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User's Guide: BASF's Portfolio for Water-Based Digital Inks



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Digital printing is a process in which tiny droplets of ink are jetted from printheads onto a substrate. Printhead types vary by the application and are viscosity-dependent. Properties such as color strength / vibrancy, scuff / mar resistance, and resolubility are all important and are largely dependent on the resin, dispersants and pigment-to-binder ratio.

In a water-based inkjet system, it is even more challenging considering the resins' influence over jetting, open time and film formation. Low particle size resins with anti-clogging properties are critical in such application. In many instances, the ink needs to adhere over an ink-receptive coating. Currently, water-based inkjet has received considerable attention for applications over porous substrates and is expanding its scope in the area of fashion, homecare and advertising. The user's guide for products within the digital space is tailored to help our customers target properties such as dispersibility, balance of film formation and resolubility, property development and better printhead performance, in inkjet applications.

The product focus is in three areas (a) Products enabling high performance pigment dispersions, (b) Emulsions of smaller particle size, enabling good jet performance and film formation and (c) Low molecular weight resins that can be solubilized in water and ammonia that could be useful in imparting resolubility.

Joncryl® HPD Resins: Stronger Inks for a More Colorful World:

Joncryl HPD (High Performance Dispersion) resins and resin solutions offer excellent color development, ink stability, processing efficiencies, and improved cost-in-use. In analog ink application, the use of Joncryl HPD resins and resin solutions provide strong, high performance, viscosity-stable inks that meet the needs of high quality imaging. In color concentrates, these Joncryl HPD resins and resin solutions provide an ideal combination of increased color strength with excellent flow properties, while maintaining good shock and storage stability. These key features, balanced with excellent pigment wetting and milling characteristics, provide a potentially lower cost-in-use. Inks formulated with Joncryl HPD resins and resin solutions can provide benefits that include (a) Lower viscosity, (b) Higher pigment load and improved dispersion and ink viscosity stability, (c) Improved milling efficiency, enabling ink manufacturer to effectively produce high strength, stable dispersions and inks.

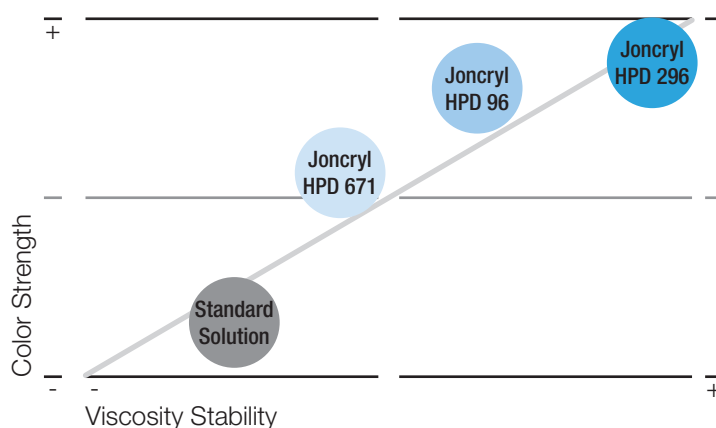


Figure 1. Color development and stability of pigment dispersion resins in inks

There are several benefits of using Joncryl resins and dispersions in digital applications:



- Optimum open time and resolubility
- High gloss and holdout for inks and OPVs
- Great adhesion, block resistance, rub, alkali and alcohol resistance
- Suitable for inkjet needs
- High quality pigment dispersions with good color strength and viscosity stability
- Resins have low viscosity at high solid content

As a leading supplier of resins and additives into the analog printing arena, BASF's product portfolio is also designed to provide customers a unique solution to their digital needs. Use this guide to select the right products or combination of products for your ink and overprint varnish formulations.

Joncryl® Resins and Resin Solutions:

Resin solutions are a convenient alternative to solid resins. These materials can be used in overprint varnishes as well as printing inks to enable high gloss and holdout. Resin solutions have excellent resolubility, which can help prevent ink buildup on the nozzle orifices of the printhead faceplate. These resin solutions may be used in combination with emulsions to enable better resolubility and film formation for performance characteristics. In solution form, these resins also filter well through 1 micron filter. The table lists solid resins and their corresponding resin solution that are currently recommended for water-based digital inks.

