Lubrizol

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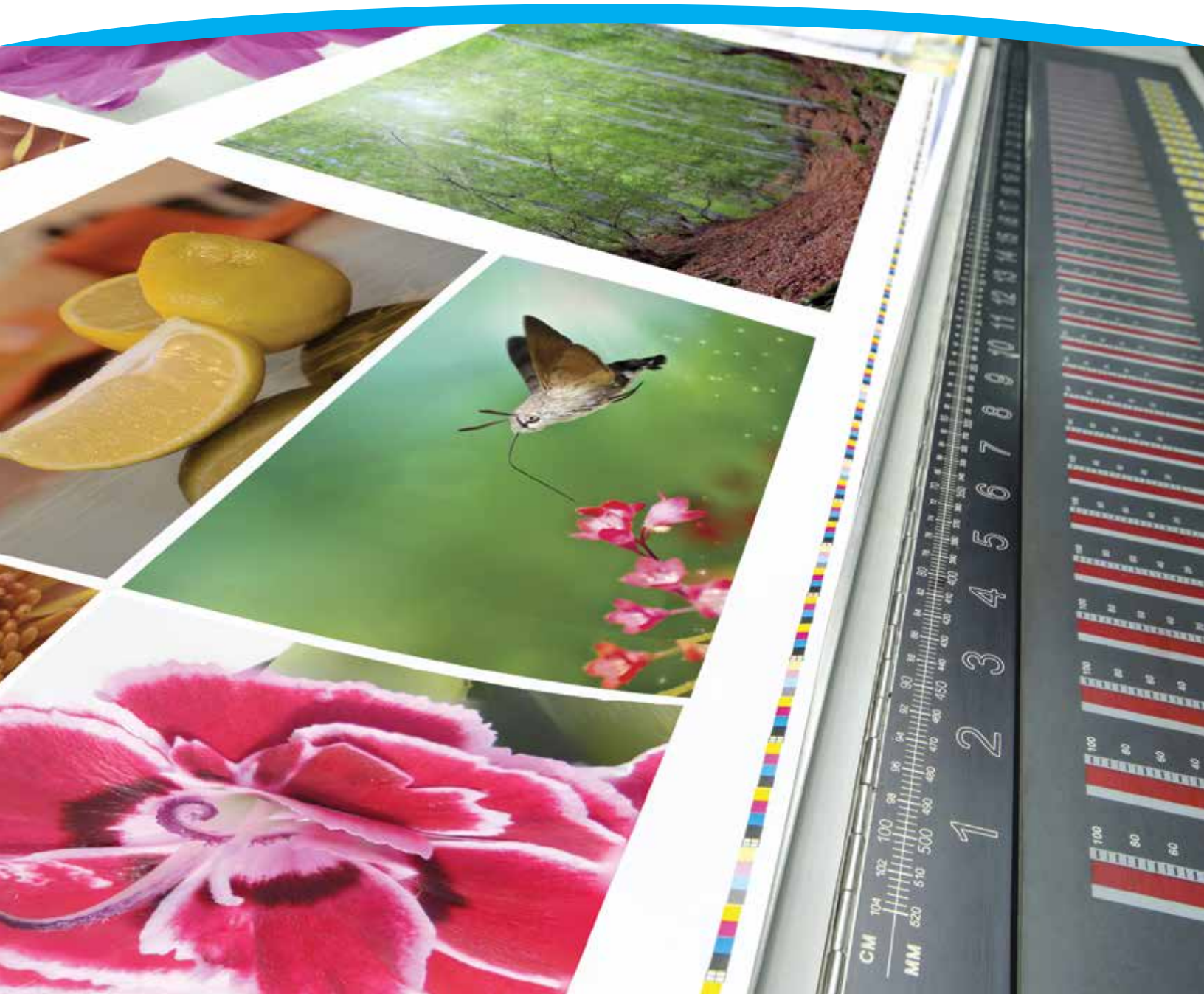
Dispersants Product Guide



Benefits of Using Dispersants

Solsperse™ Hyperdispersant technology is an essential ingredient for advanced performance in paint, coating and graphic art formulations. The technology enables the production of highly loaded, highly stable, broadly compatible dispersions in almost any combination of solid particles and continuous phases (liquid or solid). This dispersant technology combines polymeric stabilizing chains selected for solubility in a given solvent and/or resin combination, with anchor groups optimized for strong adsorption to the particle surface, where the dosage is determined by the particle's surface area. This technology allows the production of sterically stabilized dispersions with higher solids content, lower viscosity, and improved viscosity and particle size stability compared to dispersions made using resins or lower molecular weight dispersants or surfactants.

