

# SELECTION 32 780–900°C

## Resistant onglaze colors

### 1. General Information and Color chart

#### Features!

- Intermixable, very intensive and high chemical resistant colors.
- Very low lead and cadmium release.
- Relief flux and white are available.
- Very opaque underlay white is available.



## SELECTION 32 780-900°C Intermixable, low metal release, resistant, onglaze colors for porcelain, bone china, earthenware and vitreous china.

**Table 1**

Product No.	Color tone	Pantone No.	Intermixable	Precious metal containing	Lead free (below 90ppm)	Cadmium free (below 40ppm)	Acid resistant, DIN 1388-1-2 *1	Pb release DIN 1388-1-2 (mg/dm <sup>2</sup> ) *1	Cd release DIN 1388-1-2 (mg/dm <sup>2</sup> ) *1	Alkali resistant, ASTM C556-88 *2	32100 overprinting flux	32101 overprinting flux	Enamel ware	Bone, vitreous china, earthenware	Hard porcelain, porcelain	Remarks
32100	flux		✓			✓	✓	0.03	<0.002	✓	✓	✓	✓	✓	✓	mixing and overprinting
32101	flux		✓			✓	✓	0.05	<0.002	✓	✓	✓	✓	✓	✓	overprinting
32210	mixing white		✓			✓	✓	0.021	<0.002	✓	✓	✓	✓	✓	✓	mixing white
32201	white		✓			✓	✓	0.025	<0.002	✓	✓	✓	✓	✓	✓	opaque white
32220	underlay white		✓			✓	✓	0.03	<0.002	✓	✓	✓	✓	✓	✓	underlay white
32344	lemon yellow	process yellowC	✓			✓	✓	0.03	<0.002	✓	✓	✓	✓	✓	✓	four-color yellow
32345	orange yellow	107C	✓			✓	✓	0.24	<0.002	✓	✓	✓	✓	✓	✓	four-color yellow
32313	cadmium yellow	109C	✓			✓	✓	0.07	0.03	✓	✓	✓	✓	✓	✓	four-color Cd yellow
32318	cadmium orange	orange021C	✓			✓	✓	0.07	0.03	✓	✓	✓	✓	✓	✓	
32413	cadmium green	370C	✓			✓	✓	0.1	0.03	✓	✓	✓	✓	✓	✓	
32404	chrome green	364C	✓			✓	✓	0.045	<0.002	✓	✓	✓	✓	✓	✓	
32412	grass green	356C	✓			✓	✓	0.03	<0.002	✓	✓	✓	✓	✓	✓	
32406	blue green	328C	✓			✓	✓	0.038	<0.002	✓	✓	✓	✓	✓	✓	
32521	yellow brown	143C	✓			✓	✓	0.03	<0.002	✓	✓	✓	✓	✓	✓	
32514	ochre	145C	✓			✓	✓	0.04	<0.002	✓	✓	✓	✓	✓	✓	
32524	chestnut	478C	✓			✓	✓	0.05	<0.002	✓	✓	✓	✓	✓	✓	
32601	iron red	484C	✓			✓	✓	0.023	<0.002	✓	✓	✓	✓	✓	✓	iron red, mixture limited
32609	iron red	1665C	✓			✓	✓	0.05	<0.002	✓	✓	✓	✓	✓	✓	iron red, intermixable
32623	cadmium red	1788C 2X	✓			✓	✓	0.07	0.03	✓	✓	✓	✓	✓	✓	four-color Cd red
32628	cadmium red	485C 2X	✓			✓	✓	0.07	0.03	✓	✓	✓	✓	✓	✓	
32721	gray	650C	✓			✓	✓	0.026	<0.002	✓	✓	✓	✓	✓	✓	
32745	black	process blackC	✓			✓	✓	0.036	<0.002	✓	✓	✓	✓	✓	✓	four-color black
32821	turquoise	297C	✓			✓	✓	0.02	<0.002	✓	✓	✓	✓	✓	✓	
32841	cyan	process cyanC	✓			✓	✓	0.033	<0.002	✓	✓	✓	✓	✓	✓	four-color cyan
32845	dark cyan	3015C	✓			✓	✓	0.033	<0.002	✓	✓	✓	✓	✓	✓	four-color cyan
32822	sky blue	2935C	✓			✓	✓	0.03	<0.002	✓	✓	✓	✓	✓	✓	
32808	dark azure	293C	✓			✓	✓	0.3	<0.002	✓	✓	✓	✓	✓	✓	non acid resistant
32900	violet	521C	✓			✓	✓	0.02	<0.002	✓	✓	✓	✓	✓	✓	
32937	light pink	674C	✓	✓		✓	✓	0.036	<0.002	✓	✓	✓	✓	✓	✓	
32908	pink	205C	✓	✓		✓	✓	0.025	<0.002	✓	✓	✓	✓	✓	✓	
32943	blue magenta	228C	✓	✓		✓	✓	0.03	<0.002	✓	✓	✓	✓	✓	✓	four-color bluish magenta, Cd colors mixable
32910	magenta	227C	✓	✓		✓	✓	0.025	<0.002	✓	✓	✓	✓	✓	✓	four-color magenta
32916	dark blue maroon	2415C	✓	✓		✓	✓	0.03	<0.002	✓	✓	✓	✓	✓	✓	Cd colors mixable
32921	dark red maroon	201C	✓	✓		✓	✓	0.035	<0.002	✓	✓	✓	✓	✓	✓	
<b>Relief flux &amp; white</b>																
32189	relief flux		✓			✓	✓	0.05	<0.002	✓	✓	✓	✓	✓	✓	transparent relief flux, intermixable except Cd colors
32286	relief white		✓			✓	✓	0.03	<0.002	✓	✓	✓	✓	✓	✓	opaque relief white, intermixable except Cd colors

