Technical Data Sheet

MAINCOTE™ PR-71 Waterborne Acrylic Resin

For Maintenance Primers

Introduction

For all protective coating applications, the first need is for adhesion to and passivation of the substrate. In the past, difficult-to-adhere-to substrates were often treated with a vinyl wash primer to passivate the substrate and provide adhesion for subsequent coats. These vinyl wash primers are increasingly difficult to use as they are very low in solids, high in VOC, and contain toxic pigments. In contrast, MAINCOTE™ PR-71 Waterborne Acrylic Resin allows the coatings manufacturer to supply primers that not only adhere to difficult metallic substrates, but also give good corrosion resistance over carbon steel. This resin's ability to be topcoated by most solvent-based coating systems makes it a very versatile water-based primer.

Features

- Exceptional adhesion to galvanized steel – even chromate-treated.
- Exceptional adhesion to aluminum – even untreated.
- Good inherent corrosion resistance and reactive pigment stability.
- Maintenance of properties even when applied under marginal, low-temperature drying conditions.
- Capability of being topcoated by most solvent-borne coatings.

Typical Physical Properties[1]

Property	Typical Values
Solids Content, % Weight Volume	 50.0 47.8
Viscosity, Brookfield, cPs (25°C) (#2 spindle, 60 rpm)	500 max
pH	9.0
Bulking Value, US gal/lb Wet Dry	 0.1149 0.1099
Density, US lb/gal	8.70
Minimum Film Formation Temperature, (MFFT), °C	20
Glass Transition Temperature, Tg, °C (DSC Method)	25

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

Performance Results

To demonstrate the excellent performance of MAINCOTE™ PR-71 Waterborne Acrylic Resin coatings under marginal conditions, several test systems were applied outside at temperatures of 40° to 50°F to chromate treated galvanized steel. These panels were then weathered for three weeks during February in Philadelphia, PA. The systems were next subjected to four days of high humidity in the laboratory fog box, and subsequently tested for adhesion by a cross-hatch test. The results of these tests were:

2 coats solventborne, 2-pack acrylic / urethane topcoat	Fail
Solventborne, 2-pack wash primer / urethane topcoat	Marginal
MAINCOTE™ PR-71 Acrylic Emulsion Formulation P-71-1 / urethane topcoat	Pass
2 coats solventborne, 2-pack polyamide / epoxy topcoat	Fail
Solventborne, 2-pack wash primer / epoxy topcoat	Fail
MAINCOTE™ PR-71 Acrylic Emulsion Formulation P-71-1 / epoxy topcoat	Pass

Formulating Guidelines

As with all resins, improper formulation can detract from the performance of MAINCOTE™ PR-71 Waterborne Acrylic Resin. The choice of paint ingredients determines its protective as well as its application properties. The choice and amount of each ingredient in the formulations provided are significant to the paint performance. Substitutes should be carefully evaluated.

Dispersants

As in all maintenance formulations, the choice of dispersant is critical. Many dispersants, particularly polymethacrylic acid or polyacrylic acid, reduce corrosion resistance. TAMOL™ 165 Dispersant provides the best balance of corrosion resistance and dispersing efficiency in MAINCOTE™ PR-71 Waterborne Acrylic Resin formulations. TAMOL™ 681 Dispersant can also be used but, because higher levels are required, it provides less corrosion resistance than TAMOL™ 165 Dispersant in laboratory tests. Some formulators may prefer to use propylene-based solvents because of their reduced toxicity. Care must be taken when an alternative coalescent to Butyl CELLOSOLVE™ Coalescent is preferred. Butyl CELLOSOLVE™ Coalescent is water miscible so it can be added in the grind. However, if the alternative is hydrophobic, it must be added in the letdown. This necessitates that extra water be used in the grind for fluidity. To get good pigment wetting, we have used Surfynol 104 surfactant. This appears to have minimal affect on resistance properties.

Thickeners/Rheology Modifiers

Nonionic rheology modifiers such as ACRYSOL™ RM-1020 and ACRYSOL™ RM-8 are recommended with MAINCOTE™ Cellulosic Thickeners detract severely from corrosion resistance. Please note that the efficiency of most rheology modifiers is strongly affected by the presence of water miscible solvents such as Butyl CELLOSOLVE™ Coalescent and ethanol. Hydrophobic solvents such as Butyl PROPASOL™ Coalescent and Texanol ester alcohol have little effect.

