

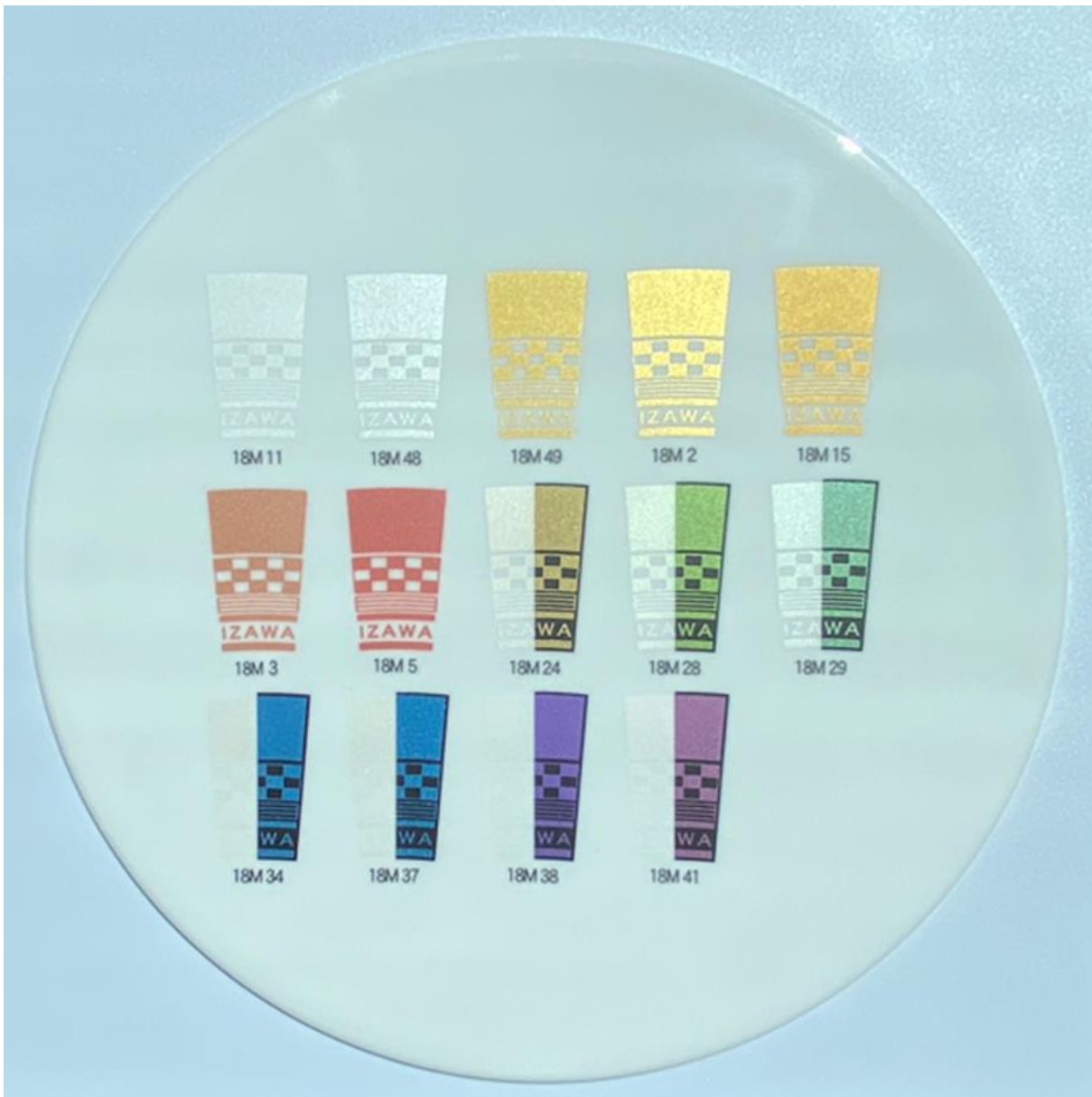
SELECTION 18M 620–700°C

Lead- and cadmium-free high resistant metallic glass colors

1. General Information and Color chart

Features!

- Intermixable with SELECTION 18 colors.
- High resistant and intensive colors.
- Lead and cadmium free.



SELECTION 18M 620–700°C Lead- and cadmium-free, intermixable, high resistant, metallic and interference metallic glass colors for bottles, cosmetic containers and glass tableware.

