

Jetable Fluid Formulation Guidelines

FLUID EVAPORATION

The jetting fluid system must not dry at the nozzle / air interface. Therefore, the fluid must have a low evaporation rate. Aqueous fluids usually perform better with the addition of a humectant such as a glycol to lower evaporation. Solvent systems should be formulated similarly using low evaporation rate high boiling point solvents.

VISCOSITY

Viscosity should be between 10-12 cPs (1.0×10^{-2} - 1.2×10^{-2} Pa·s) at operating temperature. The printhead can be heated up to 70°C to lower the working viscosity if the fluid is viscous and can tolerate high temperatures. Viscosities up to 30 cPs at jetting temperature have been jetted, but drop velocities may be too slow for some applications. Low viscosity fluids can be jetted, but the operating performance is typically limited.

SURFACE TENSION

Surface tension should be between 28 and 33 dynes/cm (0.028 - 0.033 N/m). Typically a surfactant is added to water-based fluids to achieve this surface tension range. High surface tension fluids (up to 70 dynes/cm) may be jetted with limited performance.

SUSPENSIONS

Particles must not settle rapidly or agglomerate.

FILTERING

In general, a syringe filter is used to remove any large aggregates or particles. Fluids should be filtered through a 0.2 μm filter to remove large aggregates. In general, the fluid can be removed from its storage container, and a syringe filter is put on the end of the syringe in front of the needle used to load the cartridge. The particles in the fluid should be $1/100^{\text{th}}$ the size of the nozzle. The effective diameter of a 10 picoliter nozzle is 21 μm , so any particle, polymer, or aggregate should be less than 0.2 μm . The 1 picoliter printheads have a nozzle diameter of 9 μm , so any particle, polymer, or aggregate should be less than 0.09 μm .

DEGASSING

Removal of dissolved gas improves jetting and priming characteristics of most fluids. Degas the fluid before loading into the fluid module. Degassing is especially helpful for aqueous-based fluids.

pH

It is recommended to use only fluids with a pH within the range of 4-9. Fluids outside of this range may cause corrosion and damage the printhead.