Joncryl® RC (Rheology Controlled) Emulsions and Colloids:

Emulsions play an important role in enabling ink properties, such as holdout, adhesion to substrates, block resistance, film formation, and cure. These properties to a large extent depend on the emulsion particle size, ink rheology, and the ink's ability to interact with certain salts to coagulate on to a substrate. At the same time these emulsions need to provide good jet performance & reliability, avoiding any ink buildup on the faceplate. In many instances the ink is jetted onto a substrate that has been primed with an ink-receptive coating. In digital pigmented inks, pigment-to-binder ratio needs to be optimized to enable best performance properties. These emulsions may also be used in conjunction with other soluble resins to impart ink resolubility. The product table lists emulsions which could be suitable for digital printing. These Joncryl resins herein impart good filterability and also have low viscosity at a solid content of 36 to 48%. Also note that in addition to the main binder systems, the type of humectants, co-solvents, surfactants and defoamer are also critical not only to jetting performance but also substrate & nozzle wetting, film formation, and cure.

Product	Product Type	% Solids	Appearance	pH at Dilution ¹	Filterability ^{1,2}	Coagulation with Salts ³	Surface Tension ¹ mN/m
Joncryl HPD resins and resin solutions for high performance pigment dispersion							
Joncryl® HPD 71	Solution	27.5	Clear	8.2	Excellent	Good	40.6
Joncryl HPD 671	Solid Resin	99.4	Clear	–	–	–	–
Joncryl HPD 96	Solution	34.0	Clear	8.1	Excellent	Moderate	40.4
Joncryl HPD 296	Solution	36.3	Yellow	8.0	Excellent	Moderate	38.3
Joncryl resins and resin solutions for resolubility, gloss and holdout							
Joncryl 50	Solution	50.0	Clear Amber	8.1	Excellent	Excellent	40.7
Joncryl 682	Solid Resin	99.5	Yellow	–	–	–	–
Joncryl 60	Solution	34.0	Yellow	8.3	Excellent	Excellent	42.4
Joncryl 678	Solid Resin	98.7	Clear	–	–	–	–
Joncryl 63	Solution	30.5	Clear	8.3	Excellent	Moderate	43.2
Joncryl 67	Solid Resin	98.6	Clear	–	–	–	–
Joncryl LMV 7025	Solution	31.0	Clear	7.1	Good	Excellent	40.2
Joncryl RC Emulsions and Colloids							
Joncryl 100	Colloidal Solution	36.9	Slight Hazy Liquid	8.1	Excellent	Good	38.5
Joncryl 142	Colloidal Emulsion	39.5	Opaque	6.0	Excellent	Best	36.2
Joncryl 537	RC Emulsion	45.7	Translucent	8.8	Moderate	Moderate	39.1
Joncryl 538-A	RC Emulsion	45.0	Translucent	8.8	Excellent	Good	41.5
Joncryl 585	RC Emulsion	44.0	Translucent	9.0	Moderate	Excellent	36.1
Joncryl 2664	RC Emulsion	43.5	Translucent	9.0	Good	Excellent	37.3
Joncryl LMV 7034	RC Emulsion	47.8	Translucent	7.8	Moderate	Excellent	37.1
Joncryl LMV 7040	RC Emulsion	45.5	Semi Translucent	7.3	Excellent	Excellent	40.8
Additives for water-based digital inks							
Dispex® Ultra PX 4585	Dispersant	50.0	–	–	–	–	–
Hydropalat® WE 3370	Surfactant	60.0	–	–	–	–	–

¹ Carried out at 15% resin solids.

² Filtered through a 1 micron filter, times were recorded and the ratings are based on the consistency of time.

³ Coagulation of 15% resin solution was evaluated using 5% calcium chloride solution, ratings are based on degree of coagulation.

