Carboset CR-765

Styrene-Acrylic Copolymer Emulsion

TECHNICAL DATA SHEET

General Description

Carboset® CR-765 is a thermoplastic styrene-acrylic emulsion designed to provide an excellent balance of gloss and adhesion to various metal and non-metal substrates, as well as excellent corrosion protection. **Carboset CR-765**-based enamels exhibit excellent gloss readings at both 60° and 20°. This high gloss ability can be used to develop enamels that appear much more "alkyd-like" than other emulsion-based enamels. **Carboset CR-765** resin can also be formulated to provide very good application properties, such as flow and leveling, for good brushability and spray applications. Finished paints provide good overall properties of block resistance, gloss and color retention, chalk resistance and general chemical and stain resistance.

Carboset CR-765 resin is readily coalesced with traditionally used glycol ethers, and is recommended for both topcoat, DTM and primer applications.

Suggested Applications

- Industrial Finishes for Metal
- Maintenance Topcoats and Primers
- Plastic Finishes
- Railcar Coatings
- Alkyd Blending Vehicle
- DIY Gloss and Semi-Gloss Enamels
- DTM Gloss and Semi-Gloss Enamels
- Specialty Architectural Tintable Coatings

Performance Features

- High gloss
- Good hardness
- Reactive pigment stability
- Excellent adhesion to metal, plastic wood and masonry surfaces
- Very good corrosion resistance
- Excellent water and humidity resistance
- Good stain resistance
- Good block resistance

Typical Physical Properties*

Appearance	Milky White Emulsion
Total Solids by Weight, %	42.0
Total Solids by Volume, %	40.7
Density, pounds/gallon	8.6
Specific Gravity	1.03
Brookfield Viscosity, 25ϒC, #2 Spindle, cps	75
pH	8.2
MFFT, ϒC	34ϒC
Mechanical Stability, 15 min., Waring Blender	Pass
Freeze/Thaw Stability	Protect from Freezing

*Property values represent typical results only and are not to be considered specifications.

FDA Status

Carboset CR-765 emulsion is composed of materials that meet the following FDA paragraphs: 175.105 and 176.180[7].

[7] The final food contact article cannot contain more than 0.06 g Carboset CR-765/in^2 (0.01 g Carboset CR-765/cm^2) of paper or paperboard.

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Typical Performance Data

WHITE GLOSS DTM BRUSHING ENAMEL
(Model Formula CR-765-B4)

Dry Film Thickness: 1.5 mils Cure: Air Dry, Time as Noted Substrate: CRS (unless otherwise noted)

(CRS panel should be wiped with damp cloth, dried, then wiped with MEK or acetone prior to application of coating.)

Test Results

Test	1 Day	3 Day	7 Day
1. Gloss, 60°/20°	90/70	90/65	90/65
2. Hardness (Set-to-Touch = 15 min.)			
• Pencil Hardness	<2B	B	B
• Konig Hardness	12	26	38
• Sward Hardness	5	12	16
3. Flexibility			
• Impact D/R	160/160	150/150	40/0
• Conical Mandrel	Pass 1/8"	Pass 1/8"	Pass 1/8"
4. Crosshatch Adhesion			
• On CRS			5B
• On Aluminum			5B
5. Block Resistance: 1.5 PSI, 1 Hour, 120°F	0	5	8

- 0 - 10 Scale: 10 = No block
  0 = Cannot Separate

Other Test Results

6. Leneta Anti-sag 9
7. NYPC Leveling 6
8. Cleveland Condensing Humidity
- 1000 Hours Exposure: Few #8 Blisters at panel edge
  Slight Gloss Loss
9. Salt Fog (CRS, 7 day dry); 100 Hours Exposure
- Field blisters: Excellent
- Scribe Creep: 1/16"
- Scribe blisters: Slight #8 Blisters
- Tape Off: 3B Initial, 5B After 1 Hour Recovery

10. QUV (CRS, 7 day dry)
- 1000 Hours Exposure:)E = 0.61, No chalk

11. Cold Coalescence Test: 45°F, 85-90%, R.H., CRS
- 1 Day: No rust, no cracking of film
- 2 Day: No rust, no cracking of film

Typical Performance Data

COMPARATIVE TEST RESULTS
WHITE HIGH GLOSS DTM BRUSHING ENAMELS
CARBOSET CR-765-B4 VS. COMPETITIVE LATEX

Dry Film Thickness: 2.7 - 2.9 mils Cure: Air Dry, Time as Noted Substrate: CRS

	Carboset CR-765-B4			Leading Competitive Latex		
Test	**1 Day**	**3 Day**	**7 Day**	**1 Day**	**3 Day**	**7 Day**
1. Gloss: 60°/20°	90/70	90/70	90/70	84/52	84/52	84/52
2. Hardness: Konig	10	18	29	7	10	14
3. Adhesion: Crosshatch	1B	4B	5B	5B	5B	5B
4. Impact: D/R	160/160	160/160	100/40	160/160	160/160	160/160
5. Block Resistance *						
100°F - 0.5/1.0 Hr.	0/0	8/7	9/9	0/0	0/0	3/2
120°F - 0.5/1.0 Hr.	0/0	6/2	8/7	0/0	0/0	0/0
6. Salt Fog: 100 Hr.						
Field:			Excellent			Excellent
Scribe Creep:			1 mm			1.5 mm
Scribe Blisters:			Mod. #8			Few #4, 6, 8

