The Application of Fluid Mixers in the Painting & Coating Industry

PAINTS AND COATINGS

BACKGROUND

Although these terms can be used synonymously, we generally think of Coatings as products designed to give long-term protection under difficult corrosive conditions. Paints, on the other hand, are used for general appearance and shorter-term protection against milder atmospheric conditions.

Whatever we choose to call them, they have many strong similarities in formulation and processing.

- The components typically include binders, coloring pigment, reinforcing pigments, inhibitors, viscosity builders, and solvents.
- All require pigment dispersion, blending of major components, and final mixing for viscosity or color adjustments.

GENERAL CLASSIFICATION

Trade Sale Paints: These products air-drying formulations used primarily for interior and exterior coatings on houses and buildings. The two general classes of trade sale paints are *Alkyd* and *Latex*. These are also known as *solvent based* and *water based* paints, respectively. Ease of application, clean ability with soap and water, reduced odor, and good service has made latex paints the most popular by a wide margin.

Industrial Finishes: These will also be both *water based* and *solvent based* but will usually have more stringent controls on composition and color matching. They will also utilize a broader range of resins (polymers) and components such as corrosion inhibitors, fire retardants and biocides.

THE PROCESS

Pigment Dispersion will usually involve the use of high shear dispersers. With alkyd paints, the pigment will be dispersed in the resin solution, taking advantage of the higher viscosity to the maximize shear stress.

Because lattices tend to be shear sensitive, pigments for these formulations are often dispersed in water and then added to the latex. Some pigment manufactures now provide their products pre-dispersed in water approximately 70% solids. This simplifies handling and processing for the paint formulation.

The degree of dispersion of pigments in a paint formulation is often characterized by a *Hegman* or Production Club gage reading (see Table on following page).

GAGE READINGS		MAXIMUM PARICLE SIZE				GAGE READINGS		MAXIMUM PARTICLE SIZE		
Hegman	**Prod. Club**	**Mils**	**Microns**	**Us Sieve**		**Hegman**	**Prod. Club**	**Mils**	**Microns**	**Us Sieve**
8	10	0	0			3 ½		2.25	57.2	
7 ½		0.25	6.4				4	2.40	61.0	230
	9	0.40	10.2			3		2.50	63.5	
7		0.50	12.7			2 ½		2.75	69.9	
6 ½		0.75	19.1				3	2.80	71.1	
	8	0.80	20.3					2.90	73.7	200
6		1.00	25.4			2		3.00	76.2	
	7	1.20	30.5				2	3.20	81.3	
5 ½		1.25	31.8			1 ½		3.25	82.6	
5		1.50	38.1	400		1		3.50	88.9	170
	6	1.60	40.6				1	3.60	91.4	
4 ½		1.75	44.5	325		½		3.75	95.3	
4	5	2.00	50.8			0		4.00	101.6	
		2.10	53.3	270						

Letdown and Compounding: The final blending of all components in the paint formulation takes place in "letdown" or "compounding" tanks.

With solvent-based paints, roughly 50% of the ingredients are mixed in the dispersion step. This viscous material will then be blended with thinners, additives, tints, and possible additional resins. Axial flow impellers (AXF4's) are common at 0.33 D/T ratios and;

- 4-8 hp/1000 gallons for trade sale paints,
- 6-10 hp/1000 gallons for industrial finishes.

