TECHNICAL PRODUCTS

ACS Epoxol® CA118

Zero VOC Coalescent

FORMULARY, PERFORMANCE & TECHNICAL INFORMATION

Revised 03162018

ACS TECHNICAL PRODUCTS

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Contents

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Introduction

Epoxol® CA-118™ is a Zero VOC*, non-phthalate coalescent / plasticizer designed to replace fugitive coalescent in paint and coatings applications. The product is approximately 95% derived from renewable sources as evidenced by ASTM D-6866-12 test results.

*VOC = Volatile Organic Compound. Based on independent lab testing of latex paint using ASTM D6886 used as recommended at up to 10% weight percent based on total paint formulation.

Key Features and Benefits

- Wide polymer compatibility allows “drop-in” reformulation and saves bench time
- Effective Tg suppression lowers MFFT and helps to prevent finished film defects
- Low odor profile promotes finished product consumer acceptance
- Low color, high stability ester structure prevents yellowing
- Very low hazard profile reduces operator and consumer health concerns
- High bio-based content helps to meet sustainability commitments

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Chemical Description

Proprietary ester

Physical Properties

Property	Value	Test
Specific Gravity	0.949-0.955	ASTM D1045
Color	<50	ASTM D1209
Pour Point	6-9°C	ASTM D 6749
Cloud Point	6°C	ASTM D 5773
Boiling point	140 °C @ 0.7 Torr	ACS Technical Services
Flash point	>190 °C	--
VOC*	0	ASTM D6886-14
Bio-based Material	95%	D6866-12/Method-B

*VOC = Volatile Organic Compound. Based on independent lab testing of latex paint using ASTM D6886 used as recommended at up to 10% weight percent based on total paint formulation.

Toxicology and Safety Testing Summary

Test	Result	Standard
Acute Oral Toxicity	LD_{50} > 5,000mg /kg female rats	OPPTS 870.1100 OECD 425
Primary Skin Irritation	Non-irritating	OPPTS 8700.2500 OECD 404
Primary Eye Irritation (Draize)	Minimally irritating All animals free of irritation with 48 h	OPPTS 870.2400 OECD 405
Dermal Sensitization (LLNA)	Negative	OPPTS 870.2600 OECD 429
Reverse Mutation Assay (Ames Test)	Non-mutagenic	OPPTS 870.5100 OECD 471
Ready Biodegradability	Readily biodegradable	OECD 301 D
Aquatic Toxicity, Daphnia	EC_{50} >100 mg/L NOEC 100 mg/L	OECD 202

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Inventory Information

Registry	Status	Country
TSCA	Listed	United States
IECSC	Listed	China
DSL	Listed	Canada
EINECS	Listed	Europe
ECL	Listed	Korea

Solvent Compatibility

Solvent	Compatibility
Acetone	Miscible – clear solution
Diethylene Glycol Methyl Ether (Dowanol™ DM)	Miscible – clear solution
Propylene Glycol n-Butyl Ether (Dowanol™ PnB)	Miscible – clear solution
Propylene Glycol n-Propyl Ether (Dowanol™ PnP)	Miscible – clear solution
Tripropylene Glycol Methyl Ether (Dowanol™ TPM)	Miscible – clear solution
Diethylene Glycol Monoethyl Ether (Ethyl Carbitol)	Miscible – clear solution
Dipropylene Glycol (Proglyde™ DMM)	Miscible – clear solution
Toluene	Miscible – clear solution
Ethanol	Miscible – clear solution
Ethyl Acetate	Miscible – clear solution
Isopropyl Alcohol (IPA)	Miscible – clear solution
Methyl Amyl Ketone (MAK)	Miscible – clear solution
Methyl Ethyl Ketone (MEK)	Miscible – clear solution
Methanol	Miscible – clear solution
Methyl Isobutyl Ketone (MIBK)	Miscible – clear solution
1,3-pentanediol, 2,2,4-trimethyl-, 1-isobutyrate (Texanol™)	Miscible – clear solution
Petroleum Hydrocarbon Naphtha Solvent (Varsol™ 18 Fluid)	Miscible – clear solution
Xylene	Miscible – clear solution

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Solvent Compatibility-Continued

Solvent	Compatibility
Propylene Glycol	Immiscible – 2 layers
Ethylene Glycol	Immiscible – 2 layers
Polyethylene Glycol 200 (Carbowax™ 200)	Immiscible – 2 layers
Polyethylene Glycol 300 (Carbowax™ 300)	Immiscible – 2 layers
Water	Immiscible – 2 layers

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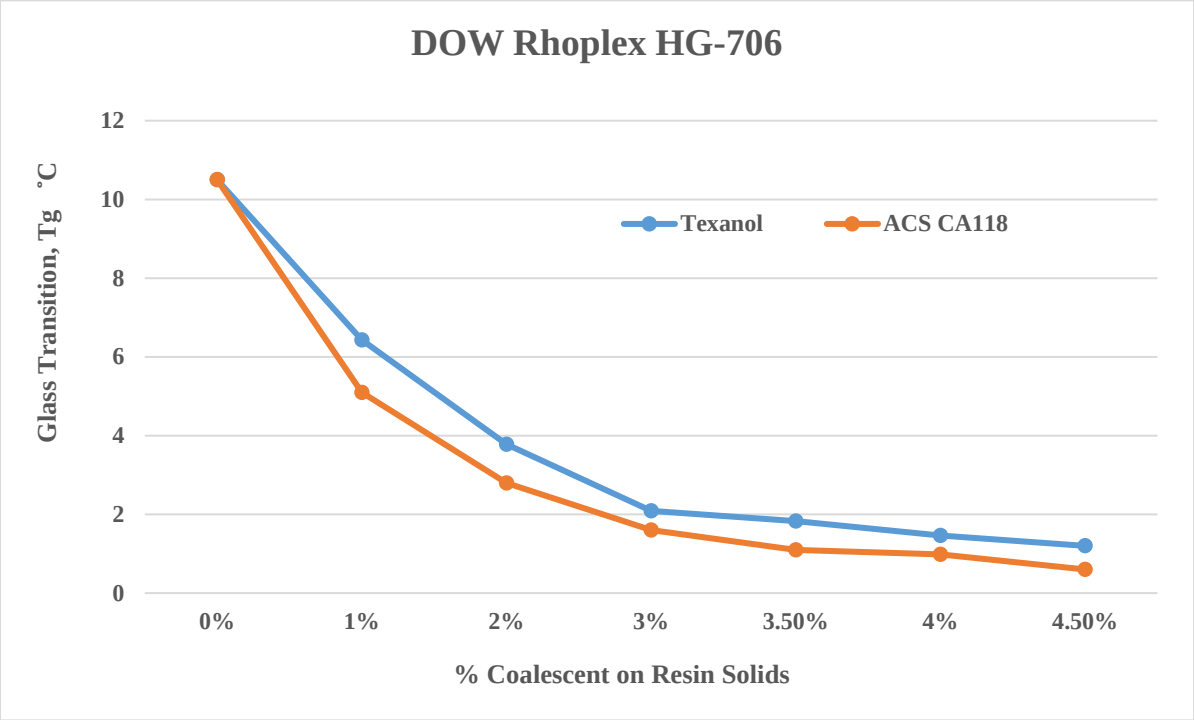
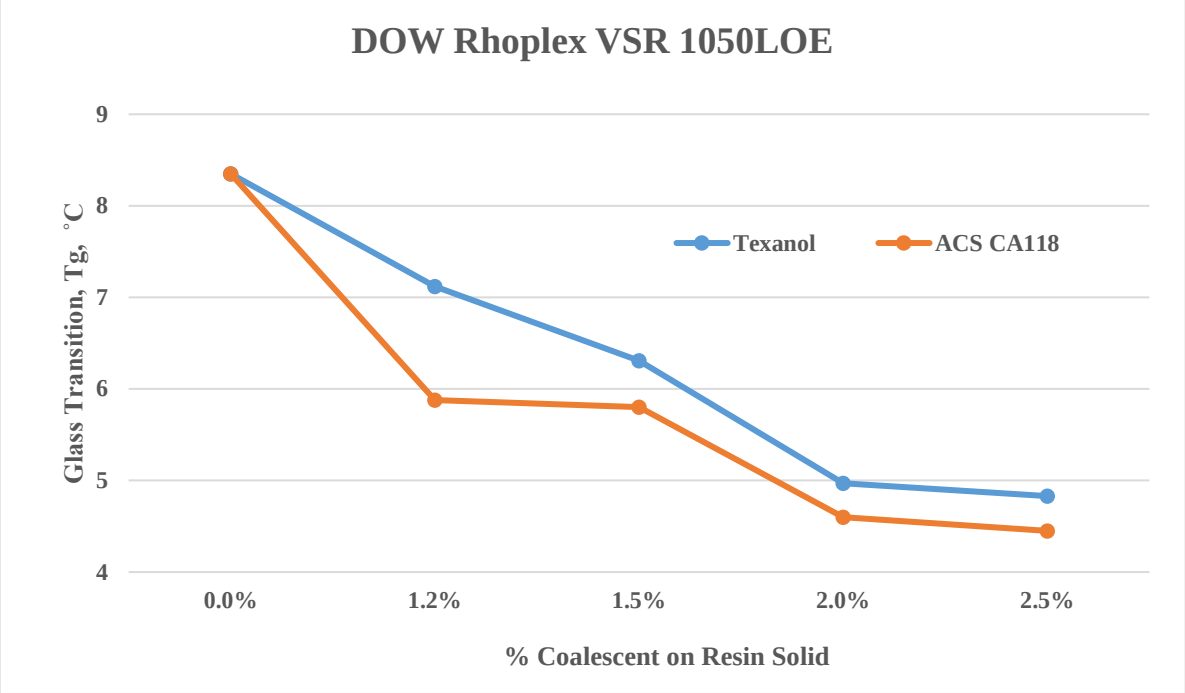
Glass Transition Temperature Studies - DSC Method for Selected Polymers



DOW Rhoplex™ HG-706 is an ambient temperature crosslinking all acrylic emulsion MFFT < 5°C