More Efficient Dispersion

- Increased productivity
- Higher pigment/ filler loadings
- Increased color strength
- Lower energy usage
- Upgraded performance of lower cost systems

Cost Savings

Improved Quality

- Stronger, brighter colors
- Higher gloss
- Better flocculation resistance
- Improved stability
- Uniform flow and improved leveling
- Meet new environmental standards

Solsperse™ Hyperdispersant Formulation Guidelines

MINIMAL RESIN

Solsperse™ Hyperdispersants are widely used in applications where resins are a component of the millbase e.g. inks and paints. Anchoring of the Solsperse™ Hyperdispersant to the pigment surface can be affected by competition between the resin and the hyperdispersant for the surface of the particle. Once the Solsperse™ Hyperdispersant anchor group is attached to the pigment surface it will remain firmly attached. Molecules of resin, however, are transiently adsorbed on the surface of the pigment, and even though not firmly anchored, they can still hinder the Solsperse™ Hyperdispersant anchoring process. The competition for the pigment surface, resulting from using "good wetting" resins, is the most severe case.

In the presence of Solsperse™ Hyperdispersants, good "wetting" or "grinding" resins need not necessarily be selected for use in the dispersion medium. Other resins, more suitable to end-film properties, can be used since Solsperse™ hyperdispersants will provide the essential pigment wetting function. We recommend that MINIMUM resin solids are used in the millbase, but present in sufficient quantities to produce the necessary let-down stability or to produce final coatings with the appropriate resin and solvent contents. If relatively good wetting resins are used, we recommend using approximately 10% resin-solids solution as the grinding medium, and for relatively poor wetting resins, the minimum amount up to the level conventionally used.

NEED FOR A HIGHER PIGMENT LOADING

Solsperse™ Hyperdispersants typically will cause the millbase viscosity to be dramatically reduced. Solsperse™ hyperdispersants will also reduce the viscosity of non-resin-containing dispersions e.g. plasticizer dispersions. This lowering of viscosity may occur to such an extent that there could be insufficient shear in the system to facilitate effective dispersion.

It is therefore essential to increase the pigment content of a Solsperse™ Hyperdispersant millbase to ensure adequate shear. This is necessary for most effective pigment dispersion.

METHOD OF USE AND DOSAGE

1. Select the correct polymeric Solsperse™ Hyperdispersant according to the solvent system in the millbase or tinter formulation.

2. With certain organic pigments, it may be advantageous to include the use of a Solsperse™ Synergist in combination with the hyperdispersant. The synergist helps to improve the polarity of the surface of various organic pigments (i.e. phthalocyanine blue, green and certain carbon blacks) and increase the performance of the polymeric agent.
   - **Solsperse™ 5000S** (blue synergist for solvent based systems)
   - **Solsperse™ 12000S** (blue synergist for water based and alcohol solvent systems)
   - **Solsperse™ 22000** (yellow synergist for solvent based systems)

The recommended polymeric to synergist ratios are 9:1 (for high surface area carbon blacks), 4:1 (for medium surface area carbon blacks, blue, green), 9:1 (red, yellow).

