

T.I.P # 32

Digital Printing: On the Printer

Page 1 of 3

- Cleanliness
- Static Control
- Temperature
- Speed
- Ink Drying

Digital Printer Maintenance is far more demanding and critical to making high quality prints than was ever the case with sign cutting.

Daily print head checks for port clearance and calibration are a must if unexpected print failures are to be prevented. Print heads are also prone to drying when any more than a few hours has elapsed between print jobs. Early drying at the print head is one of the trade-offs that come with certain "hotter" inks, which demonstrate aggressive ink anchorage, and a wide range of ink compatibility with unusual substrates.

Even the most elementary maintenance routine at the start of each working day will save a good deal of lost time and scrapped prints in the long run.

Cleanliness

The primary concern is that the work area immediately around the printer is dust and dirt free. If the sheet is contaminated with either hand oil or dust before printing the resultant print will show fisheyes and fingerprints. Gloves and a hands-off approach to the face of the vinyl are the best policy when loading fresh rolls of film.

Static Control

As all films going into the printer are carried on a plastic coated release liner and will be unwound then passed over guidance and tension rollers they will pick up a certain amount of static. Be sure this static is neutralized with either deionized air or grounded with conductive string or copper tinsel that is lead to ground. The accumulated dust that is attracted to freshly printed film will get in the way of an attractive overlaminating job.

Temperature Effects

Although all printers are equipped with preprint and postprint temperature controls which are meant to enhance ink receptivity these are effective it should be remembered that these heat from the back (through the release liner, adhesive and back of the film) and result in raising the film face temperature only a few degrees. The printing areas should be in clean and temperature controlled area and film should be delivered to the printer at comfortable room temperature about 74°F or 22°C. These steps assure that the heaters can do their job of preheating the vinyl and subsequent drying of the print. At much higher or lower temperatures print defects such as banding and, high dot gain can occur.

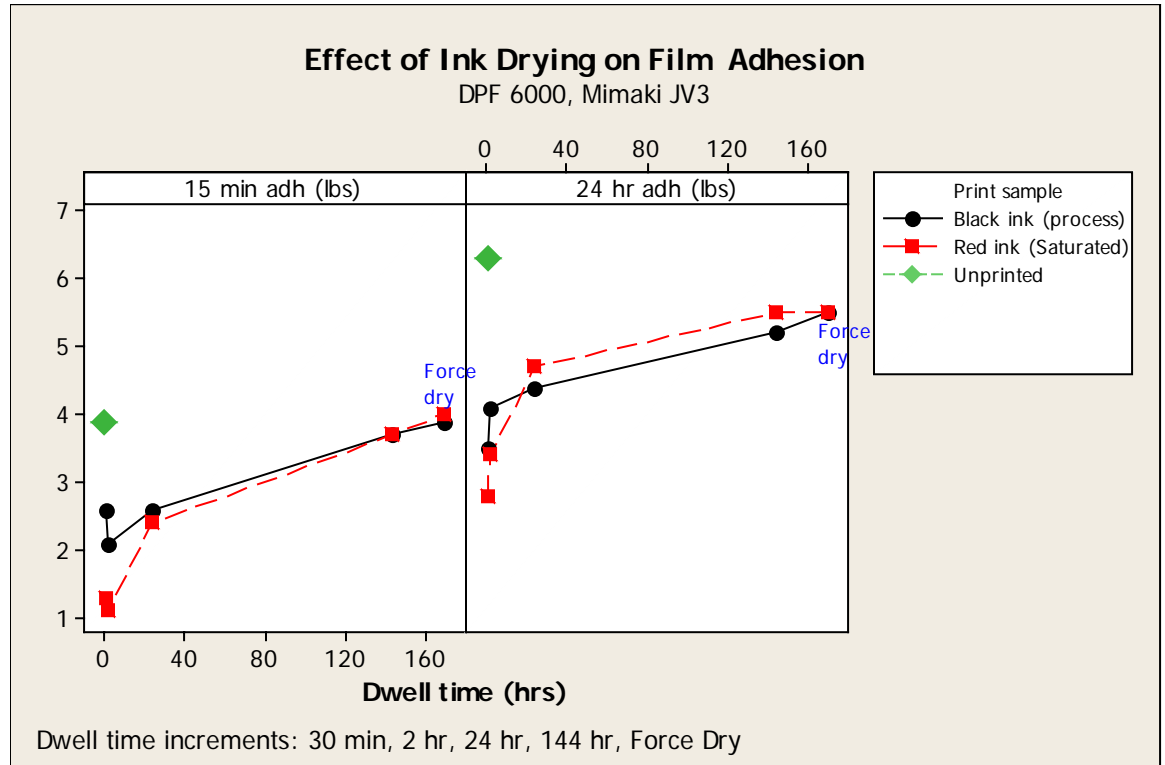
Speed

Throughput rate is also a controllable variable in achieving good looking print results and is often the source of banding problems. Heat transfer from heater rods to substrate is affected by film selection and depends on thickness, density and thermal capacity of the substrate. Use of very thick film or release liner can slow the rate at which the heating system will actually get the desired vinyl temperature. When running initial calibration procedures be sure to keep an eye on printing defects which may be caused by forcing a print through the print heads and heaters too quickly.