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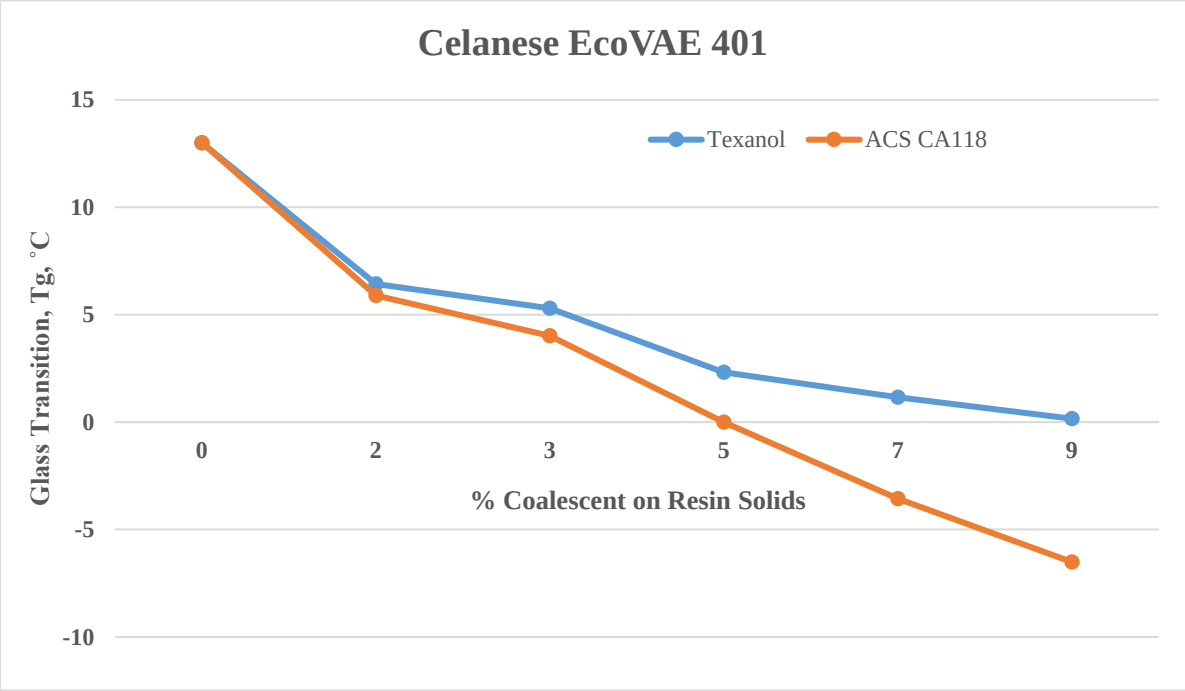
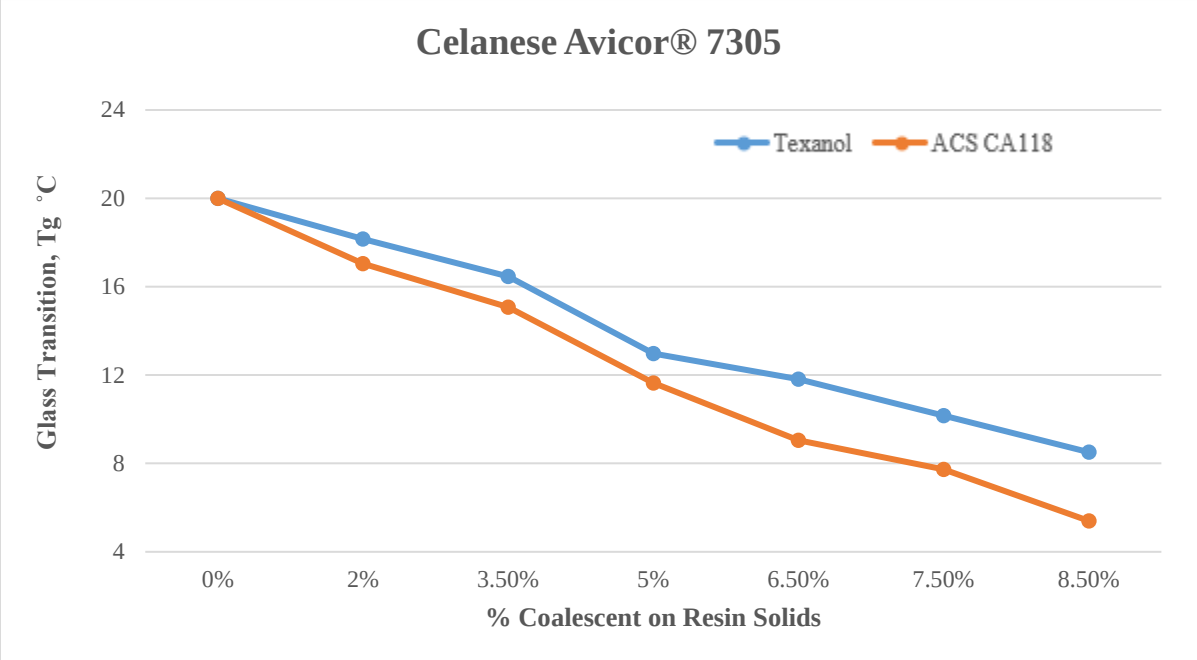
DOW Rhoplex® VSR-1050 LOE is an ambient temperature crosslinking all acrylic emulsion MFFT 2°C



Celanese EcoVAE® 401 is a vinyl acetate ethylene emulsion MFFT 0°C; Tg 13˚ C



Celanese Avicor® 7305 is a Vinyl Acrylic copolymer MFFT 13 ˚C; Tg 20 ˚C

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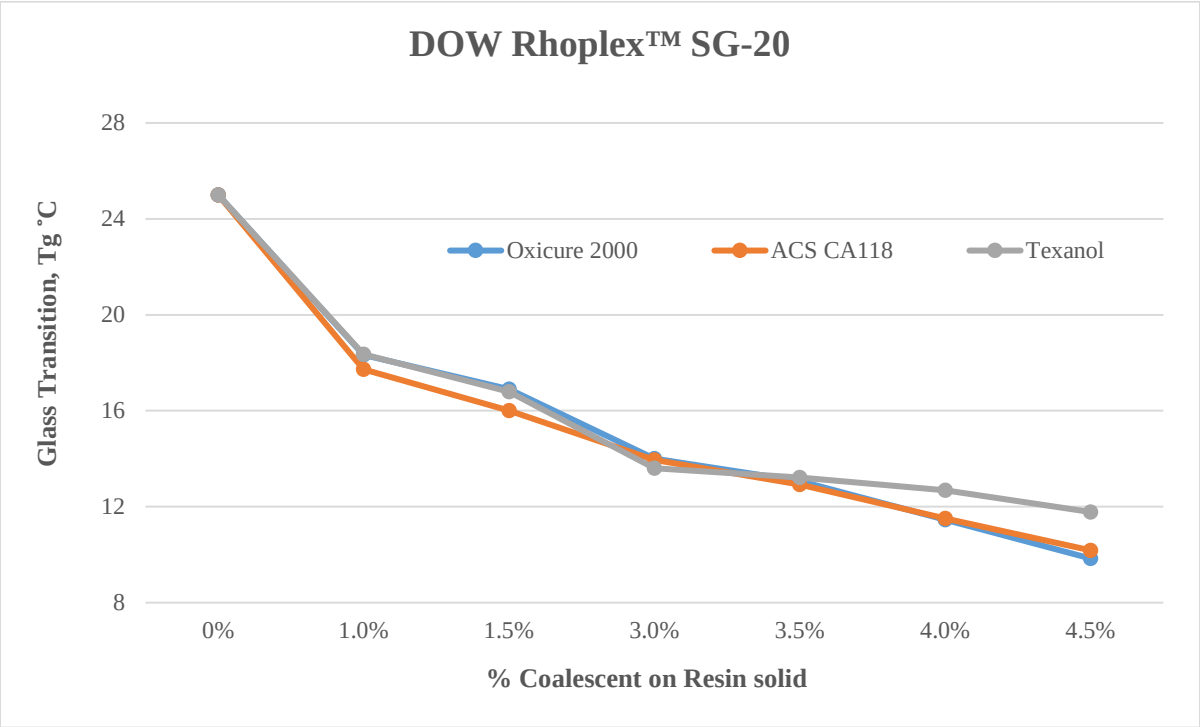

DOW Rhoplex™ SG-20 is a 100% Acrylic Binder

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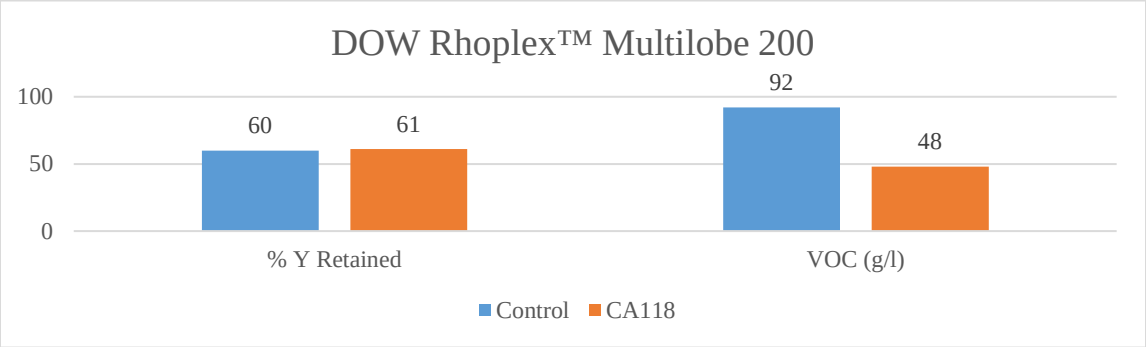
Accelerated Dirt Pick-up Studies for Selected Polymers
Test Method (Modified Dow Method)

1. Apply test and control paint on clean Aluminum Panel (9" x 3") at 6 mils for Exterior Flat and 8 mils for Elastomeric
2. Dry coated panels at normal laboratory room temperature for 7 days.
3. Y Reflectance was measured using X-Rite Color i5 Spectrophotometer before application of Iron Oxide Slurry.
4. Iron Oxide Slurry (50% Mapico 444 in DI Water) was brushed on one half of each panel, dried for an hour at room temperature.
5. Panels were washed under running lukewarm tap water, and wiped off all excess stain with cheesecloth using moderate pressure until no stain is visible on the cheesecloth. Fresh cheesecloth pad was used for each sample.
6. Panels were dried for two hours then Y Reflectance was read on stained portion.
   % Reflectance (Y) retained was reported as:

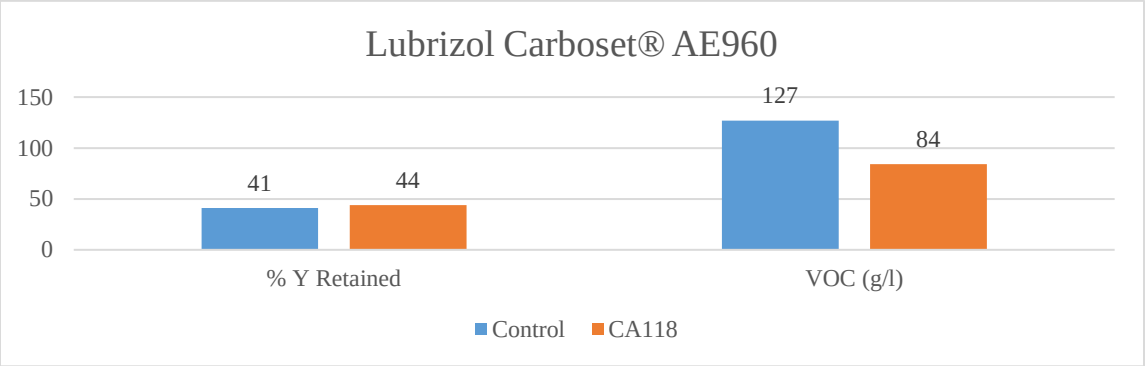
$$\frac{\text{Y Reflectance (stained)}}{\text{Y Reflectance (unstained)}} \times 100 = \%\ \text{Y Retained}$$

A greater value of % Y Retained was equated to better dirt pick-up resistance.

