PARALOID™ AU-1166
PARALOID Reactive Modifier QM-1007M
Maintenance and Marine Coatings

Description

Designed for urethane coatings, PARALOID AU-1166 provides high solids, low VOC, acrylic systems with an excellent balance of dry time and pot life. In addition, urethane coatings based on PARALOID AU-1166 are produced economically due to the low isocyanate demand.

Formulators also will find this resin to be extremely versatile when used in conjunction with Dow's PARALOID Reactive Modifier QM-1007M. As a sole vehicle, PARALOID AU-1166 affords the formulator low VOC urethane coatings with low isocyanate demand. Partial replacement of PARALOID AU-1166 with PARALOID QM-1007M offers the opportunity to produce even lower VOC urethane coatings with improved performance properties over coatings based solely on PARALOID AU-1166.

Acrylic urethane formulations using PARALOID AU-1166 with and without PARALOID QM-1007M modification are included in this bulletin. These formulations are suitable for applications ranging from light-duty industrial—general product, business machines, wood finishing— to heavy-duty maintenance— chemical storage tanks, offshore rigs and platforms.

Features of Coatings Based Solely on PARALOID AU-1166:

- Economical urethane systems
- Low VOC potential
- Excellent dry time
- Excellent catalyzed pot life
- Good alkali and acid resistance

Added Features with PARALOID Reactive Modifier QM-1007M Modification:

- Lower VOC potential
- Good dry time/pot life balance
- Excellent flexibility and impact resistance
- Good solvent resistance

Typical Physical Properties
These properties are typical but do not constitute specifications.

Solids Content, %[1]	73
Solvent	n-Butyl Acetate
Viscosity, as supplied, cPs	8,000
Hydroxyl Equivalent Weight	
Solids Basis	1,000
As Supplied	1,370
Hydroxyl Number, Solids Basis	56
% Hydroxyl, Solids Basis	1.7
Tg, °C	40
Molecular Weight, Average	9,000
Wet Density at 25°C, lb/U.S. gal	8.8

[1]Measured at 150°C for one hour

Acrylic Urethane Coatings Based on PARALOID AU-1166

Formulators will find PARALOID AU-1166 to be an extremely versatile resin. When modified with PARALOID Reactive Modifier QM-1007M, coatings can be formulated to a desired balance of performance, as shown in Tables 1-4.

Table 1: Property Comparisons of PARALOID AU-1166 Based Paints Unmodified and Modified with PARALOID Reactive Modifier QM-1007M[1]

Formulation Numbers % PARALOID QM-1007M Modification[2]	G-1166-1 0%	G-1166-2 20%	G-1166-3 40%
% Catalyst (T-12)	0.02	0.01[3]	0.01[3]
% Weight Solids ("in can")	52.8	59.3[4]	65.8[4]
VOC (lb/gal)[5]	4.0	3.5[6]	3.1[6]
Viscosity Profile (#4 Ford Cup, sec)			
Initial	26	25	27
1 hour	28	33	39
2 hours	30	41	56
3 hours	32	46	67
4 hours	36	55	83
5 hours	40	62	105
Tack-Free Time (hours)[7]	3.0	4.0	4.25
Initial Gloss (20°/60°)	86/92	85/93	86/94

[1]11% Deeptone Blue formulation with Desmodur N-3300. (See Appendix.)
[2]Weight percent QM-1007M of total polyol component (AU-1166 solids and QM-1007M).
[3]An additional 0.2% benzoic acid catalyst is added based on total resin solids.
[4]Calculated assuming no hydrolysis of QM-1007M; actual weight solids should be measured by EPA Test Method #24. (See Appendix.)
[5]Volatile organic compounds of formulations tested. (See Appendix.)
[6]Volatile organic compounds calculated assuming no hydrolysis of PARALOID Reactive Modifier QM-1007M; actual VOC should be measured by EPA Test Method #24. (See Appendix.)
[7]500 gram weight on Zapon Tack Tester - no sticking.