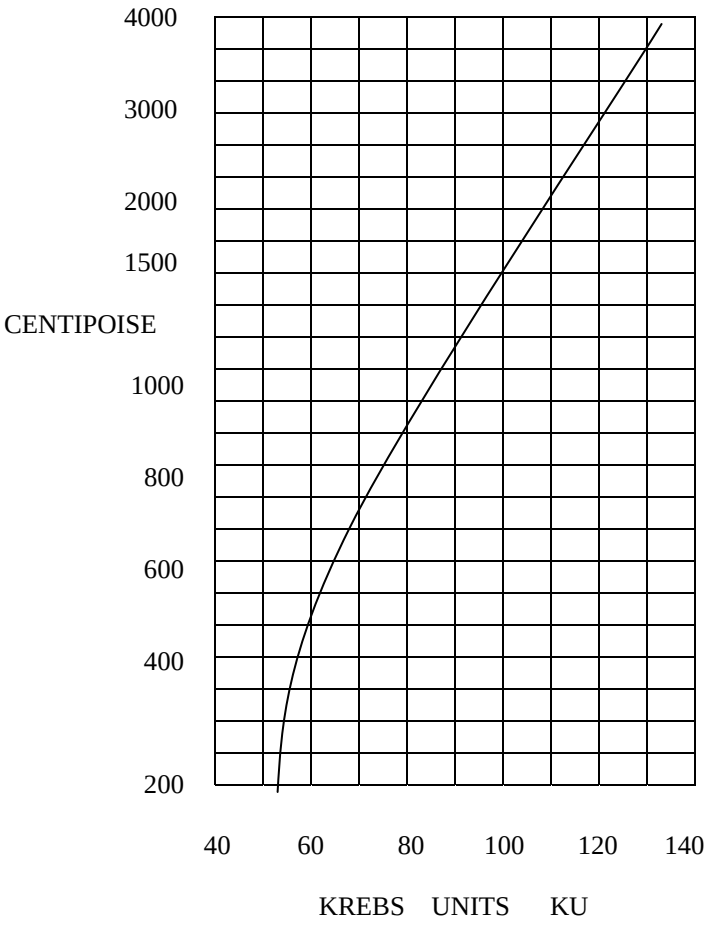
Latex compounding will involve formulations with specific gravities in the range of 1.25-1.8 and a wide range of final viscosities. Because of the extreme variability, customer experience is a valuable guideline. Lacking customer input, we will base selections on AXF4 impellers at 0.35-0.45 D/T ratios and;

- 1.5-4 hp/1000 gallons for viscosities of 100-1000cps,
- 3-15 hp/1000 gallons for viscosities of 1000-10000 cps
  (based on viscosities measured at 2.3 sec)

Storage Tanks for resin and latex need minimum fluid motion to prevent skinning over at the surface and to maintain uniformity.

- Below 1000 cps, use XTF3's at 0.1 hp/ 1000 gallons and a D/T of at least 0.30.
- As viscosity increases up to 10000 cps, use AXF4's or XTF3's (if Reynolds's Number is greater than 200) at D/T ratios of 0.35-0.50 and (0.1) (μ/1000) hp/1000 gallons.
  (For example, at 5000 cps, we would have (0.1) (5000/1000) = 0.5 hp/1000 gallons.)

Paint Viscosity: Historically, the industry has used a Stormer viscometer with special paddle and calibration chart, and reports viscosity in Krebs Units, KU.



Even though most paints are pseudoplastic, you will rarely be given viscosity readings at more than one shear rate (but it doesn't hurt to ask). Even finding the shear rate for the reading you are given can be very helpful.

You will find that the industry tends to refer to their paints as thixotrpoic, or time-shear dependent. In some cases, this may be true, but they will also be pseudoplastic, and that is the property of interest for mixing sizing.

If, by chance, your customer uses Brookfield viscometer, ask them to run the same spindle at two different speeds. This will give us the data we need to do the best possible design job. Typical data will look like this:

Model LVF, spindle #4 --- 6 rpm --- 8000 cps
30 rpm --- 2500 cps

Small Jobs can be done using gear drive portables in tanks below 500 gallons. Use two times the indicated horsepower per 1000 gallons and dual props (Reynolds's Number will usually be too low for foils).

SUMMARY

APPLICATION	HP/ 1000 GAL.	D/T RATIO	IMPELLER TYPE
Pigment Dispersion			
Alkyds	50 – 150	0.25	High Shear Dispersers
Latex	25 – 50	0.25	
Letdown Tanks			
Alkyd- Trade Sale	4 – 8	0.33	AXF4's
Alkyd- Ind. Finish	6 – 10	0.33	AXF4's
Compounding Tanks			
Latex-to 1000 cps	1 ½ - 4	0.35	AXF4's
Latex-to 10000 cps	3 – 15	0.45	AXF4's
Storage tanks			
Resin or Latex			
To 1000 cps	0.1	0.30	XTF3's
To 10000 cps	(0.1) (μ/1000)	0.35 – 0.5	XTF3's or AXF4's