



ZERO VOC 2-Component, Polyester Modified Acrylic Polyurethane Topcoat (Using Exempt Solvents)

K-FLEX® Polyester Diols¹ are low molecular weight, linear, saturated, aliphatic, 100% active polyester diols with primary hydroxyl groups. They are recommended for use as modifying resins for isocyanate crosslinked coating systems. The low molecular weight and narrow molecular weight distribution of **K-FLEX Polyester Diols** provide excellent solubility in exempt solvents, allowing the formulation of zero VOC coatings. The formulations below demonstrate the effect of **K-FLEX** modification of a white, 2-component acrylic urethane using exempt solvents. Improvements in flexibility and impact resistance are evident in this study.

MATERIAL	DESCRIPTION	WEIGHT %
GRIND		
Joncryl 906-AC ²	Acrylic resin	15.6
Titanium Dioxide	Pigment	71.3
Oxsol 100 ³	Solvent	12.7
K-SPERSE® 152 ⁴	Dispersant	0.4
TOTAL		100.0

MATERIAL	DESCRIPTION	WEIGHT %					
COMPONENT I, LETDOWN	Component	Acrylic Control	K-FLEX XM-337	K-FLEX 188	K-FLEX XM-366	K-FLEX A308	K-FLEX XM-332
Grind	Above	35.9	37.9	37.8	38.3	38.3	38.6
Joncryl 906-AC	Acrylic Resin	35.8	26.4	26.3	26.3	26.4	26.5
K-FLEX	Polyester Diol	--	5.9	5.9	5.9	5.9	6.0
Oxsol 100	Exempt Solvent	8.4	7.8	7.8	7.2	7.2	6.7
t-Butyl Acetate	Exempt Solvent	8.4	7.8	7.8	7.2	7.2	6.7
Byk 310 ⁵	Wetting Agent	0.1	0.1	0.1	0.1	0.1	0.1
Tinuvin 123 ⁶	HALS	0.4	0.4	0.4	0.4	0.4	0.4
Tinuvin 1130 ⁷	UV Absorber	1.0	1.0	1.0	1.1	1.1	1.1
K-KAT® 635 ⁸	Catalyst	0.1	0.1	0.1	0.1	0.1	0.1
COMPONENT II							
Basonat HI-100 ⁹	HDI Trimer	9.9	12.5	12.7	13.5	13.4	13.7
TOTAL		100.0	100.0	100.0	100.0	100.0	100.0

FORMULATION CHARACTERISTICS	Acrylic Control	K-FLEX XM-337	K-FLEX 188	K-FLEX XM-366	K-FLEX A308	K-FLEX XM-332
Acrylic replacement, % by weight	0	20	20	20	20	20
K-FLEX, % on resin solids	0	14.1	14.0	13.7	13.7	13.7
Total solids, %	68.0	71.5	71.5	72.8	72.8	73.5
Total resin solids, %	40.1	42.1	42.2	43.0	43.0	43.5
Pigment/Binder	0.694	0.698	0.695	0.691	0.691	0.689
VOC, lbs./gal. (calc.)	0	0	0	0	0	0
Measure viscosity, 25°C, cP	250	250	250	250	250	250
NCO/OH	1.04	1.04	1.04	1.04	1.04	1.04

APPLICATION CONDITIONS						
Cure schedule	30 minutes at 80°C (180°F), 1 week ambient					
Dry film thickness	25 μ (1 mil)					
Substrate	Bonderite 1000 ¹⁰					
FILM PROPERTIES	Acrylic Control	K-FLEX XM-337	K-FLEX 188	K-FLEX XM-366	K-FLEX A308	K-FLEX XM-332
Pendulum hardness, cycles	120	122	116	100	96	73
Pencil hardness	H-2H	H-2H	H-2H	H-2H	H-2H	H-2H
Double MEK rubs	100	100	100	100	100	100
Crosshatch adhesion, %	100	100	100	100	100	100
Reverse impact, in-lbs	60-70	160+	160+	160+	160+	160+
Direct impact, in-lbs	70-80	160+	160+	160+	160+	160+

APPLICATION CONDITIONS						
Cure schedule	1 month ambient					
Dry film thickness	25 μ (1 mil)					
Substrate	Bonderite 1000					
FILM PROPERTIES	Acrylic Control	K-FLEX XM-337	K-FLEX 188	K-FLEX XM-366	K-FLEX A308	K-FLEX XM-332
Pendulum hardness, cycles	125	136	136	126	127	109
Pencil hardness	H-2H	2H-3H	2H-3H	2H-3H	2H-3H	2H-3H
Double MEK rubs	100	100	100	100	100	100.
Crosshatch adhesion, %	100	100	100	100	100	100
Reverse impact, in-lbs	30-40	160+	160+	160+	160+	160+
Direct impact, in-lbs	110-120	160+	160+	160+	160+	160+

APPLICATION CONDITIONS						
Cure schedule	1 month ambient					
Dry film thickness	25 μ (1 mil)					
Substrate	Bare cold rolled steel					
FILM PROPERTIES	Acrylic Control	K-FLEX XM-337	K-FLEX 188	K-FLEX XM-366	K-FLEX A308	K-FLEX XM-332
Pendulum hardness, cycles	132	134	134	122	123	109
Pencil hardness	HB-F	F-H	F-H	F-H	F-H	F-H
Double MEK rubs	100	100	100	100	100	100
Crosshatch adhesion, %	100	100	100	100	100	100
Reverse impact, in-lbs	30-40	160+	160+	160+	160+	160+
Direct impact, in-lbs	100-110	160+	160+	160+	160+	160+

TYPICAL PROPERTIES	K-FLEX XM-337	K-FLEX 188	K-FLEX XM-366	K-FLEX A308	K-FLEX XM-332
Active, %	100	100	100	100	100
Hydroxyl Number	220	230	270	260	265
Viscosity (25°C), cP	55,000	10,000	2,000	1,500	400
Tg, °C	-20	-32	-45	-59	-68

SUPPLIER REFERENCES	
1.) King Industries, Inc. – Polyester diols, 100% active, see chart above	6.) BASF Chemicals – Hindered aminoether light stabilizer, 100% active
2.) BASF Resins – Acrylic polyol cut in acetone, 72% solids, 833 g./eq. (as supplied)	7.) BASF Chemicals – Ultraviolet light absorber, 100% active
3.) Makhteshim Agan Group - Parachlorobenzotrifluoride	8.) King Industries, Inc. – Zinc catalyst, 100% active
4.) King Industries, Inc. – Monomeric dispersant	9.) BASF Chemicals – Hexamethylene diisocyanate trimer, 100% solids, 194 g./eq.
5.) Byk Chemie – Solution of a polyester modified polydimethylsiloxane	10.) Henkel Corp., Parker Div. – Iron phosphated cold rolled steel
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12/29/14