Test Results with VOC Reduction vs. Control Formulation



SCAQMD VOC Compliant Economy Exterior Flat with Rhoplex™ Multilobe 200



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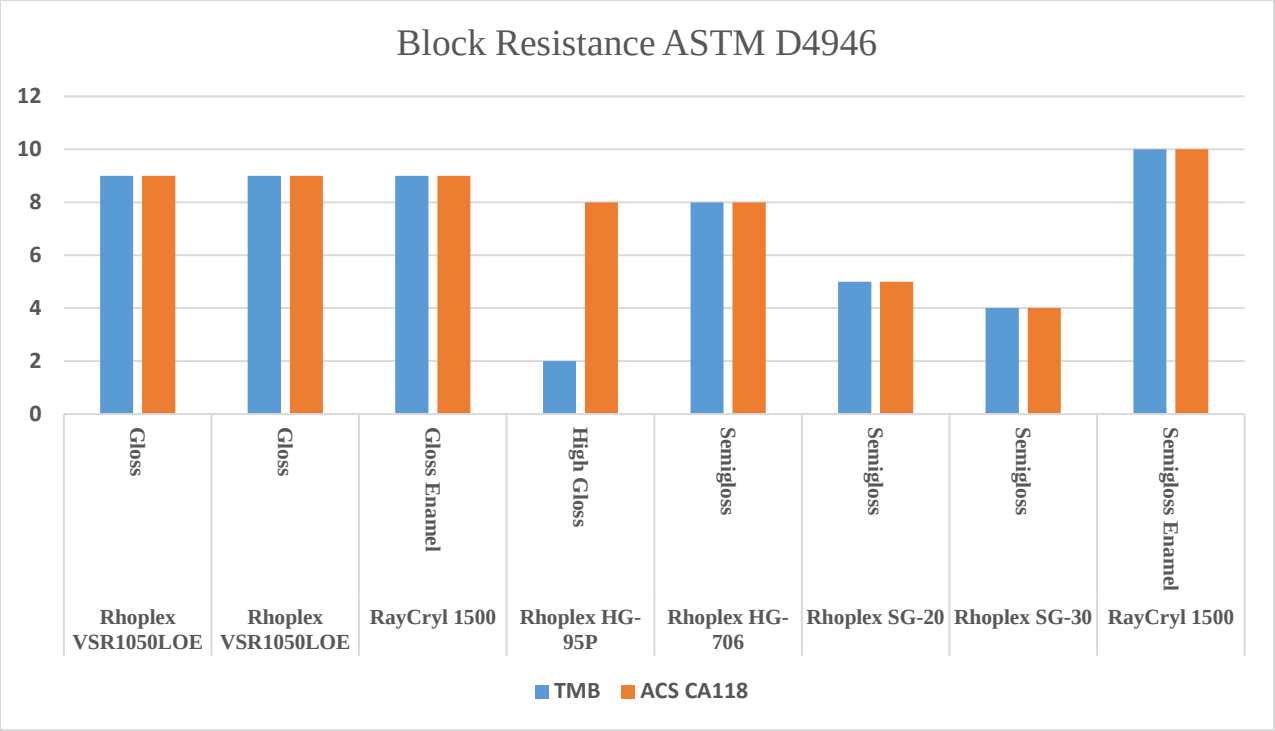
Semi-Elastomeric Masonry Coating with Carboset® AE960

ASTM D4946 Block Resistance for Selected Polymers



Result	Performance
10	Perfect
9	Excellent
8	Very Good
7	Good to Very Good
6	Good to Very Good
5	Fair
4	Poor to Fair
3	Poor
2	Poor
1	Very Poor
0	Very Poor

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Ultra-low VOC High Gloss with SNAP® 728 Acrylic Polymer

ACS 12-1106-GG

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 6½ – 7 Hegman grind			
Water	32.0	3.84	
Byk® 024	1.0	0.12	Byk-Chemie
Coadis™ BR-40	5.0	0.49	Coatex
28% Ammonia	4.0	0.52	
Strodex™ PK0VOC	5.0	0.54	Ashland
Ti-Pure® R-706	200.0	5.92	DuPont
Water	50.0	6.0	
Add following ingredients while mixing to complete the batch.			
SNAP® 728	600.0	67.42	Arkema
Byk® 024	2.0	0.24	Byk-Chemie
Aquaflow™ XLS00	2.0	0.24	Ashland
Coapur™ 2025	8.0	0.96	Coatex
Epoxol® CA118™	**7.65**	**0.96**	**ACS Technical Products**
Water	80.0	9.60	
Adjust Viscosity			
Water	26.2	3.15	
TOTAL	**1022.85**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	0.0	Viscosity, Krebs, ku	110 +- 2
Density, #/gal	10.5	ICI, p	0.7 – 0.8
% Volume Solids	38.47	pH	8.5 – 9.0
% Weight Solids	49.97	Gloss @ 60 deg	77 - 78
% PVC	15.38	Contrast Ratio, 3 mil	98 – 99
		Y Reflectance	95 – 95
		Scrub Resistance	>2400

Notes: Epoxol CA118™ replaced 85% of the Loxanol® EFC 200 in the published formulation

Formula Reference: Arkema Snap® 728 323-00001 ACS 12-1106-GG 0814

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VOC Compliant (100 g/l) Exterior High Gloss with Rhoplex™ HG-95P

ACS 12-1106-Z

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 6½ – 7 Hegman grind			
Propylene Glycol	32.00	3.7	ACS Technical Products
Water	15.00	1.8	
Kathon™ LX 1.5%	1.00	0.12	Dow Chemical
Tamol™ 1124	4.93	0.5	Dow Chemical
Surfynol® 104E	1.00	0.12	Air Products
Igepal® CTA 639W	1.00	0.11	Rhodia
Byk® 022	0.16	0.02	Byk-Chemie
Ti-Pure® R 706	225.00	6.66	DuPont
Add following ingredients while mixing to complete the batch.			
Water	100.0	12.0	
Rhoplex™ HG-95P	519.37	58.75	Dow Chemical
Epoxol® CA118™	**21.90**	**2.75**	**ACS Technical Products**
Byk® 022	0.50	0.06	Byk-Chemie
Water	55.0	6.6	
Acrysol™ RM 2020NPR	25.00	2.87	Dow Chemical
Acrysol™ RM 8W	2.00	0.23	Dow Chemical
Adjust Viscosity			
Water	30.8	3.7	
TOTAL	**1034.66**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	99.23	Viscosity, Krebs, ku	92 + - 2
Density, #/gal	10.3	ICI, p	0.9 – 1.0
% Volume Solids	35.7	pH	8.5 – 9.0
% Weight Solids	48.11	Gloss @ 60 deg.	77 – 78
% PVC	18.65	Contrast Ratio, 3 mil	97 – 98
		Y Reflectance	92 – 93

Note: Epoxol CA118™ replaced 85% of the Texanol™ in the published formulation

Formula Reference: DOW HG95P-4 (81A212 Sep 1998) ACS 12-1106-Z-2 0714

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Low VOC High Quality Extended Gloss with Rhoplex® 1050LOE

ACS 12-1106-L

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 6½ – 7 Hegman grind			
Water	20.9	2.51	
Tamol™ 165A	6.0	0.68	
BYK® 348	2.0	0.23	Byk-Chemie
Foamstar® ST-2434	1.0	0.12	BASF
Minex® 10	7.5	0.35	Unimin
Kronos® 4311 Slurry	336.8	17.27	BASF
Kathon™ LX 1.5%	1.8	0.21	Dow Chemical
Add following ingredients while mixing to complete the batch.			
Rhoplex™ VSR 1050LOE	454.2	51.91	Dow Chemical
Celocor® Opacifier	23.5	2.75	Arkema
Propylene Glycol	9.0	1.04	ADM
Epoxol® CA118™	**3.83**	**0.48**	**ACS Technical Products**
Foamstar® ST-2434	1.0	0.12	BASF
28% Ammonia	0.8	0.10	
Acrysol™ RM 2020NPR	33.0	3.79	Dow Chemical
Acrysol™ SCT-275	5.0	0.58	Dow Chemical
Water	100.0	12.0	
Adjust Viscosity			
Water	48.7	5.85	
TOTAL	**1055.03**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	33.09	Viscosity, Krebs, ku	110 +- 2
Density, #/gal	10.5	ICI, p	1.1 – 1.2
% Volume Solids	35.94	pH	8.5 – 9.0
% Weight Solids	48.91	Gloss @ 60 deg.	64 – 65
% PVC	26.56	Contrast Ratio, 3 mil	97 – 98
		Y Reflectance	94 – 95

Note: Epoxol® CA118™ replaced 85% of the Texanol™ in the published formulation

Formula Reference: Dow Chemical Formulation VSR 1050LOE-2 ACS 12-1106-L 0613

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Low VOC High Quality Unextended Gloss with Rhoplex® VSR 1050LOE

ACS 12-1106-LA

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 6½ – 7 Hegman grind			
Water	70.9	8.51	
Tamol™ 165A	6.0	0.67	Dow Chemical
Propylene Glycol	8.6	0.99	ACS Technical Products
Kronos® 4311 Slurry	341.1	17.49	Kronos®
Kathon™ LX 1.5%	1.8	0.21	Dow Chemical
Add following ingredients while mixing to complete the batch.			
Rhoplex™ VSR 1050LOE	484.0	55.31	Dow Chemical
Propylene Glycol	2.0	0.23	ADM
Epoxol® CA118™	**4.8**	**0.6**	**ACS Technical Products**
Byk® 348	2.0	0.23	Byk-Chemie
Foamstar® ST-2434	2.0	0.25	BASF
28% Ammonia	0.4	0.05	
Acrysol™ RM 2020NPR	30.3	3.45	Dow Chemical
Acrysol™ SCT-275	4.5	0.52	Dow Chemical
Water	80.0	9.6	
Adjust Viscosity			
Water	15.2	1.82	
TOTAL	**1053.6**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	37.17	Viscosity, Krebs, ku	118 +- 2
Density, #/gal	10.5	ICI, p	1.0 – 1.1
% Volume Solids	35.95	pH	8.5 – 9.0
% Weight Solids	49.35	Gloss @ 60 deg.	76 – 77
% PVC	21.9	Contrast Ratio, 3 mil	98 – 99
		Y Reflectance	95 – 96

Formula Reference: Dow Chemical Formulation VSR 1050LOE-1 ACS 12-1106-LA 0613

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Low VOC Gloss Enamel with RayCryl® 1500

