Low Melting Glass Enamels for Decorative Glass and Hollow Glassware

Product range 30

lithium free

Firing range 520 - 580 °C

Low melting glass enamels are mainly used for the decoration of thin glassware which would deform at higher temperatures; such as lamps, fancy and hollow glassware.

This product range is **lithium free** with the exception of product **19 166, satin matt**. For lithium free satin matt glass enamel, we recommend product **19 961, satin matt**.

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Product range

	Product number	Shade	Pantone Reference ® *
Group I **- li free -**	**10 042**	Mixing flux	
	11 641	Green	349 C
	11 642	Light Green	364 C
	11 642	Light Green	364 C
	11 667	Dark Green	3435 C
	11 688	Blue Green	634 C
	12 530	Light Blue	293 C
	12 570	Light Blue	284 C
	12 602 Cd free	Dark Blue	Reflex Blue C
	12 1517 Cd free	Cyan	3015 C
	13 440	Yellow	116 C
	13 464	Orange	166 C
	13 602	Orange Yellow	1485 C
	14 171 Cd free	Black	Black 6C
	15 125	Grey	430 C Warm Grey 10 C
	16 310	Yellow Brown	160 C
	16 311	Red Brown	175 C
	16 444 Cd free	Dark Brown	1817 C
	17 395	Red	85 C 2X
	17 396	Pink	700 C
	17 417	Dark Red	187 C
	19 130	White	
	19 172 Cd free	White	
	19 961	Satin Matt	
	77 495 Cd free	Purple	520 C
	77 496 Cd free	Old Rose	521 C
	29 610	Matting agent	
Group II **- li-containing -**	**19 166**	Satin Matt	

*) The above mentioned **Pantone Reference®** numbers only represent an indication for the respective colour shade. Actual results may depend on production conditions.

All colours of **group I** and **group II** are lead and cadmium containing

Exceptions: **12 602** dark blue, **14 171** black, **12 1517** cyanblue, **16 444** dark brown, **19 172** white, **77 495** and **77 496** pink are **cadmium free**.

Mixability & Colour Development

The colours of **Product range 30** are completely intermixable. With the glass enamels of this range, almost all common shades can be achieved by mixing. The mixing chart shows the corresponding formulations. Intermixing of Cd free and Cd containing glass enamels is possible, but not recommended.

4-Colour Process

An interesting combination is the 4-Colour Process which provides a large spectrum of colour shades with only five basic enamels. The three primary colours **Cyan 12 1517**, **Yellow 13 440** and **Magenta red 17 417** together with **Black 14 171** and **White 19 172** (Underlayer) are well suited for the process.

Note: Ceramic colours are less intense and less bright than organic colours.

Order of printing	Product	Description	Recommended flux
1. 2. 3. 4. 5.	**19 172** **17 417** **12 1517** **13 440** **14 171**	White, Underlayer Magenta red Cyan Yellow Black	 10 042 10 042 10 042
Temperature	540 - 580 °C		
Printing media	80 820		
Mixing ratio	100 : 60		
Screen	Polyester – 120 T/cm, 300 mesh/inch		
Dots / Lines	100 -120 lines per inch		

Thermoplastic glass enamels (TH) for the 4-Colour Process are ready for use.
No additional flux is required.

Order of printing	Product	Description
1. 2. 3. 4. 5.	**19 172 TH** **17 417 TH** **12 1519 TH** **13 649 TH** **14 227 TH**	Underlayer: white Magenta red Cyan blue Yellow Black
Screen	steel or 350 - 400 mesh/inch	Metalen VA 120 - 140
Dots / Lines	40/cm, 100/inch	

For the 4-Colour Process and half tone printing it is recommended to use our thixotropic thermoplastic glass enamels pasted in medium **80 1025**.

The **colour shade** is mainly influenced by the surface of the glass. In comparison with non-treated glasses the colour shade might vary on different surface treatment systems like titanium or tin which are used for holloware glasses. With regard to floatglass, the Sn-side (bath side) causes a different colour shade than the air side (firing side) of the glass.