Extenders

Choice of extender can be critical, especially for adhesion to difficult substrates. In our formulation work, we have chosen to use talc. Other pigments may be satisfactory but any changes should be rigorously checked for effects on adhesion, particularly at higher PVCs. The use of calcium carbonate has been shown to interfere with the adhesion of these paints over galvanized. If only protection over mild steel is required, calcium carbonate may be satisfactory.

Defoamers
In our most recent formulations, we have used SAG 5440 defoamer. The use of silicone defoamers should be avoided as they can affect adhesion.

Hiding Pigments
Hiding pigments can have an effect on the performance of a paint system. The use of an untreated TiO_2 such TiPure R-900 titanium dioxide has been shown to be better for corrosion resistance and is therefore the pigment of choice in primer formulations. We have found differences in red iron oxide pigments on our formulations. R-2899 in Formulations P-71-4 and P-71-2M has been shown to have minimal effect on gassing. Other RIO pigments may be suitable but they should be screened for their effect on gassing. Chromium oxide X-1134 is used solely as a green hiding pigment and has no effect on corrosion. It is not hexavalent and is generally considered to be benign. The use of oxide pigments in the presence of zinc ions can cause stability problems. Generally, the limit is around 100 #/100 gals. Untreated TiO_2 is again, better than treated but this cautionary note applies to all oxide pigments, including red, yellow, and black iron oxides.

Reactive Pigments
For general purpose corrosion resistance, a combination of zinc phosphate and Shieldex inhibitive pigment gives a good balance of properties in MAINCOTE™ PR-71 Waterborne Acrylic Resin formulations. K-white #84S anti-corrosive pigment as a replacement for the above pigments has been shown to give very good service, although some pH drift has been observed. Halox SZP371 corrosion inhibitor is also a good replacement for zinc phosphate. The use of Mineral Pigments' Phosguard J0853 zinc phosphate is a suitable replacement for the combination of zinc phosphate and Shieldex. Where unusual substrates lead to severe flash rusting, the addition of Busan 11M-1 corrosion-inhibiting pigment to these pigments is beneficial.

Coalescent/Plasticizer
Again, the choice of ingredients such as coalescent and plasticizer can be critical to the performance of a paint primer. The level of Butyl CELLOSOLVE™ Coalescent in the formulation is significant in the early corrosion resistance (early rust) and development of adhesion at low temperatures. Fast evaporating solvents are preferred for quick property development and to avoid solvent entrapment in the primer coat with subsequent topcoats. Propylene glycol monobutyl ether is a suitable alternative coalescent, however, since it is a hydrophobic solvent it needs to be added in the letdown. Other coalescents may be suitable but should be evaluated for their effect on adhesion and corrosion. For formulations with ultra low VOC, Monomer QM-57T reactive plasticizer may be a useful coalescent. This monomer oxidizes in the film and thus does not contribute to VOCs. As this material will harden the film, we do not know its affect on long-term properties. These should be evaluated carefully.

Note: While MAINCOTE™ PR-71 Waterborne Acrylic Resin formulations show excellent adhesion over a wide variety of clean substrates, we have found no foolproof solution to its use over uncleaned galvanized. Over these substrates, while early adhesion is poor, we observed that this improved after a three week dry.

In addition, while MAINCOTE™ PR-71 Waterborne Acrylic Resin based paints can be topcoated with a large number of paints including many solventborne paints, it is critical to check adhesion of a given paint before recommending. Many factors may affect the intercoat adhesion including hardness differences between primer and topcoat and sensitivity of the primer to solvents used in the topcoat.

Flash Rusting

All the formulations shown prior to this exhibit satisfactory flash rust resistance in most instances. This includes most sand blasted and media blasted substrates. There are, however, some unusual substrates which exhibit flash rusting even in a well formulated primer containing sodium nitrite. In primer formulations, problems are most commonly seen over some weld seams. For these specific problem areas the formulator could consider the use of Busan 11M1 corrosion-inhibiting pigment as an auxiliary pigment. This pigment will improve the flash rust tendencies but with the risk of compromising on paint stability. A suggested starting-point formulation follows.

