

VNB Series Technical Data



VNB Series

Main Market Use

These lead-free enamels are recommended for decoration of low expansion scientific or pharmaceutical (borosilicate) glass. The series consist of an intermixable color palette that can be blended with other intermediates in the VNB Series to achieve the widest possible color range.

Product Development

Recommended firing range is 1170 °F to 1200 °F (632 °C to 649 °C). See Firing Parameters for specifics.

Product Color	Product Number	PMS Equivalent
White	20-8585	-
Red	21-8193	492 C
Purple*	22-8132	2573 C
Limelight	23-8292	611 C
Black	24-80199	Black 6 C
Dark Green	26-8610	357 C
Blue	27-8722	279 C
Dark Blue	27-8723	289 C
Orange	28-8064	145 C

The VNB Series does not contain voluntary additions of heavy metals- Pb, Cd, Hg and Cr⁶⁺.

*Gold bearing pigments (marked * above) are needed to achieve some color tones required by the market.*

*It is recommended that preliminary test be performed prior to launching production with color mixtures utilizing gold bearing colors (marked * above).*

The Pantone equivalents are based on visual evaluation with trials fired under Ferro QC criteria and conditions.

Properties of Base Frit(s)

Coefficient of Thermal Expansion C.o.E. (ASTM C-824-91)	~ 68 X10 ⁻⁷ /°C
Citric Acid Resistance (ASTM C-724)	3-4
Detergent Resistance (DTM 75)	3-4
Alkali Resistance (DTM 63)	7

See Chemical Durability Ratings for explanation.

Printing Conditions

It is recommended that the printing room be temperature controlled between 68 °F (20 °C) and 78 °F (26 °C) with a relative humidity between 20% and 70%. Enamel paints should be stored in the printing room at least 24 hours prior to use. This will allow the paint temperature to reach equilibrium with the room temperature.

Firing Parameters

The firing range for this series is 1170 °F to 1200 °F (632 °C to 649 °C) based on laboratory control tests, established during the formulation of the frit system. Under production conditions, the actual firing cycle can be influenced by factors such as kiln type, ware loading, weight of ware, and lehr belt speed. The pre-heat zone must be hot enough to volatilize the medium efficiently. There must be good ventilation to remove the volatilized organic material. Airflow through the lehr should be in the direction of the entrance to ensure the carbonaceous products of combustion are not present in the firing zone. An oxidized atmosphere is recommended to achieve optimal fired appearance, gloss, and brightness. Peak temperature in the firing zone must be sufficient to fully mature the product. Temperature progression through the zones, from pre-heat to fire zone to the cooling zone, should be as smooth as possible to avoid any rapid changes of temperature. Total cycle time can range from 1 to 2 hours, depending on the nature of the color and the final product. The following is a typical lehr cycle (please note that this lehr cycle is an approximation and will need to be modified due to the previously mentioned reasons).

Zone	Description	Time
Pre-Heat Zone(s)	Room temperature to peak temperature	20-40 min.
Firing Zone(s)	Optimal peak temperature for enamel development	15-20 min.
Cooling Zone(s)	Peak temperature to handling temperature	Varies

Chemical Durability Ratings

1. No attack apparent.
2. Appearance of iridescence or visible stain on the exposed surface when viewed at a 45° angle but not apparent at angles less than 30°.
3. A definite stain that does not blur reflected images and is visible at angles less than 30°.
4. Definite stain with a gross color change or strongly iridescent surface visible at angles less than 30° and which may blur reflected images.
5. Surface dull or matte with chalking possible.
6. Significant removal of enamel with pinhole evident.
7. Complete removal of enamel in exposed area.

Storage and Shelf Life

Ferro IR glass enamel paste/paints must be stored in a cool and dry area. A storage temperature range of 41 °F (5 °C) to 95 °F (35 °C) is recommended. Glass enamel paste containers must be closed after each use to avoid evaporation of solvents and minimize flaking of dried enamel in the paste. The shelf life of Ferro IR glass enamels is one year from the manufacturing date. All paste should be shaken, stirred, or mixed prior to use to ensure consistency. After one year, our glass enamel paste can still be used, but may require high speed mixing for ten minutes or more to re-disperse settled components from the bottom of the container into the bulk phase.

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