

SELECTION 10/11 540-600°C

SELECTION 10 : Low firing temperature non-resistant opaque glass colors

SELECTION 11 : Low firing temperature non-resistant transparent glass colors

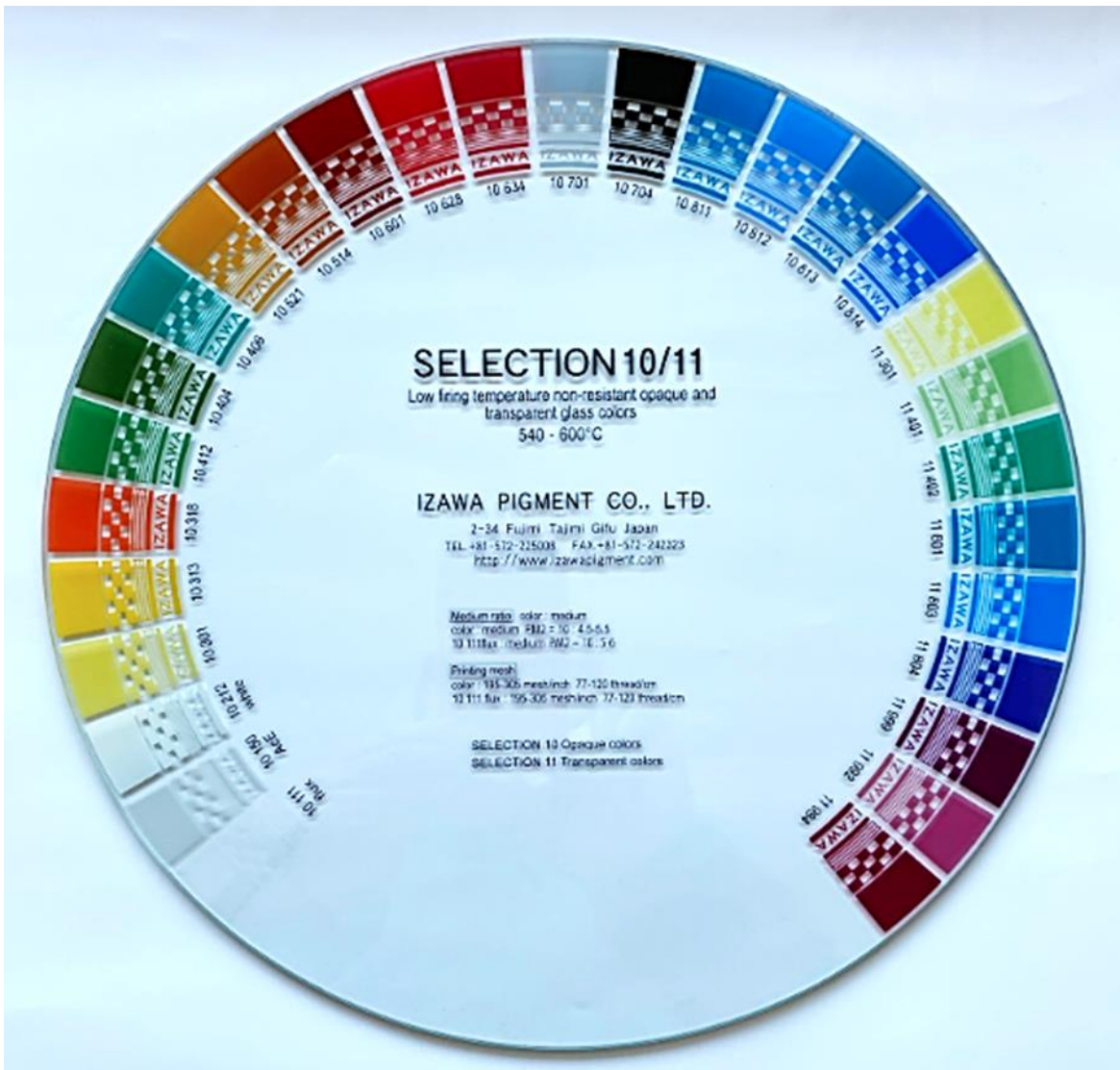
1. General Information and Color chart

Features!

Intermixable and very low firing temperature.

Very glossy.

Very intensive opaque and transparent colors.



SELECTION 10/11 540-600°C Low firing temperature non-resistant opaque and transparent glass colors for bottles and cosmetic containers.

Table 1

Product No.	Color tone	Pantone No.	Intermixable	Precious metal containing	Opaque	Transparent	Lead free (below 90ppm)	Cadmium free (below 40ppm)	Acid resistant, DIN 1388-1-2 *1	Alkali resistant, ASTM C556-88 *2	10111 mixing and overprinting flux	Glass	Remarks
SELECTION 10 Opaque colors													
10111	flux		✓		✓						✓	✓	
10150	AcE flux		✓		✓						✓	✓	acid etch effect flux
10212	white		✓		✓						✓	✓	opaque, underlay & mixing white for all colors
10301	lemon yellow	101C	✓		✓						✓	✓	
10313	cadmium yellow	108C	✓		✓						✓	✓	cadmium yellow
10318	cadmium orange	1585C	✓		✓						✓	✓	cadmium orange
10412	yellow green	355C	✓		✓						✓	✓	
10404	chrome green	363C	✓		✓						✓	✓	
10406	blue green	322C	✓		✓						✓	✓	
10521	yellow brown	143C	✓		✓						✓	✓	
10514	ocher	160C	✓		✓						✓	✓	
10601	dark iron red	1815C	✓		✓						✓	✓	
10628	cadmium red	1797C	✓		✓						✓	✓	cadmium red
10634	cadmium red	187C	✓		✓						✓	✓	cadmium red
10701	gray	429C	✓		✓						✓	✓	
10704	black	process blackC	✓		✓						✓	✓	
10811	dark cyan	307C	✓		✓						✓	✓	
10812	blue	2852	✓		✓						✓	✓	
10813	sky blue	2935C	✓		✓						✓	✓	
10814	dark azure	293C	✓		✓						✓	✓	
SELECTION 11 Transparent colors													
11301	yellow	100C	✓		✓		✓				✓	✓	
11401	yellow green	374C	✓		✓		✓				✓	✓	
11402	blue green	3278C	✓		✓		✓				✓	✓	
11801	cyan	307C	✓		✓		✓				✓	✓	
11803	sky blue	300C	✓		✓		✓				✓	✓	
11804	cobalt blue	2748C	✓		✓		✓				✓	✓	
11999	purple	259C	✓	✓	✓		✓				✓	✓	
11992	pink	197C	✓	✓	✓		✓				✓	✓	
11994	magenta	207C	✓	✓	✓		✓				✓	✓	