Table 2: Mechanical Property Comparisons of PARALOID AU-1166 Based Paints Unmodified and Modified with PARALOID Reactive Modifier QM-1007M[1]

Formulation Numbers % PARALOID QM-1007M Modification[2]	G-1166-1 0%	G-1166-2 20%	G-1166-3 40%
% Catalyst (T-12)	0.02	0.01[3]	0.01[3]
Pencil Hardness			
3-Day Ambient Cure	F	2H	3H
14-Day Ambient Cure	2H	3H	4H
Flexibility (Mandrel Bends)[4]			
72°F	1/8"	1/8"	1/8"
32°F	1/8"	1/8"	1/8"
Impact Resistance[5]			
Direct	16	20	>120
Reverse	<2	<2	110

[1]11% Deeptone Blue formulation with Desmodur N-3300. (See Appendix.)
[2]Weight percent QM-1007M of total polyol component (AU-1166 solids and QM-1007M).
[3]An additional 0.2% benzoic acid catalyst is added based on total resin solids.
[4]Number indicates smallest Mandrel size tested that passed; measured at 72°F and 32°F after two-week ambient cure.
[5]Measured after two-week ambient cure.

Table 3: Chemical Resistance Property Comparisons of PARALOID AU-1166 Based Paints Unmodified and Modified with PARALOID Reactive Modifier QM-1007M[1]

Formulation Numbers % PARALOID QM-1007M Modification[2]	G-1166-1 0%	G-1166-2 20%	G-1166-3 40%
% Catalyst (T-12)	0.02	0.01[3]	0.01[3]
MEK Double Rubs	20	65	>200
Initial Pencil Hardness	2H	3H	3H
10% NaOH, 3 hours	2H	2H	3H
10% NaOH, 24 hours	2H	2H	3H
10% HCL, 3 hours	2H	2H	3H
10% HCL, 24 hours	2H	2H	3H
10% Acetic Acid, 3 hours	2H	2H	3H
10% Acetic Acid, 24 hours	F	2H	4B[4]
Xylene, 3 minutes	6B+	3H	3H
Xylene, 30 minutes	6B+	6B+	3H
Cleaning Solution[5], 3 minutes	6B+	3H	3H
Cleaning Solution[5], 30 minutes	6B+	6B+	3H
1,1,1 Trichloroethane, 3 minutes	6B+	2B	F
1,1,1 Trichloroethane, 30 minutes	6B+	6B+	F

[1]11% Deeptone Blue formulation with Desmodur N-3300; tested after two-week ambient cure. (See Appendix.)
[2]Weight percent QM-1007M of total polyol component (AU-1166 solids and QM-1007M).
[3]An additional 0.2% benzoic acid catalyst is added based on total resin solids.
[4]Blisters.
[5]EGMBE/Water/NH_4OH (47/50/3).

Table 4: Durability Comparisons of PARALOID AU-1166 Based Paints Unmodified and Modified with PARALOID Reactive Modifier QM-100M[1]

Formulation Numbers % PARALOID QM-1007M Modification[2]	G-1166-1 0%	G-1166-2 20%	G-1166-3 40%
% Catalyst (T-12)	0.02	0.02[3]	0.02[3]
QUV Durability			
20° Gloss			
Initial	84	85	86
232 hours	52	81	74
400 hours	15	70	67
663 hours	1	31	59
Fading[4]			
232 hours	7	8+	9
663 hours	4	6	8

[1]11% Deeptone Blue formulation with Desmodur N-3300. (See Appendix.)
[2]Weight percent QM-1007M of total polyol component (AU-1166 solids and QM-1007M).
[3]An additional 0.2% benzoic acid catalyst is added based on total resin solids.
[4]Measured after indicated hours of QUV exposures; 10 = no change.

Acrylic Urethane Coatings Based on PARALOID AU-1166 Modified with PARALOID Reactive Modifier QM-1007M VS. Coatings Based on PARALOID AU-946

As shown in Tables 5-8, acrylic urethane coatings formulated with Desmodur N-3300 and an 80/20 weight solids percent ratio of PARALOID AU-1166 with PARALOID Reactive Modifier QM-1007M afford a similar balance of performance and systems costs to coatings formulated with Dow's high-solids polyol, PARALOID AU-946. Coatings formulated with AU-1166/QM-1007M (80/20 weight percent ratio) offer advantages in VOC potential, catalyzed pot life, and low-temperature flexibility vs. coatings formulated with PARALOID AU-946. Conversely, coatings formulated with PARALOID AU-946 offer advantages in chemical resistance vs. AU-1166/QM-1007M (80/20 weight solids percent) based coatings.

