Technical Data Sheet

MAINCOTE™ HG-86 Direct-to-Metal Waterborne Resin

For High Gloss Maintenance Coatings

Introduction

MAINCOTE™ HG-86 Acrylic Resin is the latest waterborne polymer for high-performance, high-gloss, direct-to-metal (DTM) coatings from The Dow Chemical Company. It provides formulators with a package of performance benefits that makes it ideal for industrial maintenance coatings and transportation applications.

MAINCOTE™ HG-86 Acrylic Resin can be formulated into primers, direct-to-metal coatings, and topcoats, providing an outstanding combination of adhesion, chemical and solvent resistance, gloss, gloss retention, and corrosion resistance. The performance benefits of MAINCOTE™ HG-86 Acrylic Resin are significantly higher than those of conventional acrylic DTM resins.

Benefits

MAINCOTE™ HG-86 Acrylic Resin provides coating formulators with greater options in their formulation of maintenance and transportation paints.

- Single acrylic resin that can be formulated for primer, mid-coat, topcoat, or direct-to-metal applications
- Outstanding durability associated with acrylic resins along with:
  - Improved adhesion
  - Excellent chemical and solvent resistance
  - Enhanced corrosion resistance
  - High gloss
  - Improved gloss retention
- Capability of producing low-volatile organic content formulations
- Technical service to help formulate and use MAINCOTE™ HG-86 Acrylic Resin from the dedicated metal coatings team at The Dow Chemical Company.

Typical Physical Properties[1]

Property	Typical Values
Solids Content, %	43 - 44
Viscosity, Brookfield, cps (25°C)	30
pH	8.0 - 9.0
Density, US lb/gal	8.58
Minimum Film Formation Temperature, (MFFT), °C	31

1. These properties are typical but do not constitute specifications.

Performance Data

The typical performance demonstrated by MAINCOTE™ HG-86 Acrylic Resin when formulated into a white DTM formulation is shown in Tables 1 through 3. The formulation used (G-86-1) was 18 PVC with 35% volume solids using Ti-Pure R-706 titanium dioxide as the only pigment (no anticorrosive pigments were used) and coalesced with 15% Texanol™ ester alcohol.

Table 1: Gloss, Sag, and Adhesion Profile[1]

Gloss	
20°	59
60°	84
Sag Resistance, No Sag	≥ 20 mils, wet
Adhesion, % Remaining Cold Rolled Steel	
Dry	100
Wet	100
Aluminum	
Dry	100
Wet	100
Galvanized Steel	
Dry	100
Wet	95

1. Paint Formulation: 18% PVC/35% VS with Ti-Pure R-706 titanium dioxide coalesced with 15% Texanol ester alcohol.

Table 2: Chemical Resistance, Hardness, and Heat Age Stability Profile

Gasoline Rubs, 3 mil DFT	> 300
Chemical Spot Resistance (5 = best)	
Methyl Ethyl Ketone	3
Toluene	3
Ethanol	3
Clorox Formula 409™ cleaner	3
10% H_2SO4	5
10% NaOH	5
Methyl Ethyl Ketone Rubs, 3 mil DFT	40
Konig Hardness, sec.	25
Heat Age Stability	Pass

Table 3: Corrosion Resistance, Salt Spray (ASTM B-117)[2]

7 Days (168 hrs.)		
Unscribed	Blister	6 - 9; Few
	Rust	Slight; 5%
Scribed	Rust	Slight to Medium; 12%
15 Days (360 hrs.)		
Unscribed	Blister	6 - 8; Few
	Rust	Slight; 6%
Scribed	Rust	Slight to Medium; 10%
29 Days (696 hrs.)	|	
Unscribed	Blister	5; Medium
	Rust	Slight; 7%
Scribed	Rust	Slight to Medium; 18%

2. Two week CTR dry on blast cleaned hot-rolled steel; 1 coat at 3 mil. Blister: Number represents size of blister (9 is small, 1 is large); description describes number of blisters. Rust: Number represents amount of rust, description describes qualitative rating.

Formulating Guidelines

The ingredients in a formulation and their level of usage play a significant role in the performance of the coating. The following guidelines serve as a starting point to help maximize the performance of a coating. Formulations should be carefully evaluated prior to commercialization. Following is a list of factors that can have a significant impact on the paint stability of a formulation as well as coating performance.

