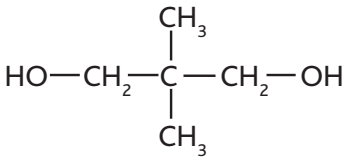
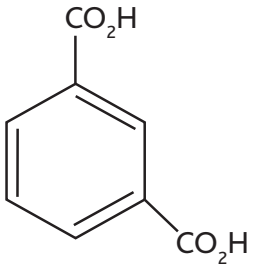
High-solids, polyester resin formulation HS-3-4ND

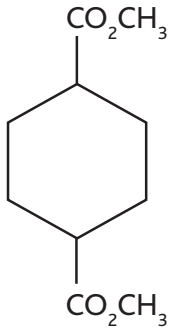
Based on Eastman NPG™ glycol, Eastman™ purified isophthalic acid (PIA), and Eastman™ DMCD



Eastman NPG™ glycol



Eastman™ purified isophthalic acid (PIA)



Eastman™ DMCD

Features

- 305 g/L (2.54 lb/gal) determined VOC
- Excellent stain resistance
- Excellent corrosion resistance
- Excellent chemical resistance
- Good hardness

HS-3-4ND resin formulation

	Reactant	Equivalent	Moles	Weight, g
Stage 1	Eastman NPG™ glycol	30.23	15.11	1,574
	Trimethylolpropane (TMP)	1.20	0.40	54
	Eastman™ DMCD	10.25	5.12	1,026
Stage 2	Eastman™ purified isophthalic acid (PIA)	10.25	5.12	852
	TMP	1.20	0.40	54
			Total charge	3,560
Catalyst:	0.1% Fascat™ 4100 catalyst based on total charge		Calculated methanol loss	–328
			Calculated H_2O loss @ A.N. = 10	–179
Stabilizer:	0.1% *p*-Toluenesulfonic acid based on total charge		Theoretical yield	3,053

Nitrogen purge: Adequate to maintain <1% oxygen (0.4 standard cubic feet per hour)

Processing procedure

1. Charge Stage 1 reactants, catalyst, and stabilizer to a 5-liter flask equipped with a heating mantle, agitator, nitrogen purge, thermocouple, partial condenser, water trap, and total condenser.

2. Increase temperature to a maximum 190°C (374°F) and hold for 2 to 3 hours. Increase temperature to 220°C (428°F) and hold until approximately 95% of the theoretical Stage 1 methanol is collected.

3. Cool to 150°C (302°F) and add Stage 2 reactants. Increase temperature to 220°C (428°F) and hold for an acid number of 10 ± 3 and an ICI viscosity of 3 ± 0.1 Pa·s (3 ± 1 P) at 125°C (257°F) or a Gardner-Holdt™ viscosity of Z1 at 85 wt% theoretical nonvolatiles in xylene.

4. Cool resin to 140°C (284°F) and add solvent.

Resin properties

Target acid number, mg KOH/g resin	7–13
Calculated hydroxyl number, mg KOH/g resin	210
Determined number average molecular weight (by gel permeation chromatography)	900–1,100
Gardner-Holdt™ viscosity	Z_1
ICI viscosity @ 125°C, P	2–4
Gardner™ color	<1
Calculated nonvolatiles, wt%	85
Solvent	Xylene

High-solids, polyester resin formulation HS-3-4ND based on Eastman NPG™ glycol, Eastman™ purified isophthalic acid (PIA), and Eastman™ DMCD *(Continued)*

Enamel composition

Component[a]	Weight %
HS-3-4ND (85% calculated NV in xylene)	45.0
Hexamethoxymethylmelamine	12.0
Ti-Pure™ R-900 TiO_2	33.0
p-Toluenesulfonic acid catalyst (40% NV in isopropanol)	0.3
Fluorad™ FC-4430 flow control additive (20% NV in Eastman™ EEP solvent)	0.5
Eastman™ MAK	5.2
Eastman™ EEP	2.0
Eastman™ *n*-butyl alcohol	2.0
	100.0

[a]*See Raw Material Suppliers on this page*

Enamel properties

Pigment/binder ratio	40/60
Polyester/melamine ratio	75/25
Determined density, g/L (lb/gal)	1,339 (11.17)
Determined nonvolatiles, wt%	80.7
Determined VOC, g/L (lb/gal)[a]	305 (2.54)
Viscosity, #4 Ford cup, s	20–25

[a]*VOC = Volatile organic content*

Raw material suppliers

Eastman NPG™ glycol	Eastman
Eastman™ DMCD	Eastman
Trimethylolpropane	Celanese, Perstorp
Eastman™ purified isophthalic acid (PIA)	Eastman
Fascat™ 4100 catalyst	Arkema
Fluorad™ FC-4430	3M
Eastman™ MAK (methyl *n*-amyl ketone)	Eastman
Eastman™ EEP	Eastman
Ti-Pure™ R-900 TiO_2	DuPont
Hexamethoxymethyl-melamine	Cytec
Eastman™ *n*-butyl alcohol	Eastman

Cured film properties[1]

Film thickness, microns (mils)	46 (1.8)
Gloss, 60°/20°	92/78
Pencil hardness, cut	2H
Impact resistance, N·m (in.-lb)	
Direct	15.2 (135)
Reverse	9.6 (85)
Solvent resistance, MEK double-rub	200+
Conical mandrel flexibility, 1/8 in.	Pass
Cleveland™ humidity, 48 h @ 60°C (140°F)	
% Gloss retention, 60°/20°	88
Blistering	None
Stain resistance	
Iodine for 30 min	Slight stain
Mustard for 24 h	No stain
Salt spray resistance after 500 h	No creepage
Chemical resistance	
50% NaOH solution for 1 h @ room temperature	No effect
50% H_2SO_4 solution for 1 h @ room temperature	No effect

[1]*Coating applied to 20-gauge cold-rolled steel test panels with Bonderite™ 37 treatment; cure 20 minutes. Baked at 177°C (350°F).*

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