3. The quantity of Solsperse™ Hyperdispersant to use is generally based on 2 mg/m^2 of pigment surface area. The generic formula for the calculation of theoretical dosage is:

$$\text{\% Active Solsperse Hyperdispersant on weight of pigment} = \frac{\text{pigment surface area } (m^2/g)}{5}$$

For example: typically the surface area of a phthalocyanine blue pigment is 50 m^2/g.

$$\% \text{ AOWP} = \frac{50}{5} = 10\% \text{ polymeric agent on the weight of the pigment.}$$

So, a typical dosage would be:	30
Phthalocyanine blue pigment	
Polymeric agent	3.0 (equivalent to 10% AOWP)

However, for phthalocyanine blue, a Solsperse™ Synergist (e.g. Solsperse™ 5000S) is used in addition to the polymeric agent usually at a ratio of 4:1 polymeric agent to synergist. So the final millbase formulation would be:

Phthalocyanine blue pigment	30.0
Polymeric agent	3.0
Synergist	0.75 (equivalent to 4:1 ratio)
20% resin solids solution	66.25
	100

A ladder series of Solsperse™ hyperdispersant levels should be carried out around the 2 mg/m^2 level.

4. Avoid other additives in the dispersion phase (e.g. thixotropes) as they may interfere with the efficiency of the Solsperse™ hyperdispersant in its dispersion of the pigment.

5. In general, use a low amount of resin in the dispersion (maximum of 10%) to try to minimize the competition between the resin and the Solsperse™ hyperdispersant for the wetting of the pigment surface

6. The recommended order of addition is:

   a.) Dissolve the Solsperse™ Hyperdispersant into the millbase solvent(s) or in the solvent/resin mixture, ensuring that the product is fully dissolved before proceeding further.

   b.) If required, add the synergist and distribute evenly with stirring (note: the synergist is virtually insoluble).

   c.) Add the pigment(s) in stages and disperse in the normal manner.

7. As a result of the effect of the Solsperse™ Hyperdispersant and the reduced resin solids, the dispersion viscosity is lower. To achieve an acceptable milling viscosity, gradually increase the pigment loading.

8. After milling, continue to process as normal, adding any other additives as needed, into the letdown phase.

9. For digital inks, the dosage will be considerably higher as levels of 6 mg/m^2 to 10 mg/m^2 are typical.

10. For viscous inks, such as offset lithographic heatset or sheetfed inks, the resin solids in the dispersion will be higher to accommodate the final printing viscosity and also to facilitate the transfer of the millbase over the three roll mill. A solids of 40% (40/60, solid varnish/solvent) is recommended.