\*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 9.1 and 9.2

\*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 9.3

## 2. Firing Conditions

Type of ware	Firing range
Porcelain	800–900°C
Vitreous China	750–880°C
Bone China	750–880°C
Earthenware	750–800°C

**SELECTION 32** colors are suitable for both normal firing 3–10 hours and fast-firing 60–120 minutes, cold-to-cold conditions.

## 3. Application

**SELECTION 32** 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.)
<b>SELECTION 32</b> colors (average)	Varies between $5.6\text{--}6.3 \times 10^{-6}/^{\circ}\text{C}$
<b>32100</b> mixing and overprinting flux	$5.8 \times 10^{-6}/^{\circ}\text{C}$
<b>32101</b> overprinting flux	$5.1 \times 10^{-6}/^{\circ}\text{C}$
<b>32189</b> relief flux	$5.1 \times 10^{-6}/^{\circ}\text{C}$
<b>32286</b> relief white	$5.6 \times 10^{-6}/^{\circ}\text{C}$

**SELECTION 32** colors are carefully developed and tested under optimum conditions to minimize cracking or chipping problems. The maximum thickness of the color layer should be below  $25 \mu\text{m}$  (approx. by 195 mesh/inch, 77 thread/cm, triple printing) for porcelain glaze (C.O.E.  $4.5\text{--}5.5 \times 10^{-6}/^{\circ}\text{C}$ ). Thicker printing of more than  $25 \mu\text{m}$  could be allowed for bone china, earthen ware and vitreous china (C.O.E.  $5.5\text{--}7.5 \times 10^{-6}/^{\circ}\text{C}$ ). However, it is necessary to test the cracking or chipping before mass production. The results will depend on the end-user's conditions.

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

Product	D <sub>50</sub> average	D <sub>100</sub> biggest
<b>SELECTION 32</b> colors (average)	4.0–6.0 $\mu\text{m}$ ( $\pm 1.0$ )	40 $\mu\text{m}$ ( $\pm 10$ )
<b>32100, 32101</b> flux	4.0–6.0 $\mu\text{m}$ ( $\pm 1.0$ )	40 $\mu\text{m}$ ( $\pm 10$ )
<b>32189</b> relief flux	3.5–4.5 $\mu\text{m}$ ( $\pm 1.0$ )	25–30 $\mu\text{m}$ ( $\pm 10$ )
<b>32286</b> relief white	4.0–6.0 $\mu\text{m}$ ( $\pm 1.0$ )	40 $\mu\text{m}$ ( $\pm 10$ )

## 6. Printing

### 【6.1 Mesh size】

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

**Gold and high silver containing colors:** We recommend that **32908** pink, **32910** and **32921** maroon are printed using 260–355 mesh/inch (100–140 thread/cm). If the color deposit is too thick, the high silver-containing colors become brownish especially the firing temperature is not high enough.