ACS 12-1106-NB

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 6½ – 7 Hegman grind			
Water	40.0	4.8	
Byk® 024	0.5	0.06	Byk-Chemie
AMP 95®	1.0	0.13	Angus
Disperbyk® 191	7.50	0.86	Byk-Chemie
Surfynol® CT-111	3.0	0.36	Air Products
Ti-Pure® R-706	225.0	6.66	DuPont
Water	62.98	7.56	
Add following ingredients while mixing to complete the batch.			
RayCryl® 1500	619.0	71.15	Specialty Polymer
Michem® Emulsion 39235	25.0	3.0	Michelman
Epoxol® CA118™	**4.42**	**0.55**	**ACS Technical Products**
Propylene Glycol	6.03	0.7	ADM
Byk® 333	3.0	0.35	Byk-Chemie
Mergal® K12N	2.0	0.23	Troy
Water	10.0	1.2	
Acrysol™ RM202NPR	10.0	1.15	Dow Chemical
Acrysol™ RM-825	2.0	0.23	Dow Chemical
Adjust Viscosity			
Water	8.5	1.02	
TOTAL	**1029.93**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	21.42	Viscosity, Krebs, ku	101 +- 2
Density, #/gal	10.3	ICI, p	0.85 – 0.9
% Volume Solids	38.09	pH	8.5 – 9.0
% Weight Solids	50.67	Gloss @ 60 deg.	77 – 78
% PVC	17.48	Contrast Ratio, 3 mil	98 – 99
		Y Reflectance	94 – 96

Note: Epoxol CA118 replaced 85% of the Texanol™ in the published formulation

Formula Reference: Specialty Polymer TDS Raycryl® 1500 ACS 12-1106-NB 1013

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Low VOC Interior-Exterior Semigloss with Rhoplex™ HG-706

ACS 12-1106-A

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 6½ – 7 Hegman grind			
Water	66.8	8.0	
Kathon™ LX 1.5%	1.5	0.2	Dow Chemical
Tamol™ 2001	5.0	0.6	Dow Chemical
28% Ammonia	1.0	0.1	
Triton™ CF-10	1.0	0.1	Dow Chemical
Byk® 022	1.0	0.1	Dow Chemical
Ti-Pure® R-706	220.0	6.6	DuPont
Add following ingredients while mixing			
Rhoplex™ HG-706	584.1	66.0	Dow Chemical
Epoxol® CA118™	**7.9**	**1.0**	**ACS Technical Products**
Water	49.83	6.0	
Pre-mix then add while mixing			
Triton™ X-100	4.4	0.5	Dow Chemical
Propylene Glycol	6.0	0.7	ADM
Water	8.3	1.0	
Add following ingredients while mixing to complete the batch			
Byk® 024	2.0	0.2	Byk Chemie
Acrysol™ RM 2020NPR	30.0	3.4	Dow Chemical
Acrysol™ SCT 275	3.50	0.4	Dow Chemical
Water	23.25	2.8	
Adjust Viscosity			
Water	18.7	2.24	
TOTAL	**1034.28**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	21.58	Viscosity, Krebs, ku	101 +- 2
Density, #/gal	10.3	ICI, p	1.2 – 1.3
% Volume Solids	36.77	pH	8.5 – 9.0
% Weight Solids	49.08	Gloss @ 60 deg.	76 – 77
% PVC	17.70	Contrast Ratio, 3 mil	96 – 97
		Y Reflectance	93 – 94

Formula Reference: DOW Formulation G-706-8 ACS 12-1106-A 0812

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Ultra-low VOC Interior Semigloss with Rhoplex™ SG-20 Acrylic

ACS 12-1106-B

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 6½ – 7 Hegman grind			
Water	80.29	9.64	
Tamol™ 731A	13.29	1.35	Dow Chemical
Drewplus™ TS-4385	3.32	0.39	Ashland
AMP 95®	1.11	0.14	Angus
Triton™ CF 10	1.66	0.18	Dow Chemical
Ti-Pure® R 706	309.2	9.15	DuPont
Kathon™ LX 1.5%	1.66	0.20	Dow Chemical
Water	22.15	2.66	
Add following ingredients while mixing to complete the batch.			
Rhoplex™ SG-20	575.86	65.44	Dow Chemical
Water	47.33	5.68	
Triton™ GR-7M	5.32	0.63	Dow Chemical
Drewplus™ TS 4386	1.11	0.13	Ashland
Epoxol® CA118™	**8.86**	**1.11**	**ACS Technical Products**
Acrysol™ RM 8W	7.75	0.89	Dow Chemical
Adjust Viscosity			
Water	20.0	2.40	
TOTAL	**1098.91**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	0.18	Viscosity, Krebs, ku	110 +- 2
Density, #/gal	10.9	pH	8.5 – 9.0
% Volume Solids	38.93	Gloss @ 60 deg.	76 - 77
% Weight Solids	53.76	Contrast Ratio, 3 mil	98 – 99
% PVC	23.50	Y Reflectance	95 – 96

Formula Reference: Cargill Suggested Formulation – Rhoplex™ SG-20 with Oxi-cure® 2000 ACS 12-1106-B 0812

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Interior Semigloss Paint with Rhoplex™ SG-30

ACS 12-1106-BB-1

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 6½ – 7 Hegman grind			
Water	70.0	8.40	
Ethylene Glycol	12.0	1.29	
Tamol™ 1124	5.0	0.51	Dow Chemical
Omyacarb® UF	165.0	7.31	Omya
Kathon™ LX 1.5%	1.75	0.21	Dow Chemical
TiO2 Slurry 4311	260.0	13.33	Kronos®
Add ingredients in the following order to complete the batch			
Water	60.0	7.20	Dow Chemical
Rhoplex™ SG-30	440.0	51.19	Dow Chemical
Epoxol® CA118™	**9.58**	**1.20**	**ACS Technical Products**
Aerosol® OT-75	1.5	0.16	Cytec
Byk® 022	2.06	0.25	Byk-Chemie
28% Ammonia	1.5	0.20	
Acrysol™ RM 2020NPR	16.0	1.84	Dow Chemical
Acrysol™ SCT 275	6.0	0.70	Dow Chemical
Water	31.7	3.81	Ashland
Adjust Viscosity			
Water	20.0	2.40	
TOTAL	**1102.09**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	44.30	Viscosity, Krebs, ku	105 +- 2
Density, #/gal	11.0	ICI, p	0.73 – 0.75
% Volume Solids	40.22	pH	8.5 – 9.0
% Weight Solids	54.75	Gloss @ 60 deg.	21 – 22
% PVC	33.09	Contrast Ratio, 3 mil	97 – 98
		Y Reflectance	93 – 94

Formula Reference: ACS 30-1011 ACS 12-1106-BB-1 0714

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Low VOC Exterior Semigloss with Rhoplex™ AC-264

ACS 12-1106-CC

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 6½ – 7 Hegman grind			
Water	83.00	9.96	
Tamol™ 731A	16.10	1.75	Dow Chemical
Triton™ CF-10	2.0	0.22	Dow Chemical
Kathon™ LX 1.5%	2.0	0.24	Dow Chemical
Natrosol™ Plus 330	1.50	0.13	Ashland
Drewplus™ L-475	2.0	0.28	Rhodia
Ti-Pure R®® 706	225.0	6.65	DuPont
Minex® 4	43.4	2.0	Unimin
Add following ingredients while mixing to complete the batch.			
Water	222.91	26.76	
Rhoplex™ AC-264	398.72	45.07	Dow Chemical
Drewplus™ L-475	5.0	0.71	Rhodia
Rozone™ 2000	3.0	0.33	Dow Chemical
Epoxol® CA118™	**12.92**	**1.62**	**ACS Technical Products**
28% Ammonia	2.0	0.26	Dow Chemical
Acrysol™ RM8W	5.98	0.69	Dow Chemical
Acrysol™ RM 2020NPR	7.11	0.82	Dow Chemical
Adjust Viscosity			
Water	20.9	2.51	
TOTAL	**1053.54**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	18.42	Viscosity, Krebs, ku	93 +- 2
Density, #/gal	10.5	ICI, p	0.85 – 0.87
% Volume Solids	37.74	pH	8.5 – 9.0
% Weight Solids	50.88	Gloss @ 60 deg.	27 – 28
% PVC	23.28	Contrast Ratio, 3 mil	97 – 98
		Y Reflectance	93 - 94

Formula Reference: ACS 12-1106-CC 0614

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Low VOC Interior Semigloss with EcoVAE® 405

ACS 12-1106-IB

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 6½ – 7 Hegman grind			
Water	250.00	30.01	
Propylene Glycol	10.00	1.16	ADM
Natrosol™ Plus 330	2.00	0.17	Ashland
AMP 95®	2.00	0.25	Angus
Acticide® BW-20	1.10	0.12	Thor
Foamaster® ST 2438	2.50	0.32	BASF
Tamol™ 1124	2.70	0.27	Dow Chemical
Carbowet® 106	2.00	0.25	Air Products
TiO2 Kronos® 2310	235.00	7.04	Kronos®
Burgess No. 28	30.00	1.37	Burgess
Add following ingredients while mixing to complete the batch.			
Water	30.0	3.6	
EcoVAE® 405	445.9	49.82	Celanese
Epoxol® CA118™	**12.00**	**1.51**	**ACS Technical Products**
Acrysol™ RM 825	10.00	1.15	Dow Chemical
Acrysol™ RM 2020 NPR	12.00	1.38	Dow Chemical
Foamaster® ST 2438	2.50	0.32	BASF
Adjust Viscosity			
Water	10.6	1.27	
TOTAL	**1060.29**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	36.35	Viscosity, Krebs, ku	90 +- 2
Density, #/gal	10.6	ICI, p	1.0 – 1.1
% Volume Solids	37.28	pH	8.5 – 9.0
% Weight Solids	50.87	Gloss @ 60 deg.	55 – 56
% PVC	23.01	Contrast Ratio, 3 mil	97 – 98
		Y Reflectance	93 – 94
		Scrub Resistance	>4000

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Formula Reference: Celanese Formulation 09-SG25023 ACS 12-1106-IB 0613

Low VOC Interior Semigloss with EcoVAE® 401

ACS 12-1106-JB

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 6½ – 7 Hegman grind			
Water	250.00	30.01	
Propylene Glycol	5.0	0.58	ADM
Natrosol™ Plus 330	2.5	0.22	Ashland
AMP 95®	2.2	0.28	Angus
Acticide® BW-20	1.1	0.12	Thor
Foamaster® ST 2438	2.5	0.32	BASF
Tamol™ 1124	3.0	0.30	Dow Chemical
Carbowet® 106	2.0	0.25	Air Products
TiO2 Kronos® 2310	250.0	7.49	Kronos®
Burgess No. 28	50.0	2.28	Burgess
Camel-Wite®	25.0	1.11	IMERYS
Add following ingredients while mixing to complete the batch.			
Water	40.0	4.80	
EcoVAE® 401	408.00	45.59	Celanese
Epoxol® CA118™	**5.0**	**0.63**	**ACS Technical Products**
Acrysol™ RM 825	12.0	1.38	Dow Chemical
Acrysol™ RM 2020 NPR	14.0	1.61	Dow Chemical
Foamaster® ST 2438	2.50	0.32	BASF
Adjust Viscosity			
Water	22.75	2.73	
TOTAL	**1097.55**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	22.75	Viscosity, Krebs, ku	100 +- 2
Density, #/gal	10.9	ICI, p	1.2 – 1.3
% Volume Solids	36.83	pH	8.5 – 9.0
% Weight Solids	52.23	Gloss @ 60 deg.	37 – 38
% PVC	30.12	Contrast Ratio, 3 mil	96 – 97
		Y Reflectance	94 – 95
		Scrub Resistance	>5000

