Technical Data Sheet

MAINCOTE™ HG-54D Waterborne Acrylic Resin

For Corrosion-Resistant Primers and High-Gloss Topcoats

Introduction

MAINCOTE™ HG-54D Acrylic Resin has established the performance standard for acrylic waterborne maintenance paint vehicles. It can be formulated into primers and gloss topcoats which are designed for commercial, institutional, and industrial maintenance markets. The full gloss capability, corrosion resistance, flow, hardness, and chemical resistance characteristics imparted by MAINCOTE™ HG-54D Acrylic Resin in a waterborne finish are typical of those associated with conventional solvent-based maintenance systems. Primer formulations exhibit stability with commonly used corrosion-inhibiting pigments.

A properly formulated coating based on MAINCOTE™ HG-54D Acrylic Resin:

- Decreases maintenance expenses and replacement costs.
- Reduces the need to paint as frequently.
- Provides protection to the paint user's valuable investment.
- Exhibits excellent resistance to gloss loss, corrosion, fading, chalking, chemicals, and solvents.

Typical Physical Properties[1]

Property	Typical Values
Solids Content, %	41 – 42
Viscosity, cPs (25°C)	50 – 400
pH	7.2 - 7.8
Bulking Value, US gal/lb Wet Dry	 0.117 0.112
Density, US lb/gal	8.5
Minimum Film Formation Temperature, (MFFT), °C	30
Glass Transition Temperature, °C	40
Tukon Hardness, KHN	6.0

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

Industrial Maintenance Applications

Corrosion resistance of a typical medium-duty industrial maintenance system based on MAINCOTE™ HG-54D Acrylic Resin is shown in Table 1 (on Page 2) for two coats of primer, two coats of a gloss topcoat, and a two-coat primer, topcoat system. MAINCOTE™ HG-54D Acrylic Resin provides good chemical resistance properties as illustrated by the protection imparted by clear and pigmented finishes to metal substrates when subjected to acid exposure.

®™ Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow

Table 1: Corrosion Resistance of Finishes Based on MAINCOTE™ HG-54D Acrylic Resin
2 Dry mil/coat, Exposed 500 hrs.

	Cold Rolled Steel			Sandblasted Hot Rolled Steel		
Resistance Property	Topcoat 2 Coats	Primer 2 Coats	Primer Topcoat	Topcoat 2 Coats	Primer 2 Coats	Primer Topcoat
Salt Spray						
Unscored panels						
Rust	None	None	None	Sl	Tr	None
Blister	10	10	4M	4F	6F	6VF
X-Scribe						
Undercutting	Sl	Sl	Sl	S-Med	Sl	Sl
Blister	4F-M	6F-M	4M	5F-M	6F	6F
High Humidity						
Unscored panels						
Rust				None	None	None
Blister				10	8F-M	8F
X-Scribe						
Undercutting				Tr	Tr	Sl
Blister				10	8F	10

Rating System Rust	Blister Size	Density	Undercutting
Trace <2%	1 - Large (1/4" dia.)	F - Few	Sl 1/8"
Slight <5%	9 - Very Small (1/32")	M - Moderate	Mod 1/4"
Mod. 20%	10 - None	D - Dense	Heavy 1/2"
Heavy 50%			

Formulating Guidelines

The formulation methodology is a major contributor to the performance of MAINCOTE™ HG-54D Acrylic Resin in paint. The choice of paint ingredients determines the protective as well as the application properties. The choice and amount of each ingredient in the formulations provided is significant to the performance. Substitutes should be carefully evaluated.

Coalescent and Co-solvent Effects

The type and level of coalescent in the formulation is critical to the balance of properties. Hydrophobic coalescents that partition to the polymer phase are recommended as opposed to water-soluble coalescents. Texanol ester alcohol at 15% on polymer solids is optimum for gloss.

Formulations HB-54-2, G-54-6, and G-54-7 illustrate starting-point formulations for Topcoat/DTM applications using different types of coalescent packages. Both HB-54-2 and G-54-6 are recommended high-gloss formulations. Formulation G-54-7 contains DPnB/DBP which is a coalescent package giving good early water resistance properties. This coalescent package will not yield the high gloss of formulations HB-54-2 and G-54-6, but it will show better early water resistance and corrosion properties. DPnB/DBP is also the coalescent package for our starting point primer formulation P-54-9.

®™ Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow

Dispersing and Wetting Agents

Like coalescents, the type and level of dispersant will influence the property balance of paints based on MAINCOTE™ HG-54D Acrylic Resin. TAMOL™ 165 and TAMOL™ 681 Dispersants at 1.0% and 1.5% on pigment (solids/solids), respectively, are recommended starting points. TAMOL™ 165 Dispersant will give maximum corrosion protection. TAMOL™ 681 Dispersant will provide higher gloss and will suppress low shear viscosities (Kreb Units), which is an added feature when using this dispersant. Surfynol 104 DPM defoamer is the wetting aid of choice because it has the least effect on corrosion resistance. It is advantageous to corrosion resistance to minimize the use of these materials as long as other properties like paint stability are not compromised.