1. Reactive pigments type and level (soluble components)
2. Extender types and levels (soluble components)
3. Dispersant type and level
4. Coalescent type and level
5. Formulation PVC

Our technical literature puts forth starting point formulations that meet our criteria for imparting a level of metal protection and for passing paint stability tests. These starting points are intended to demonstrate the potential of MAINCOTE™ HG-86 Acrylic Resin and any formulation deviation must be checked by the formulator. Also, imparting excessive shear due to color shading or working in a "hot" plant can impact the viscosity stability of a paint and these conditions should be evaluated before the actual production of paint on a large scale.

We do not imply that these starting point formulas can be introduced into any production situation without adequate screening of the paint making process.

Coalescents

The selection of coalescent depends largely on the intended end use of the formulation. For industrial maintenance applications, Texanol ester alcohol at 15% on polymer solids provides excellent film formation, gloss, and corrosion resistance. Where faster drying is required, laboratory evaluations have shown that the use of 15% Exxate 800 solvent provides fast hardness development while maintaining corrosion resistance. Alternatively, DOWANOL™ Dipropylene Glycol Monobutyl Ether (DPnB) or DOWANOL™ PPh Glycol Ether (at 15% on polymer solids) can also be used to provide quicker hardness development than Texanol ester alcohol. Low levels of plasticizer such as dibutylphthalate (3 to 5%) can be used in combination with DOWANOL™ Dipropylene Glycol Monobutyl Ether (DPnB) and DOWANOL™ PPh Glycol Ether to improve low-temperature applications.

Freeze/Thaw Protection

Laboratory evaluations have shown that freeze/thaw resistance of coatings based on MAINCOTE™ HG-86 Acrylic Resin can be achieved by using methanol (at 45 lbs / 100 gal) or combinations of methanol and propylene glycol (35 lbs methanol, 10 lbs PG / 100 gal). Typical solvents used for freeze/ thaw protection include ethylene glycol, propylene glycol, and Butyl CARBITOL™ Solvent. Although these solvents can be used, they may adversely affect properties that depend on early water resistance, such as early rust resistance. Methanol or ethanol provide freeze thaw resistance, but are volatile enough that they do not interfere with early water resistance.

Thickeners

Nonionic urethane thickeners such as ACRYSOL™ RM-8W, ACRYSOL™ RM-12W, and ACRYSOL™ RM-2020NPR Rheology Modifiers are key to formulating a high-quality, corrosion-resistant coating. The use of cellulosic or alkali-soluble thickeners significantly degrades the water and corrosion resistance.

Expected method of application is an important parameter to consider when selecting rheology control agents. Brushing formulations require higher viscosity under high shear conditions for best brush drag. On the other hand, lower high shear viscosity is desired for ease of atomization during spraying. The viscosity range suitable for brushing is 1.5 to 2.0 poise, while 0.5 poise is characteristic of a paint with good atomization. High shear viscosity is measured by the ICI Viscometer (cone and plate) with units in poise.

A suitable viscosity range for airless spray is 95 to 105 Kreb Units to minimize sagging tendencies. For brushing, formulate to lower values of approximately 85 KU so that brush marks flow out. Low shear viscosity is measured with the Stormer Viscometer with units in Krebs.

ACRYSOL™ RM-8W and ACRYSOL™ RM-12W Rheology Modifiers are recommended for paints designed for spray application. ACRYSOL™ RM-12W Rheology Modifier is excellent for spray application where flow/sag balance is critical. ACRYSOL™ RM-2020NPR Rheology Modifier is more suitable for brush or roller application. Having a paint that provides optimum viscosity for both brush and spray application is difficult and having a viscosity of 90 Kreb Units/1.0 poise (low shear/high shear viscosity) is a compromise. To attain this rheology profile, it would be necessary to use both thickeners.

Flash Rust Inhibitors

In waterborne paints for steel, the water phase should contain flash rust inhibitors since rapid rusting (flash rust) can occur. The recommended additive is sodium nitrite, which is effective at low use levels, such as 1 to 2 lbs (solid) per 100 gallons. Addition in a diluted form (15% aqueous solution) is recommended to prevent stability problems and grit formation. Other inhibitors are available that can be used, such as ammonium benzoate.