Application

The colours have been developed and tested for the following application processes:

- indirect screen printing (decals)
- direct screen printing, paste
- direct screen printing, thermoplastic paste
- spraying
- machine banding
- brush banding

For screen printing the following mesh-sizes are recommended:

- indirect screen printing (decals) 61 - 90 threads/cm polyester (155 - 230 mesh/inch)
  VA 70 - 100 steel (180 - 270 mesh/inch)

- direct screen printing 44 - 70 threads/cm polyester (110 - 180 mesh/inch)
  or VA 70 - 100 steel (180 - 270 mesh/inch)

- direct screen printing thermoplastic VA 70 - 100 steel

Processing

Screen printing pastes

Recommended pasting ratios:

Colour : medium = 100 : 25 - 50 (direct screen printing)
Colour : medium = 100 : 50 - 60 (indirect screen printing)

Suspension for spraying

Enamels can be suitable dispersed in appropriate media using a high speed stirrer or in a ball mill.

The colour paste can be modified with a suitable diluent to spraying consistency.
(See **"Decorating Auxiliaries"**).

Under normal conditions, the **Range 30** enamels fire glossy. If reduced gloss or matter films are required, matting agent **29 610** can be added. Depending on the firing conditions and the desired degree of matting, the addition of 20 - 40 % is recommended.

Good opacitiy is obtained with average to thick layers; thin layers provide adequate light transmission, as required for lighting fixtures.

Media

Suitable Ferro media are available for all standard machine and manual processes such as screen printing, spraying, banding, curtain and roller coating. For the production of decals, a broad range of suitable media and covercoats are also available.

Specific examples of suitable media types are listed in the **“Decoration Auxiliaries”.**

Firing

520 - 580 °C (conventional firing). A temperature of approximately 540 °C is recommended.

Properties

Thermal expansion

The thermal expansion is suitable for glasses with a linear thermal expansion coefficient range of 85 - 100 x 10^{-7}/K, (50 - 300 °C).

Chemical resistance

Range 30 glass enamels for decorative glass and hollow glassware are naturally much less durable than **range 38** colours (normal firing of **580 - 630 °C**). For this reason **Product range 30** glass enamels they should only be used in cases where chemical resistance is of low importance.

Availability

- Colour powder
- Colour pastes (oil based and water soluble)
- Thermoplastic colour, ready for use

Minimum order quantity per colour: 5 kg for each standard colour shade

Storage and shelf life

The **colour powder** must be stored in dry conditions. Partly used tins must be tightly sealed after use. It is recommended that colour powders are dried at 130 °C before pasting into oil based media.

Media should not be stored below 5 °C or above 35 °C. The ideal storage temperature is between 8 °C and 15 °C. Partly used tins must be tightly sealed after use. If stored as recommended, a minimum shelf life of 6 months after production date is guaranteed.

Colour pastes must be stored in dry and cool conditions. The storage temperatures should not be below 5 °C or exceed 35 °C. Before printing, pastes must be stirred thoroughly. Partly used tins must be tightly sealed after use. If stored as recommended, a minimum shelf life of 6 months after the production date is guaranteed.

Any indications given in this brochure are based on the actual information stand on the date of issue. Technical investigations on our products are carried out continuously. This brochure is not subjected to an alteration service and will therefore not be updated automatically.

Safety Data Sheets

Our safety data sheets which are available for every product, will give you advice on health and safety aspects for working with Ferro products.

10/2002

Decoration Auxiliaries

Standard Range for the Decoration with Glass Enamels

Decoration aids are special media developed for specific decoration techniques.

These media are devided into two main classes:

1. water soluble: - contains only components which can be thinned with water
- equipment can be cleaned with water

2. oil based: - can neither be diluted nor thinned with water

Screen transfer printing
(decals)

Product number	Product designation	Notes
80 820	Medium **oil based, low thixotropy**	suitable for half tone and solid printing
83 450	Standard covercoat	** EGA free
83 2040	Standard covercoat, thixotropic	** EGA free
83 894	Covercoat	** EGA free – in combination with **80 820** recommended for heat release application (see Media guide)

**) EGA: Ethyl Glycol Acetate

Direct screen printing

Product number	Product designation	Notes
80 392	Medium **oil based**	medium drying time
80 599	Medium **oil based**	slow drying time
80 840	Medium **water soluble**	low odour, medium drying time
80 858	Medium **water soluble**	low odour, very slow drying time
80 549	Medium **for thermoplastic colours**	thermoplastic colours are only supplied ready mixed
80 1025	Medium **for thermoplastic colours / thixotropic**	high definition and half tone printing (4-Colour Process)

