

Typical location for UV or IR unit on a 2-colour press. Interdeck units are sometimes used in multicolour work.

Developments in Oxidation Drying

Rapid setting has overcome many of the problems associated with the slow reaction rates of oxidation and polymerisation. But ultimately quicksetting inks rely on these two chemical processes to reach a completely dry state. There are a number of ways that the rate of oxidation can be increased but these in turn, impose their own restrictions. The major compromise, as has already been mentioned, is to maintain stability on the press as drying times decrease.

The majority of letterpress and lithographic inks contain a balanced amount of heavy metal compounds (driers) eg cobalt linoleate, which accelerate the process of oxidation. Up to a limit, an increase in the percentage of drier will increase the drying rate, but press stability will soon suffer. An important recent development has been the introduction of slow skinning inks which are capable of maintaining a more acceptable balance of drying and stability. These inks contain antioxidants which are capable of retarding surface skinning without significantly affecting setting and drying on the paper.

Another inherent disadvantage of oxidation drying is that odorous by-products (eg aldehydes and ketones) are produced.

This is most significant when inks are to be used for food packaging work, as it is possible for these by-products to affect the odour and flavour of the foodstuff. Print buyers today are increasingly aware of this fact and impose severe restrictions on the types of inks that can be used for certain applications. The inkmaker has responded with the introduction of quicksetting inks which have a relatively low odour. The formulating principles are the same, but again the success of these inks has been through careful raw material selection.

Perhaps the most significant development in recent years has been the application of infra-red drying to accelerate the oxidation process. As a rough rule of thumb, for any chemical reaction, the speed of the reaction is doubled for each 10°C rise in temperature. The siting of an infra-red unit at the delivery end of the press introduces a source of heat. The principle of the process is that the printed sheet is heated as it passes an IR dryer. This in itself does not produce a dry print but the increase in stack temperature to 40-45°C accelerates the oxidation reaction and, where quicksetting inks are used, increases the rate of penetration of the mineral oil. The temperature is maintained for a considerable period in the stack.

The benefits of infra-red drying are many. Special inks are not required, the need for anti-set-off powders is greatly reduced and drying rates are considerably increased. The drying does not interfere with the stability of the inks on the press. The main holdups to its widespread use include additional capital outlay, efficiency, and safety problems associated particularly with medium wave IR (2-4 microns).

Penetrate or Oxidise

Quicksetting inks have many advantages but for a number of reasons have not totally superseded other inks. By its very nature, the quicksetting process of penetration and oxidation is totally unsuitable when printing on non-absorbent substrates, in particular foil and some synthetic plastic 'papers'. The reason for this is simple - there is nowhere for the thin mineral oil to go and as it cannot oxidise it will remain in the ink film making it soft and tacky. Inks for non-absorbent substrates therefore rely solely on oxidation and the printer is faced with the traditional problems of slow drying on the print.

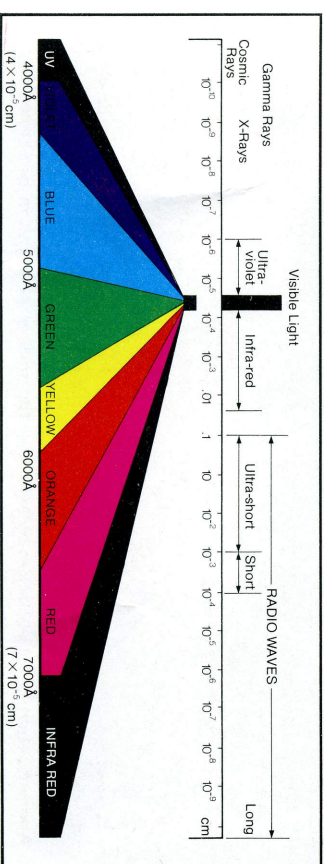
The effect of these can, however, be limited if care is taken. Small delivery stacks and the use of anti-set-off spray are effective measures but spray detracts from the appearance of the print. Alternatively, fount drier additives can be incorporated into the fount solution on a lithographic press. When ink meets water on the plate,

a partial emulsion forms and if extra drier is present in the water, the effective percentage in the ink is increased. The advantage of this method is that the press stability of the ink is not affected.

The totally non-absorbent surface of metal precludes the use of penetration or quick-coatings has to rely on evaporation and/or chemical means. At the same time, excellent adhesion and resistance properties are essential and the process thus requires the use of high temperature stoving ovens. The ovens are physically very large and need to maintain a temperature of 150-200°C.

The drying mechanism for enamels and varnishes relies on the initial evaporation of a high-boiling solvent followed by a chemical reaction initiated by the high temperature. The reaction is not primarily one of oxidation but involves the cross-linking of the polymer chains within the ink film.

Tin printing inks do not undergo the initial evaporation stage and are similar to oxidation drying paper inks. One advantage of this method is that sheets or preformed cans are ready for further processing immediately they leave the oven. The major disadvantage is the extremely high energy costs involved in maintaining such high temperatures - a disadvantage which is currently being exploited by UV curing.



The electromagnetic spectrum - visible light represents only a small fraction.