Defoamers

Foam control is a major concern in waterborne paint formulation design. Additives are necessary to eliminate foam during manufacture and film application. The choice of defoamer type and level will depend primarily on the formulation and mode of application. Deeptone formulations for airless spray application, which use pre-dispersed colorants, will require the most effective defoamer package. Brushing formulations prepared with in-house, factory-dispersed dry pigments are typically easier to effectively defoam.

A good start in choosing the right defoamer package is to have a silicone-based defoamer in the grind followed by a non-silicone in the letdown. Effectiveness of the defoamer can be screened by the shaker test, but the best candidates should be checked by actual application. Drawdowns should be made to check for surface defects and impact on gloss. Defoamer persistence should be checked by oven aging and retesting the defoaming capabilities.

Dispersants and Wetting Agents

Like coalescent, the type and level of dispersant will influence the property balance of paints based on MAINCOTE™ HG-86 Acrylic Resin. TAMOL™ 165 or TAMOL™ 681 Dispersants at 1.0% to 1.5% on pigment (solids/solids) are recommended starting points. It is advantageous to corrosion resistance to minimize the use of these materials as long as other properties like paint stability are not compromised.

Colorants

Good choices for coloring formulations based on MAINCOTE™ HG-86 Acrylic Resin are the UCD™ E-Line or Q-Line colorants from The Dow Chemical Company. They provide color fastness and full color ranges. The UCD E-Line of colorants is suitable for in-plant tinting of industrial paints, and the Q-Line colorant is suitable for volumetric dispensing and in-store tinting. Colorant selection, like most additive choices, should be done carefully for waterborne maintenance coatings, since pre-dispersed colorants can negatively impact corrosion resistance due to the high level of surfactants or additives used to disperse and stabilize the colored pigments.

Reactive Pigments

The choice of reactive pigment can have a major impact not only on the corrosion protection offered by the paint formulation but also on the stability of the system. Using modified zinc phosphates, such as Heucophos™ ZMP corrosion inhibiting pigment, zinc oxides, or other reactive pigments at levels of 25 lbs / 100 gallons and below offers the best balance of resistance to corrosion while not negatively impacting the in-can stability. Given the wide variation in the types of reactive pigments available and their strong impact on performance and stability, it is strongly recommended that any reactive pigment selection be thoroughly tested.

Gloss Direct-To-Metal Topcoat Paint[3]
Formulation G-86-1

Materials		Pounds	Gallons
Grind			
Water		40.0	4.8
DOWANOL™ DPM Coalescent		20.0	2.5
TAMOL™ 681 Dispersant		9.0	1.0
Drewplus™ L-493 defoamer		1.0	0.1
TRITON™ CF-10 Surfactant		2.0	0.2
Ammonium Hydroxide (28%)		1.0	0.1
Ti-Pure R-706 titanium dioxide		205.0	6.2
Cowles grind to 7+ Hegman, then let down:			
MAINCOTE™ HG-86 Acrylic Resin		577.0	66.9
Water		88.0	10.6
Ammonium Hydroxide (14%)		3.0	0.4
Grind (from above)		278.0	*14.9*
Texanol ester alcohol		37.5	4.8
Sodium Nitrite (15% Aqueous)		9.0	1.1
Ammonium Hydroxide (14%) (adjust to pH 9.5)		1.0	0.1
Water		5.5	0.7
ACRYSOL™ RM-8W Rheology Modifier		1.6	0.2
ACRYSOL™ RM-12W Rheology Modifier		2.2	0.3
	Totals	1002.8	100.0

Formulation Constants	
Pigment Volume Concentration, %	18.0
Volume, Solids, %	35.1
Weight, Solids, %	46.3
Density, US gal/lb	10.0
Viscosity, Stormer, Krebs	94
pH	9.4
VOC, g/L	163

3. This formulation exhibits excellent gloss and corrosion resistance, and features good sag resistance for thicker film applications. It is suitable for industrial maintenance applications. Performance data is presented in Tables 1 through 3.