**Relief flux and white:** We recommend that **32189** relief flux and **32286** relief white are printed using 103–148 mesh/inch (40–58 thread/cm). Printing 1–3 times is recommended. Printing by finer mesh shows smoother surface and less pinhole than rough mesh.

### 【6.2 Medium ratio】

<b>SELECTION 32</b> color : Medium PM2/PMT8	10 : 6–8/7–9
<b>32100, 32101</b> overprinting flux : Medium PM2	10 : 8–10
<b>32189</b> relief flux : Medium PM2/PMT9	10 : 6–6.5/6–6.5
<b>32286</b> relief white : Medium PM2/PMT9	10 : 6–6.5/6–6.5

**SELECTION 32 colors:** 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).

**Relief flux and white:** We recommend PM2 flowing medium for smooth relief and PMT9 weak thixotropic medium for high and sharp relief. We recommend C12 cover coat by printing 70 mesh/inch (27 thread/cm). Adding just sufficient medium will improve the surface of relief, if it has pinhole problems.

Onglaze colors absorb any moisture easily. Therefore, keep powder colors in a dry place. We recommend drying the color powder before using

## 7. Color and Mixability

**SELECTION 32** colors can be mixed with each other in any proportions. 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.

**Mixing white:** To obtain pastel-color tone, **32210** mixing white or **32201** opaque white are suitable.

**Mixing flux:** **32100** flux is suitable for mixing all colors. After mixing with flux, the color is lighter and glossier.

**Iron oxide red:** When **32601** iron red is mixed with other colors, it is necessary for **32601** to be mixed over 50% in order to maintain the stability of iron oxide but it is not recommended for mixing with cadmium-containing colors.

**Cadmium containing colors:** **32313** yellow, **32318** orange, **32413** green, **32623** and **32628** red can only be mixed with one another. Also, up to 5% of cyan, blue, and black and up to 20% of **32100** flux and **32210** mixing white can be mixed for these cadmium-containing colors.

**Overprinting flux:** **32100** flux is suitable as overprinting flux for all colors, but if **32601** iron red and **32808** blue become very weak, and reddish gold-containing pinks and maroons become brownish, we recommend **32101** flux instead. Overprinting flux improves color gloss and chemical durability, such as heavy metal release, alkali durability and dishwasher resistance.

**Relief flux and white:** **32192** relief flux and **32286** relief white are suitable for mixing and overprinting with all colors except cadmium containing colors. After mixing with **SELECTION 32** colors, color relief can be developed.

Mixing with cadmium containing colors show unstable color tone and babble or orange skin surface if it is overprinted.

**Underlay white:** **32220** underlay white can be under-printed and mixed with **SELECTION 32** colors in any proportions. In case of color changing defects, overprinting **32100** or **32101** flux as top of the color layer is effective. However we recommend testing the stability of colors under end-user's firing conditions before mass production. If you find unstable or color changing defects, please refer to the following guidelines.

**Cobalt-containing colors:** such as **32808** blue and **32845** cyan can be greenish.

**Chrome-containing colors:** such as **32404**, **32406** green can be yellowish and **32220** underlay white becomes yellowish tone.

**Chrome-tin violet:** such as **32900** violet can be yellowish.

**Iron red:** such as **32601** iron red can be lighter.

**Cadmium-containing colors:** such as **32313** yellow, **32318** orange, **32413** green, **32623** and **32628** red become matte surface if they are over fired.