Table 5: Paint Properties of PARALOID AU-1166/PARALOID Reactive Modifier QM-1007M (80/20)[1] vs. PARALOID AU-946 Based Paints [2]

Formulation Numbers	AU-1166/QM-1007 G-1166-2	QR-946 G-946-11
% Catalyst (T-12)	0.01[3]	0.01
% Weight Solids ("in can")	59.3[4]	51.7
VOC [5]	3.5[6]	4.1
Viscosity Profile (#4 Ford Cup, sec)		
Initial	25	26
1 hour	33	41
3 hours	46	145
5 hours	62	GEL
Tack-Free Time (hours)[7]	4.0	4.25
Initial Gloss (20°/60°)	86/94	86/92

[1]Weight percent QM-1007M and AU-1166 of total polyol component (AU-1166 solids and QM-1007M).
[2]11% Deeptone Blue formulation with Desmodur N-3300. (See Appendix.)
[3]Calculated assuming no hydrolysis of QM-1007M; actual weight solids should be measured.
[4]An additional 0.2% benzoic acid catalyst is added based on total resin solids.
[5]Volatile organic compounds of formulations tested. (See Appendix.)
[6]Volatile organic compounds calculated assuming no hydrolysis of QM-1007M; actual VOC should be measured by EPA Test Method #24. (See Appendix.)
[7]500 gram weight on Zapon Tack Tester - no sticking.

Table 6: Mechanical Properties of PARALOID AU-1166/PARALOID Reactive Modifier QM-1007M 80/20)[1] vs. PARALOID AU-946 Based Paints[2]

Formulation Numbers	AU-1166/QM-1007 G-1166-2	AU-946 G-946-11
% Catalyst (T-12)	0.01[3];	0.01
Pencil Hardness		
3-Day Ambient	2H	2H
14-Day Ambient	3H	3H
Flexibility (Mandrel Bends)[4]		
72°F	1/8"	1/8"
32°F	1/8"	1/4"
Impact Resistance[5]		
Direct	20	18
Indirect	<2	<2

[1]Weight percent QM-1007M and AU-1166 of total polyol component (AU-1166 solids and QM-1007M).
[2]11% Deeptone Blue formulation with Desmodur N-3300. (See Appendix.)
[3]An additional 0.2% benzoic acid catalyst is added based on total resin solids.
[4]Number indicates smallest Mandrel size tested that passed; measured at 72°F and 32°F after two-week ambient cure.
[5]Measured after two-week ambient cure.

Table 7: Chemical Resistance Properties of PARALOID AU-1166/PARALOID Reactive Modifier QM-1007M (80/20)[1] vs. PARALOID AU-946 Based Paints[2]

Formulation Numbers	AU-1166/QM-1007 G-1166-2	AU-946 G-946-11
% Catalyst (T-12)	0.01[3]	0.01
MEK Double Rubs	65	190
Initial Pencil Hardness	3H	3H
10% NaOH, 3 hours	2H	3H
10% NaOH, 24 hours	2H	3H
10% HCL, 3 hours	2H	3H
10% HCL, 24 hours	2H	3H
10% Acetic Acid, 3 hours	2H	3H
10% Acetic Acid, 24 hours	2H	3H
Xylene, 3 minutes	3H	3H
Xylene, 30 minutes	6B+	3H
Cleaning Solution[4], 3 minutes	3H	3H
Cleaning Solution[4], 30 minutes	6B+	3H
1,1,1 Trichloroethane, 3 minutes	2B	3H
1,1,1 Trichloroethane, 30 minutes	6B+	3H

[1]Weight percent QM-1007M and AU-1166 of total polyol component (AU-1166 solids and QM-1007M).
[2]11% Deeptone Blue formulation with Desmodur N-3300 tested after two-week ambient cure. (See Appendix.).
[3]An additional 0.2% benzoic acid catalyst is added based on total resin solids.
[4]Butyl Cellosolve/Water/NH_4OH (47/50/3).