Gloss Equipment Yellow DTM/Topcoat Paint[4]
Formulation G-86-3

Materials		Pounds	Gallons
Grind			
Water		50.0	6.0
TAMOL™ 681 Dispersant		7.0	0.8
Byk 022 defoamer		2.0	0.2
TRITON™ CF-10 Surfactant		2.0	0.2
Ammonium Hydroxide (28%)		1.0	0.1
Ti-Pure R-706 titanium dioxide		65.0	2.0
Bayferrox 142M black iron oxide		65.0	1.9
Cowles grind to 7+ Hegman on high speed, then let down:			
MAINCOTE™ HG-86 Acrylic Resin		642.0	74.5
Ammonium Hydroxide (14%)		3.0	0.4
Grind (from above)		192.0	11.2
Exxate 800 solvent		42.0	5.8
Propylene Glycol		10.0	1.2
Methanol		35.0	5.3
Sodium Nitrite (15% Aqueous)		9.0	1.1
Ammonium Hydroxide (14%) (adjust to pH 9.5)		1.8	0.2
ACRYSOL™ RM-8W Rheology Modifier		2.3	0.3
	Totals	937.1	100.0

Formulation Constants	
Pigment Volume Concentration, %	11.0
Volume, Solids, %	36.0
Weight, Solids, %	44.6
Density, US lb/gal	9.37
Viscosity, Stormer, Krebs	95
pH	9.5
VOC, g/L	216
Paint Properties	
Gloss 20° 60°	 57 80
Koning Hardness, 2 week dry, 2 mil DFT, sec	62
Salt Spray Resistance, 384 hrs. (16 days), 3 mil DFT on blasted hot-rolled steel Blister Rating Rust Rating, % Undercut, mm	 6, few Slight, 10 < 1

4. This formulation has excellent gloss, hardness development, and corrosion resistance. The propylene glycol/methanol package provides some freeze/thaw stability without hurting early water properties.

Safe Handling Information

The Dow Chemical Company Material Safety Data Sheets (MSDS) contain pertinent information that you may need to protect your employees and customers against any known health or safety hazards associated with our products.

Under the OSHA Hazard Communication Standard, workers must have access to and understand MSDS on all hazardous substances to which they are exposed. Thus, it is important that you provide appropriate training and information to your employees and make sure they have available to them MSDS on any hazardous products in their workplace.

The Dow Chemical Company sends MSDS for all its products, whether or not they are considered OSHA-hazardous, to both the "bill to" and/or "ship to" locations of all its customers upon initial shipment, including samples. If you do not have access to one of these MSDS, please contact your local Dow representative for an additional copy.

Updated MSDS are sent upon revision to all customers of record. In addition, MSDS are sent annually to all customers receiving products deemed hazardous under the Superfund Amendments and Reauthorization Act.

MSDS should be obtained from your suppliers of other materials recommended in this bulletin. MSDS should be obtained from your suppliers of other materials recommended in this bulletin.

The Dow Chemical Company is a member of the American Chemistry Council and is committed to ACC's Responsible Care® Program.

Handling Precautions

Before using this product, consult the Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS) for details on product hazards, recommended handling precautions and product storage.

CAUTION! Keep combustible and/or flammable products and their vapors away from heat, sparks, flames and other sources of ignition including static discharge. Processing or operating at temperatures near or above product flashpoint may pose a fire hazard. Use appropriate grounding and bonding techniques to manage static discharge hazards.

CAUTION! Failure to maintain proper volume level when using immersion heaters can expose tank and solution to excessive heat resulting in a possible combustion hazard, particularly when plastic tanks are used.

Storage

Store products in tightly closed original containers at temperatures recommended on the product label.

Disposal Considerations

Dispose in accordance with all local, state (provincial) and federal regulations. Empty containers may contain hazardous residues. This material and its container must be disposed in a safe and legal manner.

It is the user's responsibility to verify that treatment and disposal procedures comply with local, state (provincial) and federal regulations. Contact your Dow Technical Representative for more information.

Product Stewardship

Dow has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products – from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

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Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to ensure that Dow products are not used in ways for which they are not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including safety data sheets, should be consulted prior to use of Dow products. Current safety data sheets are available from Dow.

Contact:
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Latin America: (+55)-11-5188-9000
Europe: (+800)-3-694-6367
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http://www.dow.com