Formula Reference: Celanese Formulation 09-SG32004 ACS 12-1106-JB 0613

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Low VOC Semigloss Enamel with RayCryl® 1500

ACS 12-1106-NA-1

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 6½ – 7 Hegman grind			
Water	66.64	8.0	
Tamol™ 165A	9.25	1.05	Dow Chemical
Triton™ CF-10	2.0	0.22	Dow Chemical
Propylene Glycol	6.46	0.75	ADM
Optiflo®-L1400	7.50	0.86	Byk-Chemie
Byk® 022	2.0	0.24	Byk-Chemie
Ti-Pure® R-706	250.0	7.4	DuPont
Omyacarb® UF	30.0	1.33	Omya
Water	49.52	5.94	
Add following ingredients while mixing to complete the batch.			
RayCryl® 1500	600.00	68.97	Specialty Polymer
Optifilm™ Enhancer 400	11.6	1.44	Eastman Chemical
Epoxol® CA118™	**7.75**	**0.97**	**ACS Technical Products**
Byk® 346	2.0	0.24	Byk-Chemie
28% Ammonia	1.0	0.13	
Mergal® K12N	2.0	0.23	Troy
Water	10.66	1.28	Dow Chemical
Optiflo® H3300VF	0.75	0.09	Byk-Chemie
Adjust Viscosity			
Water	7.2	0.86	
TOTAL	**1066.33**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	21.32	Viscosity, Krebs, ku	99 +- 2
Density, #/gal	10.7	ICI, p	0.8 – 0.9
% Volume Solids	40.66	pH	8.5 – 9.0
% Weight Solids	53.62	Gloss @ 60 deg.	58 - 59
% PVC	21.46	Contrast Ratio, 3 mil	98 – 99
		Y Reflectance	94 – 95

Formula Reference: Specialty Polymer TDS Raycryl® 1500 ACS 12-1106-NA-1 1213

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Low VOC Eggshell Interior Paint with EcoVAE® 405

ACS 12-1106-I

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 5 – 6 Hegman grind			
Water	250.00	30.01	
Propylene Glycol	10.00	1.16	ADM
Natrosol™ 330 Plus	2.2	0.19	Ashland
AMP-95	3.00	0.38	Angus
Acticide™ BW-20	1.10	0.12	Thor
Foamstar® A-38	2.50	0.32	BASF
Tamol™ 1124	3.60	0.37	Dow Chemical
Carbowet® 106	3.00	0.37	Air Products
Tronox® CR 826	200.00	5.99	Tronox
Optiwhite MX®	75.00	4.08	Burgess
Minex® 7	50.00	2.3	Unimin
Add following ingredients while mixing to complete the batch			
Water	80.72	9.69	
EcoVAE® 405	375.00	41.90	Celanese
Epoxol® CA118™	**10.00**	**1.26**	**ACS Technical Products**
Acrysol™ RM 825	14.00	1.61	Dow Chemical
Foamstar® A-38	2.50	0.32	BASF
TOTAL	**1082.62**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	38.75	Viscosity, Krebs, ku	93 +- 2
Density, #/gal	10.82	ICI, p	1.0 – 1.1
% Volume Solids	36.94	pH	8.5 -9.0
% Weight Solids	51.69	Gloss @ 60 deg.	4 – 5
% PVC	34.01	Contrast Ratio, 3 mil	97 – 98
		Y Reflectance	93 – 94
		Scrub Resistance	>5000

Formula Reference: Celanese Formulation 09-ES36026 ACS 12-1106-I 0613

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Low VOC Interior Quality Satin with Rhoplex™ VSR 1050LOE

ACS 12-1106-LB

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 5 – 6 Hegman grind			
Water	10.5	1.26	
Tamol™ 165A	3.6	0.41	Dow Chemical
Kronos® TiO2 Slurry 4311	267.1	13.7	Kronos®
Minex® 10	50.0	2.30	Unimin
Foamstar® ST-2434	1.0	0.13	BASF
Kathon™ LX 1.5%	1.8	0.21	Dow Chemical
Add following ingredients while mixing to complete the batch			
Water	50.0	6.0	
Rhoplex™ VSR-1050LOE	472.3	53.98	Dow Chemical
Celocor® Opacifier	49.2	5.75	Arkema
Propylene Glycol	10.8	1.25	ADM
Epoxol® CA118™	**4.6**	**0.58**	**ACS Technical Products**
Byk® 348	1.6	0.2	Byk Chemie
Ammonia (28%)	0.4	0.05	
Acrysol™ RM-2020NPR	26.0	3.00	Dow Chemical
Acrysol™ SCT 275	2.2	0.26	Dow Chemical
Water	80.0	9.61	
Adjust viscosity			
Water	11.1	1.32	
TOTAL	**1042.2**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	35.11	Viscosity, Krebs, ku	100 +- 2
Density, #/gal	10.44	ICI, p	1.0 – 1.1
% Volume Solids	38.58	pH	8.5 – 9.0
% Weight Solids	49.81	Gloss @ 60 deg.	34 – 35
% PVC	29.69	Contrast Ratio, 3 mil	98 – 99
		Y Reflectance	94 - 95

Formula Reference: Dow Chemical Formula VSR 1050LOE-3 ACS 12-1106-LB 0613

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Low VOC Interior Satin Paint with Encor® 379G

ACS 12-1106-H

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 5 – 6 Hegman grind			
Water	108.3	13.0	
KTPP	1.0	0.13	
Rhodoline® 111	5.0	0.48	Rhodia
Triton™ CF-10	3.0	0.33	Dow Chemical
Drewplus™ L475	2.0	0.26	Ashland
Kathon™ LX 1.5%	1.5	0.18	Dow Chemical
Sodium Carbonate	3.0	0.39	
Ti-Pure® R960	220.0	6.76	DuPont
Atomite®	60.0	2.66	IMERYS
Water	83.3	10.0	
Add following ingredients while mixing to complete the batch			
Encor® 379G	471.3	52.08	Arkema
Epoxol® CA118™	**8.0**	**1.0**	**ACS Technical Products**
Drewplus™ L475	2.0	0.26	Ashland
Polyphobe™ TR 116	2.3	0.25	Coatex
Polyphobe™ TR 117	17.4	1.9	Coatex
Water	60.0	6.81	
Adjust Viscosity			
Water	25.95	2.94	
TOTAL	**1074.05**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	6.60	Viscosity, ku	66.+- 2
Density, #/gal	11.28	pH	8.0 – 8.5
% Volume Solids	37.6	Gloss @ 60 deg.	18 - 19
% Weight Solids	52.2	Contrast Ratio, 3 mil	95 - 96
% PVC	25.06	Y Reflectance	91 – 92

Formula Reference: ACS 30-1011 ACS 12-1106-H 1212

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Ultra-low VOC Vinyl Acrylic Satin Paint with Encor® 379G

ACS 12-1106-WA

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 5 – 6 Hegman grind			
Water	191.42	22.98	
ADM 6200™	5.03	0.55	ADM
AMP 95®	3.0	0.38	Angus
Kathon™ LX 1.5%	1.5	0.18	Dow Chemical
ADM 1000™	1.28	0.15	ADM
Drewplus™ L475	2.03	0.27	Ashland
Natrosol™ 330 Plus	1.50	0.13	Ashland
Ti-Pure® R960	220.0	6.76	DuPont
Atomite	60.0	2.66	IMERYS
Add following ingredients while mixing to complete the batch			
Encor® 379G	471.23	52.08	Arkema
Epoxol® CA118™	**8.0**	**1.0**	**ACS Technical Products**
Drewplus™ L475	2.46	0.32	Ashland
Polyphobe® TR 116	4.28	0.47	Coatex
Polyphobe® TR 117	4.28	0.47	Coatex
Water	60.0	7.2	
AMP 95®	0.75	0.1	Angus
Adjust Viscosity			
Water	34.05	4.32	
TOTAL	**1070.81**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	6.46	Viscosity, Krebs, ku	95 +- 2
Density, #/gal	10.7	ICI, p	0.85 – 0.90
% Volume Solids	37.77	pH	8.5 – 9.0
% Weight Solids	52.31	Gloss @ 60 deg	28.3
% PVC	25.29	Contrast Ratio, 3 mil	97 – 98
		Y Reflectance	94 - 95

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Formula Reference: ACS 12-1183-13 ACS 12-1106-WA 0114

SCAQMD VOC Compliant Economy Exterior Flat with Rhoplex™ Multilobe 200

ACS 12-1106 AA-1

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 3 Hegman grind			
Natrosol™ 250MHR 2.5% in Water	100.00	11.92	Ashland
Ethylene Glycol	13.0	1.40	
Kathon™ LX 1.5%	1.8	0.21	Dow Chemical
Tamol™ 1124	5.3	0.54	Dow Chemical
Triton™ CF 10	1.0	0.11	Dow Chemical
Rhodoline® 643	2.0	0.28	Rhodia
Ti-Pure® R-902	175.0	5.24	DuPont
Minex® 4	280.0	12.9	Unimin
Water	49.0	5.88	
Add following ingredients while mixing to complete the batch			
Rhoplex™ Multilobe 200	295.0	33.26	Dow Chemical
Epoxol® CA118™	**7.9**	**0.99**	**ACS Technical Products**
Rhodoline® 643	2.0	0.28	Rhodia
28% Ammonia	1.6	0.21	
Natrosol™ 250MHR 2.5% soln.	140.0	16.7	Dow Chemical
Water	70.0	8.40	
Adjust viscosity			
Water	13.9	1.64	
TOTAL	**1157.5**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	48.14	Viscosity, Krebs, ku	97 +- 2
Density, #/gal	11.6	ICI, p	0.9 – 1.0
% Volume Solids	37.04	pH	8.5 – 9.0
% Weight Solids	54.64	Gloss @ 85 deg	1.6 – 2.0
% PVC	50.41	Contrast Ratio, 3 mil	96 - 97
		Y Reflectance	91 - 92

Notes: To meet VOC of <50 g/L, Ethylene Glycol was decreased from 20 to 13 lbs./gal, without affecting open time, freeze thaw and drying time