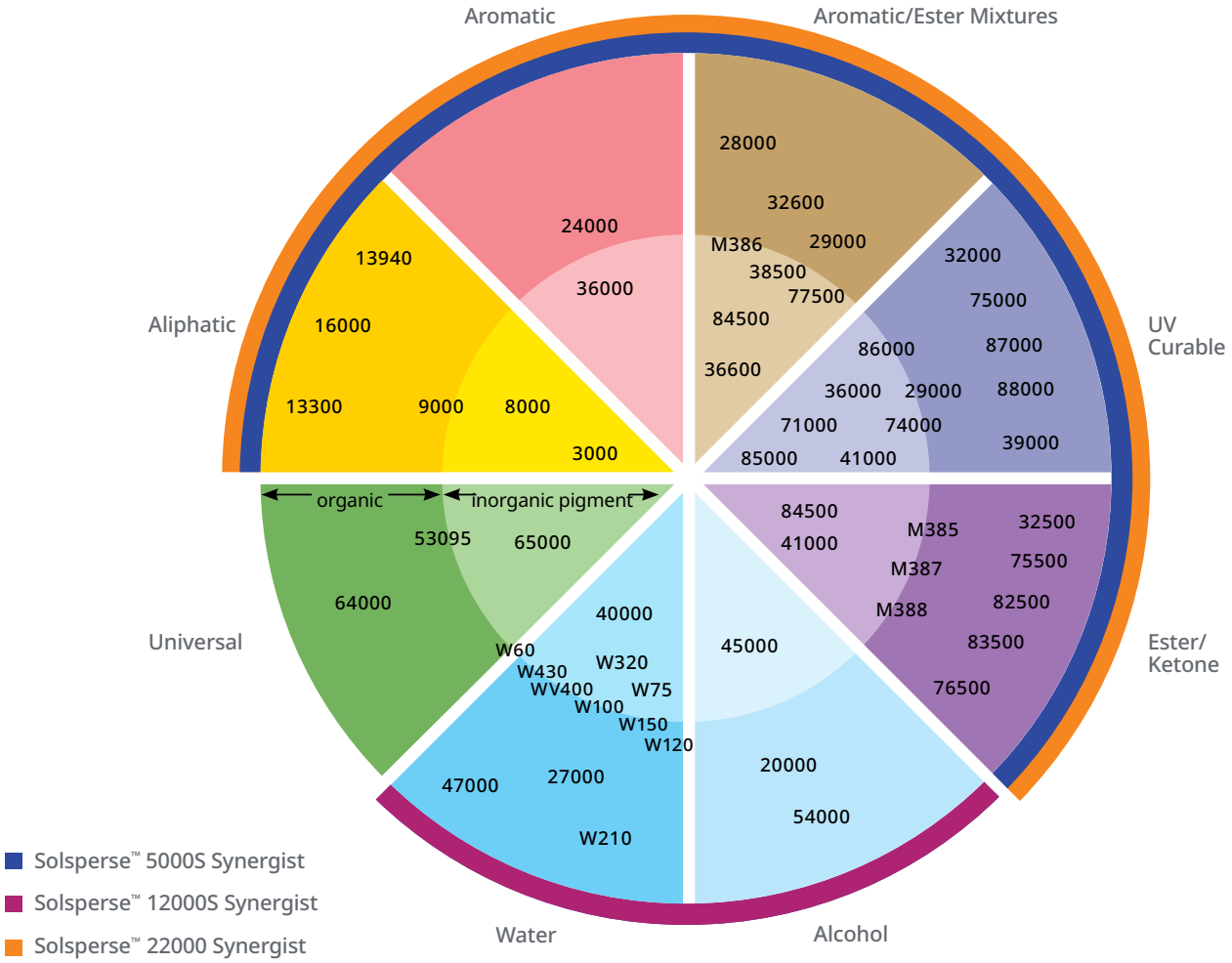
Dispersants for Paints and Coatings

Dispersant selection is dependent on the surface functionality of the pigment or particle as well as the polarity of the continuous phase. Dispersion stability is optimized when the functional anchor group of the dispersant is matched to the surface of the pigment or particle. For acid to neutral surfaces, including many organic pigments, a dispersant with basic functionality or strong hydrogen bonding potential is most effective. For basic surfaces, including many inorganic pigments, an acidic functional dispersant is preferred. Although many particles will have multifunctional surface functionality, some generalizations can be made to aid in dispersant selection by matching anchor functionality:

	Basic Surface	Acidic to Neutral Surface
Pigment	Laked organic pigments Alkaline carbon blacks	Organic pigments Oxidized carbon blacks Neutral carbon blacks
	Alumina treated TiO_2	Silica treated TiO_2
	Iron oxides Calcium Carbonate Talc & other basic silicates	Silica & silica matting agents Kaolin
Preferred Dispersant	Acidic anchor	Basic or neutral anchor

On the following Solsperse™ Hyperdispersant selector guides, dispersants with basic or neutral anchors are located on the outer circle and acidic anchored dispersants on the interior. Solsperse™ Synergist selection details are shown on the outside ring.

For a polymeric dispersant to be effective, it must be soluble in the solvent into which the pigment or filler is being dispersed. The solvent medium used during dispersion is therefore the main criteria used in dispersant selection. Solsperse™ Hyperdispersants available for use in paints and coatings applications are highlighted in the following product selection chart for a range of solvents:



With certain organic pigments, it may be advantageous to include the use of a Solsperse™ Synergist in combination with the polymeric Solsperse™ dispersants. The synergists help to improve the interaction between the polymeric agent and the surface of certain organic pigments (e.g. phthalocyanine blues, greens) and carbon black pigments. The synergist hyperdispersants include:

Solsperse™ 5000S - For use on organic blues/ greens and carbon black pigments in solvent based systems

Solsperse™ 12000S - For use on organic blues/ greens and carbon black pigments in water and alcohol based systems