MAINCOTE™ PR-71 Acrylic Emulsion General Purpose Primer Sprayable Formulation

Formulation P-71-1M

Materials		Pounds	Gallons
Grind			
Water		170.00	20.40
TAMOL™ 165 Dispersant		11.00	1.25
Sag 5440 defoamer		1.00	0.14
Butyl CELLOSOLVE™ Coalescent		35.90	4.77
Dibutyl Phthalate plasticizer		7.20	0.82
Ammonium Hydroxide (28%) NH_3		2.00	2.00
2610 Talc		100.00	4.45
Chromium Oxide X-1134		50.00	1.17
Shieldex inhibitive pigment		25.00	1.67
Heucophos ZMP corrosion-inhibiting pigment		50.00	1.67
Water		5.00	0.60
Grind the above for 15 minutes then, at slower speed, add Bentone LT additive/water pregelled mix and continue grinding 25.00 2.95 for 5 minutes. (1 lb Bentone LT additive pregelled with 24 lbs water.)		25.00	2.95
Let down			
MAINCOTE™ PR-71 Acrylic Emulsion		471.80	54.21
Water		4.00	0.48
Grind from above		482.10	40.10
Sag 5440 defoamer		1.00	0.14
Ethanol		17.90	2.67
Sodium Nitrite (15% Aqueous)		9.00	1.08
ACRYSOL™ RM-8 Rheology Modifier (35%)		6.60	0.73
Water		4.93	0.59
	Totals	997.33	100.00

Formulation Constants	
Pigment Volume Concentration, %	25.58
Volume, Solids, %	34.84
pH	8.7
Viscosity, Initial, Stormer, Krebs (after 24 hours)	79/85
VOC[1], lb/gal (g/liter)	1.28 (153)

1. Weight of volatile organic material per volume minus water.

MAINCOTE™ PR-71 Acrylic Emulsion Gray Primer
Formulation P-71-3

Materials		Pounds	Gallons
Grind			
Water		170.00	20.40
TAMOL™ 165 Dispersant		11.00	1.25
Sag 5440 defoamer		1.00	0.14
Butyl CELLOSOLVE™ Coalescent		35.90	4.77
KP-140 plasticizer (tributoxy ethyl phosphate)		7.20	0.82
Ammonium Hydroxide (28%) NH_3		2.00	0.26
Ti-Pure R-900 titanium dioxide		50.00	1.50
2610 Talc		100.00	4.45
Shieldex inhibitive pigment		25.00	1.67
Heucophos ZMP corrosion inhibiting pigment		50.00	1.62
Bayferrox 318M pigment		5.00	0.13
Grind the above for 15 minutes then, at slower speed, add Bentone LT additive/water pregelled mix and continue grinding for 5 minutes. (1 lb Bentone LT additive pregelled with 24 lbs water.)		25.00	2.95
Let down			
MAINCOTE™ PR-71 Acrylic Emulsion		465.25	53.46
Water		22.00	2.64
Grind (from above)		482.10	39.96
Sag 5440 defoamer		1.00	0.14
Sodium Nitrite (15% Aqueous)		9.00	1.08
ACRYSOL™ RM-8 Rheology Modifier		10.00	1.11
Water		13.40	1.61
	Totals	997.33	100.00

Formulation Constants	
Pigment Volume Concentration, %	26.83
Volume, Solids, %	34.94
pH	8.7
Viscosity, Initial, Stormer, Krebs (after 24 hours)	75/85
VOC[1], lb/gal (g/liter)	0.96 (114)

1. Weight of volatile organic material per volume minus water.

MAINCOTE™ PR-71 Acrylic Emulsion Gray Primer Using Propylene Based Coalescent

Formulation P-71-3B

Materials		Pounds	Gallons
Grind			
Water		195.00	23.40
TAMOL™ 165 Dispersant		11.00	1.25
Sag 5440 defoamer		1.00	0.14
Surfynol 104 defoamer		4.00	0.51
Aqueous Ammonia (28%)		2.00	0.26
Ti-Pure R-900 titanium dioxide		50.00	1.50
2610 Talc		100.00	4.45
Shieldex inhibititive pigment		25.00	1.67
Heucophos ZMP corrosion inhibiting pigment		50.00	1.62
Chroma-Chem 896-9901 lamp black		1.00	0.11
Grind the above for 15 minutes then, at slower speed, add Bentone LT additive/water pregelled mix and continue grinding for 5 minutes. (1 lb Bentone LT additive pregelled with 24 lbs water.)		25.00	2.95
Let down			
MAINCOTE™ PR-71 Acrylic Emulsion		465.25	53.46
Grind (from above)		460.00	37.35
Propylene Glycol Monobutyl Ether (PnB)		35.89	4.90
KP-140 plasticizer (Tributoyx Ethyl Phosphate)		7.18	0.82
Sag 5440 defoamer		1.00	0.14
Ethanol		17.90	2.67
Sodium Nitrite (15% Aqueous)		9.00	1.08
ACRYSOL™ RM-8 Rheology Modifier		4.70	0.55
	Totals	1002.75	100.00