Table 1

Product No.	Color tone	Pantone No. / interference color on 1874 black	Intermixable	Precious metal containing	Lead free (below 90ppm)	Cadmium free (below 40ppm)	Acid resistant, DIN 1388-1-2 *1	Alkali resistant, ASTM C556-88 *2	Glass	Fine particle size *3	Coarse particle size *3	P.S.D. D50 average μ m	P.S.D. D100 biggest μ m	Remarks
Metallic colors														
18M11	white silver		✓	✓	✓	✓	✓	✓	✓			9-11	45-55	fine white silver, can mix with all of SELECTION 18 colors
18M48	white silver		✓	✓	✓	✓	✓	✓	✓			9-11	45-55	white silver, can mix with all of SELECTION 18 colors
18M49	lemon gold	8640C	✓	✓	✓	✓	✓	✓	✓			9-11	45-55	greenish gold
18M2	lemon gold	8641C	✓	✓	✓	✓	✓	✓	✓	✓	20-22	125-135		coarse particle size, lemon gold
18M15	lemon gold	871C	✓	✓	✓	✓	✓	✓	✓			9-11	45-55	orange gold
18M3	copper	876C	✓	✓	✓	✓	✓	✓	✓			9-11	45-55	
18M5	red copper	8903C	✓	✓	✓	✓	✓	✓	✓			9-11	45-55	
Interference metallic colors														
18M24	orange gold	-/8660C	✓	✓	✓	✓	✓	✓	✓			9-11	45-55	
18M28	yellow green	-/8703C	✓	✓	✓	✓	✓	✓	✓	✓	18-20	95-105		coarse particle size
18M29	green	-/8323C	✓	✓	✓	✓	✓	✓	✓			9-11	45-55	
18M34	blue	-/8182C	✓	✓	✓	✓	✓	✓	✓			9-11	45-55	
18M37	blue	-/8183C	✓	✓	✓	✓	✓	✓	✓			9-11	45-55	
18M38	lilac	-/8103C	✓	✓	✓	✓	✓	✓	✓			9-11	45-55	
18M41	red	-/8063C	✓	✓	✓	✓	✓	✓	✓			9-11	45-55	
Special colors from SELECTION 18 colors														
1811	flux		✓	✓	✓	✓	✓	✓	✓			4-5	20-30	mixing flux
1822	underlay white		✓	✓	✓	✓	✓	✓	✓			4-5	20-30	underlay white
1874	black	process blackC	✓	✓	✓	✓	✓	✓	✓			4-5	20-30	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. Refer section 7.2 and 7.3

*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. Refer section 7.4

*3: P.S.D. D50 average particle size. Refer section 5.1

*3: P.S.D. D100 biggest particle size. Refer section 5.1

2. Firing Conditions

Normal firing is from 620–700°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 18M 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 18M colors (average)	Varies between $9.0-9.5 \times 10^{-6}/^{\circ}\text{C}$
SELECTION 18 colors (average)	Varies between $9.0-9.5 \times 10^{-6}/^{\circ}\text{C}$
1811 flux	$9.7 \times 10^{-6}/^{\circ}\text{C}$

If **SELECTION 18M** 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

【5.1 Mesh size】

SELECTION 18M 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 colors	Coarse particle colors
Appearance	Smooth and opaque	Intensive and high metallic effect
Particle size	D₅₀ average 8-11 μm , D₁₀₀ biggest 45-55 μm	D₅₀ average 18-22 μm , D₁₀₀ biggest 95-135 μm
Mesh size	103-260 mesh/inch /40-100 thread/cm	103-195 mesh /40-80 thread/cm

【5.2 Medium ratio】

Product	Color : medium	Recommended mesh
SELECTION 18M colors: Medium PM2	10 : 11-13	103-260 mesh/inch /(40-100 thread/cm)
SELECTION 18 colors: Medium PM2	10 : 6.5-9	195-305 mesh/inch (77-120 thread/cm)
1811 flux : Medium PM2	10 : 9-11	195-305 mesh/inch (77-120 thread/cm)

Screen-transfer printing: We recommend PM2 flowing medium. We recommend C12 cover coat by printing 70 mesh/inch (27 thread/cm).

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 coarse-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 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 18M metallic colors can be mixed with each other in any proportions. Mixing with other **SELECTION 18** 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 **18M11** or **18M48** white silver with approximate 15–30% of **SELECTION 18** colors. To make gray silver tone, mixing **18M 11** or **18M48** white silver with **1874** black is recommended. Cadmium-containing colors, **1832** yellow, **1833** orange, **1864** and **1865** red also can be mixed with **18M** metallic colors.

Underlay colors: Any of **SELECTION 18** colors can be printed as underlay colors. **1874** black and **1822** 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: **1811** flux is recommended to mix with **18M** metallic colors to lighten the colors. According to our experience, maximum 30% of additional flux is allowed.

Overprinting flux: We do not recommend printing **1811** flux on **SELECTION 18M** colors. If printed on **SELECTION 18M** colors, they lose metallic effect.

7. Chemical durability (refer to the Table 1)

Chemical durability of **SELECTION 18M** 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 650°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 18M colors contain less than 90 ppm residual lead and less than 40 ppm residual cadmium and are therefore in compliance with Californian Proposition 65, FDA, CPSIA, EU, and Japanese requirements.

【7.2 Lead and cadmium release】

According to the DI EN 1388-1-2 test, **SELECTION 18M** colors show lead and cadmium releases are below AAS limits.

【7.3 Acid resistance】

According to the DI EN 1388-1-2 test, **SELECTION 18M** colors do not show any visible attack after immersion in a 4% acetic acid solution for 24 hours at room temperature $22\pm 2^{\circ}\text{C}$.

【7.4 Alkali resistance】

According to the ASTM C556-88 test, **SELECTION 18M** colors do not show any visible attack for up to 4 hours.

8. Safety Data Sheet (SDS)

Safety data sheet (SDS) of **SELECTION 18M** colors are available on request.

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