Thickeners

Nonionic urethane thickeners such as ACRYSOL™ RM-2020NPR, ACRYSOL™ RM-8W, and ACRYSOL™ RM-12W Rheology Modifiers are key to the performance of MAINCOTE™ HG-54D Acrylic Resin. The use of cellulosic or alkali-soluble thickeners significantly downgrades its performance, especially corrosion resistance.

Expected method of application is significant to the selection of 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. High shear viscosity is measured by the ICI Viscometer (cone and plate) with units in poise. 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.

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

ACRYSOL™ RM-2020NPR Rheology Modifier is the choice for brush or roller application. ACRYSOL™ RM-8W and ACRYSOL™ RM-12W Rheology Modifiers are more suitable in paints designed for spray application. ACRYSOL™ RM-12W Rheology Modifier is excellent for spray application where flow/sag balance is critical. 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.

Wet Edge and Freeze-Thaw Agents

The most effective additives to extend the wet edge time and to inhibit freezing of aqueous paints are propylene glycol and ethylene glycol, but they are hygroscopic and can present film-formation problems, especially at high humidity. As such, these materials have a detrimental effect on corrosion resistance, especially early rusting.

The starting point formulations optimized for corrosion resistance tend to have marginal freeze-thaw stability. Paints with improved freeze-thaw stability can be formulated but with some sacrifice in corrosion resistance.

®™ Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow

Flash Rust Inhibitors

In waterborne paints for steel, the water phase must be inhibited or flash rusting will occur. The recommended additive is sodium nitrite, which is very effective at very low use levels. Raybo 60 rust inhibitor or ammonium benzoate are alternatives.

Defoamers

Foam control is a major concern in waterborne paint formulation design. Additives are necessary to eliminate foam during manufacture and on 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 predispersed colorants, will require the most potent defoamer package. Brushing formulations with in-house, factory-dispersed dry pigments will require less.

A good start in choosing the right defoamer package is to have a silicone type 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 also be done to check for surface defects and impact on gloss. Defoamer persistence should be checked by oven aging and retesting the defoaming capabilities.

Colorants

Colorant addition to waterborne maintenance paints generally lowers corrosion resistance due to the high level of surfactants or additives used to disperse and stabilize the colored pigments. Colorants recommended for industrial applications, such as Huls America lubricant, Aqua Chem 896 colorant, have minimal effect as opposed to the universal colorants commonly used in architectural paints.

®™ Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow

High-Build Gloss White Topcoat for Airless Spray Application HB-54-2

Materials		Pounds	Gallons
MAINCOTE™ HG-54D Acrylic Resin		400.0	46.80
Surfynol CT-151 defoamer		8.5	0.91
Ammonium Hydroxide (28%)		1.0	0.14
Surfynol DF-210 defoamer		2.4	0.32
Ti-Pure R-900 titanium dioxide		127.6	3.71
Allow pigment to wet thoroughly, then add:			
ACRYSOL™ RM-8W Rheology Modifier		1.2	0.14
Let down			
MAINCOTE™ HG-54D Acrylic Resin		318.5	37.62
Texanol ester alcohol		44.7	5.64
Surfynol DF-210 defoamer		2.4	0.32
Surfynol 104DPM defoamer		10.0	1.28
Ammonium Hydroxide (28%)		4.0	0.54
Sodium Nitrite (15% Aqueous)		8.2	0.99
Water		28.0	3.36
ACRYSOL™ RM-8W Rheology Modifier		0.8	0.09
	Totals	966.3	101.86

Formulation Constants	
Pigment Volume Concentration, %	10.0
Volume, Solids, %	36.5
Weight, Solids, %	44.42
Viscosity, Initial, Krebs	95
pH	9.3
VOC, g/L	119.78
Grind	7+ Hegman

®™ Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow

High Gloss Fast-Dry DTM Topcoat for Airless Spray Application G-54-6

Materials		Pounds	Gallons
Grind			
Dipropylene Glycol Monomethyl Ether (DPM)		18.0	2.28
Water		35.0	4.20
TAMOL™ 165 Dispersant		9.5	1.08
Aqueous Ammonia (28%)		1.0	0.13
TRITON™ CF-10 Surfactant		1.5	0.17
Tego Foamex 1488 defoamer		1.5	0.18
Ti-Pure R-706 titanium dioxide		195.0	5.85
Grind in Cowles to 7+ Hegman, then let down at low speed.			
Water		5.0	0.60
	Totals	266.50	14.49
Let down			
MAINCOTE™ HG-54D Acrylic Resin		660.0	77.22
Aqueous Ammonia (28%)		4.0	0.52
Butyl CELLOSOLVE™ Coalescent		110.0	14.63
Tego Foamex 1488 defoamer		2.5	0.30
Sodium Nitrite (15% Aqueous)		9.0	1.08
	Totals	1052.0	108.34

Formulation Constants	
Pigment Volume Concentration, %	16.0
Volume, Solids, %	33.7
Weight, Solids, %	44.57
Viscosity, Initial, Krebs	95
pH	8.5+
VOC, g/L	281.61
Grind	7+ Hegman