Formulation Constants	
Pigment Volume Concentration, %	26.55
Volume, Solids, %	34.30
pH	8.6
Viscosity, Initial, Stormer, Krebs (after 24 hours)	86
VOC[1], lb/gal (g/liter)	1.27 (152)

1. Weight of volatile organic material per volume minus water.

MAINCOTE™ PR-71 Acrylic Emulsion Red Primer
Formulation P-71-4

Materials		Pounds	Gallons
Grind			
Water		180.00	21.60
TAMOL™ 165 Dispersant		11.00	1.25
Sag 5440 defoamer		1.00	0.14
Butyl CELLOSOLVE™ Coalescent		35.90	4.77
KP-140 plasticizer (tributoxy ethyl phosphate)		7.20	0.82
Ammonium Hydroxide (28%) NH_3		2.00	0.26
R-2899 Copperas Red (RIO) red iron oxide		50.00	1.17
2610 Talc		100.00	4.45
Shieldex inhibititive pigment		25.00	1.67
Heucophos ZMP corrosion-inhibiting pigment		50.00	1.62
Grind the above for 15 minutes then, at slower speed, add Bentone LT additive/water pregelled mix and continue grinding for 5 minutes. (1 lb Bentone LT additive pregelled with 24 lbs water.)		25.00	2.95
Let down			
MAINCOTE™ PR-71 Acrylic Emulsion		465.25	53.46
Water		15.00	1.80
Grind (from above)		487.10	40.70
Sag 5440 defomaer		1.00	0.14
Sodium Nitrite (15% Aqueous)		9.00	1.08
ACRYSOL™ RM-8 Rheology Modifier		7.50	0.83
Water		16.60	1.99
	Totals	1001.45	100.00

Formulation Constants	
Pigment Volume Concentration, %	25.85
Volume, Solids, %	34.48
pH	8.7
Viscosity, Initial, Stormer, Krebs (after 24 hours)	74/85
VOC[1], lb/gal (g/liter)	0.95 (113)

1. Weight of volatile organic material per volume minus water.

MAINCOTE™ PR-71 Acrylic Emulsion Red Primer with Freeze/Thaw Stability Roller, Brush, and Spray Capability
Formulation P-71-5

Materials		Pounds	Gallons
Grind			
Water		130.00	15.60
TAMOL™ 165 Dispersant		10.00	1.13
TRITON™ CF-10 Surfactant		1.70	0.19
Aqueous Ammonia (28%)		1.50	0.19
Sag 5440 defoamer		1.7	0.21
R-2899 Copperas Red (RIO) red iron oxide		50.00	1.17
Shieldex inhibitive pigment		25.00	1.67
Heucophos ZMP corrosion-inhibiting pigment		50.00	1.62
2610 Talc		100.00	4.53
Grind the above for 15 minutes then, at slower speed, add Bentone LT additive/water pregelled mix and continue grinding for 5 minutes. (1 lb Bentone LT additive pregelled with 24 lbs water.)		25.00	2.95
Let down			
MAINCOTE™ PR-71 Acrylic Emulsion		455.0	52.28
Water		30.00	3.60
Grind (from above)		394.9	29.26
Dipropylene Glycol Monobutyl Ether (DPnB)		8.4	1.10
Dipropylene Glycol Monomethyl Ether (DPM)		50.4	6.37
n-Methyl-2-Pyrrolidone		16.8	1.96
Sag 5440 defoamer		1.7	0.21
Sodium Nitrite (15% Aqueous)		9.0	1.08
ACRYSOL™ SCT-275 Rheology Modifier		10.0	1.16
ACRYSOL™ RM-1020 Rheology Modifier		4.0	0.45
Water		21.0	2.53
	Totals	1001.2	100.00

Formulation Constants	
Pigment Volume Concentration, %	26.60
Volume, Solids, %	34.06
pH	8.7
Viscosity, Initial, Stormer, Krebs (after 24 hours)	73/85
VOC[1], lb/gal (g/liter)	1.75 (209)