* Rating for Block Resistance, 0 - 10: 0 = Complete Block, Cannot Separate
10 = No Block, Falls Apart

Formulation

WHITE HIGH GLOSS DTM BRUSHING ENAMEL
Model Formula CR-765-B4

Material	Pounds	Gallons	Use
		Charge to Letdown tank	
Carboset® CR-765 resin	618.60	71.93	Acrylic Emulsion
Ammonia, 28%	1.00	0.13	pH Adjustment
Premix next three items and add to CARBOSET CR765 with agitation			
Dowanol™ DM	57.00	6.73	Cosolvent
Dowanol™ EPh	22.40	2.43	Cosolvent
Water 21.85	2.62		
In a separate tank, high speed disperse the following to a 7 Hegman, then add to letdown tank			
Water	42.00	5.04	
AMP-95™	1.60	0.20	Amine
Dowanol™ DM	10.50	1.24	Cosolvent
Rheolate® 350	12.00	1.42	Thickener
Byk® 156	4.20	0.48	Surfactant
Byk 024 1.50	0.18		Defoamer
Kronos® 2310	200.00	6.04	White Pigment
Add next four items with moderate agitation			
Proxel® GXL	1.00	0.11	Preservative
Byk 024 2.00	0.24		Defoamer
Triton® CF-10	2.00	0.22	Wetting Agent
Raybo 60	8.00	0.86	Flash Rust Inhibitor
Adjust pH 8.0 - 8.5			
Ammonia, 28%	1.00	0.13	pH Adjustment
	1006.65	**100.00**	

Total Solids by Weight, %	47.37
Total Solids by Volume, %	36.85
Weight per Gallon, lbs.	10.07
VOC, grams/liter	232
pounds/gallon	1.92
P. V. C., %	16.4
Pigment to Binder ratio	0.77
Viscosity, Stormer, KU	90
Viscosity, ICI, poise	1.5
pH	8.5

Formulation Suggestions and Raw Material Information

COALESCING

To effectively lower the minimum film forming temperature to produce a continuous film, the use of coalescents is required. **Carboset® CR-765** resin responds well to various ethylene and propylene based glycol ethers and blends.

For spray applied Industrial Finishes, a recommended starting point level when coalescing with glycol ether solvents is 28-35% on polymer solids. Temperature, humidity and efficiency of coalescent may alter the choice of solvent and the necessary level. In some cases it may also be desirable to use plasticizers to reduce coalescent levels.

Characteristics of the coating such as dry time, hardness development, VOC, as well as coating performance, can vary with the selection of different coalescents. It is most efficient to first look at coalescing the unpigmented polymer to achieve a clear continuous film at the desired film formation temperature.

Reduction in the minimum film forming temperature can also be achieved with the use of coalescing solvents with plasticizers. Use of plasticizers will allow the formulator to further reduce the VOC of the final coating. Dibutyl phthalate and butyl benzyl phthalate are just two plasticizers that could be evaluated.

For **Brushing Enamels,** a blend of two cosolvents is generally used. A fast evaporating, water miscible cosolvent is used to increase wet edge and improve freeze/thaw stability. For direct to metal applications, ethylene or propylene glycol should not be used because they tend to promote flash rusting. Dowanol™ DM avoids this situation without imparting an offensive odor to the coating. Glycol ether DPM can also be used, however hardness development will be slower.

A slow evaporating, water immiscible cosolvent is used to lower the MFFT of **Carboset CR-765** resin**.** Glycol ether PPh will properly coalesce **Carboset CR-765** resin without being retained in the applied film for extended periods of time. A 4:1 ratio of DM/PPh at 35% on **Carboset CR-765** resin solids will lower MFFT below 0°C and maintain VOC below 250 g/l. Alternatives to Glycol Ether PPh are glycol ether EPh, Dalpad® A (Dow) or Exxate® 1000.

Dowanol™ DM, DPM, PPh, EPh	Dow Chemical
Dalpad® A	Dow Chemical
Exxate® 1000	Exxon

COALESCING - USE OF PROPYLENE-BASED GLYCOL ETHERS

Many coatings formulations currently utilize coalescent agents that are in the ethylene-based glycol ether family. Because of the desire to effectively address emerging regulatory issues, some formulators are looking for alternative coalescents that might be used as replacements for Butyl Cellosolve® or Glycol Ether EB®. One formulation direction is toward propylene-based glycol ethers, because of generally lower toxicity and minimized reporting requirements.

