Kane International Corporation
411 Theodore Fremd Avenue
Rye, New York 10580
Phone: (914) 921-3100
Fax: (914) 921-3180

Product Information

Polyurethane resins impart excellent adhesion to various substrates and offer good heat seal release with resistance to blocking, deep-freeze, oils, fats and water when used to modify nitrocellulose, vinyl, or other film forming resin systems.

Chemistry of the Resin

The polymer is derived from the reaction of a polyol and isocyanate.eg.

Polyol + Isocyanate = Polyurethane

R-OH + R-NCO = RNHCOOR

Generally, a 1:1 ratio of the reactants is processed to a specific molecular weight and terminated by neutralizing traces of free NCO through the addition of ethanol, preventing further cross-linking.

The resulting product range is composed of two main types of polyurethanes: plasticizing and film-forming:

KPLAST 1022	KPLAST 1039	KPLAST 1055
KPLAST 1035	KPLAST 1044	KPLAST 8381

These products are essentially polymeric plasticizers for nitrocellulose, available at different levels of molecular complexity from soft to relatively hard grades. The softer grades offer superior plasticizing characteristics, lower solvent retention, and better resistance to heat seal, as well as higher alcohol tolerance and nitrocellulose compatibility. The harder grades exhibit improved film strength and increased levels of adhesion.

Recommend application for plasticizing types is in flexo and gravure inks for surface printing, where resistance to heat is important.

Suggested N/C : Urethane Ratio

For softer grades = 1.0 : 0.75 (by weight)
For harder grades = 1.0 : 1.50 (by weight)

Suggested Solvent Blend

For flexo 4 : 1 ratio Ethanol : Ethyl Acetate
For gravure 1 : 1 ratio Ethanol : Ethyl Acetate

KFILM 2071 and KFILM 2072

These are more complex urethane polymers with film-forming properties, ranging from softer, more elastic products to stronger, more rigid urethanes. Cast films, when solvent-free exhibit minimal surface tack. These four polyurethanes are thermoplastic, nonreactive polymers with excellent adhesion and elastomeric characteristics.

Kane International Corporation
411 Theodore Fremd Avenue
Rye, New York 10580
Phone: (914) 921-3100
Fax: (914) 921-3180

As a result of higher molecular complexity, this type is supplied at low solids with low gloss. Due to urethanes having relatively poor pigment wetting properties, it is recommended that these be used in conjunction with nitrocellulose or other film forming resins to achieve optimum color strength development and gloss or as a component in lamination inks (either adhesive or extrusion where superior laminar bond strength is required).

Suggested N/C : Urethane Ratio

KFILM 2071 = 1.0 : 2.0 (by weight)
KFILM 2072 = 1.0 : 1.5 (by weight)

Formulation Background Information

Liquid inks, as used in the packaging printing industry, consist or pigment, resin, solvent and specific additives.

Considerations with reference to ingredients used:

Pigments

Organic pigments are the most expensive ingredient in any formulation. Therefore, it is essential to maximize their effect, which is to achieve optimum color strength, gloss and transparency. Selection of grade is particularly important is specific fastness properties are a requisite to performance.

Resin

The primary binder is usually nitrocellulose. For flexo application, considering the higher alcohol content of such ink systems, low viscosity grades with lower nitrogen content are preferred. Secondary resins include polyurethanes, which are incorporated into packaging inks to provide a number of key functions;

1. Polymeric plasticizer (non-migrating in character)
2. Enhance flexibility
3. Higher temperature resistance
4. Improved adhesion
5. Resistance to water and deep freeze

Specific grades may be selected for particular applications, dependent on performance requirement. Harder types provide adhesion and film strength, softer grades offer better solvent release, flexibility and heat seal resistance.

Other Resins

Ketone = for improved gloss and adhesion
Maleic (high acid value) = for stabilization of ink viscosity when adhesion promoters (titanium complexes) are used.

There is a limitation on maximum levels applicable with such resins, as they are more brittle in character than other polymeric components.