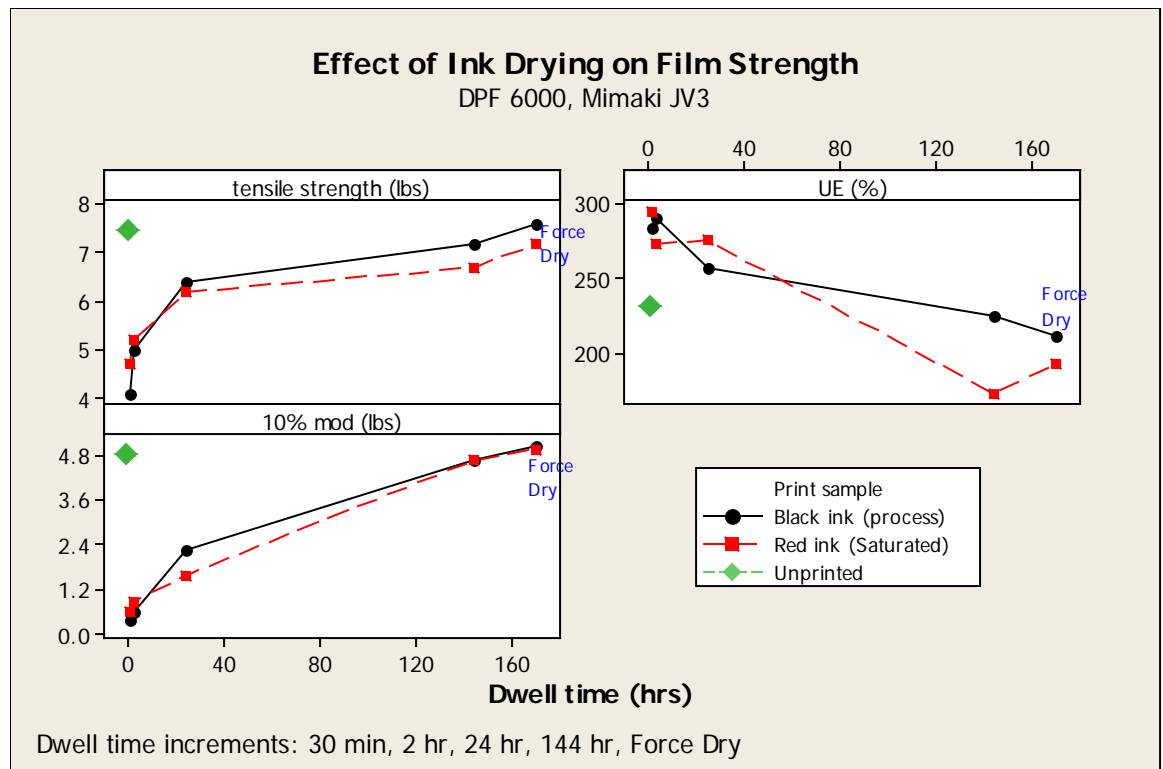
Ink Drying

It is important to allow ink to dry as much as possible before laminating with a clear film or overcoating with a clear protective topcoat. Regardless of the film used controlling this step of the process cannot be overemphasized, especially when using film in a wrap with complex channels and deep distortions. The solvents that carry all but UV inks soften both film and adhesive. When the film is softened it becomes easy to distort, easy to stretch (even after being laminated) while being installed and hard to cut cleanly with a razor knife. When the adhesive is likewise contaminated and not allowed to ventilate it loses as much as 75% of its original tack and long term bond. Considering the level of stretch and consequent lifting force of vinyl which has been made to conform to deep channels, bumpers, wheel flares and mirror cowlings it is easy to see how premature adhesion failure can occur.

Take advantage of as much post-print heat as the printer and media will allow, wind printed material loosely and give printed material at least a day of ventilation prior to lamination or clear coating for best application and greatest chance of long term durability.



The graphs above show the slope of increasing adhesion strength for both initial tack and long term bond when a printed piece is allowed to dry. The printer used has a common mix of solvents. The two lines represent both a spot color (dashed) at high saturation as well as process black. The diamond at the upper left of each graph shows the level of tack and long term bond of DPF 6000 before printing. In all cases we find that allowing more drying time gives greater adhesion recovery and thus increases the assurance of vinyl staying in place.



The graph above depicts basic properties of the PVC film itself: tensile strength at break, tensile strength when film is stretched 10% of its original length and elongation at break. The diamond in the upper left shows the properties of unprinted film. As with the previous example of adhesion all printed film characteristics recover, that is the PVC regains strength and body, as it dries. When film is closest to its preprinted condition it is less flimsy, traps fewer air bubbles and is faster to install.

Methods for assuring best solvent evaporation:

- Set ink limits to the minimum ink density with acceptable tonal saturation. This makes both economic and process sense. The less ink that is used the less problems there will be with surface pooling as well as the lower the residence time of the ink solvent. The less the residence time the lower the likelihood of the solvent penetrating the PVC and adhesive and the easier it will be to dry.
- Using as much heat during the print process as possible without exceeding the upper limit. In our experience heaters under the print station should be near 120°F (50°C) and heat under the dryer section should be 160°F (70°C). When these temperatures are used the solvents will evaporate quickly.
- Allowing for as much drying between the printing process and any downstream processes such as lamination, overspraying or installation will create a finished lamination whose PVC film and adhesive have returned to their original physical properties and bonding characteristics as possible. No matter which manufacturer of film is involved all will perform better at both installation and in long term service when they are applied with little or no ink solvents remaining.
- When conditions require consistent compression of the time between printing and lamination or application a *permanent system of heat (100° – 120°f) and or fans should be added to the drying process. An ideal location for this would be on the vertical web path between printing and roll wind-up.

* One such unit is manufactured by Digi-Dri of Fenton, MO.