Although there may not be a single coalescent which is fully effective in replacing Glycol Ether EB in formulations with **Carboset®** emulsions, we have determined several blends of solvents which provide similar dry times and coating properties.

Two such blends, free of Glycol Ether EB, are as follows:

Ratio:	
A) Dowanol™ DPM:Dowanol PnB	70:30
B) Exxate™ 900:Dowanol PnB	60:40

These solvent blends are starting points, and should be adjusted by the formulator for appropriate drying times and coating performance requirements. As an example, faster dry times can be obtained if Exxate 700 is used to replace Exxate 900. Slower dry times will be obtained if DPM is used as a replacement for PnB in Blend B.

Glycol Ether EB®	Eastman Chemical
Dowanol™ DPM & PnB	Dow Chemical
Exxate® 700 & 900	Exxon

Formulation Suggestions and Raw Material Information

COALESCING - MINIMIZING USE OF TEXANOL®

Texanol has often been used as a major coalescing solvent in many trade sales applications, due to its slow evaporation rate, low odor, and very efficient coalescence. We have found, however, that too much Texanol may leave coatings tacky for too long, in formulations utilizing **Carboset® CR-765** resin**.**

For this reason, we recommend the use of Texanol be kept below a maximum level of 5% on emulsion solids for **Carboset CR-765** resin**.**

As always, testing should include dry time, hardness development physical properties, and other important performance criteria to determine the appropriate usage level of Texanol, or other coalescent, in any specific formulation.

Texanol®	Eastman Chemical

GLOSS CONTROL

Carboset CR-765 like other **Carboset® CR-760** series emulsions, is designed to produce high gloss coatings when properly coalesced. When lower gloss levels are desired these emulsions can be efficiently flatted with a variety of inert flatting agents. Inerts such as calcium carbonate, clays and silicas can all be utilized. Care must be given in the selection of the proper inert to preserve polymer properties and package stability. It is suggested an inert grade of neutral or slightly basic pH be utilized for maximum formulation stability. Some efficient flatting agents that can be utilized include:

Syloid® 169	W. R. Grace
OK-412	Degussa
Nytal® 400	Vanderbilt

DEFOAMERS

In order to reduce foam during manufacturing and during application, it may be necessary to use a defoamer. Commercial defoamers that have demonstrated effectiveness are:

Surfynol® DF-37	Air Products
Surfynol® DF-210	Air Products
Byk® 024	Byk Chemie
Troy 999	Troy Chemical
DeeFo® XGM-14-I	Ultra Additives
Dehydran® 1620	Henkel
Tego® Foamex 1488	Tego-Chemie

ANTI-MAR AND SLIP ADDITIVES

To provide additional slip and mar resistance, silicone, fluorocarbon or wax-based additives can be used. Thorough testing should be performed to determine the additives effect on the coating properties. Some additives may produce a negative effect on intercoat adhesion and film appearance. Some effective anti-mar slip additives recommended are:

Fluorad® FC-120	3M Corporation
Byk® 333	Byk Chemie

Formulation Suggestions and Raw Material Information

VISCOSITY AND RHEOLOGY CONTROL

Carboset® CR-765 resin has been engineered with self thickening properties. For DIY and DTM Brushing Enamels, associative thickeners are suggested to obtain alkyd-like flow without excessive sagging at a reasonable brushing viscosity. These properties can be easily achieved with a combination of Rheolate® 300 and Rheolate® 350. By changing the ratio of these thickeners, a balance of Stormer (package) and ICI (brushing) viscosities can be obtained for individual application requirements. The resulting paint will not show clear liquid separation upon shelf-aging or viscosity drift during heat-aging. For some **Industrial Finishes,** additional external rheology modifiers may be necessary.

Rheolate 300	Rheox
Rheolate 350	Rheox
DSX-1514	Henkel
Acrysol® QR-708	Rohm & Haas
RM 2020	Rohm & Haas
Carboflow® 32W	**Lubrizol**

DISPERSANTS

Surfynol® CT-151 can be used as an optional pigment dispersant to provide high gloss. Additionally the formulator may be able to decrease the need for other formula surfactants, which can contribute to increased water resistance.

OTHER RAW MATERIALS

Byk® 156	Byk-Chemie
Triton® CF-10	Union Carbide
Ammonium Benzoate	Caschem
Tamol® 681	Rohm & Haas
Ti-Pure® R902	DuPont
Proxel® GXL	Avecia
Dalpad® A	Dow Chemical
Exxate® 1000	Exxon
Kronos® 2310	Kronos, Inc.
Raybo 60	Raybo Chemical Co.
AMP 95™	Angus
Surfynol® CT-151	Air Products
Tiona RCL 628	SCM Pigments