Kane International Corporation
411 Theodore Fremd Avenue
Rye, New York 10580
Phone: (914) 921-3100
Fax: (914) 921-3180

Solvents

Polymer types and printing application usually dictate solvent types applicable.

For flexo: ethanol, isopropanol or n-propanol are preferred to avoid swelling when polymer plates are employed.

Ethyl acetate or isopropyl acetate can be incorporated to ensure adequate solubilization of the resin system but normally kept below 10% of the solvent content in the formulation.

For gravure: stronger ester solvents are acceptable, indeed desirable, to maximize resolubility from cells thus maintaining optimum printability.

Additives

Adhesion promoters – Titanium complexes, such as Tilcom TIA10 (from Tioxide Specialties) are widely used.
These products cross-link with the OH functional groups in the resin and surface molecular layer of substrate for optimum adhesion.
Levels of addition vary from 1 – 4%. When maximum levels are incorporated, some increase in ink viscosity may occur.
Acceptable levels of viscosity stability may be achieved by incorporation of some acidic material (maleic resin, maleic acid, etc.). Presence of alcohol solvent also assists in maintaining viscosity stability on storage.

Plasticizers

Solvent plasticizers may be considered as supplementary additives to an N/C urethane polymer system. Consideration needs to be given to a particular application, i.e. “food quality” if packaging is for or related to food.

Waxes and Silicones

Products of this type are usually included to obtain required slip characteristics and scuff resistance. Polyethylene waxes are commonly used.
High levels of silicone are to be avoided as this can cause reticulation when printing and excessive slip, undesirable in handling.

Suggested Starting Point Formulation for both Plasticizing and Film Forming Types:

Pigments may be dispersed by dry grind method into a nitrocellulose varnish or alternatively proprietary dispersions or N/C chips may be utilized.

Kane International Corporation
411 Theodore Fremd Avenue
Rye, New York 10580
Phone: (914) 921-3100
Fax: (914) 921-3180

Nitrocellulose Varnish Formulation	
	Percent
Alcohol Soluble Nitrocellulose*	35.00
Ethyl Acetate	32.50
Ethanol	32.50
Total	100.00

*DLX 3/5 – 70% damped with IPA (ex-ICI Explosives, UK)

Printing Ink Formulation		
	Printing Ink - Flexo	**Printing Ink - Gravure**
Organic Pigment	10 - 12	10 – 12
N/C Varnish	40 - 50	40 – 50
KPLAST 1044	15 - 17	15 - 17
Solvent Blend*	26 - 30	26 - 30
Total	100	100
Solvent Blend*	90% Ethanol 10% Ethyl Acetate	50% Ethanol 50% Ethyl Acetate

Note: Pigment content for white ink = 30 – 32% (remainder of formulation to be adjusted in ratio).

For printing viscosity, inks may be further diluted with relevant solvent blends to 25 – 35 secs., Shell cup 3 @ 23°C.

Recommended N/C: Urethane (KPLAST plasticizing types) ratio solids = 1:1.

For inks based on film forming types, N/C: Urethane ration needs to be adjusted to 1:1.5 – 2.0 (by weight).

Lamination

Blend Vehicle Formulation		
	Components	**Percent**
Nitrocellulose Varnish	N/C DLX 3/5 (70% - IPA damped)	35.00 (24.5% solids)
	Ethyl Acetate	15.00
	Ethanol	50.00
	Total	**100.00**
Ink Formulation	Organic Pigment	10.00
	Nitrocellulose Varnish	40.00 (9.8% solids)
	Ethanol	5.00
	Disperse and add:	
	White (TiO_2) Pigment	31.00
	Nitrocellulose Varnish	32.47
	KFILM 2071	28.41
	Ethanol	8.12
Note: KFILM 2072 is also suggested for lamination ink formulation.		