Table 8: Durability Comparisons of PARALOID AU-1166/PARALOID Reactive Modifier QM-1007M (80/20)[1] vs. PARALOID AU-946 Based Paints[2]

Formulation Numbers	AU-1166/QM-1007 G-1188-2	AU-946 G-948-11
% Catalyst (T-12)	0.01[3]	0.02
QUV Durability		
20° Gloss		
Initial	85	87
232 hours	81	86
400 hours	70	78
663 hours	31	13
Fading[4]		
232 hours	8+	8
663 hours	6	5

[1]Weight percent QM-1007M and AU-1166 of total polyol component (AU-1166 solids and QM-1007M).
[2]11% Deeptone Blue formulation with Desmodur N-3300. (See Appendix.)
[3]An additional 0.2% benzoic acid catalyst is added based on total resin solids.
[4]Measured after indicated hours of QUV exposures; 10 = no change.

Acrylic Urethane Coatings Based on PARALOID AU-1166 Modified With PARALOID Reactive Modifier QM-1007M vs. Polyester Urethane Coatings

As shown in Tables 9–12, acrylic urethane coatings formulated with PARALOID AU-1166/PARALOID Reactive Modifier QM-1007M (60/40 weight solids percent) and Desmodur N-3300 offer an interesting balance of properties versus polyester urethane coatings based on Desmophen 650A and Desmodur N-3300.

As illustrated in Table 9, coatings based on AU-1166/QM-1007M offer a better balance of catalyzed pot life and dry times than coatings based on Desmophen 650A. If a catalyst is not used, the pot life of the polyester urethane coating is comparable to the AU-1166/QM-1007M coating, but the tack-free time of the polyester urethane coating increases significantly; e.g., greater than seven hours.

Mechanical properties, as illustrated in Table 10, are comparable for both systems. The overall chemical resistance of these systems is also comparable, except for a slight advantage of the polyester urethane to exposure to 1,1,1 Trichloroethane and long-term acetic acid chemical exposure. The QUV durability and fading characteristics of the AU-1166/QM-1007M based acrylic urethane vs. the Desmophen 650A based polyester urethane are shown in Table 12.

Table 9: Properties of PARALOID AU-1166/PARALOID Reactive Modifier QM-1007M (60/40)[1] vs. Desmophen 650A Based Paints[2]

Formulation Numbers	AU-1166/QM-1007 G-1166-3	Desmophen 650A G-650A-11
Formulation Constants		
Weight Solids	65.8[3]	54.5
Weight % Polyol/Isocyanate	53.2/46.8	52.5/47.5
Weight % Catalyst (T-12)	0.01[4]	0.05
VOC (lb/gal)[5]	3.1[6]	3.9
Viscosity Profile (#4 Ford Cup, sec)		
Initial	27	28
1 hour	39	GEL
2 hours	56	-
3 hours	67	-
4 hours	83	-
5 hours	105	-
Tack-Free Time (hours)[7]	4.25	3.0
Initial Gloss (20°/60°)	84/92	91/98

[1]Weight percent QM-1007M and AU-1166 of total polyol component (AU-1166 solids and QM-1007M).
[2]11% Deeptone Blue formulation with Desmodur N-3300. (See Appendix.)
[3]Calculated assuming no hydrolysis of QM-1007M; actual weight solids should be measured.
[4]An additional 0.2% benzoic acid catalyst is used based on total resin solids.
[5]Volatile organic compounds of formulations tested. (See Appendix.)
[6]Volatile organic compounds calculated assuming no hydrolysis of QM-1007M; actual VOC should be measured by EPA Test Method #24. (See Appendix.)
[7]500 gram weight on Zapon Tack Tester - no sticking.

Table 10: Mechanical Properties of PARALOID AU-1166/PARALOID Reactive Modifier QM-1007M (60/40)[1] vs. Desmophen 650A Based Paints[2]

Formulation Numbers	AU-1166/QM-1007 G-1166-3	Desmophen 650A G-650A-11
% Catalyst (T-12)	0.01[3]	0.05
Pencil Hardness		
3-Day Ambient	3H	HB
14-Day Ambient	3H	3H
Flexibility (Mandrel Bends)[4]		
72°F	1/8"	1/8"
32°F	1/8"	1/8"
Impact Resistance[5]		
Direct	>120	>120
Indirect	110	110

[1]Weight percent QM-1007M and AU-1166 of total polyol component (AU-1166 solids and QM-1007M).
[2]11% Deeptone Blue formulation with Desmodur N-3300. (See Appendix.)
[3]An additional 0.2% benzoic acid catalyst is added based on total resin solids.
[4]Number indicates smallest Mandrel size tested that passed; measured at 72°F and 32°F after two-week ambient cure.
[5]Tested after two-week ambient cure.