Solsperse™ 22000 - For use on certain organic red and yellow pigments in solvent based systems

Dispersants for Paints and Coatings

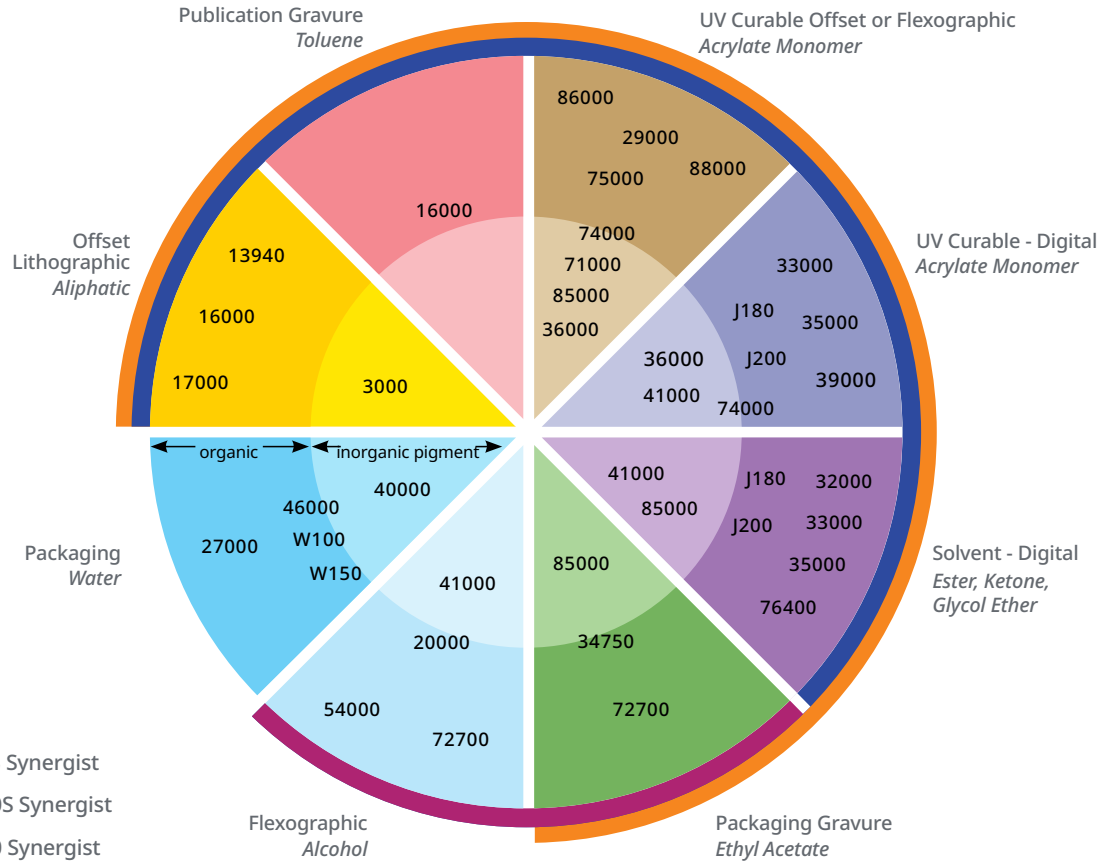
			Solvent Recommendation								Primary Applications					
Product Name	Active Content	Carrier Solvent	Aliphatic	Aromatic	Aromatic/Ester	Acrylate Monomer	Ester Ketone	Alcohol	Water	Water/Glycol	Organic Pigments	Carbon Black	Titanium Dioxide	Inorganic Pigment	Silica	Main Applications
Solsperse™ 3000	100%		•	•									•	•		Non polar dispersions
Solsperse™ 5000S	100%		•	•	•	•	•				•	•				Synergist for phthalo blue, violet and black pigments
Solsperse™ 8000	100%		•	•							•			•		Low polarity coatings
Solsperse™ 9000	100%		•	•							•	•		•		Low polarity coatings and colorants
Solsperse™ 11200	50%	D40 Aliphatic	•								•	•				Alkyd coatings and colorants
Solsperse™ 12000S	100%					•	•	•	•		•	•				Synergist for phthalo blue, violet and black pigments
Solsperse™ 13300	50%	D40 Aliphatic	•								•	•				Alkyd coatings and colorants
Solsperse™ 13940	40%	Aliphatic Distillate	•	•							•	•				Alkyd coatings and colorants
Solsperse™ 16000	100%		•	•							•	•				Low polarity coatings
Solsperse™ 17000	100%		•	•							•	•				Low polarity dispersions
Solsperse™ 19000	100%		•	•							•	•				Low polarity coatings
Solsperse™ 20000	100%							•	•		•	•				High polarity coatings