Formula Reference: DOW Formulation W-200-3 ACS 12-1106-AA-1 0514

SCAQMD VOC Compliant Quality Economy Flat with Rhoplex™ AC-264

ACS 12-1106-CCB

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 3 Hegman grind			
Water	200.0	24.00	
Tamol™ 731A	12.9	1.40	Dow Chemical
Rhodoline® 643	2.0	0.26	Rhodia
Ethylene Glycol	13.5	1.45	
Natrosol™ 250 MHR	2.5	0.22	Ashland
Kathon™ LX 1.5%	2.0	0.24	Dow Chemical
Ti-Pure® R-902	180.0	5.40	DuPont
Minex® 4	275.0	12.68	Unimin
Attagel® 50	5.0	0.25	BASF
Add following ingredients while mixing			
Rhoplex™ AC-264	260.0	29.38	Dow Chemical
Rhodoline® 643	4.0	0.52	Rhodia
Epoxol® CA118™	**11.80**	**1.49**	**ACS Technical Products**
28% Ammonia	2.2	0.29	
Water	48.79	5.85	
Pre-mix before adding			
Water	131.0	15.73	
Natrosol™ 250 MHR	3.30	0.29	Ashland
Adjust viscosity			
Water	4.0	0.48	
TOTAL	**1157.99**	**100.0**	

Physical Constants	
VOC, g/L	49.42
Density, #/gal	11.58
% Volume Solids	37.97
% Weight Solids	55.37
PVC, %	48.92

Performance Properties	
Viscosity, Krebs, ku	96 +- 2
ICI, p	0.8 – 0.9
pH	8.5 – 9.5
Gloss @ 85 deg	1.5 – 2.0
Contrast Ratio, 3 mil	96 - 97
Y Reflectance	91 - 92

Notes: To meet VOC of <50 g/L, Ethylene Glycol was decreased from 18 to 13.5 lbs. /gal, without affecting open time, freeze thaw and drying time.

Formula Reference: DOW Formulation W-264-9 ACS 12-1106-CCB 0614

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SCAQMD VOC Compliant High Quality Flat with Rhoplex™ VSR 1050 LOE

ACS 12-1106-LE-1

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 3 Hegman grind			
Natrosol™ 250MHR 2% in Water	100.8	12.02	Aqualon
Water	55.7	6.69	
Tamol™ 165A	17.6	2.00	Dow Chemical
Surfynol® CT111	2.2	0.24	Air Products
Foamaster® SA-3	1.0	0.14	BASF
Kathon™ LX 1.5%	1.8	0.21	Dow Chemical
Ti-Pure® R-902+	200.0	5.99	DuPont
Minex® 4	175.0	8.06	Unimin Specialty Chemicals
Diafil® 525	12.5	0.65	IMERYS
Add following ingredients while mixing to complete the batch			
Water	37.7	4.53	
Rhoplex™ VSR 1050LOE	375.0	42.86	Dow Chemical
Celocor™ Opacifier	48.7	5.69	Arkema Inc.
Foamaster® SA-3	1.5	0.21	BASF
Epoxol® CA118™	**4.0**	**0.50**	**ACS Technical Products**
Propylene Glycol	12.2	1.41	ADM
Acrysol™ RM-2020NPR	17.5	2.00	Dow Chemical
Adjust viscosity			
Water	56.5	6.78	
TOTAL	**1119.7**	**100.0**	

Physical Constants	
VOC, g/L	38.42
Density, #/gal	11.20
% Volume Solids	39.41
% Weight Solids	53.93
PVC, %	45.38

Performance Properties	
Viscosity, Krebs, ku	102 +- 2
ICI, p	1.0 – 1.2
pH	8.5 – 9.0
Gloss @ 85 deg	4.0 – 4.5
Contrast Ratio, 3 mil	98 – 99
Y Reflectance	92 – 93

Notes: Triton™ CF-10 was replaced with Sulfonyl® CT-111 to improve scrub resistance. It also decreased foam formation with better open time.

Formula Reference: DOW Formulation VSR 1050LOE-4 ACS 12-1106-LE-1 0414

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Ultra Low VOC Flat Enamel with RayCryl® 1500

ACS 12-1106-N

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 3 Hegman grind			
Water	208.0	24.97	
Natrosol 330 PA	4.0	0.35	Ashland
28% Ammonia	1.0	0.13	
Byk® 024	1.0	0.14	Byk Chemie
Tamol™ 681	6.5	0.68	Dow Chemical
Triton™ CF-10	2.0	0.22	Dow Chemical
Ti-Pure® R-902	200.0	5.99	DuPont USA
Minex® 4	150.0	6.91	Unimin
Optiwhite™	50.0	2.72	Burgess
Celite® 281	15.0	0.78	IMERYS
Water	9.12	1.09	
Add following ingredients while mixing to complete the batch			
RayCryl® 1500	450.0	50.85	Specialty Polymer
Byk® 035	1.0	0.14	Byk Chemie
Epoxol® CA118™	**12.33**	**1.55**	**ACS Technical Products**
Acrysol™ RM -W	0.5	0.06	Dow Chemical
Water	20.0	2.40	
Mergal® K12N	2.0	0.23	Troy Corp
Adjust viscosity			
Water	6.65	0.80	
TOTAL	**1139.09**	**100.00**	

Physical Constants	
VOC, g/L	4.73
Density, #/gal	11.4
% Volume Solids	42.68
% Weight Solids	58.09
PVC, %	39.25

Performance Properties	
Viscosity, Krebs, ku	109 +- 2
ICI, p	0.8 – 0.9
pH	8.5 - 9
Gloss @ 85 deg	3 - 4
Contrast Ratio, 3 mil	97 – 98
Y Reflectance	92 – 93

Notes: Epoxol® CA118 replaced 85% of the Texanol™ in the published formulation.
Formula Reference: Specialty Polymer TDS RayCryl® 1500 ACS 12-1106-N 1113

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SCAQMD VOC Compliant Quality Interior Flat with EcoVAE® 405

ACS 12-1106-IA

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 3 Hegman grind			
Water	275.60	33.09	
Natrosol™ Plus 330	2.50	0.22	Ashland
AMP 95®	4.50	0.57	Angus
Acticide®BW-20	1.10	0.12	Thor
Foamstar® A-38	2.00	0.25	BASF
Tamol™ 1124	7.00	0.71	Dow Chemical
Carbowet® DC01	2.00	0.24	Air Products
Tronox® CR 828	195.00	5.70	Tronox
#10 White	100.00	4.44	IMERYS
Optiwhite™ MX	75.00	4.08	Burgess
Minex® 7	100.00	4.61	Unimin
Diafil® 525	30.00	1.56	IMERYS
Add following ingredients while mixing to complete the batch			
Water	70.0	8.4	
EcoVAE® 405	290.00	32.4	Celanese
Epoxol® CA118™	**8.00**	**1.0**	**ACS Technical Products**
Polyphobe® TR 116	9.00	0.98	Coatex
Foamstar® A-38	2.00	0.25	BASF
Adjust viscosity			
Water	11.40	1.37	
TOTAL	**1185.1**	**100.00**	

Physical Constants	
VOC, g/L	0.00
Density, #/gal	11.85
% Volume Solids	39.17
% Weight Solids	57.83
PVC, %	52.61

Performance Properties	
Viscosity, Krebs, ku	116 +- 2
ICI, p	1.9 – 2.1
pH	8.5 – 9.0
Gloss @ 85 deg.	2 – 2.5
Contrast Ratio, 3 mil	97 – 98
Y Reflectance	89 -90
Scrub Resistance	>1800

Formula Reference: Celanese Formulation 09-FL55008 ACS 12-1106-IA 0613

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SCAQMD VOC Compliant Interior Flat ACS 6200™ and EcoVAE® 401

ACS 12-1106-JA

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing. Adjust pH to at least 9 before adding the pigments, then disperse to 3 Hegman grind			
Water	270.00	32.41	
ACS 6200™	3.75	0.18	ADM
AMP 95®	4.50	0.57	Angus
Nuosept™ 95	1.10	0.12	Ashland
Drewplus™ L-475	1.50	0.20	Ashland
Natrosol™ 250 MBR	2.00	0.18	Ashland
TiO2 CR 826	100.00	3.00	Tronox
#10 White	110.00	4.88	IMERYS
Minex®® 4	110.00	5.07	Unimin
Optiwhite™ MX	100.00	5.45	Burgess
Diafil 525	50.00	2.6	IMERYS
Add following ingredients while mixing to complete the batch			
Water	200.0	24.01	
EcoVAE® 401	155.00	17.32	Celanese
Epoxol® CA118™	**4.60**	**0.58**	**ACS Technical Products**
Polyphobe® TR 115	6.40	0.70	Coatex
Drewplus™ L-475	1.50	0.20	Ashland
Adjust Viscosity			
Water	19.35	2.32	
TOTAL	**1139.70**	**100.00**	

Physical Constants	
VOC, g/L	2.17
Density, #/gal	11.40
% Volume Solids	31.08
% Weight Solids	50.22
PVC, %	68.13

Performance Properties	
Viscosity, Krebs, ku /	106 +- 2
ICI, p	0.5 – 0.6
pH	9 – 9.5
Gloss @ 85 deg.	2.0 – 2.2
Contrast Ratio, 3 mil	98 - 99
Scrub Resistance	>150
Color Acceptance (CPS Color)	9 – 10

Note: Replacement of Tamol™ 1124 Dispersant and Carbowet® DC01 Surfactant with ADM 6200™ Dispersant on solid-solid basis. ADM 6200™ improved the scrub resistance.

Formula Reference: Celanese Formulation 09-FL70009 ACS 12-1106-JA 0613

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SCAQMD VOC Compliant Quality Interior Flat with Avicor® 7305

ACS 12-1106-C

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 3 Hegman grind			
Water	230.0	27.61	
Natrosol™ Plus 330	2.0	0.17	Ashland
AMP 95®	3.0	0.38	Angus
Nuosept™ 95	1.1	0.12	Ashland
Drewplus™ L-475	2.5	0.33	Ashland
Tamol™ 1124	9.5	0.96	Dow Chemical
Carbowet® DC01	3.0	0.36	Air Products
Tronox® CR 826	195.0	5.84	Tronox
#10 White	100.0	4.44	IMERYS
Minex® 4	100.0	4.61	Unimin
Optiwhite™ MX	75.0	4.08	Burgess
Diafil® 525	30.0	1.56	IMERYS
Add following ingredients while mixing			
Avicor® 7305 Emulsion	280.0	31.06	Celanese
Epoxol® CA118™	**12.0**	**1.51**	**ACS Technical Products**
Drewplus™ L-475	2.5	0.33	Ashland
Premix before adding, Continue mixing to complete the batch			
Water	120.0	14.41	
Natrosol™ Plus 330	3.0	0.26	Ashland
Adjust viscosity			
Water	16.3	1.96	
TOTAL	**1184.90**	**100.00**	

Physical Constants	
VOC, g/L	0.19
Density, #/gal	11.83
% Volume Solids	38.87
% Weight Solids	57.27
PVC, %	53.94