Table 11: Chemical Resistance Properties of PARALOID AU-1166/PARALOID Reactive Modifier QM-1007M (60/40)[1] vs. Desmophen 650A Based Paints[2]

Formulation Numbers	AU-1166/QM-1007 G-1166-3	Desmophen 650A G-650A-11
% Catalyst (T-12)	0.01[3]	0.05
MEK Double Rubs	>200	>200
Initial Pencil Hardness	3H	3H
10% NaOH, 3 hours	2H	3H
10% NaOH, 24 hours	2H	3H
10% HCL, 3 hours	2H	3H
10% HCL, 24 hours	2H	3H
10% Acetic Acid, 3 hours	2H	3H
10% Acetic Acid, 24 hours	4B[4]	3H
Xylene, 3 minutes	3H	3H
Xylene, 30 minutes	3H	3H
Cleaning Solution[5], 3 minutes	3H	3H
Cleaning Solution[5], 30 minutes	3H	3H
1,1,1 Trichloroethane, 3 minutes	F	3H
1,1,1 Trichloroethane, 30 minutes	F	3H

[1]Weight percent QM-1007M and AU-1166 of total polyol component (AU-1166 solids and QM-1007M).
[2]11% Deeptone Blue formulation with Desmodur N-3300 tested after two-week ambient cure. (See Appendix.).
[3]An additional 0.2% benzoic acid catalyst is added based on total resin solids.
[4]Blisters.
[5]EGMBE/Water/NH_4OH (47/50/3).

Table 12: Durability Comparisons of PARALOID AU-1166/PARALOID Reactive Modifier QM--1007M (60/40)[1] vs. Desmophen 650A Based Paints[2]

Formulation Numbers	AU-1166/QM-1007 G-1166-3	Desmophen 650A G-650A-11
% Catalyst (T-12)	0.02[3]	0.05
QUV Durability		
20° Gloss		
Initial	86	91
232 hours	74	48
400 hours	67	23
663 hours	59	7
Fading[4]		
232 hours	9	6+
663 hours	8	3

[1]Weight percent QM-1007M and AU-1166 of total polyol component (AU-1166 solids and QM-1007M).
[2]11% Deeptone Blue formulation with Desmodur N-3300. (See Appendix.)
[3]An additional 0.2% benzoic acid catalyst is added based on total resin solids.
[4]Measured after indicated hours of QUV exposures; 10 = no change.

Formulating Suggestions

The two-component formulations given herein are recommended for initial evaluation of PARALOID AU-1166 with and without modification by PARALOID Reactive Modifier QM-1007M. For best pot life, polyurethane-grade solvents are recommended and contamination with water should be avoided. The following formulating suggestions are offered.

Catalyst Suggestions

Coatings using PARALOID AU-1166 with and without PARALOID Reactive Modifier QM-1007M offer a better balance of performance properties when a catalyst is utilized. We recommend the use of a tin catalyst such as Metacure™ T-12 (dibutyltin dilaurate) at levels of 0.01–0.05 percent based on total vehicle solids. When coatings are formulated with PARALOID Reactive Modifier QM-1007M, we also recommend the use of benzoic acid as a co-catalyst at a level of 0.2 percent based on total resin solids. Tables 13–15 illustrate the effects of the addition of a tin catalyst to a coating based on AU-1166. This data shows the catalyst greatly improves flexibility without significantly detracting from pot life or affecting other film properties.

Table 13: Effect of Catalyst Level on the Paint Properties of PARALOID AU-1166 Based Paints[1]

	AU-1166	
	Uncatalyzed	Catalyzed
% Catalyst (T-12)	0	0.02
Viscosity Profile (#4 Ford Cup, sec)		
Initial	26	26
1 hour	27	28
3 hours	27	32
5 hours	28	40
Tack-Free Time (hours)[2]	3.5	3.0

[1]11% Deeptone Blue formulation with Desmodur N-3300. (See Appendix; see Formulation G-1166-1.)
[2]500 gram weight on Zapon Tack Tester - no sticking.