®™ Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow

Mid Gloss DTM Topcoat with Early Water Resistance for Airless Spray Application G-54-7

Materials		Pounds	Gallons
Grind			
Dipropylene Glycol Monomethyl Ether (DPM)		18.0	2.28
Water		35.0	4.20
TAMOL™ 165 Dispersant		9.5	1.08
Aqueous Ammonia (28%)		1.0	0.13
TRITON™ CF-10 Surfactant		1.5	0.17
Tego Foamex 1488 defoamer		1.5	0.18
Ti-Pure R-706 titanium dioxide		195.0	5.85
Grind in Cowles to 7+ Hegman, then let down at low speed.			
Water		5.0	0.60
	Totals	266.50	14.49
Let down			
MAINCOTE™ HG-54D Acrylic Resin		660.0	77.22
Aqueous Ammonia (28%)		4.0	0.52
Dipropylene Glycol Monobutyl Ether (DPnB)		55.0	7.22
DiButyl Phthalate plasticizer		14.0	1.60
Tego Foamex 1488 defoamer		2.5	0.30
Sodium Nitrite (15% Aqueous)		9.0	1.08
ACRYSOL™ RM-8W Rheology Modifier		4.5	0.52
	Totals	1015.5.0	102.94

Formulation Constants	
Pigment Volume Concentration, %	16.0
Volume, Solids, %	35.5
Weight, Solids, %	46.17
Viscosity, Initial, Krebs	97
pH	8.5+
VOC, g/L	179.53
Grind	7+ Hegman

Red Primer Paint for Airless Spray Application P-54-9

Materials		Pounds	Gallons
Dipropylene Glycol Monomethyl Ether (DPM)		20.0	2.53
Water		60.0	7.20
TAMOL™ 165 Dispersant		13.0	1.47
Aqueous Ammonia (28%)		1.0	0.13
TRITON™ CF-10 Surfactant		1.6	0.18
Tego Foamex 1488 defoamer		2.0	0.24
Bayferrox 120NM red iron oxide		50.0	1.22
Atomite calcium carbonate extender pigment		100.0	4.43
Heucophos ZMP corrosion inhibiting pigment		50.0	1.70
Shieldex inhibitive pigment		26.0	1.67
Aerosil R-972 fumed silica		5.0	0.27
Grind to 5+ Hegman			
	Totals	327.6	21.04
Let down			
MAINCOTE™ HG-54D Acrylic Resin		563.0	65.87
Aqueous Ammonia (28%)		3.2	0.42
Premix			
Water		20.0	2.40
Dipropylene Glycol Monobutyl Ether (DPnB)		30.0	3.94
Dibutyl Phthalate		15.0	1.71
Tego Foamex 1488 defoamer		4.0	0.48
Sodium Nitrite (15% Aqueous)		9.0	1.08
Premix then add:			
ACRYSOL™ RM-12W Rheology Modifier		4.0	0.47
Water		4.0	0.48
	Totals	979.8	97.90

Formulation Constants	
Pigment Volume Concentration, %	26.2
Volume, Solids, %	36.2
Weight, Solids, %	47.32
Viscosity, Initial, Krebs	97
pH	8.5+
VOC, g/L	133.7
Grind	5+ Hegman

®™ Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow

Based on its composition, MAINCOTE™ HG-54D Acrylic Resin is not expected to be acutely toxic via single oral, dermal, or inhalation exposure. It may be a mild to moderate skin, eye, or respiratory irritant.

The polymer portion of MAINCOTE™ HG-54D Acrylic Resin is derived in part from acrylonitrile. However, the level of free acrylonitrile in this polymer is less than 10 ppm. The Dow Chemical Company has developed objective data, available upon request, which indicate that this product should result in workroom acrylonitrile air levels well below 1 ppm, under recommended use conditions, and should thus be exempt from regulation under the OSHA acrylonitrile standard.

This bulletin recommends the use of many different formulating ingredients. If improperly used, these materials may pose varying degrees of health or safety concerns. It is important to practice good industrial hygiene and maintain adherence to manufacturer's recommendations for handling these materials.

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 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.

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

®Responsible Care is a registered service mark of the American Chemistry Council in the United States.
®™ Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow

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.

Customer Notice

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:
North America: 1-800-447-4369
Latin America: (+55)-11-5188-9000
Europe: (+800)-3-694-6367
Asia-Pacific: (+800)-7776-7776
http://www.dow.com

Notice: No freedom from infringement of any patent owned by Dow or others is to be inferred. Because use conditions and applicable laws may differ from one location to another and may change with time, Customer is responsible for determining whether products and the information in this document are appropriate for Customer's use and for ensuring that Customer's workplace and disposal practices are in compliance with applicable laws and other government enactments. The product shown in this literature may not be available for sale and/or available in all geographies where Dow is represented. The claims made may not have been approved for use in all countries. Dow assumes no obligation or liability for the information in this document. References to “Dow” or the “Company” mean the Dow legal entity selling the products to Customer unless otherwise expressly noted. NO WARRANTIES ARE GIVEN; ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.

® Trademark of The Dow Chemical Company