*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 8.1 and 8.2

*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 8.3

Table 2 Mixability

Product No.	Color tone	10111	10150	10212	10301	10313	10318	10412	10404	10406	10521	10514	10601	10628	10634	10701	10704	10811	10812	10813	10814	11301	11401	11402	11801	11803	11804	11999	11992	11994		
SELECTION 10 Opaque colors																																
10111	flux	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10150	AcE flux	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10212	white	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10301	lemon yellow	✓	✓	✓	-	✗	✗	✓	✓	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	
10313	cadmium yellow	✓	✓	✓	✗	-	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	
10318	cadmium orange	✓	✓	✓	✗	✓	-	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	
10412	yellow green	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10404	chrome green	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10406	blue green	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10521	yellow brown	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10514	ocher	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	-	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10601	dark iron red	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓	-	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10628	cadmium red	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✗	✗	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	
10634	cadmium red	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✗	✗	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	
10701	gray	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10704	black	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10811	dark cyan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10812	blue	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10813	sky blue	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10814	dark azure	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	
SELECTION 11 Transparent colors																																
11301	yellow	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✗	✗	✗
11401	yellow green	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✗	✗	✗
11402	blue green	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✗	✗	✗
11801	cyan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	
11803	sky blue	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	
11804	cobalt blue	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	
11999	purple	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓	✓	✓	-	✓	✓
11992	pink	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	-	✓
11994	magenta	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓	-

✓ can mix each other
 ✗ can not mix each other

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 decorated object has to be fired at a slowly increasing temperature particularly in the first firing phase up to approx. 400°C to take care to maintain good ventilation otherwise the carbon ash will be remained on the colors. The best firing condition depends on firing speed and type of ware and kiln. This series can be used for decoration on earthenware and tiles at 540–600°C also.

3. Application

SELECTION 10/11 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 10/11 colors (average)	Varies between 9.0–10.0 × 10 ⁻⁶ /°C

If **SELECTION 10/11** 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 testing the application of the colors under your conditions before mass production use.

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

Product	D ₅₀ average	D ₁₀₀ biggest
SELECTION 10/11 colors (average)	3.5–4.5 μ m	40 μ m
10111 flux	5.5–6.0 μ m	50–55 μ m

6. Printing

【6.1 Mesh size】

We recommend mesh sizes that are 195–305 mesh/inch (77–120 thread/cm) for all screen applications.

【6.2 Medium ratio】

SELECTION 10/11 colors: Medium PM2/PMT8	10 : 4–5.5/5.0–7.0
10111 mixing and overprinting flux: Medium PM2	10 : 5.0–6.0

Screen-transfer printing: We recommend PM2 flowing medium, PMT8 thixotropic medium for dot and four-color printing. We recommend C12 cover coat by printing 70 mesh/inch (27 thread/cm).

7. Color and Mixability

SELECTION 10/11 colors can be mixed with each other in any proportions (exceptions as follows) However, we recommend testing the stability of mixing colors and overprinted flux colors under end-user's firing conditions before mass production. Please note following points and refer to Table 1 and 2.

Underlay white: 10212 white is suitable as underlay white.

Mixing white: To obtain pastel-color tone, it is suitable to mix 10212 white

Mixing flux: 10111 flux is suitable for mixing all colors.

Overprinting flux: Overprinting 10111 flux can increase color gloss but it cannot improve chemical durability, such as heavy metal release, alkali durability and dishwasher resistance.

AcE flux: 10150 flux can make AcE (acid etching) effect after firing. It can be printed and fired as normal colors.

8. Chemical durability (refer to the Table 1)

Chemical durability of **SELECTION 10/11** colors depends on type of ware, kiln, color deposit and firing conditions. The following are the results of tests on soda lime glass bottle, fired at 580°C, with 10 minutes of soaking time and 90 minutes of cold-to-cold firing conditions of gas kiln in production.

【8.1 Lead and cadmium release】

According to the DI EN 1388-1-2 test, **SELECTION 10/11** colors show very high lead and cadmium releases.

【8.2 Acid resistance】

According to the DI EN 1388-1-2 test, **SELECTION 10/11** colors show visible attack and come off completely after immersion in a 4% acetic acid solution for 10 minutes at room temperature $22 \pm 2^\circ\text{C}$.

【8.3 Alkali resistance】

According to the ASTM C556-88 test, **SELECTION 10/11** colors show visible attack before 2 hours. Even if 10111 flux is overprinted, they cannot stand up to 2 hours.

9. Safety Data Sheet (SDS)

Safety data sheet (SDS) of **SELECTION 10/11** colors are available on request.

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