Table 14: Effect of Catalyst Level on the Mechanical Properties of PARALOID AU-1166 Based Paints[1]

	AU-1166	
	Uncatalyzed	**Catalyzed**
% Catalyst (T-12)	0	0.02
Pencil Hardness		
3-Day Ambient	F	F
14-Day Ambient	2H	2H
Flexibility (Mandrel Bends)[2]		
72°F	1/2" F	1/8" P
32°F	1/2" F	1/8" P
Impact Resistance[3]		
Direct	12	16
Indirect	<2	<2

[1]11% Deeptone Blue formulation with Desmodur N-3300. (See Appendix; see Formulation G-1166-1.)
[2]Number indicates smallest Mandrel size tested; P = Pass, F = Fail; measured after two-week ambient cure.
[3]Measured after two-week ambient cure.

Table 15: Effect of Catalyst Level on the Chemical Resistance of PARALOID AU-1166 Based Paints[1]

	AU-1166	
	Uncatalyzed	**Catalyzed**
% Catalyst (T-12)	0	0.02
MEK Double Rubs	25	20
Initial Pencil Hardness[2]		
10% NaOH, 3 hours	2H	2H
10% NaOH, 24 hours	2H	2H
10% HCL, 3 hours	2H	2H
10% HCL, 24 hours	2H	2H
10% Acetic Acid, 3 hours	2H	2H
10% Acetic Acid, 24 hours	2H	F
Xylene, 3 minutes	6B+	6B+
Xylene, 30 minutes	6B+	6B+
Cleaning Solution[3], 3 minutes	6B+	6B+
Cleaning Solution[3], 30 minutes	6B+	6B+
1,1,1 Trichloroethane, 3 minutes	6B+	4B+
1,1,1 Trichloroethane, 30 minutes	6B+	6B+

[1]11% Deeptone Blue formulation with Desmodur N-3300. (See Appendix; see Formulation G-1166-1.)
[2]Measured after two-week ambient cure.
[3]EGMBE/Water/NH_4OH (47/50/3).

Flow Aids

In many formulations, the addition of a flow aid is beneficial. Either SF-1023 or Byk™ 300 can be tried in this application at a maximum of 0.1 percent on total resin solids.

UV Absorbers

The addition of UV absorbers (1 percent each of Tinuvin™ 328 and Tinuvin 292 on total resin solids) can enhance the weathering properties of acrylic urethane coatings.

Colorants

Most colors can be produced using a sand mill grind with PARALOID AU-1166. In some instances, it may be preferable to use a grinding medium such as PARALOID DM-55. (Suggested starting point formulations follow.) If predispersed colorants are preferred, we recommend the use of acrylic-based colorants.

Isocyanates

The use of isocyanates based on HMDI trimers with isocyanurate ring structures; e.g., Bayer Desmodur N-3300 or Lyondell's Luxate HT 2000, has shown some advantages in lab tests over those based on HMDI biurets; e.g., Bayer's Desmodur N-75.

The formulations in this bulletin are based on an 84/16 percent weight solids of AU-1166 to Desmodur N-3300. This ratio, approximately 1/1 stoichiometric, should represent the minimum isocyanate level to be used. Excesses of 5 percent to 25 percent isocyanate should be investigated by the formulator.

Blue-Screening Acrylic Formulations Based on PARALOID DM-55 Dispersions		
Prepare PARALOID DM-55 sand grind as follows:		
PARALOID DM-55	} Premix	28.0
n-Butyl Acetate (PUG)	} Premix	72.0
Phthalo Blue BT-417D		16.5
TiO_2, R-960		40.6

Filter sand grind and prepare formulations as follows:

	Formulation G-1166-1 AU-1166 (73%)	**Formulation G-1166-2 AU-1166/QM-1007M (80/20)**	**Formulation G-1166-3 AU-1166/QM-1007M (60/40)**
Component I			
PARALOID DM-55 Sand Grind	32.7	35.5	38.2
PARALOID AU-1166	110.6	71.5	49.2
PARALOID Reactive Modifier QM-1007M	0	13.4	24.4
n-Butyl Acetate (PUG)	26.2	21.9	12.6
10% SF-1023 (in Butyl Acetate)	1.0	1.0	1.0
1% Metacure T-12 (in Butyl Acetate)	1.9	1.0	1.1
20% Benzoic Acid (in Ethanol)	0	1.0	1.1
Component II			
Desmodur N-3300 (100%)	15.4	34.7	52.4
n-Butyl Acetate (PUG)	36.0	21.0	22.0
Total Weight	223.8	201.0	202.0
% Weight Solids ("in can")	50.9	59.3	65.8
Initial Viscosity (#4 Ford Cup, sec)	26	25	27