Solsperse™ 21000	100%		•	•									•	•		Non polar dispersions
Solsperse™ 22000	100%		•	•	•	•	•				•					Synergist for organic yellow and orange pigments
Solsperse™ 24000SC	100%			•	•						•	•				Automotive and industrial coatings
Solsperse™ 27000	100%							•	•	•	•	•				Water-based coatings and colorants
Solsperse™ 28000	100%			•	•		•				•	•	•	•		Industrial coatings
Solsperse™ 29000	100%			•	•	•	•				•	•	•	•		Industrial coatings and high-solids systems
Solsperse™ 32000	100%				•	•	•				•	•				Energy cured coatings
Solsperse™ 32500	40%	Butyl Acetate			•		•				•	•				Automotive and industrial coatings
Solsperse™ 32600	40%	Aromatic 100		•	•						•	•				Automotive and industrial coatings
Solsperse™ 35000	100%				•	•	•				•					Automotive and industrial coatings
Solsperse™ 35100	40%	Butyl Acetate			•		•				•					Dilution of Solsperse™ 35000
Solsperse™ 36000	100%			•	•	•							•	•		Energy cured coatings
Solsperse™ 36600	50%	Aromatic 100		•	•								•	•		Coil and industrial coatings
Solsperse™ 37500	40%	Butyl Acetate			•		•				•	•				Automotive and industrial coatings
Solsperse™ 38500	40%	PM Acetate		•	•		•				•	•				General purpose multimedia colorants
Solsperse™ 39000	100%				•	•	•				•	•				Energy cured coatings
Solsperse™ 40000	85%	Water, DEA							•	•			•	•	•	General-purpose water-based coatings
Solsperse™ 41000	100%					•	•	•					•	•	•	Energy cured coatings