**Gold-containing colors:** they become bluish tone.



## 8. Four-color printing

### 【8.1 Choice of colors】

	Combination 1 (without cadmium colors)	Combination 2 (with cadmium colors)
Yellow	<b>32344</b> lemon yellow, <b>32345</b> orange yellow	<b>32313</b> cadmium yellow
Magenta	<b>32943</b> bluish magenta, <b>32910</b> reddish magenta	<b>32943</b> bluish magenta
Red		<b>32623</b> cadmium red
Cyan	<b>32841</b> cyan, <b>32845</b> dark cyan	<b>32841</b> cyan, <b>32845</b> dark cyan
Black	<b>32745</b> black	<b>32745</b> black
Flux	<b>32100</b> for mixing and overprinting flux	<b>32100</b> for mixing and overprinting flux

To adjust each color tone, **32344** lemon yellow can be mixed with **32345** orange yellow. **32943** bluish magenta can be mixed with **32910** reddish magenta. **32841** cyan can be mixed with **32845** dark cyan. **32943** bluish magenta can be used with cadmium-containing colors. In this case, yellow should be **32313** cadmium yellow, and additional overprinting of cadmium colors are possible. **32100** flux is suitable as overprinting flux for all colors.

### 【8.2 Printing order】

Combination 1, Y-M-C-K-F: yellow → magenta → cyan → black → overprinting flux.

Combination 2, CdY-M/CdR-C-K-F: cadmium yellow → **32943** magenta/cadmium red → cyan → black → overprinting flux. (Additional overprinting of cadmium colors is possible before overprinting flux)

### 【8.3 Mesh size】

We recommend mesh sizes that are polyester 305–420 mesh/inch (120–165thread/cm).

### 【8.4 Medium ratio】

<b>32344</b> lemon yellow, <b>32345</b> orange yellow, <b>32313</b> cadmium yellow : PMT8	10 : 6.5–7.5
<b>32943</b> bluish magenta, <b>32910</b> magenta : PMT8	10 : 7–8
<b>32623</b> cadmium red : PMT8	10 : 7–8
<b>32841</b> cyan, <b>32845</b> dark cyan : PMT8	10 : 7–8
<b>32745</b> black : PMT8	10 : 7–8
<b>32100</b> overprinting flux : PM2	10 : 8–10

We recommend PMT8 thixotropic medium for printing **SELECTION 32** four colors.

We recommend PM2 flowing medium for overprinting **32100** flux.

We recommend C12 cover coat by printing 70 mesh/inch (27 thread/cm).

## 9. Chemical durability (refer to the Table 1)

Chemical durability of **SELECTION 32** colors depends on type of ware, glaze, kiln, color deposit and firing conditions. The following are the results of tests on porcelain, fired at 820°C, with 10 minutes of soaking time and 120 minutes of cold-to-cold firing conditions of gas kiln in production

### 【9.1 Lead and cadmium release】

According to the DI EN 1388-1-2 test, **SELECTION 32** colors show less than lead 0.3 mg/dm<sup>2</sup> and cadmium 0.03 mg/dm<sup>2</sup> releases. However, non-cadmium-containing colors show below cadmium 0.002 mg/dm<sup>2</sup> release. For each color, please refer to table 1.

### 【9.2 Acid resistance】

According to the DI EN 1388-1-2 test, **SELECTION 32** colors do not show any visible attack after immersion in a 4% acetic acid solution for 24 hours at a room temperature of 22±2°C, except **32808** dark azure.

### 【9.3 Alkali resistance】

According to the ASTM C556-88 test, **SELECTION 32** colors do not show any visible attack for up to 6 hours.

## 10. Safety Data Sheet (SDS)

Safety data sheet (SDS) of **SELECTION 32** colors are available on request.

The above information and statements are unsolicited. IZAWA PIGMENT CO., LTD. provides them to promote its products. The above information and statements are also believed to be accurate at the time of publication under their laboratory conditions. Use of them is at the sole discretion of the user and IZAWA PIGMENT CO., LTD. does not give any warranty with respect to any test results. In no event shall IZAWA PIGMENT CO., LTD. be liable for any direct, indirect, special, incidental, or consequential damages arising out of the use of the above information.