Blue-Screening Acrylic Formulations Based on PARALOID DM-55 Dispersions		
Prepare PARALOID DM-55 sand grind as follows:		
PARALOID DM-55	} Premix	28.0
n-Butyl Acetate (PUG)	} Premix	72.0
Phthalo Blue BT-417D		16.5
TiO_2, R-960		40.6

Filter sand grind and prepare formulations as follows:

	Formulation G-946-11 AU-946
Component I	
PARALOID DM-55 Sand Grind	32.7
PARALOID AU-946	99.0
n-Butyl Acetate (PUG)	16.5
10% SF-1023 (in Butyl Acetate)	1.0
1% Metacure T-12 (in Butyl Acetate)	1.0
Component II	
Desmodur N-3300 (100%)	29.8
n-Butyl Acetate (PUG)	40.2
Total Weight	220.2
% Weight Solids ("in can")	51.7
Initial Viscosity (#4 Ford Cup, sec)	26

Blue-Screening Acrylic Formulations Based on PARALOID DM-55 Dispersions		
Prepare PARALOID DM-55 sand grind as follows:		
PARALOID DM-55	} Premix	28.0
n-Butyl Acetate (PUG)	} Premix	72.0
Phthalo Blue BT-417D		16.5
TiO_2, R-960		40.6

Filter sand grind and prepare formulations as follows:

	Formulation G-650A-11 Desmophen 650A(65%)
Component I	
PARALOID DM-55 Sand Grind	32.7
Desmophen 650A	77.6
Solvent Blend[1]	18.2
10% SF-1023 (in Butyl Acetate)	1.0
1% Metacure T-12 (in Butyl Acetate)	4.0
Component II	
Desmodur N-3300 (100%)	45.7
Solvent Blend[1]	29.0
Total Weight	208.2
% Weight Solids ("in can")	54.5
Initial Viscosity (#4 Ford Cup, sec)	26

[1]PM Acetate/MEK/Xylene/n-butyl Acetate (40/40/10/10).

Alternate Blue Deeptone Acrylic Urethane Based on PARALOID AU-1166 and Desmodur N-3390 Formulation #G-1166-10				
	Weight Ratio	**Weight Solids**	**Parts per 100 Volume Basis**	**Volume Solids**
Component I				
PARALOID AU-1166 (73%)	126.3	92.2	14.43	9.76
Xylene	52.6		7.26	
TiO_2, Ti-Pure R-960	40.4	40.4	1.23	1.23
Phthalo Blue, BT-417D	17.0	17.0	1.23	1.23
Grind the above with an equivalent weight of sand to the desired dispersion, filter and letdown with:				
PARALOID AU-1166 (73%)	410.0	299.3	46.85	31.67
Xylene	60.1		8.29	
SF-1023 (10% in Xylene)	4.5		0.58	
Metacure T-12 (10% in Xylene)	1.0		0.13	
Component I Total	711.9		80.00	
Component II				
Desmodur N-3390(90%)	83.0	74.7	8.83	7.62
Xylene	80.9		11.17	
Component II Total	163.9		20.00	
Formulation Constants				
Solids by Weight ("in can")[1]		59.8%		
Solids by Volume ("in can")[1]		51.5%		
Volatile Organic Compound ("in can")[1]		3.5		
Weight Percent (Solids):				
Pigment/Binder		89/11		
AU-1166/QM-1007/Desmodur N-3390		84/16		
Viscosity, #4 Ford Cup		65 seconds		
ICI		2.1 poise		

[1]Application VOC should be measured by EPA Test Method #24. (See Appendix.)