Viscosity @ 25°C (cps)	MFFT (°C)	Tg (°C)	Particle Size D ₉₅ (nm)	Properties & Application
4000	–	128	–	Solution of Joncryl HPD 671, for heat resistant, high quality pigment dispersions with very good viscosity stability.
–	–	128	–	High molecular weight acrylic resin for high quality pigment dispersions with very good viscosity stability.
5000	–	88	–	Solution of high molecular weight acrylic resin that improves color development and gloss without compromising ink stability.
600	–	15	–	High performance resin solution that improves the viscosity and shock stability of highly pigmented dispersions.
5000	–	56	–	Low VOC solution of Joncryl 682 for high solids overprint varnishes that require high gloss and excellent holdout.
–	–	56	–	Very low molecular weight acrylic resin for high solids overprint varnishes with high gloss and excellent holdout.
5500	–	85	–	Low VOC solution of Joncryl 678 in water and ammonia for good gloss, holdout, and clarity in pigment dispersions, inks, and overprint varnishes.
–	–	85	–	Mid-range molecular weight acrylic resin for water-based inks, pigment dispersions, and overprint varnishes that promotes gloss, holdout, and resolubility.
5000	–	73	–	Low VOC solution of Joncryl 67 for high quality dispersions and printing inks.
–	–	73	–	High molecular weight acrylic resin for high quality pigment dispersions that can be used for maximum color development and transparency.
1200	–	97	–	pH stable, low VOC solution that modifies the resolubility and drying speed of inks.
2000	15	-7	127	Low VOC universal grind and letdown solution with excellent resolubility.
25	< 7	10	119	General purpose, acrylic colloidal emulsion for carbon black inks; also recommended as a letdown vehicle for organic pigment dispersions.
150	42	44	61	Acrylic emulsion that can be coalesced to provide alkali- and detergent- resistant film for inks, overprint varnish, and for packaging applications.
200	65	64	78	Acrylic emulsion that can be coalesced to provide alcohol- and chemical- resistant film for inks, overprint varnishes, and packaging applications; can also resist plasticizer migration.
300	< 7	-20	103	Heat-resistant, film forming acrylic emulsion that exhibits high gloss and adhesion to treated flexible films and foils in inks and overprint varnishes.
550	< 5	16	118	Film forming acrylic emulsion for high strength inks.
800	< 0	-30	109	Film forming, pH stable acrylic emulsion that provides adhesion and water resistant characteristics in inks on plastic films and foils.
750	< 0	28	115	Hard film forming, pH-stable emulsion that provides film integrity, adhesion, and rub resistance in inks for paper and primed foil
–	–	–	–	Acrylic block copolymer dispersant for high-end water-based inks that provides broad compatibility with different binder systems; pH-independent; suitable for making resin-free pigment concentrates.
–	–	–	–	Fluorocarbon-modified polyacrylate that provides excellent substrate wetting, leveling and anti-cratering in water-based inks and coatings

About BASF

BASF Corporation, headquartered in Florham Park, New Jersey, is the North American affiliate of BASF SE, Ludwigshafen, Germany. BASF has nearly 17,500 employees in North America, and had sales of \$17.4 billion in 2015. For more information about BASF's North American operations, visit www.basf.us.

At BASF, we create chemistry for a sustainable future. We combine economic success with environmental protection and social responsibility. The approximately 112,000 employees in the BASF Group work on contributing to the success of our customers in nearly all sectors and almost every country in the world. Our portfolio is organized into five segments: Chemicals, Performance Products, Functional Materials & Solutions, Agricultural Solutions and Oil & Gas. BASF generated sales of more than €70 billion in 2015. BASF shares are traded on the stock exchanges in Frankfurt (BAS), London (BFA) and Zurich (AN). Further information at www.basf.com.

About BASF's Dispersions and Resins Business

The Dispersions & Resins business of BASF develops, produces, and markets a range of high-quality resins, additives, colorants, and polymer dispersions worldwide. These raw materials are used in formulations for coatings and paints, printing and packaging products, construction chemicals, adhesives, fiberbonding, nonwovens, and paper manufacturing. With a comprehensive product portfolio and extensive knowledge of the industries we serve, our customers benefit from innovative and sustainable solutions to help them advance their formulations through chemistry. For further information about the Dispersions & Resins business in North America, please visit <http://www.basf.us/dpsolutions>.

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