test the application of the colors under your conditions before use.

5. Particle size of Distribution (P.S.D.) and Printing

【6.1 Mesh size】

SELECTION 16M metallic colors have two range of particle size, fine and coarse types. They have the following appearances and recommended mesh size to print. For each color please refer to Table 1.

	Fine particle color range	Coarse particle color range
Appearance	Smooth and opaque	Intensive and high metallic effect
Particle size	Average 8–10 μm , biggest 30 μm	Average 12–18 μm , biggest 60 μm
Mesh size (polyester)	100–250 mesh/40–100T	100–200 mesh/40–80T

【6.2 Medium ratio】

SELECTION 16M color : Medium PM2	10 : 11–13
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Screen-transfer printing: We recommend PM2 flowing medium for printing **SELECTION 16M** metallic colors. We recommend C12 cover coat by printing 70 mesh (27T).

We recommend adding a little more medium for fine particle-color range to get a better homogenous of paste because the gravity of fine-particle colors is lighter than rough-particle colors. If the ink is not a good homogeneous paste, the color will dry on the screen during printing and, after firing, the gloss will become

worse.

Lead- and cadmium-free glass metallic colors absorb any moisture easily. Therefore, keep powder colors in a dry place. We recommend drying the color powder before using.

6. Color and Mixability

SELECTION 16M metallic colors can be mixed with each other in any proportions. Mixing with other **SELECTION 16** colors can be developed a wide range of metallic effect colors. However, we recommend testing the stability of mixing colors under end-user's firing conditions before mass production. Please note the following recommendations.

Mixing white silver: To obtain colored metallic, it is suitable to mix 16M11 or 16M48 white silver with approximate 15–30% of **SELECTION 16** colors. To make gray silver tone, mixing 16M 11 or 16M 14 white silver with 1674 black is recommended. 1632 Cd yellow, 1633 Cd orange, 1664 and 1665 Cd red can be mixed with **16M** metallic colors.

Underlay colors: Any of **SELECTION 16** colors and **16M** metallic colors can be printed as underlay colors. 1674 black and 1622 white are recommended as underlay colors for both metallic and interference metallic colors to get intensive effect. If the underlay colors are over fired, especially interference metallic colors, they lose the metallic effect. In this case, we recommend firing lower.

Mixing flux: 1611 flux is recommended to mix with **16M** metallic colors to lighten the colors. According to our experience, maximum 30% of additional flux is allowed.

7. Chemical durability (refer to the Table 1)

Chemical durability of **SELECTION 16M** colors depends on type of ware, kiln, color deposit and firing conditions. The following are the results of tests on soda lime glass, fired at 580°C, with 10 minutes of soaking time and 120 minutes of cold-to-cold firing conditions of gas kiln in production.

【7.1 Residual lead and cadmium content】

SELECTION 16M metallic colors contain less than 300 ppm residual lead and less than 100 ppm residual cadmium and are therefore in compliance with Californian Proposition 65, FDA, EU and Japanese requirements.

【7.2 Lead and cadmium release】

According to the DI EN 1388-1-2 test, **SELECTION 16M** colors show lead and cadmium releases are below AAS limits.

【7.3 Acid resistance】

According to the DI EN 1388-1-2 test, **SELECTION 16M** colors show visible attack and come off completely after immersion in a 4% acetic acid solution for 10 minutes at room temperature $22 \pm 2^{\circ}\text{C}$.

【7.4 Alkali resistance】

According to the ASTM C556-88 test, **SELECTION 16M** colors show visible attack before 2 hours.

8. Material Safety Data Sheet (MSDS)

Material safety data sheet (MSDS) of **SELECTION 16M** colors are available on request.

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