Alternate Blue Deeptone Acrylic Urethane Based On PARALOID AU-1166/QM1007M (60/40) and Desmodur N-3390 Formulation #G-1166-11				
	Weight Ratio	**Weight Solids**	**Parts per 100 Volume Basis**	**Volume Solids**
Component I				
PARALOID AU-1166 (73%)	153.4	112.0	17.53	11.85
Xylene	63.9		8.82	
TiO_2, Ti-Pure R-960	49.1	49.1	1.48	1.48
Phthalo Blue, BT-417D	20.1	20.5	1.48	1.48
Grind the above with an equivalent weight of sand to the desired dispersion, filter and letdown with:				
PARALOID AU-1166 (73%)	93.8	68.5	10.72	7.25
PARALOID Reactive Modifier QM-1007M	120.0	117.6	13.63	13.38
n-Butyl Acetate (PUG)	79.7		10.92	
SF-1023 (10% in Butyl Acetate)	4.5		0.58	
Metacure T-12 (1% Butyl Acetate)	5.6		0.75	
Benzoic Acid (20% in Ethanol)	5.6		0.76	
Component I Total	595.7		66.67	
Component II				
Desmodur N-3390(90%)	292.0	262.8	31.07	26.81
n-Butyl Acetate	16.5		2.26	
Component II Total	308.5		33.33	
Formulation Constants				
Solids by Weight ("in can")[1]		69.7%		
Solids by Volume ("in can")[1]		62.2%		
Volatile Organic Compound ("in can")[1]		2.7		
Weight Percent (Solids):				
Pigment/Binder		89/11		
AU-1166/QM-1007/Desmodur N-3390		32.2/21.0/46.8		
Viscosity, #4 Ford Cup		37 seconds		
ICI		1.1 poise		

[1]Application VOC should be measured by EPA Test Method #24. (See Appendix.)

Appendix

VOC Determination

We recommend that the VOC of formulations containing PARALOID Reactive Modifier QM-1007M be measured by the following EPA and ASTM test methods:

EPA Test Method #24 measures VOC as follows:

$$\text{VOC} = \frac{\text{ASTM \% volatiles* x ASTM density**}}{100}$$

*Percent volatiles (60-minute bake at 110°C) as measured by ASTM D-2369-81.
**Density of paint in weight/gallon as measured by ASTM D-1475-60.

Calculated VOC should be checked using the above test method since formulation and environmental variables affect the degree to which PARALOID Reactive Modifier QM-1007M is activated by moisture, and isobutyraldehyde is liberated. These variables can include pigment types and levels, NCO/OH ratio, catalyst types and levels, ambient cure conditions, moisture contamination, etc.

Raw Materials Supplier List

Ingredient	Function	Supplier
PARALOID DM-55 PARALOID Reactive Modifier QM-1007M	Dispersing Resin Modifier	The Dow Chemical Company Independence Mall West Philadelphia, PA 19105 215-592-3000
Byk 300	Flow Aid	BYK-Chemie USA 524 South Cherry Street Wallingford, CT 06492 203-265-2086
Metacure T-12	Tin Catalyst	Air Products & Chemicals, Inc. P.O. Box 538 Allentown, PA 18105 800-345-3148
Dehydran ARA-7219	Defoamer	Henkel Corporation Process Chemicals Division 350 Mount Kemble Avenue Morristown, NJ 07960 201-267-1000
Desmodur N-75BA Desmodur N-3300 Desmodur N-3390 Desmophen 650A	Aliphatic Isocyanate Resin	Bayer Corporation 100 Bayer Road Pittsburgh, PA 15205 412-777-2000
Colortrend 844 Series	Predispersed Colorants	DeGussa (Creanova) 220 Davidson Avenue Somerset, NJ 08873 732-560-6724
PM Acetate Luxate HT 2000	Solvent Aliphatic Isocyanate	Lyondell Chemical 3801 West Chester Pike Newtown Square, PA 19073 610-359-2000
SF-1023 Silicone	Flow Aid	General Electric Company Mechanicville Road Waterford, NY 12188 518-237-3330
Tinuvin 328 Tinuvin 292	UV Absorbers	CIBA Specialty Chemicals 540 White Plains Road Tarrytown, NY 10591 800-200-8224
Ti-Pure R-960 Phthalo Blue BT 417-D	Titanium Dioxide Phthalo Blue	E.I. duPont de Nemours & Co., Inc. Chemicals & Pigments Dept. Wilmington, DE 19898 800-441-9442

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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.

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