Kane International Corporation
411 Theodore Fremd Avenue
Rye, New York 10580
Phone: (914) 921-3100
Fax: (914) 921-3180

Plasticizing Polyurethanes

Product	Viscosity dPa.s)	Solids (%)	Color (Gardner)	Solvent	Clarity
KPLAST 1022	5 - 9	68 - 72	2 Max	ETAC / IPA	Clear
KPLAST 1035	20 - 30	83 - 87	2 Max	ETOH	Clear
KPLAST 1039	8 – 14.5	68 - 72	2 Max	ETAC / IPA	Clear to Slightly Hazy
KPLAST 1044	12 - 16	73 – 77	2 Max	ETAC	Clear
KPLAST 1055	25 – 30	73 - 77	2 Max	ETAC	Clear
KPLAST 8381	20 – 40	68 - 72	2 Max	ETOH / NPAC / IPA	Clear

Thermoplastic polyurethane resins, used extensively as polymeric plasticizers to modify nitrocellulose based inks for flexo and gravure applications on a wide variety of substrates to enhance resistance to heat, grease, water and blocking.

Product	Solvent Release	Hardness	Flexibility	Heat Seal Release	Water Resistance	Tape Release
KPLAST 1035 KPLAST 1044 KPLAST 1055 KPLAST 1022 KPLAST 8381 KPLAST 1039	↑	↓	↑	↑	↓	↑

All are elastomeric, have no brittle nature and offer improved solvent release.

Kane International Corporation
411 Theodore Fremd Avenue
Rye, New York 10580
Phone: (914) 921-3100
Fax: (914) 921-3180

Aliphatic Film Formers –Tin Free – Nitrocellulose Compatible

Product	Viscosity dPa.s)	Solids (%)	Color (Gardner)	Solvent	Clarity
KFILM 2070	< 0.5	26 – 30	2 Max	ETAC / ETOH	Clear
KFILM 2073	20 - 30	26 – 30	2 Max	ETAC / ETOH	Clear
KFILM 2085	30 - 40	33 – 37	2 Max	ETOH / ETAC	Clear
KFILM 2086	20 - 30	48 – 52	2 Max	ETOH / ETAC	Clear
KFILM 3385	< 1.0	43 – 47	2 Max	ETAC / ETOH	Clear
KFILM 7683	< 0.5	36 – 40	2 Max	ETOH	Clear
KFILM 7686	20 - 30	42 – 46	2 Max	ETOH	Clear
KFILM 7731	4 – 7	39 - 43	2 Max	IPA / NPAC	Clear

Thermoplastic polyurethane resins, used extensively as polymeric plasticizers to modify nitrocellulose based inks for flexo and gravure applications on a wide variety of substrates to enhance resistance to heat, grease, water and blocking.

Product	Hardness	Improved Solvent Release	Print
KFILM 7683 KFILM 2070 KFILM 3385 KFILM 2086 KFILM 7686 KFILM 2085 KFILM 7731 KFILM 2073	↓	↑	↑

Kane International Corporation
411 Theodore Fremd Avenue
Rye, New York 10580
Phone: (914) 921-3100
Fax: (914) 921-3180

Aliphatic Film Formers –Tin Free – PVB Compatible

Product	Viscosity dPa.s)	Solids (%)	Color (Gardner)	Solvent	Clarity
KFILM 2010	15 - 25	33 - 37	2 Max	NPOH / NPAC	Clear
KFILM 2010HS	20 - 30	48 – 52	2 Max	NPAC / NPOH	Clear
KFILM 7890	6 – 12	40 – 44	2 Max	ETOH / ETAC	Clear
KFILM 8085	5 - 20	33 – 37	2 Max	NPOH / NPAC	Clear
KFILM 8092	5 – 15	33 - 37	2 Max	NPOH / NPAC	Clear
KFILM 8096	5 – 15	33 - 37	2 Max	NPOH / NPAC	Clear

Thermoplastic polyurethane resins, used extensively as polymeric plasticizers to modify nitrocellulose based inks for flexo and gravure applications on a wide variety of substrates to enhance resistance to heat, grease, water and blocking.

Product	Hardness	Improved Solvent Release	Improved Print
KFILM 2010HS KFILM 7890 KFILM 2010 KFILM 8085 KFILM 8092 KFILM 8096	↓	↑	↑

KFILM 8092 and KFILM 8096 can make block-free, stand-alone polyurethane inks. The remaining products require some level of PVB to remove tack.