Performance Properties	
Viscosity, Krebs, ku	92 +- 2
ICI, p	0.8 – 0.9
pH	8.5 – 9.0
Gloss @ 85 deg	1.3 – 1.5
Contrast Ratio, 3 mil	95 - 96
Y Reflectance	92 - 93

Formula Reference: Celanese Formulation 09-FL56029 ACS 12-1106-C 0812

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SCAQMD VOC Compliant Quality Interior Flat ACS 6200™ and Avicor® 7305

ACS 12-1106-D

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing. Adjust pH to at least 9 before adding the pigments, then disperse to 3 Hegman grind			
Water	250.0	30.01	
ADM 6200™	2.38	0.26	ADM
ADM 1500™	2.38	0.27	ADM
Natrosol™ Plus 330	2.0	0.17	Ashland
Nuosept™ 95	1.1	0.12	Ashland
Drewplus™ L-475	2.5	0.33	Ashland
AMP 95®	3.0	0.38	Angus
Tronox® CR 826	195.0	5.84	Tronox
#10 White	100.0	4.44	IMERYS
Minex®® 4	100.0	4.61	Unimin
Optiwhite™ MX	75.0	4.08	Burgess
Diafil 525	30.0	1.63	IMERYS
Add following ingredients while mixing			
Avicor® 7305 Emulsion	280.0	31.06	Celanese
Epoxol® CA118™	**12.0**	**1.51**	**ACS Technical Products**
Drewplus™ L-475	2.5	0.33	Ashland
Premix before adding, Continue mixing to complete the batch			
Water	120.0	14.41	
Natrosol™ Plus 330	3.0	0.26	Ashland
Adjust viscosity			
Water	3.0	0.36	
TOTAL	**1183.86**	**100.00**	

Physical Constants	
VOC, g/L	0.19
Density, #/gal	11.83
% Volume Solids	38.92
% Weight Solids	57.29
PVC, %	53.87

Performance Properties	
Viscosity, Krebs, ku /	92 +- 2
ICI, p	0.8 – 0.9
pH	8.5 – 9.0
Gloss @ 85 deg	1.2 – 1.5
Contrast Ratio, 3 mil	95 - 96
Y Reflectance	92 – 93
Color Acceptance (CPS Colors)	9 – 10

Notes: Replacing Tamol™ 1124 Dispersant with ADM 6200™/ACS 1500™ on a solid-solid basis, improved the scrub resistance.

Formula Reference: Celanese Formulation 09-FL56029 ACS 12-1102-4 ACS 12-1106-D 0812

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SCAQMD VOC Compliant Interior Flat with ENCOR® 379G

ACS 12-1106-GC

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 3 Hegman grind			
Water	445.0	53.42	
Natrosol™ Plus 330	6.0	0.52	Ashland
Proxel™ GXL	1.0	0.11	Lonza
Tamol™ 731A	12.0	1.30	Dow Chemical
Igepal® CO-630	2.2	0.25	Rhodia
AMP 95®	2.5	0.32	Angus
Drewplus™ L475	2.0	0.26	Ashland
Ti-Pure® R931	200.0	6.66	DuPont
Satintone® W	100.0	4.56	BASF
Snowflake®	100.0	4.43	IMERYS
Celite® 281	25.0	1.30	World Minerals
Attagel® 50	10.0	0.50	BASF
Add following ingredients while mixing to complete the batch			
Water	30.0	3.60	
ENCOR® 379G	167.93	18.56	Arkema
Ethylene Glycol	7.37	0.82	
Epoxol® CA118™	**2.72**	**0.43**	**ACS Technical Products**
Drewplus™ L-475	2.0	0.26	Ashland
Adjust viscosity			
Water	23.5	2.82	
TOTAL	**1139.22**	**98.78**	

Physical Constants		Performance Properties	
VOC, g/L	32.40	Viscosity, Krebs, ku	100 +- 2
Density, #/gal	11.4	pH	8.5 – 9.0
% Volume Solids	28.26	Gloss @ 85 deg	2.0 – 2.5
% Weight Solids	47.72	Contrast Ratio, 3 mil	98 – 99
% PVC	38.24	Y Reflectance	93 – 94

Formula Reference: Eastman Bulletin M-328A 07/11 Table 2 EEH ACS 12-1106-GC 1212

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SCAQMD VOC Compliant Interior Flat with ACS 6200™ and ENCOR® 379G

ACS 12-1106-W

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing. Adjust pH to at least 9 before adding the pigments, then disperse to 3 Hegman grind			
Water	445.45	53.48	
ADM 6200™	5.98	0.65	ADM
AMP 95®	2.03	0.26	Angus
Proxel™ GXL	1.01	0.11	Lonza
Drewplus™ L475	2.03	0.27	Ashland
Natrosol™ Plus 330	5.98	0.52	Ashland
Tiona® 595	200.0	5.84	Cristal
Satintone® W	100.0	4.56	BASF
Snowflake®	100.0	4.43	IMERYS
Celite® 281	25.0	1.30	World Minerals
Attage®l 50	10.0	0.50	BASF
Add following ingredients while mixing to complete the batch			
Water	49.85	5.98	
Encor® 379G	168.0	18.56	Arkema
Ethylene Glycol	6.65	0.72	
Epoxol® CA118™	**2.98**	**0.37**	**ACS Technical Products**
Drewplus™ L-475	2.03	0.27	Ashland
Adjust Viscosity			
Water	18.2	2.18	
TOTAL	**1145.19**	**100.0**	

Physical Constants	
VOC, g/L	30.26
Density, #/gal	11.45
% Volume Solids	27.55
% Weight Solids	47.44
% PVC	60.45

Performance Properties	
Viscosity, ku	120 +- 5
pH	8.5 – 9.0
Gloss @ 85 deg.	2.0 – 2.5
Contrast Ratio, 3 mil	98 – 99
Y Reflectance	93 - 94
Color Acceptance (CPS Color)	9-10

Notes: ACS CA118 replaced 85% of the Texanol™ in the published formulation.

Formula Reference: ACS 12-1102-7 061313 ACS 12-1106-W 0114

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Semi-Elastomeric Masonry Coating with Carboset® AE960

ACS 12-1106-DD

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 7+ Hegman grind			
Water	100.0	12.0	
Ethylene Glycol	35.0	3.77	
Natrosol™ 250 MBR	1.5	0.13	Ashland
Tamol™ 850	10.0	0.98	Dow Chemical
Triton™ CF-10	5.0	0.56	Dow Chemical
Drewplus™ L-475	2.0	0.26	Ashland
Troysan® 186	2.0	0.24	Troy
Ti-Pure® R-706	100.0	2.96	DuPont
Optiwhite®	100.0	5.45	Burgess
Imsil® A15	80.0	3.64	Unimin
Atomite®	60.0	2.66	IMERYS
Add following ingredients while mixing to complete the batch.			
Water	46.0	5.52	
Carboset® AE960	482.0	56.71	Lubrizol
Drewplus™ L-475	7.0	0.72	Ashland
Epoxol® CA118™	**20.0**	**2.51**	**ACS Technical Products**
28% Ammonia	2.0	0.26	
Acrysol™ RM825	1.6	0.18	Dow Chemical
Polyphase® 663	6.0	0.68	Troy
Adjust Viscosity			
Water	4.6	0.55	
TOTAL	**1064.7**	**100.0**	

Physical Constants	
VOC, g/L	77.83
Density, #/gal	10.6
% Volume Solids	48.78
% Weight Solids	59.64
% PVC	30.43

Performance Properties	
Viscosity, Krebs, ku	115 +- 2
pH	8.5 – 9.0
Gloss @ 60 deg	8 - 9
Contrast Ratio, 3 mil	97 – 98
Y Reflectance	90 – 91
Low Temp Flexibility (-18 ^{0}C / -26 ^{0}C)	Passed
Water Swelling	Excellent
Dirt pick up	Very good

Formula Reference: Lubrizol Model Formula CST AE-960 (127 g/L VOC) ACS 12-1106-DD 0814

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Low VOC Semi-Elastomeric Masonry Coating with Carboset® AE960

ACS 12-1106-DDB

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 7+ Hegman grind			
Water	120.0	14.41	
Ethylene Glycol	10.0	1.08	
Natrosol™ 250 MBR	1.5	0.13	Ashland
Tamol™ 850	10.0	0.98	Dow Chemical
Triton™ CF-10	6.0	0.67	Dow Chemical
Drewplus™ L-475	2.0	0.26	Ashland
Troysan® 186	2.0	0.24	Troy
Ti-Pure® R-706	100.0	2.96	DuPont
Optiwhite®	100.0	5.45	Burgess
Imsil® A15	80.0	3.64	Unimin
Atomite®	60.0	2.66	IMERYS
Add following ingredients while mixing to complete the batch			
Water	55.0	6.6	
Carboset® AE960	482.0	56.71	Lubrizol
Drewplus™ L-475	7.0	0.92	Ashland
Epoxol® CA118™	**10.0**	**1.25**	**ACS Technical Products**
28% Ammonia	2.0	0.26	
Acrysol™ RM 8W	1.6	0.18	Dow Chemical
Polyphase® 663	6.0	0.68	Troy
Adjust Viscosity			
Water	7.6	0.91	
TOTAL	**1062.7**	**100.0**	

Physical Constants	
VOC, g/L	24.3
Density, #/gal	10.6
% Volume Solids	47.62
% Weight Solids	58.90
% PVC	31.17

Performance Properties	
Viscosity, Krebs, ku	120 +- 2
pH	8.5 – 9.0
Gloss @ 60 deg	2 – 2.5
Contrast Ratio, 3 mil	98 – 99
Y Reflectance	91 - 92
Low Temp Flexibility (-18 ^{0}C / -26 ^{0}C)	Passed
Water Swelling	Excellent
Dirt pick up	Very good

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Formula Reference: Lubrizol Model Formula CST AE-960 (50 g/L VOC) ACS 12-1106-DDB 0814

Low VOC Elastomeric Roof Coating with Lipacryl™ MB-3640

ACS 12-1106-M

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 5 Hegman grind			
Water	145.0	17.41	
Natrosol™ 250 HR	4.0	0.36	Ashland
Tamol™ 165A	5.70	0.65	Dow Chemical
28% Ammonia	3.0	0.39	
Foamaster® NXZ	3.0	0.39	BASF
Snowhite® 12	392.5	17.42	Omya
Ti-Pure® R-960	62.5	1.92	DuPont
Add following ingredients while mixing to complete the batch.			
Water	15.2	1.82	
Lipacryl™ MB-3640	490.1	56.77	Dow Chemical
Foamaster® NXZ	3.0	0.39	BASF
Epoxol® CA118™	**6.0**	**0.75**	**ACS Technical Products**
Skane™ M-8	3.0	0.36	Dow Chemical
Propylene Glycol	10.0	1.16	ADM
TOTAL	**1143.0**	**100.0**	

Physical Constants	
VOC, g/L	29.3
Density, #/gal	11.4
% Volume Solids	51.08
% Weight Solids	64.37
% PVC	37.86