Dispersants for Paints and Coatings

			Solvent Recommendation								Primary Applications					
Product Name	Active Content	Carrier Solvent	Aliphatic	Aromatic	Aromatic/Ester	Acrylate Monomer	Ester Ketone	Alcohol	Water	Water/Glycol	Organic Pigments	Carbon Black	Titanium Dioxide	Inorganic Pigment	Silica	Main Applications
Solsperse™ 43000	50%	Water							•		•	•	•	•		General-purpose water-based coatings
Solsperse™ 44000	50%	Water							•		•	•	•	•		Water-based industrial coatings
Solsperse™ 45000	100%				•		•	•	•				•	•		Water-based coatings and colorants
Solsperse™ 46000	50%	Water							•		•	•	•	•		Water-based industrial coatings
Solsperse™ 47000	40%	Water							•	•	•	•	•	•		Water-based resin free colorants
Solsperse™ 53095	95%	Water	•							•	•	•	•	•		Color acceptance in alkyd tint bases
Solsperse™ 64000	100%							•	•	•	•	•	•	•		Universal decorative tinters
Solsperse™ 65000	100%								•	•	•	•	•	•		Universal decorative tinters
Solsperse™ 71000	100%				•	•	•	•						•	•	Energy cured coatings
Solsperse™ 74000	100%				•	•	•				•	•				Energy cured and other 100% solids coatings
Solsperse™ 75500	40%	Butyl Acetate			•		•				•	•				Automotive and industrial coatings
Solsperse™ 76400	50%	PM Acetate		•	•		•				•	•		•		Automotive and industrial coatings
Solsperse™ 76500	50%	Butyl Acetate		•	•		•				•	•		•		Automotive and industrial coatings
Solsperse™ 77500	40%	Butyl Acetate			•		•				•	•		•		Automotive and industrial coatings
Solsperse™ 79000	100%					•	•	•					•	•		Broad compatibility dispersant for inorganics
Solsperse™ 82500	50%	PMA/Butyl Acetate		•	•		•				•	•		•		Industrial coatings and colorants
Solsperse™ 83500	40%	PMA/Butyl Acetate			•		•				•					Automotive and industrial coatings
Solsperse™ 84500	50%	PM Acetate		•	•		•						•	•	•	Coil, automotive and industrial coatings
Solsperse™ 85000	100%			•	•	•	•						•	•	•	Coil, automotive and industrial coatings
Solsperse™ 86000	100%			•	•	•	•				•	•	•	•	•	Industrial coatings
Solsperse™ 87000	100%				•	•	•				•					Dispersion of lake pigments
Solsperse™ 88000	100%				•	•	•				•					Dispersion of transparent organic pigments
Solsperse™ M385	50%	PM Acetate			•		•				•	•		•		Broad compatibility multimedia colorants
Solsperse™ M386	50%	Solvesso 100		•	•						•	•		•		Broad compatibility multimedia colorants
Solsperse™ M387	100%			•	•	•	•	•			•	•		•		High solids multimedia colorants
Solsperse™ M388	50%	PM Acetate			•		•				•	•		•		High performance multimedia colorants
Solsperse™ M389	50%	Butyl Acetate			•		•				•	•		•		High performance multimedia colorants
Solsperse™ W60	90%	Water		•					•		•	•	•	•		Universal and water-based colorants
Solsperse™ W75	100%								•		•	•		•		Water-based intumescent coatings
Solsperse™ W100	40%	Water							•		•	•	•	•		Broad compatibility resin free colorants
Solsperse™ W120	40%	Water							•		•	•	•	•		Water-based coatings and colorants
Solsperse™ W150	100%								•		•	•	•	•		Water-based coatings and colorants
Solsperse™ W210	100%								•	•	•	•				Water-based coatings and colorants
Solsperse™ W320	40%	Water							•				•	•		Water-based coatings and colorants; Transparent inorganic pigments
Solsperse™ W430	50%	Water							•		•	•	•	•		APE-free; water-based coatings
Solsperse™ WV400	40%	Water							•		•	•	•	•		High performance water-based coatings and colorants

Dispersants for Graphic Arts and Digital Inks

For a polymeric dispersant to be effective, it must be soluble in the solvent into which the pigment or filler is being dispersed. The solvent medium used during dispersion is therefore the main criteria used in dispersant selection. Solsperse™ Hyperdispersants available for use in graphic arts and ink applications are highlighted in the following product selection chart for a range of solvents and their corresponding application areas.



Solsperse™ 5000S Synergist
Solsperse™ 12000S Synergist
Solsperse™ 22000 Synergist

With certain organic pigments, it may be advantageous to include the use of a Solsperse™ Synergist in combination with the polymeric Solsperse Hyperdispersant. The synergist agents help to improve the interaction between the polymeric agent and the surface of certain organic pigments (e.g. phthalocyanine blues, greens) and carbon black pigments. The synergist dispersants include:

Solsperse™ 5000S - For use on organic blues/greens and carbon black pigments in solvent based systems

Solsperse™ 12000S - For use on organic blues/ greens and carbon black pigments in water and alcohol based systems

Solsperse™ 22000 - For use on certain organic red and yellow pigments in solvent based systems