Machine banding
(brush or roller system)

Product number	Product designation	Notes
80 683	Banding Medium **water soluble**	APV 100 : 50 the suspension has to be sieved and adjusted on viscosity with water

Spraying

Product number	Product designation	Notes
80 520	Spray Medium **water soluble** + water + ethanol	Produce colour dispersion using ball milling or high speed stirrer e.g.: 15 pts medium) for 15 pts Industrial 100 pts methylated colour spirits (IMS)) powder 20 pts water) Sieve the suspension and thin with water to achieve the spraying viscosity.
80 850	Spray Medium **water soluble** + water + ethanol	Colour paste APV 100 : 40 This paste has to be adjusted to spraying viscosity by using asolution of 50 % water and 50 % ethanol. Depending on the colour shade 30 - 40 % of the a.m. mixture has to be added to the paste.

Mixing Chart for basic mixing range
Range 30

Basic colours	Mixed shades		
19 130 **white**	19 130 30 p 11 667 2 p 13 440 1 p **white green** 345 C*	19 130 10 p 11 667 1 p **pastel green** 338 C*	19 130 30 p 13 440 7 p 11 667 1 p **yellow green** 367 C*
11 667 **dark green**	12 530 10 p 11 667 5 p **russian green** 316 C*	12 530 10 p 19 130 10 p 11 667 3 p **blue green** 3292 C*	19 130 3 p 11 667 1 p **turquoise green** 3258 C*
12 530 **light blue**	12 530 1 p 19 130 1 p **light blue** 279 C*	19 130 3 p 12 530 1 p **sky blue** 278 C*	19 130 10 p 12 530 1 p **pastel blue** 277 C*
13 440 **yellow**	13 440 40 p 19 130 40 p 11 667 1 p **lemon yellow** 396 C*	13 440 1 p 19 130 1 p **honey yellow** 116 C*	19 130 10 p 13 440 1 p **jasmine yellow** 120 C*
17 395 **red**	17 395 20 p 12 530 1 p **cherry red** 1805 C*	17 395 10 p 13 440 6 p **light red** 485 C*	17 395 5 p 12 530 3 p **clared red** 188 C*

Mixed shades

19 130 30 p 12 530 3 p 11 667 1 p **pastel blue** 297 C*	19 130 40 p 12 530 1 p 11 667 1 p **ice blue** 324 C*	19 130 40 p 13 440 2 p 17 395 1 p **beige** 1555 C*	19 130 80 p 12 530 2 p 17 395 1 p **mauve** 663 C*
11 667 5 p 13 440 2 p **green** 349 C*	13 440 3 p 11 667 1 p **gras green** 379 C*	13 440 20 p 11 667 1 p **reed green** 398 C*	13 440 5 p 12 530 2 p **green** 392 C*
13 440 30 p 17 395 8 p 14 171 1 p **yellow brown** 724 C*	13 440 10 p 17 395 8 p **tobacco** 464 C*	19 130 7 p 11 667 3 p 13 440 11 p **lime green** 366 C*	13 440 20 p 17 395 2 p 14 171 1 p **beige** 139 C*
12 530 5 p 11 667 1 p **dark blue green** 3025 C*	12 530 10 p 17 395 1 p **blue violet** 533 C*	12 530 20 p 14 171 1 p **prussian blue** 653 C*	19 130 20 p 12 530 5 p 17 395 1 p **old lavender** 665 C*
19 130 40 p 13 440 1 p **light ivory** 600 C*	13 440 3 p 17 395 1 p **orange red** 021 C*	13 440 10 p 17 395 1 p **orange yellow** 1375 C*	19 130 10 p 13 440 4 p 17 395 1 p **beige red** 715 C*
19 130 5 p 17 395 1 p **dark rose** 701 C*	19 130 10 p 17 395 1 p **old rose** 508 C*	19 130 20 p 17 395 1 p **light rose** 693 C*	19 130 40 p 17 395 2 p 12 530 1 p **grey rose** 435 C*

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Note: P = parts by weight