Performance Properties	
Viscosity, Krebs, ku	94 +- 2
pH	8.5 – 9.0
Gloss @ 60 deg.	6 - 7
Contrast Ratio, 3 mil	90 – 91
Y Reflectance	86 – 87
Low Temp Flexibility (-18 ^{0}C / -26 ^{0}C)	Passed
Water Swelling	Excellent
Dirt pick up	Very good

Formula Reference: Dow Formulation ARM 3640-1 ACS 12-1106-M 0514

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High Build Masonry Clear Sealer with Carboset® CR-785

ACS 12-1106-RA-1

Ingredients	Pounds	Gallons	Supplier
Pre-mix the following			
Carboset® CR-785	592.9	69.26	Lubrizol
Water	116.59	14.0	
Adjust pH to 8.8 – 9.2			
28% Ammonia	0.50	0.07	
Pre-mix following ingredients then add with agitation			
Epoxol® CA118™	**30.2**	**3.79**	**ACS Technical Products**
Dowanol™ PnP	50.4	6.84	Dow Chemical
Water	15.0	1.8	
Byk® 024	2.0	0.24	Byk-Chemie
Add ingredients in the following order with good agitation			
Surfynol® SE-F	10.0	1.24	Air Products
Michem® Emulsion 39235	20.0	2.4	Michelman
Adjust viscosity to 45-55 sec. #4 Ford Cup			
Rheovis® PU 1214	3.3	0.37	BASF
TOTAL	**840.89**	**100.0**	

Physical Constants	
VOC, g/L	156.0
Density, #/gal	8.4
% Volume Solids	33.26
% Weight Solids	34.62
% PVC	0.0

Performance Properties	
Viscosity, #4 Ford Cup	52 +- 2
pH	8.8 – 9.5
Gloss @ 60 deg. WB Leneta	92 - 93
Chemical Resistance	Excellent

Formula Reference: Lubrizol model formula CR-785-12 ACS 12-1106-RA-1 1214

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VOC Compliant (<100 g/l) Direct-to-Metal Mid-Gloss with Maincote™ HG 56

ACS 12-1106-EE

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 7+ Hegman grind			
Eastman™ DM Solvent	19.35	2.28	Eastman Chemical
Water	37.63	4.52	
Tamol™ 165	10.21	1.16	Dow Chemical
Ammonia 28%	1.07	0.14	
Triton™ CF 10	1.61	0.18	Dow Chemical
Tego® Foamex 1488	1.61	0.21	Evonik Industries AG
Ti-Pure® R 706	209.6	6.2	DuPont
Water	5.37	0.64	
Add following ingredients while mixing to complete the batch			
Maincote™ HG 56	562.24	66.15	Dow Chemical
Ammonia 28%	4.3	0.56	
Water	91.37	10.97	
Eastman™ EEH Solvent	11.82	1.59	Eastman Chemical
Eastman™ DM Solvent	8.03	0.95	Eastman Chemical
Epoxol® CA118™	**21.5**	**2.70**	**ACS Technical Products**
Tego® Foamex 1488	2.69	0.35	Evonik Industries AG
Sodium Nitrite (15% Aq.)	9.67	1.07	
Acrysol™ RM 8W	3.22	0.37	Dow Chemical
TOTAL	**1001.32**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	98	Viscosity, Krebs, ku	95 +- 2
Density, #/gal	10.0	pH	8.5 – 9.0
% Volume Solids	41.84	Gloss @ 60 deg.	65 - 67
% Weight Solids	51.69	Contrast Ratio, 3 mil	98 – 99
% PVC	14.82	Y Reflectance	92 – 93
		Early Water Resistance	Excellent

Formula Reference: Eastman Formulation TT-101 Formula 2 ACS 12-1106-EE 1213

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VOC Compliant (<100 g/l) Direct-to-Metal Gloss with Pliotec® HDT 12

ACS 12-1106-EE-1

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 7+ Hegman grind			
Water	51.62	6.2	
Acrysol™ RM 5000	6.82	0.78	Dow Chemical
Tego® Disperse 750W	3.89	0.43	Evonik Industries AG
Surfynol® 104E	3.89	0.47	Air Products
Byk® 023	1.46	0.18	Byk-Chemie
AMP 95®	1.95	0.25	Angus
Tiona® 595	145.61	4.26	Cristal
Pre-mix the following ingredients then add while mixing			
Propylene Glycol	9.74	1.13	ADM
Dowanol™ DPM	7.78	0.92	Dow Chemical
Dowanol™ DPnB	11.69	1.57	Dow Chemical
Epoxol® CA118™	**4.87**	**0.61**	**ACS Technical Products**
Add following ingredients while mixing to complete the batch			
Pliotec® HDT 12	626.28	71.47	Omnova Solutions
Acrysol™ RM 8W	1.95	0.22	Dow Chemical
Raybo® 60	7.30	0.78	Raybo Chemical
Tego® Airex 902W	2.04	0.24	Evonik Industries AG
Water	87.4	10.49	
TOTAL	**974.30**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	88.0	Viscosity, Krebs, ku	87 +- 2
Density, #/gal	9.74	ICI, p	0.5 – 0.6
% Volume Solids	39.29	pH	8.5 – 9.0
% Weight Solids	48.34	Gloss @ 60 deg.	74 – 75
% PVC	10.83	Contrast Ratio, 3 mil	96 – 97
		Y Reflectance	92 – 93
		Early Water Resistance	Excellent

Formula Reference: Omnova Formulation WB1 ACS 12-1106-EE 0614

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SCAQMD VOC Compliant Stain Blocking Primer with Carboset® CR-760

ACS 12-1106-JJ

Ingredients	Pounds	Gallons	Supplier
Add ingredients in the following order one at a time while mixing then disperse to 7+ Hegman grind			
Water	125.0	15.01	
Propylene Glycol	30.0	3.47	ADM
Natrosol™ 330 PA	1.50	0.15	Ashland
AMP 95®	2.0	0.26	Angus
Tamol™ 165A	8.3	0.94	Dow Chemicals
Byk® 022	2.0	0.24	Byk Chemie
Ti-Pure® R 706	100.0	3.0	DuPont
Snowflake® PE	155.7	6.9	IMERYS
Add following ingredients while mixing to complete the batch			
Water	60.0	6.66	
Carboset® CR-760	467.40	55.64	Lubrizol
Epoxol® CA118™	**20.0**	**2.51**	**ACS Technical Products**
Byk® 022	2.0	0.24	Byk-Chemie
Rheovis® PU 1214	10.0	1.12	BASF
Adjust pH to 8.5 to 9.0 if needed			
28% Ammonia	1.5	0.20	
Adjust Viscosity			
Water	30.75	3.7	
TOTAL	**1022.65**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	97.0	Viscosity, Krebs, ku	110 +- 5
Density, #/gal	10.1	ICI, p	0.4 – 0.5
% Volume Solids	28.46	pH	8.5 – 9.0
% Weight Solids	32.19	Gloss @ 60 deg.	10.5
% PVC	11.0	Contrast Ratio, 3 mil	94 – 95
		Y Reflectance	93 – 94
		Stain Blocking	Very Good

Formula Reference: Lubrizol model Formula CR-760-03B ACS 12-1106-JJ 0814

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Automotive Refinish Clear with Elvacite® 2013 Acrylic

ACS 12-1106-P

Ingredients	Pounds	Gallons	Supplier
Pre-mix the following solvents			
Methyl Isobutyl Ketone	116.25	17.37	Sigma-Aldrich
Isopropyl Alcohol	46.39	7.07	Sigma-Aldrich
Toluene	274.02	37.74	Sigma-Aldrich
Methyl Amyl Ketone	28.05	4.2	Sigma-Aldrich
Add ingredients in the following order one at a time under continuous agitation and mix until completely dissolved			
Elvacite® 2013	187.32	19.52	Lucite
Eastman™ CAB 381-2	62.56	6.26	Eastman
Add with agitation and continue mixing for another 20 minutes until uniform			
Epoxol® CA118™	**62.56**	**7.85**	**ACS Technical Products**
TOTAL	**777.15**	**100.0**	

Physical Constants	
VOC, g/L	557.0
Density, #/gal	7.8
% Volume Solids	33.62
% Weight Solids	40.2
% PVC	0.0

Performance Properties	
Viscosity, ku	92 +- 2
Gloss @ 20 deg. , WB Leneta	76 – 77
CRS	94 – 95
Sward Hardness (CRS)	10

Formula Reference: Lucite Formula Reference #B2-2 using Santicizer® 160 ACS 12-1106-P 1213

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Industrial Clear Gloss with Carboset® CR-785

ACS 12-1106-R-1

Ingredients	Pounds	Gallons	Supplier
Pre-mix the following ingredients with good agitation			
Dowanol™ EB	103.26	13.70	Dow Chemical
Epoxol® CA118™	**18.36**	**2.3**	**ACS Technical Products**
Texanol™	9.18	1.16	Eastman Chemical
Add the above pre-mixed solution to the emulsion with agitation.			
Carboset® CR-785	704.93	82.35	Lubrizol
Add the following ingredients with agitation and continue mixing for another 20 minutes			
10% Sodium Nitrite	8.29	0.92	
28% Ammonia	0.26	0.03	
TOTAL	**844.28**	**100.47**	

Physical Constants	
VOC, g/L	264
Density, #/gal	8.5
% Volume Solids	35.9
% Weight Solids	37.76
% PVC	0.0

Performance Properties	
Viscosity, Krebs, ku	73 +- 2
pH	8.0 – 8.5
Gloss @ 20 deg , WB Leneta	83 – 84
CRS	92 – 93
Sward Hardness CRS	9
Glass	11
Water Resistance	Very Good

Formula Reference: Lubrizol Model Formula CR-785-02 using DBP:Texanol™ (1:1)

ACS 12-1106-R-1 1213

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One-Component PU-Acrylic Hybrid with Hybridur® 870 Dispersion

ACS 12-1106-V

Ingredients	Pounds	Gallons	Supplier
Pre-mix the following ingredients with agitation			
Proglyde™ DMM	46.62	6.19	Dow Chemical
Dowanol™ DPnB	18.26	2.4	Dow Chemical
Epoxol® CA118™	**16.39**	**2.06**	**ACS Technical Products**
Byk® 333	0.43	0.05	Byk-Chemie
Byk® 024	0.85	0.10	Byk-Chemie
Add the above pre-mixed solution to the dispersion with strong agitation.			
Hybridur® 870 Dispersion	766.58	89.18	Air Products
TOTAL	**849.13**	**100.0**	

Physical Constants		Performance Properties	
VOC, g/L	219	Viscosity, secs, #2 Zahn	28 +- 2
Density, #/gal	8.5	pH	8.0 – 8.5
% Volume Solids	36.23	Gloss @ 60 deg , WB Leneta, 6 mils	92 - 93
% Weight Solids	38.14	Sward Hardness Glass	6
% PVC	0.0	Cross Cut Adhesion	5B

Formula Reference: Air Products Formulation HY870MCT01 using Texanol™ ACS 12-1106-V 0114

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