Dispersants for Graphic Arts and Digital Inks

			Solvent Recommendation								Primary Applications					
Product Name	Active Content	Carrier Solvent	Aliphatic	Aromatic	Ester Ketone	Acrylate Monomer	Ester/Acetate	Eco Solvent/Glycol	Alcohol	Water	Organic Pigments	Carbon Black	Titanium Dioxide	Inorganic Pigment	Silica	Main Applications
Solsperse™ 3000	100%		•	•									•	•		Non-polar inks and dispersions
Solsperse™ 5000S	100%		•	•	•	•	•				•	•				Synergist for phthalo blue, violet and black pigments
Solsperse™ 12000S	100%					•	•	•	•	•	•	•				Synergist for phthalo blue, violet and black pigments
Solsperse™ 13940	40%	Aliphatic Distillate	•								•	•				Non-polar inks and dispersions
Solsperse™ 16000	100%		•	•							•	•				Litho and publication inks
Solsperse™ 17000	100%		•	•							•	•				Low polarity dispersions
Solsperse™ 20000	100%								•	•	•	•				Alcohol and acetate packaging inks - NC
Solsperse™ 22000	100%		•	•	•	•	•	•			•	•				Synergist for organic yellow and orange pigments
Solsperse™ 24000SC	100%			•							•	•				Publication and packaging inks
Solsperse™ 27000	100%								•	•	•	•				Water-based packaging inks and dispersions
Solsperse™ 32000	100%				•	•	•	•			•	•				Energy cured offset and solvent digital inks
Solsperse™ 34750	50%	Ethyl Acetate			•		•				•					Acetate packaging inks
Solsperse™ 35000	100%				•	•	•	•			•					Energy cured and solvent digital inks
Solsperse™ 36000	100%			•	•	•						•	•	•		Energy cured coatings and inks
Solsperse™ 39000	100%				•	•	•	•			•					Energy cured offset, flexo, and digital inks
Solsperse™ 40000	85%	Water, DEA								•			•	•	•	Water-based packaging inks and dispersions
Solsperse™ 41000	100%				•	•		•	•				•	•	•	Energy cured inks and coatings
Solsperse™ 45000	100%				•		•	•	•	•		•	•	•		Water-based inks and dispersions - metallics
Solsperse™ 46000	50%	Water								•	•	•	•	•		Water-based inks and dispersions
Solsperse™ 54000	100%							•	•		•					Alcohol and acetate packaging inks - polyamide
Solsperse™ 71000	100%				•	•	•	•	•			•		•	•	Energy cured coatings and inks
Solsperse™ 72700	40%	Ethyl Acetate			•		•		•		•	•				Universal dispersant for packaging inks
Solsperse™ 74000	100%				•	•	•	•			•	•				Energy cured and solvent inks
Solsperse™ 75000	100%				•	•	•				•	•				Energy cured and solvent inks
Solsperse™ 76400	50%	PM Acetate		•	•		•	•			•	•		•		Solvent-borne digital inks
Solsperse™ 79000	100%				•	•	•		•				•	•		Broad compatibility - TiO_2 and metallics
Solsperse™ 85000	100%			•	•	•	•	•				•	•	•	•	Energy cured and solvent inks
Solsperse™ 86000	100%			•	•	•	•	•			•		•	•	·	Energy cured and solvent inks
Solsperse™ 87000	100%				•	•	•	•			•					Energy cured and solvent inks
Solsperse™ 88000	100%				•	•	•	•			•					Dispersion of transparent organic pigments
Solsperse™ J180	100%				•	•		•			•	•				Energy cured and solvent digital inks
Solsperse™ J200	100%				•	•		•			•	•				Energy cured and solvent digital inks
Solsperse™ J400	40%	Water								•	•	•	•	•		Water-based digital inks
Solsperse™ W100	40%	Water								•	•	•	•	•		Broad compatibility resin free dispersions
Solsperse™ W150	100%									•	•	•	•	•		Water-based dispersion, 100% active & biocide-free
Solsperse™ W430	50%	Water								•	•	•	•	•		General-purpose water-based dispersion

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Lubrizol is an innovative, collaborative and trusted partner to the Coatings industry, bringing high-performing dispersant, resin, wax additive, color dispersions, and specialty additive technologies for a wide range of coatings, inks, paper, textiles/ nonwovens, composites and other formulated products. We apply world-class materials science to real-world challenges and collaborate with our customers to enhance the performance, productivity and sustainability capabilities of their products.

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