1. Weight of volatile organic material per volume minus water.

MAINCOTE™ PR-71 Acrylic Emulsion Anticorrosion Green Primer
Formulation P-71-5

Materials		Pounds	Gallons
Grind			
Water		147.00	17.67
TAMOL™ 165 Dispersant		11.00	1.25
Sag 5440 defoamer		3.40	0.42
Butyl CELLOSOLVE™ Coalescent		25.89	4.78
Dibutyl Phthalate plasticizer		7.18	0.83
Aqueous Ammonia (28%)		50.00	1.17
Lo-Micron Talc 399		106.00	4.71
Chromium Oxide Green J5320		47.00	1.06
Phosguard J0853 zinc phosphate		75.00	2.64
Grind the above for 15-20 minutes			
Let down			
Water		50.00	6.01
MAINCOTE™ PR-71 Acrylic Emulsion		471.83	54.23
Aqueous Ammonia (28%)		2.00	0.27
Ethanol		17.90	2.74
Sodium Nitrite		1.35	0.07
Water		7.65	0.92
ACRYSOL™ RM-8 Rheology Modifier		7.10	0.79
	Totals	993.30	98.79

Formulation Constants	
Pigment Volume Concentration, %	22.93
Volume, Solids, %	36.90
VOC[1], lb/gal (g/liter)	1.30 (155)

1. Weight of volatile organic material per volume minus water.

MAINCOTE™ PR-71 Acrylic Emulsion Nearly Solventless Formulation

Formulation P-71-7

Materials		Pounds	Gallons
Grind			
Water		200.00	24.00
TAMOL™ 165 Dispersant		11.00	1.25
QM-57T reactive plasticizer		11.8	1.32
Dibutyl Pthalate plasticizer		7.2	0.82
Sag 5440 defoamer		1.0	0.14
Ammonium Hydroxide (28%)		2.0	0.26
Surfynol 104H defoamer		6.8	0.84
2610 Talc		100.00	4.45
Bayferrox 120 nm (RIO) red iron oxide		50.00	1.23
Shieldex inhibitor pigment		25.00	1.67
Heucophos ZMP corrosion-inhibiting pigment		50.00	1.62
Grind the above for 20 minutes then premix the following and add to the grind:			
Bentone LT additive		1.0	0.07
Water		35.00	4.20
Let down			
MAINCOTE™ PR-71 Acrylic Emulsion		472.0	54.23
Sag 5440 defoamer		1.0	0.14
Sodium Nitrite (15% Aqueous)		9.0	1.08
ACRYSOL™ RM-2020 Rheology Modifier		15.0	1.70
Water		8.0	1.00
	Totals	1005.8	100.00

Formulation Constants	
Pigment Volume Concentration, %	22.93
Volume, Solids, %	36.90
VOC[1], lb/gal (g/liter)	1.30 (155)

1. Weight of volatile organic material per volume minus water.

MAINCOTE™ PR-71 Severe Flash Rust Resistant Primer
Formulation P-71-2M

Materials		Pounds	Gallons
Grind			
Water		180.00	24.00
TAMOL™ 165 Dispersant		11.00	1.25
Sag 5440 defoamer		1.00	0.14
Butyl CELLOSOLVE™ Coalescent		35.90	4.77
KP-140 plasticizer (tributoxy ethyl phosphate)		7.20	0.82
Ammonium Hydroxide (28%) NH_3		2.00	0.26
R-2899 Copperas Red (RIO)		50.00	1.17
2610 Talc		100.00	4.45
Busan 11M-1 corrosion-inhibiting pigment		25.00	0.91
Heucophos ZMP corrosion-inhibiting pigment		50.00	1.62
Grind the above for 15 minutes then at slower speed, add Bentone LT additive/water pregelled mix and continue grinding for 5 minutes. (1 lb. Bentone LT additive pregelled with 24 lbs water.)		25.00	2.95
Let down			
MAINCOTE™ PR-71 Acrylic Emulsion		465.25	53.46
Water		15.00	1.80
Grind (from above)		487.10	39.94
Sag 5440 defoamer		1.00	0.14
Sodium Nitrite		9.00	1.08
ACRYSOL™ RM-8 Rheology Modifier		7.50	0.83
Water		16.60	1.99
	Totals	1001.45	99.24

Formulation Constants	
Pigment Volume Concentration, %	4.2
Volume, Solids, %	33.7
pH	8.7
Viscosity, Initial, Stormer, Krebs (after 24 hours)	74/85
VOC[1], lb/gal (g/liter)	0.96 (155)

1. Weight of volatile organic material per volume minus water.

Material Safety Data Sheets

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 on non-OSHA-hazardous as well as OSHA-hazardous products to both the "bill to" and "ship to' location of all our customers upon initial shipment (including samples) of all our products (whether or not they are considered OSHA-hazardous). 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 on an annual basis to all customers of record.

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

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.

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